

## **SCORE Placeholder Sheet for IFW Content**

Application Number: 15245948

Document Date: 08/24/2016

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                |                        |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                | Attorney Docket Number | 64844-256633 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                | Application Number     |              |
| Title of Invention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | WOOD-GRAINED POLYMER SUBSTRATE |                        |              |
| <p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p> |                                |                        |              |

**Secrecy Order 37 CFR 5.2:**

|                          |                                                                                                                                                                                                                                       |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.) |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Inventor Information:**

|                                                                                                                                                                          |            |                |             |                      |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------|-------------|----------------------|--------|
| Inventor                                                                                                                                                                 | 1          |                |             |                      | Remove |
| Legal Name                                                                                                                                                               |            |                |             |                      |        |
| Prefix                                                                                                                                                                   | Given Name | Middle Name    | Family Name | Suffix               |        |
|                                                                                                                                                                          | Andrew     |                | Stephens    |                      |        |
| Residence Information (Select One) <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |            |                |             |                      |        |
| City                                                                                                                                                                     | Aurora     | State/Province | IL          | Country of Residence | US     |

**Mailing Address of Inventor:**

|             |                    |                |    |  |  |
|-------------|--------------------|----------------|----|--|--|
| Address 1   | 1001 Sullivan Road |                |    |  |  |
| Address 2   |                    |                |    |  |  |
| City        | Aurora             | State/Province | IL |  |  |
| Postal Code | 60506              | Country        | i  |  |  |

|                                                                                                                                                                          |            |                |             |                      |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------|-------------|----------------------|--------|
| Inventor                                                                                                                                                                 | 2          |                |             |                      | Remove |
| Legal Name                                                                                                                                                               |            |                |             |                      |        |
| Prefix                                                                                                                                                                   | Given Name | Middle Name    | Family Name | Suffix               |        |
|                                                                                                                                                                          | Francisco  |                | Morales     |                      |        |
| Residence Information (Select One) <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |            |                |             |                      |        |
| City                                                                                                                                                                     | Plano      | State/Province | IL          | Country of Residence | US     |

**Mailing Address of Inventor:**

|             |                    |                |    |    |  |
|-------------|--------------------|----------------|----|----|--|
| Address 1   | 1001 Sullivan Road |                |    |    |  |
| Address 2   |                    |                |    |    |  |
| City        | Aurora             | State/Province | IL |    |  |
| Postal Code | 60506              | Country        | i  | US |  |

|                                                                                                                                                                          |            |             |             |        |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|-------------|--------|--------|
| Inventor                                                                                                                                                                 | 3          |             |             |        | Remove |
| Legal Name                                                                                                                                                               |            |             |             |        |        |
| Prefix                                                                                                                                                                   | Given Name | Middle Name | Family Name | Suffix |        |
|                                                                                                                                                                          | Tadeusz    |             | Rybka       |        |        |
| Residence Information (Select One) <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |            |             |             |        |        |

|                                                                                                                                             |                                |                        |    |                      |                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------|----|----------------------|------------------------------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                                                   |                                | Attorney Docket Number |    | 64844-256633         |                                    |
|                                                                                                                                             |                                | Application Number     |    |                      |                                    |
| Title of Invention                                                                                                                          | WOOD-GRAINED POLYMER SUBSTRATE |                        |    |                      |                                    |
| City                                                                                                                                        | Streamwood                     | State/Province         | IL | Country of Residence | US                                 |
| <b>Mailing Address of Inventor:</b>                                                                                                         |                                |                        |    |                      |                                    |
| Address 1                                                                                                                                   | 1001 Sullivan Road             |                        |    |                      |                                    |
| Address 2                                                                                                                                   |                                |                        |    |                      |                                    |
| City                                                                                                                                        | Aurora                         | State/Province         | IL |                      |                                    |
| Postal Code                                                                                                                                 | 60506                          | Country                | US |                      |                                    |
| All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button. |                                |                        |    |                      | <input type="button" value="Add"/> |

### Correspondence Information:

|                                                                                                                                       |                     |                                          |                                             |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------------------|---------------------------------------------|
| Enter either Customer Number or complete the Correspondence Information section below.<br>For further information see 37 CFR 1.33(a). |                     |                                          |                                             |
| <input type="checkbox"/> An Address is being provided for the correspondence information of this application.                         |                     |                                          |                                             |
| Customer Number                                                                                                                       | 23644               |                                          |                                             |
| Email Address                                                                                                                         | patent-ch@btlaw.com | <input type="button" value="Add Email"/> | <input type="button" value="Remove Email"/> |

### Application Information:

|                                         |                                |                                           |                                     |
|-----------------------------------------|--------------------------------|-------------------------------------------|-------------------------------------|
| Title of the Invention                  | WOOD-GRAINED POLYMER SUBSTRATE |                                           |                                     |
| Attorney Docket Number                  | 64844-256633                   | Small Entity Status Claimed               | <input checked="" type="checkbox"/> |
| Application Type                        | Nonprovisional                 |                                           |                                     |
| Subject Matter                          | Utility                        |                                           |                                     |
| Total Number of Drawing Sheets (if any) | 9                              | Suggested Figure for Publication (if any) |                                     |

### Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

|                                                        |                          |                                            |
|--------------------------------------------------------|--------------------------|--------------------------------------------|
| Application number of the previously filed application | Filing date (YYYY-MM-DD) | Intellectual Property Authority or Country |
|                                                        |                          |                                            |

### Publication Information:

|                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Request Early Publication (Fee required at time of Request 37 CFR 1.219) |                                                                                                                                                                                                                                                                                                                                                                                               |
| <input checked="" type="checkbox"/>                                                               | <b>Request Not to Publish.</b> I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application <b>has not and will not</b> be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing. |

RPI1004

|                                           |                                |                        |              |
|-------------------------------------------|--------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                | Attorney Docket Number | 64844-256633 |
|                                           |                                | Application Number     |              |
| Title of Invention                        | WOOD-GRAINED POLYMER SUBSTRATE |                        |              |

## Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

|                    |                                                  |                                              |                                                         |
|--------------------|--------------------------------------------------|----------------------------------------------|---------------------------------------------------------|
| Please Select One: | <input checked="" type="radio"/> Customer Number | <input type="radio"/> US Patent Practitioner | <input type="radio"/> Limited Recognition (37 CFR 11.9) |
| Customer Number    | 23644                                            |                                              |                                                         |

## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

|                                                                                                                       |                               |                          |                                    |
|-----------------------------------------------------------------------------------------------------------------------|-------------------------------|--------------------------|------------------------------------|
| Prior Application Status                                                                                              | Pending                       | <a href="#">Remove</a>   |                                    |
| Application Number                                                                                                    | Continuity Type               | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
|                                                                                                                       | Claims benefit of provisional | 62/208928                | 2015-08-24                         |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the <b>Add</b> button. |                               |                          | <a href="#">Add</a>                |

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)<sup>i</sup> the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

|                                                                                                        |                      |                          |                                          |
|--------------------------------------------------------------------------------------------------------|----------------------|--------------------------|------------------------------------------|
| Application Number                                                                                     | Country <sup>i</sup> | Filing Date (YYYY-MM-DD) | <a href="#">Remove</a>                   |
|                                                                                                        |                      |                          | Access Code <sup>i</sup> (if applicable) |
| Additional Foreign Priority Data may be generated within this form by selecting the <b>Add</b> button. |                      |                          | <a href="#">Add</a>                      |

|                                           |                                |                        |              |
|-------------------------------------------|--------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                | Attorney Docket Number | 64844-256633 |
|                                           |                                | Application Number     |              |
| Title of Invention                        | WOOD-GRAINED POLYMER SUBSTRATE |                        |              |

## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.</p> <p><input type="checkbox"/> NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.</p> |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|                                           |                                |                        |              |
|-------------------------------------------|--------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                | Attorney Docket Number | 64844-256633 |
|                                           |                                | Application Number     |              |
| Title of Invention                        | WOOD-GRAINED POLYMER SUBSTRATE |                        |              |

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

**NOTE:** This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

### 1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

**A. Priority Document Exchange (PDX)** - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

**B. Search Results from U.S. Application to EPO** - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

### 2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

**NOTE:** Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

|                                           |                                |                        |              |
|-------------------------------------------|--------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                | Attorney Docket Number | 64844-256633 |
|                                           |                                | Application Number     |              |
| Title of Invention                        | WOOD-GRAINED POLYMER SUBSTRATE |                        |              |

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                          |                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------------------------------------------|
| <b>Applicant</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                                        | <a href="#">Remove</a>                                                 |
| <p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p> <p style="text-align: right;"><a href="#">Clear</a></p> |                                          |                                                                        |
| Assignee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Legal Representative under 35 U.S.C. 117 | Joint Inventor                                                         |
| <input type="radio"/> Person to whom the inventor is obligated to assign.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                          | <input type="radio"/> Person who shows sufficient proprietary interest |
| If applicant is the legal representative, indicate the authority to file the patent application, the inventor is: <div style="border: 1px solid black; height: 20px; width: 100%;"></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                                                                        |
| Name of the Deceased or Legally Incapacitated Inventor: <div style="border: 1px solid black; height: 20px; width: 100%;"></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                          |                                                                        |
| If the Applicant is an Organization check here. <input checked="" type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                          |                                                                        |
| Organization Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | TANGENT TECHNOLOGIES LLC                 |                                                                        |
| <b>Mailing Address Information For Applicant:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                          |                                                                        |
| Address 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1001 Sullivan Road                       |                                                                        |
| Address 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                                                                        |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Aurora                                   | State/Province IL                                                      |
| Country                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US                                       | Postal Code 60506                                                      |
| Phone Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          | Fax Number                                                             |
| Email Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                          |                                                                        |
| Additional Applicant Data may be generated within this form by selecting the Add button. <div style="float: right;"><a href="#">Add</a></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                          |                                                                        |

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

|                                           |                                |                        |              |
|-------------------------------------------|--------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                | Attorney Docket Number | 64844-256633 |
|                                           |                                | Application Number     |              |
| Title of Invention                        | WOOD-GRAINED POLYMER SUBSTRATE |                        |              |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |                      |                      |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|----------------------|---------------------------------------|
| <b>Assignee</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1                    |                      |                      |                                       |
| Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication. |                      |                      |                      |                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |                      |                      | <input type="button" value="Remove"/> |
| If the Assignee or Non-Applicant Assignee is an Organization check here.                                                                                                                                                                                                                                                                                                                                                                               |                      |                      |                      | <input type="checkbox"/>              |
| Prefix                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Given Name           | Middle Name          | Family Name          | Suffix                                |
| <input type="text"/>                                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/>                  |
| <b>Mailing Address Information For Assignee including Non-Applicant Assignee:</b>                                                                                                                                                                                                                                                                                                                                                                      |                      |                      |                      |                                       |
| Address 1                                                                                                                                                                                                                                                                                                                                                                                                                                              | <input type="text"/> |                      |                      |                                       |
| Address 2                                                                                                                                                                                                                                                                                                                                                                                                                                              | <input type="text"/> |                      |                      |                                       |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="text"/> | State/Province       | <input type="text"/> |                                       |
| Country <sup>i</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="text"/> | Postal Code          | <input type="text"/> |                                       |
| Phone Number                                                                                                                                                                                                                                                                                                                                                                                                                                           | <input type="text"/> | Fax Number           | <input type="text"/> |                                       |
| Email Address                                                                                                                                                                                                                                                                                                                                                                                                                                          | <input type="text"/> |                      |                      |                                       |
| Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.                                                                                                                                                                                                                                                                                                                                      |                      |                      |                      | <input type="button" value="Add"/>    |

**Signature:**

**NOTE:** This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

|                                                                                     |                  |           |                   |                                    |
|-------------------------------------------------------------------------------------|------------------|-----------|-------------------|------------------------------------|
| <b>Signature</b>                                                                    | /Kyle A. Forgue/ |           | Date (YYYY-MM-DD) | 2016-08-24                         |
| First Name                                                                          | Kyle A.          | Last Name | Forgue            | Registration Number                |
|                                                                                     |                  |           |                   | 71457                              |
| Additional Signature may be generated within this form by selecting the Add button. |                  |           |                   | <input type="button" value="Add"/> |

|                                           |                                |                        |              |
|-------------------------------------------|--------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                | Attorney Docket Number | 64844-256633 |
|                                           |                                | Application Number     |              |
| Title of Invention                        | WOOD-GRAINED POLYMER SUBSTRATE |                        |              |

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
- 2 A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4 A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5 A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6 A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7 A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8 A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9 A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

## **WOOD-GRAINED POLYMER SUBSTRATE**

### **CROSS REFERENCE TO RELATED APPLICATIONS**

**[0001]** This application claims priority to and the benefit of U.S. Provisional Patent Application Number 62/208,928, filed August 24, 2016, the disclosure of which is now expressly incorporated herein by reference.

### **FIELD OF THE DISCLOSURE**

**[0002]** The present disclosure relates to polymer composites and more particularly to polymer composites that are used as a natural wood substitute or replacement.

### **BACKGROUND**

**[0003]** The decking industry has seen numerous introductions of composite and alternative plastic lumber decking products over the past decade. Composite decking typically comprises 50% wood fiber or particles and 50% polyethylene plastic to act as a binder to hold the wood particles together. This entire matrix is extruded into linear deck boards (TREX brand is one example). Due to undesirable qualities of this product, many companies have added a coextruded polymer cap layer around the exterior of the board, which has little or no wood fiber to protect the wood fiber/plastic matrix in the core from exposure and deterioration due to environmental exposure.

**[0004]** In recent years, as composite products have evolved, manufacturers have introduced several colors to the exterior coextruded layer to produce a surface which has varied color tones to emulate natural wood. This wood grain appearance is only skin deep and cutting or planing of the wood composite removes this coextruded cap layer to expose the standard fiber-filled, homogenous core.

**[0005]** The standard plastic extrusion process is designed to evenly mix all ingredients to produce consistent quality of product. Introducing multiple colors at

the beginning of the extrusion process results in a homogeneous mixture of a single color. The industry produced multiple color tones by utilizing color concentrates (streaker colors) that have carrier resins that melt at relatively high temperatures. By keeping the temperature zones on the extrusion process at or near the temperatures of the melting point of the streaker colors, the streaker color concentrates would soften but not melt immediately whereby the streaker color concentrates would release color randomly and produce a streak effect.

**[0006]** This effect would produce a short string of color on the surface of the board. However, the streakers only produced a line of color in a single direction, usually along the extrusion direction, and when cut would not create a wood-grain like appearance through a core of the board. For example, in U.S. Pat. App. Pub. No. 2004/0038002, the streak effect shows color variation that starts and stops within a short distance due to the individual color pellet softening, streaking and then being consumed in a discrete area of the board. With the board cut, pockets of color appear on the end surface, but are discontinuous and do not form a wood-grained appearance.

**[0007]** For co-extruded products, streakers would cause a cap layer to have varied color tones on the surface, but the core of the product remains a single color as evident when the board is cut or planed. For example, in U.S. Pat. App. Pub. No. 2011/0177291, streaker pellets are swirled in an extruder to form a “two-dimensional” cap layer for co-extrusion with a foam core. The cap layer has streaks of color at the surface, but is thin and does not extend into the core of the finished product.

**[0008]** Attempts have also been made to produce polymer boards having a wood-grained appearance through a core of the board. For example, in Japanese Patent No. H07-214631, different colored plastics are extruded through concentric rings, and the molten flow becomes turbulent to swirl the colors together. However, the process produces inconsistencies in the finished product due to the turbulent flow of the extrusion, and cutting the board can

expose portions having minimal or irregular color patterns, such as breaks or gaps in the lines, presenting similar problems to the streakers discussed above.

**[0009]** Another example is French Patent No. 2,738,768 which illustrates a process for simultaneously extruding plastics of different colors to coalesce them into a single product without mixing together. However, the process has similar deficiencies to that of Japanese Patent No. H07-214631 discussed above. The patterns produced in the processes of these references are not consistent throughout the board, and post processing steps, such as cutting, can produce visible surfaces with undesirable characteristics.

## **SUMMARY**

**[0010]** The present disclosure may comprise one or more of the following features and combinations thereof.

**[0011]** In illustrative embodiments, a high density polyethylene wood-grained substrate includes a plurality of layers of different colors. The substrate is formed into elongated boards which each include a first set of polymer layers formed that include a first colorant. The substrate includes a second set of polymer layers that include a second colorant different than the first colorant. The first and second layers alternate within the substrate to form a wood-grained appearance throughout the entire substrate.

**[0012]** These and other features of the present disclosure will become more apparent from the following description of the illustrative embodiments.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0013]** Fig. 1 illustrates a sectional view through an extrusion machine used to manufacture wood-grained polymer substrates of the present disclosure;

**[0014]** Fig. 2 is an exploded perspective view of a flow adapter of the extrusion machine of Fig. 1 showing that the flow adapter includes a body plate and an co-extrusion insert;

**[0015]** Fig. 3 is a perspective view of the flow adapter of Fig. 2;

- [0016]** Fig. 4 is a front elevation view of the flow adapter of Fig. 2;
- [0017]** Fig. 5 is a side elevation view of a set of section inserts used in the extrusion machine to form layers of different color polymers as suggested in Figs. 5A-5G;
- [0018]** Figs. 5A-5G are sectional views taken at the beginning and end of each section insert in Fig. 5;
- [0019]** Fig. 6 is sectional view taken through one embodiment of a polymer substrate in accordance with the present disclosure showing a wood grain pattern of the polymer substrate;
- [0020]** Fig. 7 is a top plan view of the polymer substrate of Fig. 6 showing colorations on a surface of the substrate from the different color polymers;
- [0021]** Fig. 8 is a view similar to Fig. 6 showing embossing on an outer surface of the polymer substrate;
- [0022]** Fig. 9 is a view similar to Fig. 6 showing a wood grain pattern of the polymer substrate after a portion of the outer surface is removed;
- [0023]** Fig. 10 is sectional view taken through another embodiment of a polymer substrate in accordance with the present disclosure showing a wood grain pattern of the polymer substrate;
- [0024]** Fig. 11 is a top plan view of the polymer substrate of Fig. 10 showing a wood grain pattern of the polymer substrate after a portion of the outer surface is removed;
- [0025]** Fig. 12 is a perspective view of one embodiment of an end product formed using a polymer substrate of the present disclosure; and
- [0026]** Fig. 13 is a perspective view of another embodiment of an end product formed using a polymer substrate of the present disclosure.

#### **DETAILED DESCRIPTION OF THE DRAWINGS**

- [0027]** For the purposes of promoting an understanding of the principles of the disclosure, reference will now be made to a number of illustrative

embodiments illustrated in the drawings and specific language will be used to describe the same.

**[0028]** An illustrative extrusion machine 100 in accordance with the present disclosure is shown in Fig. 1. Extrusion machine 100 is used to form wood-grained polymer substrates 10, 210, as shown in Figs. 6-11, having varying patterns of simulated wood grain which extend through and along each substrate 10, 210. Substrates 10, 210 can be made from polymer based materials, such as recycled high density polyethylene (HDPE), having at least two different colorants added thereto to define the wood-grain patterns. Polymer substrates 10, 210 can be free of natural wood or other organic fibers. Polymer substrates 10, 210 can include additives, such as UV inhibitors, foaming agents, and color concentrates, to produce polymer substrates having desired colors and material properties, such as durability and strength.

**[0029]** The wood-grained polymer substrates 10, 210 can be post-processed, such as by planing or embossing, and cut to form various sized boards used to make polymer-lumber end products, such as those shown in Figs. 12 and 13. The boards can be shipped to customers that design and build a multitude of end products, such as furniture, and they can fabricate the end products using the wood-grained polymer boards of the present disclosure just as they typically would using natural wood lumber. Fabrication using the polymer boards could include drilling, routing, and cutting to build multi-component products such as outdoor furniture, including adirondack chairs and park benches for example.

**[0030]** Each polymer substrate 10, 210 includes a multi-tone, simulated natural wood-grain effect that runs throughout the entire substrate (cross section) as shown in Figs. 6 and 10. The simulated wood grains 16, 216 also extend to an outer surface, for example top surface 12, 212, of each substrate 10, 210 so that when removal of material occurs, such as through planing or cutting, the multi-tone wood grain effect remains both on the surface 12, 212 as well as with an

exposed core 14, 214 of the substrates as suggested in Figs. 9 and 11.

Alternatively, or in addition to planing, outer surface 12, 212 of substrates 10, 210 can be embossed, such as with a wood grain pattern, as suggested in Fig. 8.

**[0031]** In one embodiment, polymer substrate 10 of the present disclosure includes continuous linear lines of color wood grain patterns 16 particularly within the core 14 and exposed core surfaces 12 to emulate wood rings or graining, as shown in Figs. 6-9. In the illustrative embodiment, polymer substrate 10 is made using extrusion machine 100, shown in Fig. 1, from a first polymer 120 and a second polymer 124. A first extruder 118 is adapted to extrude first polymer 120 which is blended with a primary (main) base color. The first polymer 120 forms the lighter portions of polymer substrate 10. First polymer 120 includes a polymer material, such as a high density polyethylene resin. In some embodiments, the first polymer 120 is mixed with other additives, such as foaming agent, UV stabilizers, color concentrates, and other fillers such as fiberglass, minerals, etc.

**[0032]** A second extruder 122 of extrusion machine 100 is adapted to extrude second polymer 124 as shown in Fig. 1. Second polymer 124 includes a polymer material, such as a high density polyethylene resin. In some embodiments, the second polymer 124 is mixed with other additives, such as foaming agent, UV stabilizers, color concentrates, and other fillers such as fiberglass, minerals, etc.

**[0033]** Second polymer 124 is blended with an accent color used to form wood grain patterns 16 of substrate 10 as suggested in Fig. 6. The accent color for second polymer 124 and base color for first polymer 120 are different from one another. The accent color is chosen to complement the base color, and each will remain distinctive in the final extrusion. In some embodiments, the base and accent colors simulate the colors in natural wood, whether fresh cut, dried, aged, or otherwise. In some embodiments, the grains 16, 216 of substrates 10, 210 simulate natural wood grain, and the base and accent colors used are generally

not characteristic of natural wood, such as purple, orange, black, and pink, just to name a few.

**[0034]** In some embodiments, first and second polymers 120, 124 partially intermix, along with the main and accent colors, to produce shade and combinations of color which are identified as polymer A/B blend(s) 123 as suggested in Fig. 1. For example, first polymer 120 could be white in color and second polymer 124 could be black in color. When blended according to the present disclosure, areas that intermix showing shades of gray are defined as polymer A/B blend 123. One or more additional accent color extruders can be used to add other accent colored resins into the flow stream through extrusion machine 100.

**[0035]** A flow adapter 125 is coupled to first extruder 118 by securing flow adapter 125 to an adapter plate 126 by use of fasteners, such as bolts, as suggested in Fig. 1. Flow adapter 125 is positioned to receive the output flows from extruders 118, 122 and configured to initiate the combined flow of first and second polymers 120, 124 through extrusion machine 100. The combined flow of first and second polymers 120, 124 is then directed to flow divider 140 for formation of the wood grain pattern.

**[0036]** Flow adapter 125 includes a body plate 129 and a co-extrusion insert 127 as shown in Figs. 2-4. Body plate 129 includes a first face 128 and a second face 130, and is formed to include a slot 121 in first face 128. A series of first apertures 132 are formed through second face 130 and into slot 121. A series of pass-through apertures 131 extend through co-extrusion insert 127 in a similar pattern to first apertures 132. Slot 121 is configured to receive co-extrusion insert 127 to align first apertures 132 of body plate 129 with pass-through apertures 131 of co-extrusion insert 127. Aligned first apertures 132 and pass-through apertures 131 allow first polymer 120 to flow through flow adapter 125 from first face 128 to second face 130 as suggested in Figs. 1-4.

**[0037]** Co-extrusion insert 127 is also formed to include an internal passageway 133 that is coupled to second extruder 122 at a first end 134 and is in fluid communication with injection ports 136 at a second end 138 as shown in Figs. 2 and 4. A series of second apertures 135 are formed through second face 130 of body plate 129 into slot 121 and are positioned between first apertures 132 such that first and second apertures 132, 135 alternate with one another around a centerline of the extrusion machine 100 as suggested in Fig. 2.

**[0038]** Injection ports 136 align with second apertures 135 when co-extrusion insert 127 is received in slot 121 as suggested in Figs. 2-4. Body plate 129 and co-extrusion insert 127 cooperate so that first and second polymers 120, 124 are extruded together through flow adapter 125. In the illustrative embodiment, first apertures 132 are larger than second apertures 135. This arrangement allows second polymer 124, which is the accent color, to exit the flow adapter 125 simultaneously with first polymer 120 in a defined geometric relationship and proportional flow rate. Flow adapter 125 permits the ability to design a variety of patterns and flow rates of first and second polymers 120, 124 to associate with different profile sizes and well as different linear graining and streaking aesthetics by changing the number and size of the openings 132, 135.

**[0039]** The combined flow of first and second polymer 120, 124 exit from flow adapter 125 and enter a reducer 139 of extrusion machine 100 as shown in Fig. 1. Reducer 139 increases pressure of the flow by reducing a cross section of the combined extrusions. Reducer 139 directs the flow of the first and second polymers 120, 124 into flow divider 140.

**[0040]** Flow divider 140 includes a channel 149 formed through flow divider 140 and a plurality of section inserts 141-147 positioned within the channel 149 as shown in Fig. 1. Section inserts 141-147 are coupled to one another to form a continuous dividing element 148 as suggested in Fig. 5. In the illustrative embodiment, each section insert 141-147 is a plate having opposing ends twisted relative to one another to form a helical profile. Section inserts 141-

147 are coupled to one another such that the helical profile along the combined dividing element is offset and reversed with each connected section insert 141-147.

**[0041]** Section inserts 141-147 cut across and redirect the combined flow of first and second polymer 120, 124 as the flow passes through channel 149 of flow divider 140 as suggested in Figs. 1 and 5-5G. Section inserts 141-147 can be of different designs and fit together in a variety of orientations to vary the wood grain patterns 16 of polymer substrate 10. For illustrative purposes, six section inserts 141-146 are shown in Fig. 5. Seven section inserts 141-147, as shown in Fig. 1, can be included in the flow divider 140, but it is contemplated that any number of section inserts can be used to vary the grain pattern formed in the polymer substrate 10. Generally, the number of section inserts can be used to control the number of layers in the substrate. More or less section inserts can also be used depending on the size of the substrate being produced.

**[0042]** In the illustrative embodiment, the design, orientation, and number of section inserts 141-147 determine the linear graining and layering aesthetics for a particular profile size and shape of polymer substrate 10. For example, as suggested in Figs. 5 and 5G, a horizontal (longitudinal to the substrate) orientation of the final end of the dividing element 148 produces horizontal layers in the flow, which leads to horizontal grains in the final polymer substrate 10 as suggested in Fig. 6. Having the final end of the dividing element 148 oriented vertically produces vertical (transverse to the substrate) layers in the flow, which leads to vertical grains in the final polymer substrate 10 as suggested in Fig. 10.

**[0043]** With each successive section insert 141-147, the interlayering of first polymer 120 and second polymer 124 increases the amount of linear graining between the two polymers 120, 124 as well as promote the polymer A/B blending 123 which produces multiple color combinations and layers of the two colors as depicted in Figs. 5A-5G. The portions of the flow contacting the channel 149 and inner dividing element 148 experience less movement than other

portions of the flow due to the viscosity of the material. The continuous dividing and rotation of the flow causes layers of first and second polymer 120, 124 to form on one another within the flow rather than forming a homogeneous mixture.

**[0044]** The combined flow of layered polymers 120, 124 exiting section insert 147 enters an expander 152 as shown in Fig. 1. Expander 152 reduces pressure of the flow by allowing the flow to expand. Expander 152 directs the flow into the entry of a die 154 for forming the general profile of polymer substrate 10. The substrate 10 enters tooling with similar dimensions to the die exit to begin cooling and forming the final product.

**[0045]** As shown in Fig. 6, polymer substrate 10 can be cut through the core 14 to expose the wood grain pattern 16 created by extrusion machine 100. The wood grain 16 in the core 14 of polymer substrate 10 is oriented generally horizontal and the individual grains are closely spaced to one another. The grains 16 (formed from second polymer 124) are generally thinner than the remaining layers (formed from first polymer 120) of the substrate 10. Outer surfaces 12 of polymer substrate 10 have a matte finish and limited wood grain visibility after exiting the die 154 as suggested in Fig. 7. In some embodiments, surfaces 12 of polymer substrate 10 can be further enhanced by embossing techniques applied to the surfaces 12 as suggested in Fig. 8. Embossing can provide a texture similar to natural wood lumber and add to the wood grain effect in the final product. Alternatively or in addition to embossing, a thin layer can be removed from each outer surface 12, such as by planing, to expose the wood grain pattern 16 as suggested in Fig. 9. In the illustrative embodiment, a burling effect is created due to the horizontally oriented and closely spaced grains 16.

**[0046]** As noted above, variations in wood grain patterns can be created depending upon the arrangement of the flow divider. A polymer substrate 210 produced by extrusion machine 100 includes vertical graining 216 in a core 214 of polymer substrate 210 as shown in Fig. 10. The wood grain 16 in the core 14 of polymer substrate 10 is oriented generally vertical and the individual grains are

widely spaced from one another. The grains 216 (formed from second polymer 124) are generally thinner than the remaining layers (formed from first polymer 120) of the substrate 10. Similar post processing steps to polymer substrate 10 can be performed on polymer substrate 210. For example, planing of outer surfaces 212 of polymer substrate 210 can expose the wood grain 216 as suggested in Fig. 11. In the illustrative embodiment, the exposed grains generally align with one another along a length of the substrate 210 due to the vertically oriented and widely spaced grains 216. In some embodiments, the grains 216 mimic the organic rings of a tree.

**[0047]** The illustrative process can be used to form polymer substrates form 10, 210 continuously as an extrudate. As noted above, polymer substrates 10, 210 can be cut to form polymer boards used in the construction of various end products. In the illustrative embodiment, boards are created by making subsequent cuts across the extrudate to define a length of the board, with the orientation of the ends of the board defining a length direction. Various cross-sectional profiles are possible, such as round, polygonal, or other unique shapes, such as those used for molding used around windows and doors for example. These profiles can be created using the die 154, or through post processing of the boards.

**[0048]** The wood-grain patterns 16, 216 in the resulting boards formed from polymer substrates 10, 210 generally extend along the length of the board. In some embodiments, a majority of the wood grains 16, created by the layers of the second polymer 124, extend along the length of the entire board. Likewise, the remaining portions of the board, created by the interspersed layers of the first polymer 120, also generally extend along the length of the board. In some embodiments, a majority of the layers of the first polymer 120 extend along the length of the entire board. This creates a substantially consistent pattern along the length of the board such that cuts various points along a length of the board will expose a substantially similar grain pattern.

**[0049]** As noted above, the wood grains 16, 216 can be oriented along different directions. In some embodiments, a width direction of the substrate 10 is oriented such that wood grains 16 extend between lateral sides 11, 13 of substrate 10 as suggested in Fig. 6. The layers of first and second polymers 120, 124 are stacked from a bottom surface 18 of substrate 10 toward the top surface 12. In some embodiments, a width direction of the substrate 10 is oriented such that wood grains 216 extend between top surface 212 and a bottom surface 218 of substrate 210 as suggested in Fig. 10. The layers of first and second polymers 120, 124 are stacked from a lateral surface 211 toward a lateral surface 213 of substrate 210. Generally, the width direction is perpendicular to the length direction and rotationally oriented around the length direction.

**[0050]** The width direction (i.e., cross-direction of the grains 16, 216) can assume various orientations to change the orientation of the grains 16, 216 to simulate natural wood grains of different patterns. For example, the exposed grain patterns in natural wood assume different orientations depending on the portion of the timber the board is cut from. The orientation of the grains 16, 216 can be changed to simulate these different patterns. In the illustrative embodiments, the grains 16, 216 extend along curvilinear paths across the width of the substrates 10, 210. In some embodiments, a majority of the grains 16, 216 extend substantially uninterrupted across the board, i.e., with minimal or no gaps in the visible grain 16, 216.

**[0051]** In illustrative embodiments, the other portions of the substrates 10, 210 formed by the first polymer 120 are similar to the grains 16, 216. The layers formed by the first polymer 120 extend along a length of the boards made from the substrates 10, 210 and across a width of the boards. In some embodiments, the grains 16, 216 are thinner than the layers formed by the first polymer 120.

**[0052]** Example of illustrative end products formed using the wood-grained polymer boards of the present disclosure are shown in Figs. 12 and 13. A chair armrest 390 formed using polymer substrate 10, which was embossed on the

outer surfaces 12, is shown in Fig. 12. The exposed wood grain 16 is clearly visible after cutting out the shape of the armrest 390 while the embossing provides the feel of natural wood. Another example of a chair armrest 490 formed using polymer substrate 210, which was embossed on the outer surfaces 212, is shown in Fig. 13. The exposed wood grain 216 is clearly visible after cutting out the shape of the armrest 490 while the embossing provides the feel of natural wood. Other structural and non-structural uses, such as decking and siding for example, are contemplated by this disclosure.

**[0053]** In illustrative embodiments, a wood-grained polymer substrate is provided having alternating layers of differently colored polymer material to produce a simulated natural wood grain appearance. The wood grain appearance runs through a core of the substrate such that the simulated wood grains are exposed when the substrate is cut. The wood-grained polymer substrate can be cut to length to form a wood-grained polymer board. The wood-grain polymer board use useful in the production of various end products, such as furniture and decking for example. The grain patterns are adjustable to simulate various cuts of natural wood timber. The grain patterns are substantially consistent along a length of the board such that cuts across the board at various points along the length will expose similar patterns.

**[0054]** While the disclosure has been illustrated and described in detail in the foregoing drawings and description, the same is to be considered as exemplary and not restrictive in character, it being understood that only illustrative embodiments thereof have been shown and described and that all changes and modifications that come within the spirit of the disclosure are desired to be protected.

**What is claimed is:**

1. A simulated natural wood-grained polymer board having a first side and a second side spaced apart from the first side along a width direction, the first and second sides defining a width of the board, the first and second sides extending along a length direction different than the width direction between a first end and a second end, the first and second ends defining a length of the board, a core of the board extending between the first and second sides and between the first and second ends, the board comprising:

a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers extending along the length of the entire board; and

a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers extending along the length of the entire board;

wherein individual layers of the first and second sets of polymer layers alternate within the core of the board to form a natural wood-grained appearance throughout the core of the board such that a plurality of the first and second sets of polymer layers extend along a curvilinear path in the width direction and are substantially uninterrupted from the first side to the second side.

2. The board of claim 1, wherein the layers of the first set of polymer layers are generally thinner than layers of the second set of polymer layers.

3. The board of claim 1, wherein a portion of at least one of the first side and second side of the board is removed to expose portions of the first and second sets of polymer layers along the length direction.

4. The board of claim 3, wherein the exposed portions of the first and second sets of polymer layers form a burling grain pattern.

5. The board of claim 1, wherein at least one of the first and second sides of the board is embossed with a wood grain pattern.

6. The board of claim 1, wherein the first and second sets of polymer layers are formed from high density polyethylene

7. The board of claim 6, wherein the first and second sets of polymer layers further include at least one of a UV inhibitor and a foaming agent.

8. The board of claim 6, wherein one of the first and second sets of polymer layers further includes a foaming agent.

9. The board of claim 1, wherein the board is formed to define a polygonal cross-section along a length of the board.

10. A simulated natural wood-grained polymer substrate extending along a first direction, the substrate having a first side and a second side spaced apart from the first side along a width direction different than the length direction, the first and second sides defining a width of the substrate, the first and second sides extending along the length direction, a core of the substrate extending between the first and second sides and along the length direction, the substrate comprising:

a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers being substantially continuous along the length direction; and

a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers being substantially continuous along the length direction;

wherein individual layers of the first and second sets of polymer layers alternate within the core of the substrate to form a natural wood-grained appearance throughout the core of the substrate such that a plurality of the first and second sets of polymer layers extend along a curvilinear path in the width

direction and are substantially uninterrupted from the first side to the second side.

11. The substrate of claim 10, wherein the layers of the first set of polymer layers are generally thinner than layers of the second set of polymer layers.

12. The substrate of claim 10, wherein the first and second sets of polymer layers are formed from high density polyethylene

13. The substrate of claim 12, wherein the first and second sets of polymer layers further include at least one of a UV inhibitor and a foaming agent.

14. The substrate of claim 12, wherein one of the first and second sets of polymer layers further includes a foaming agent.

15. The substrate of claim 10, wherein the board is formed to define a polygonal cross-section along a length of the board.

16. A polymer lumber end product comprising:  
 a first simulated natural wood-grained polymer board, and  
 a first simulated natural wood-grained polymer board coupled to the first simulated natural wood-grained polymer board,  
 wherein each of the first and second simulated natural wood-grained polymer boards includes:

a first set of polymer layers generally extending along the board and containing a first colorant, a majority of the first set of polymer layers being substantially continuous along a length of the board; and

a second set of polymer layers generally extending along the board and containing a second colorant different than the first colorant, a majority of the second set of polymer layers being substantially continuous along a length of the board;

wherein individual layers of the first and second sets of polymer layers alternate within a core of the board to form a natural wood-

grained appearance throughout the core of the board such that a plurality of the first and second sets of polymer layers extend along a substantially uninterrupted, curvilinear path across a width of the board.

### **ABSTRACT OF THE DISCLOSURE**

A wood-grained polymer substrate includes a plurality of layers of different colors. The substrate is formed into elongated boards and used in the production of various end products similar to natural wood.

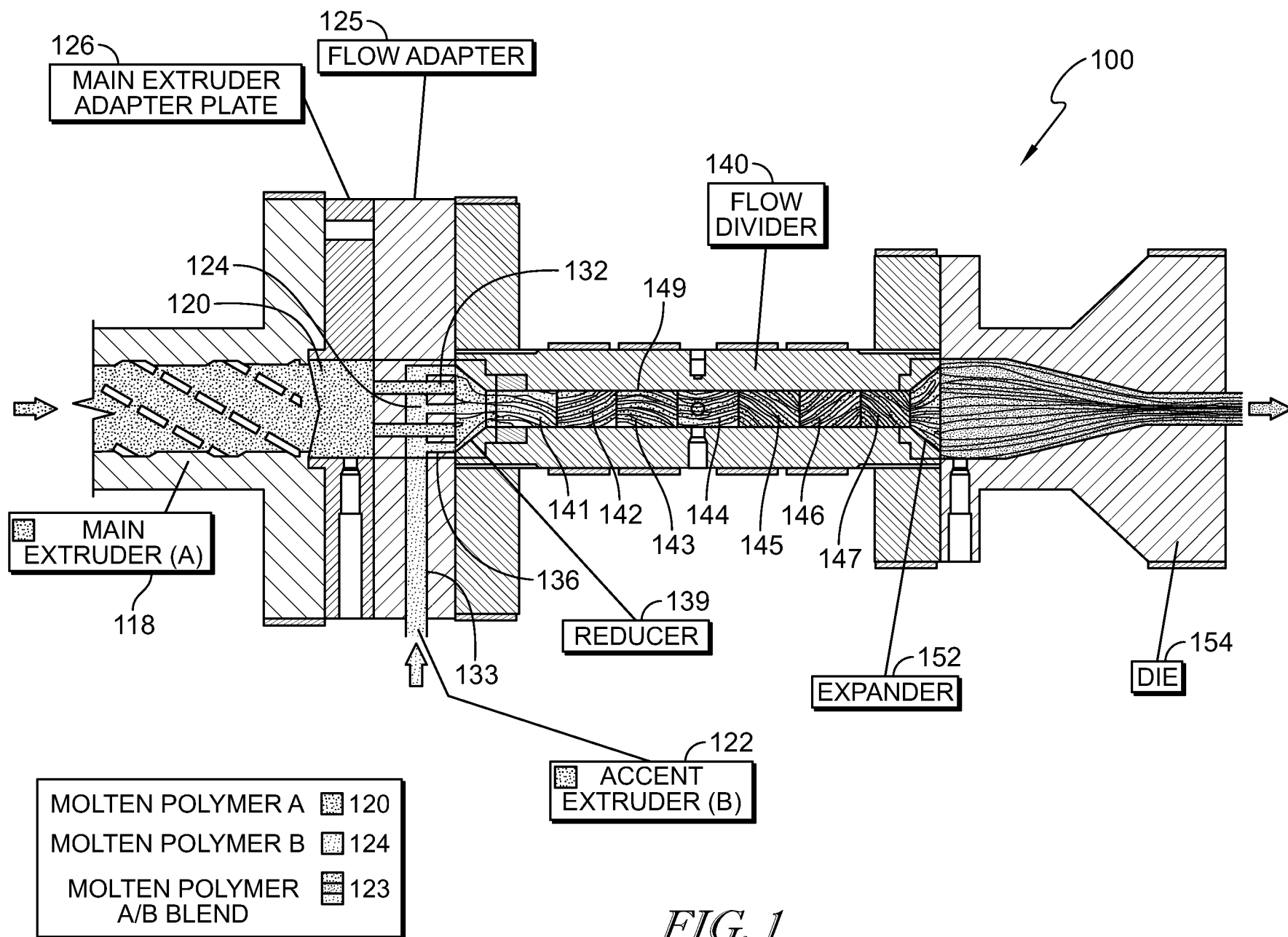


*FIG. 1*

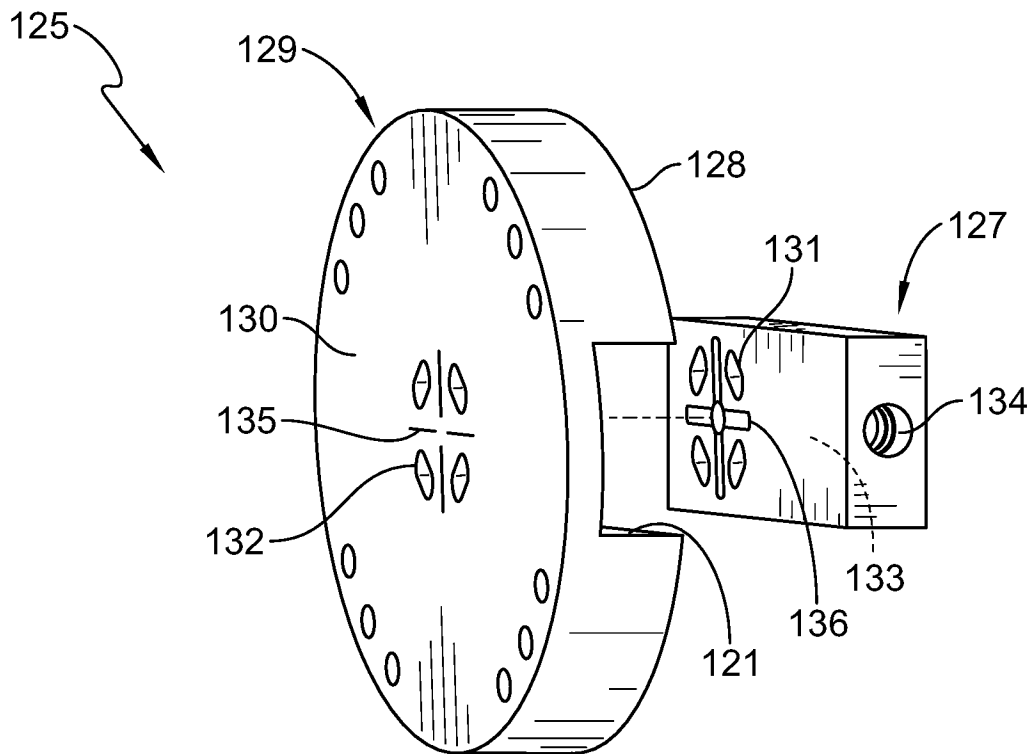


*FIG. 2*

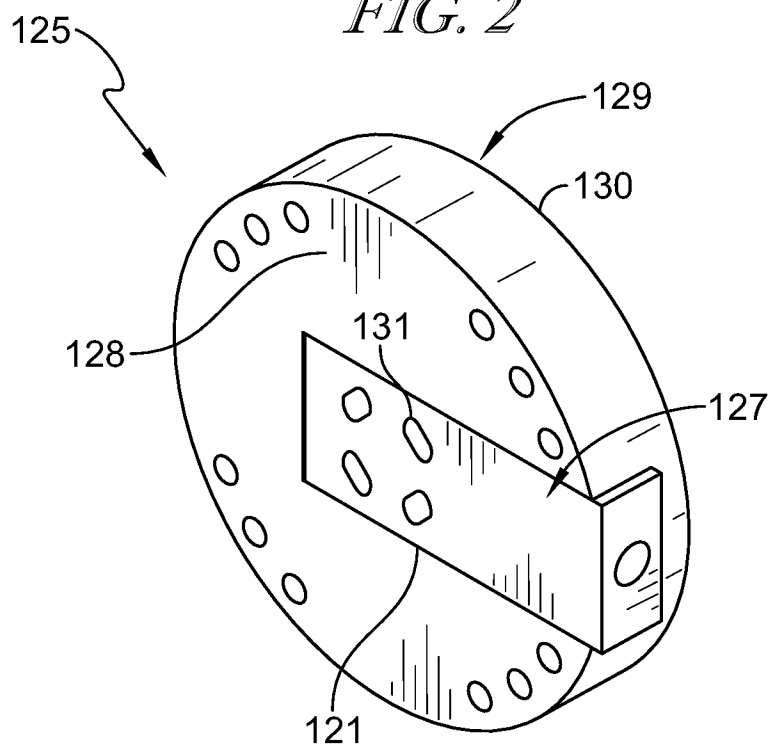


*FIG. 3*

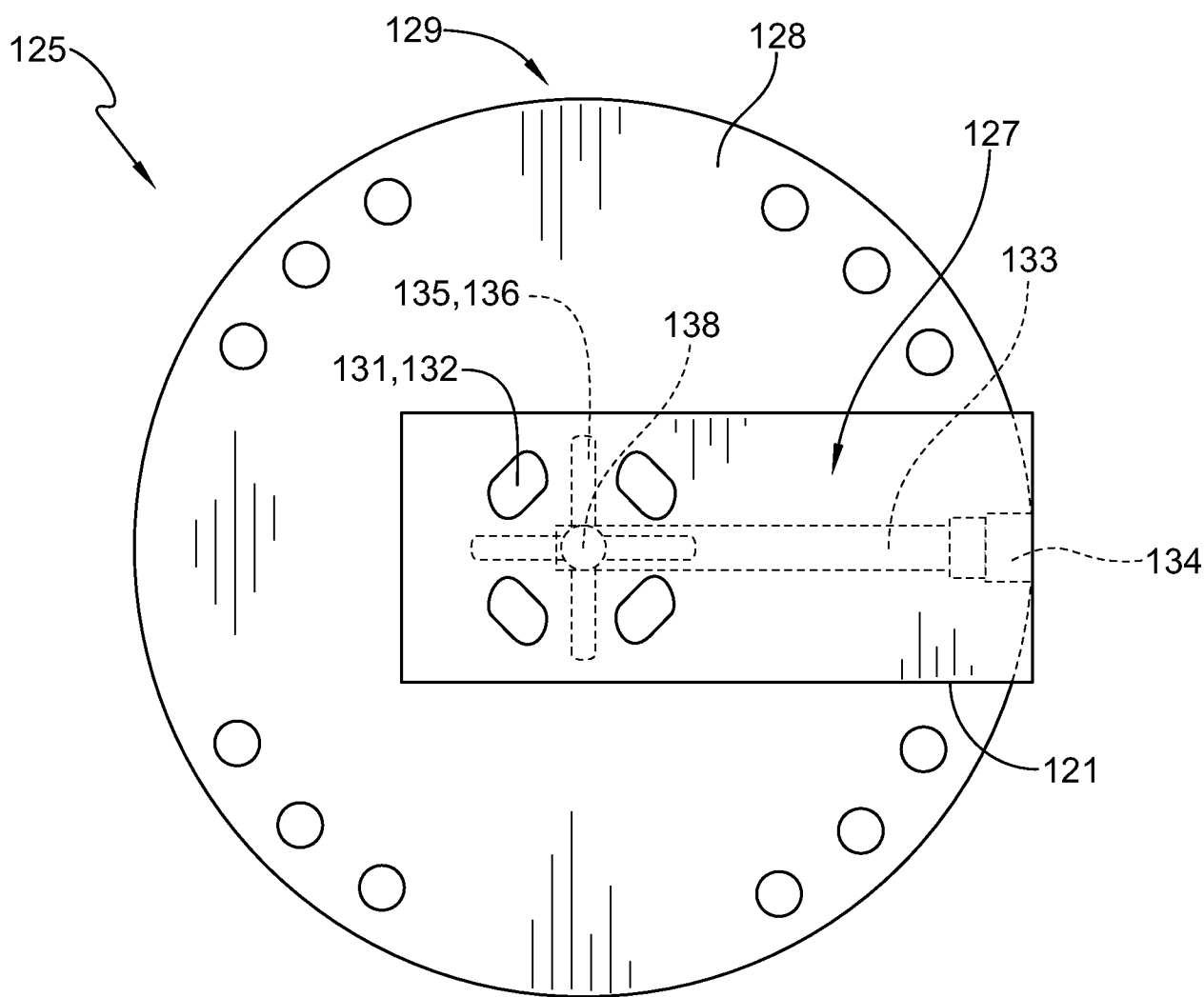
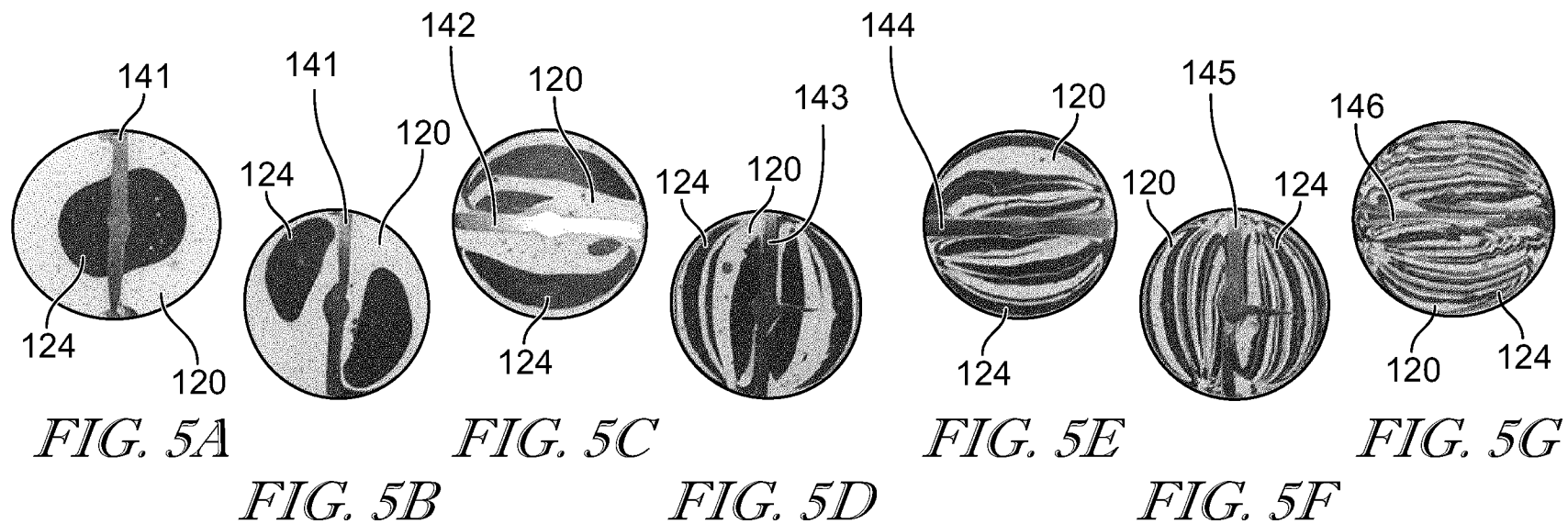
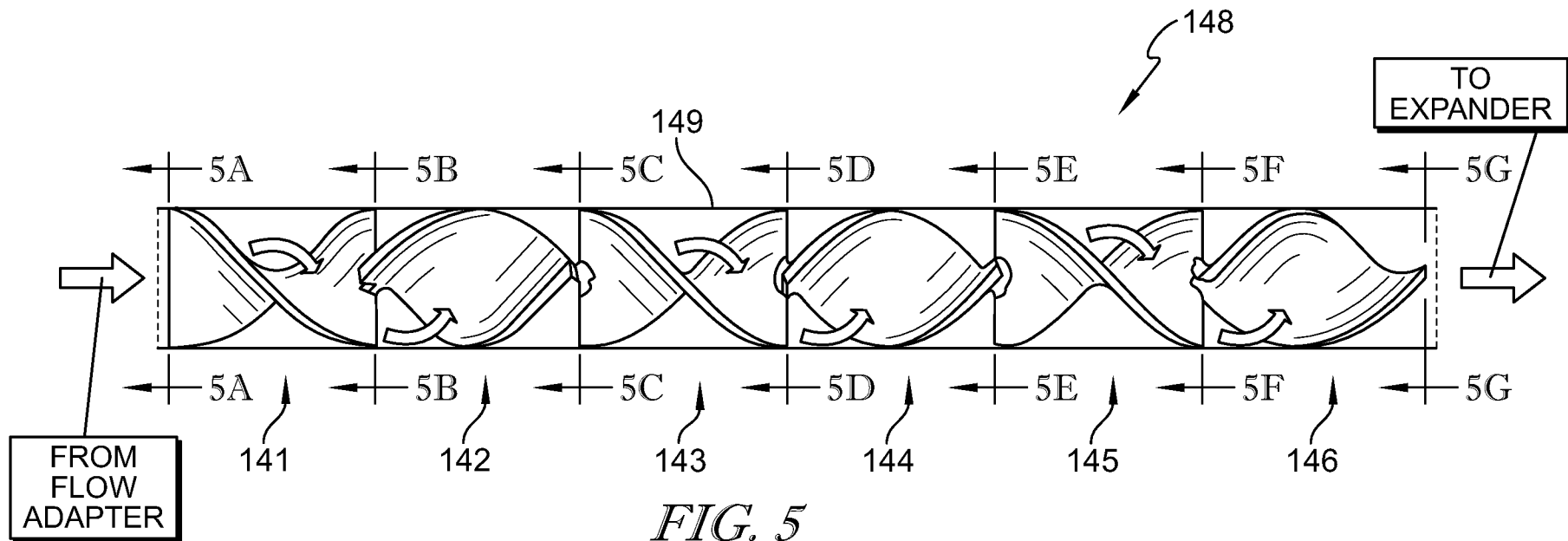


*FIG. 4*



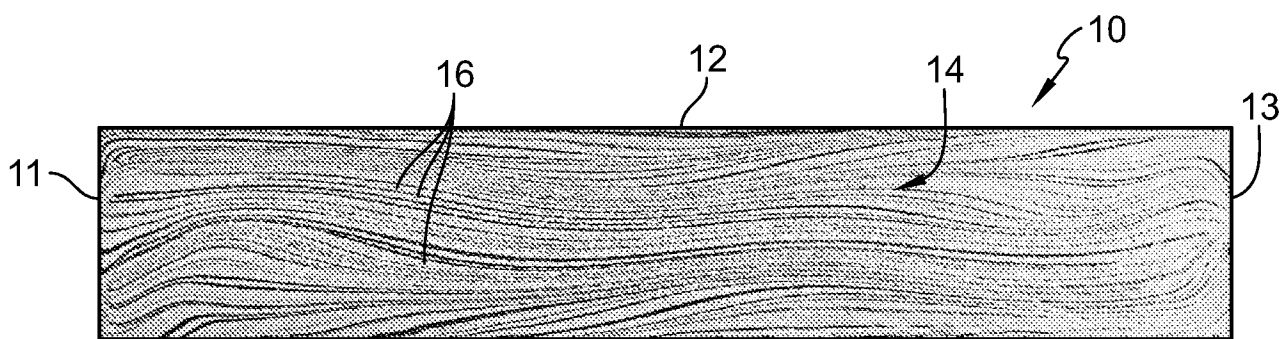


*FIG. 6*

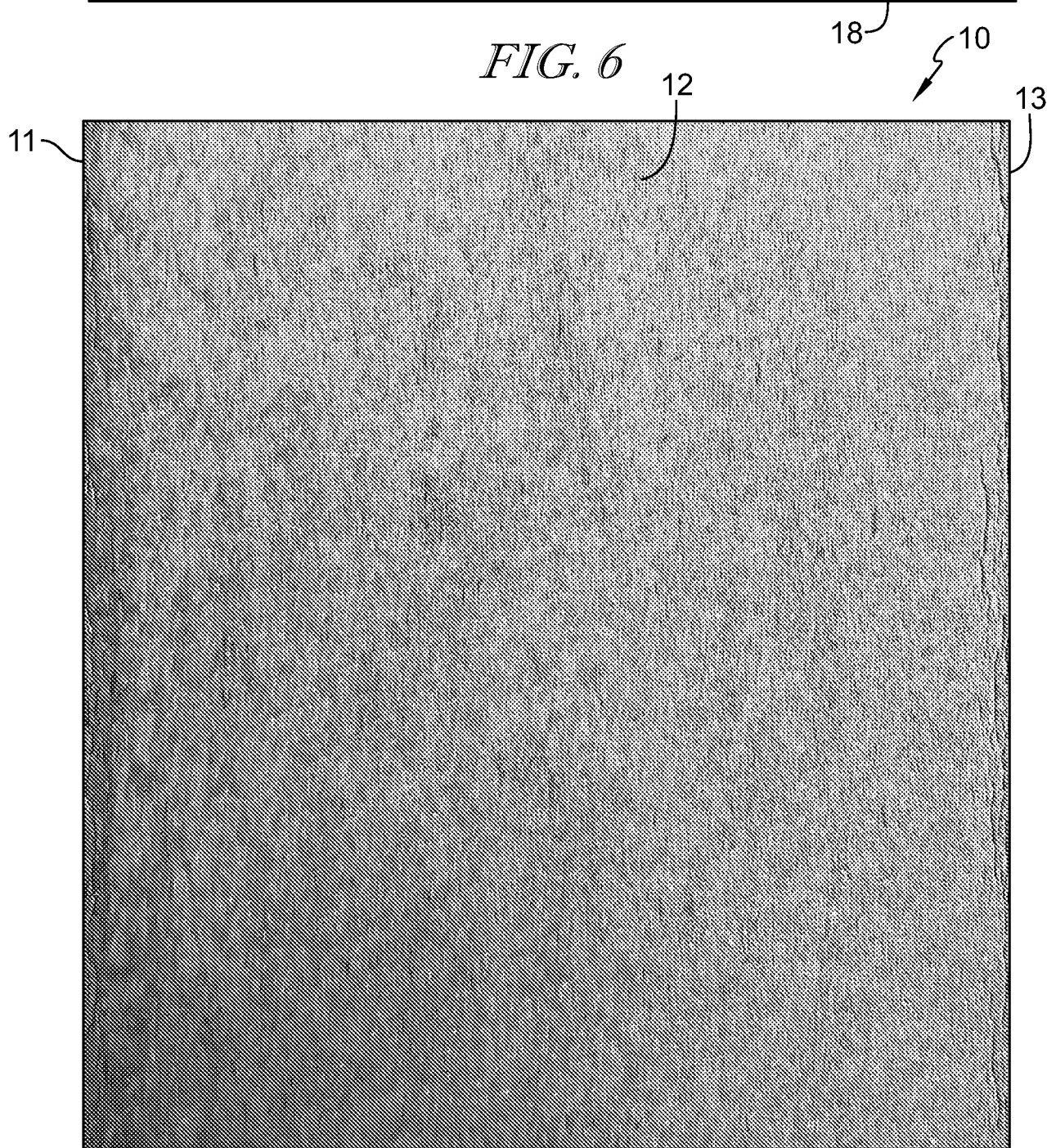


*FIG. 7*

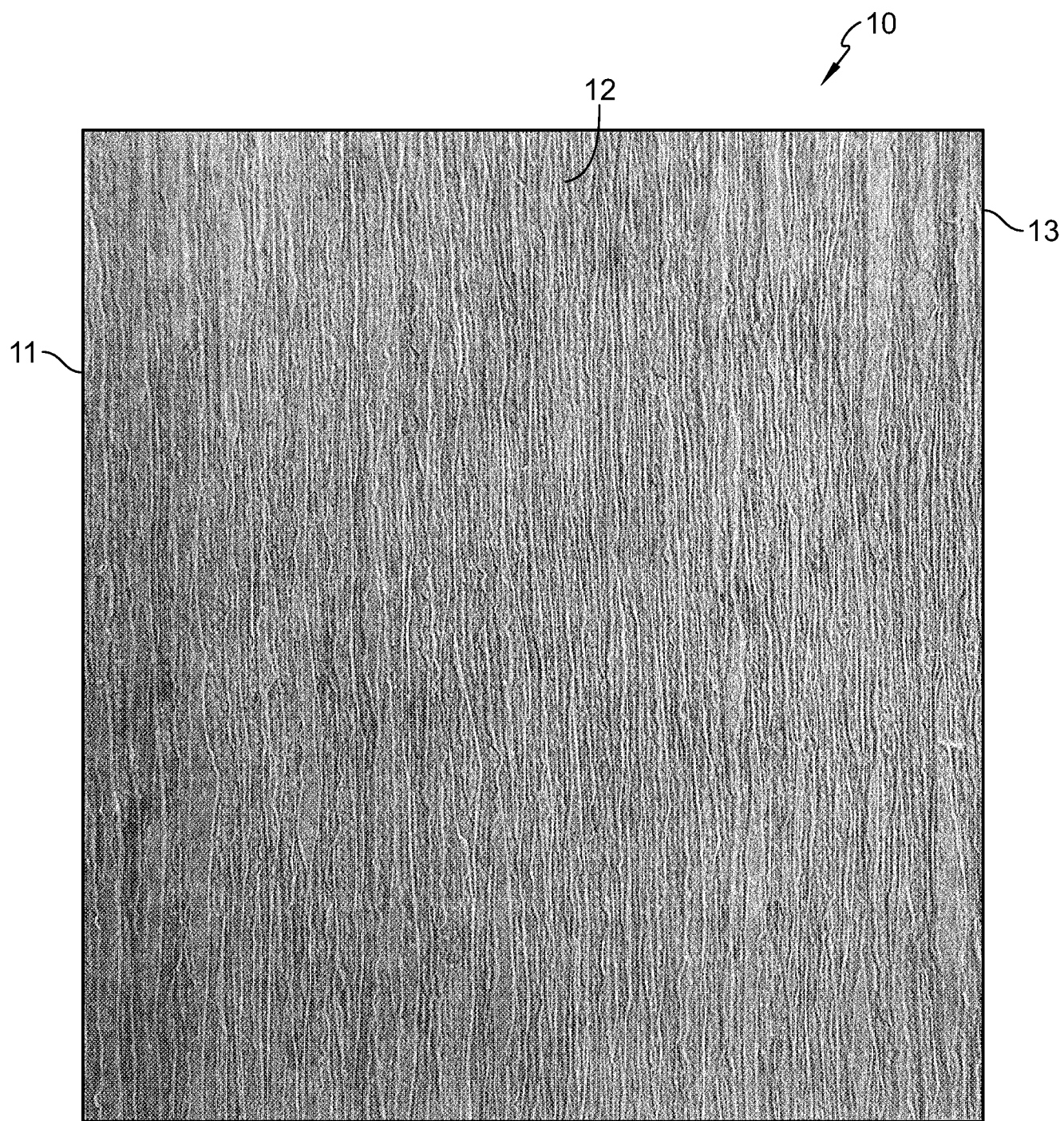


*FIG. 8*

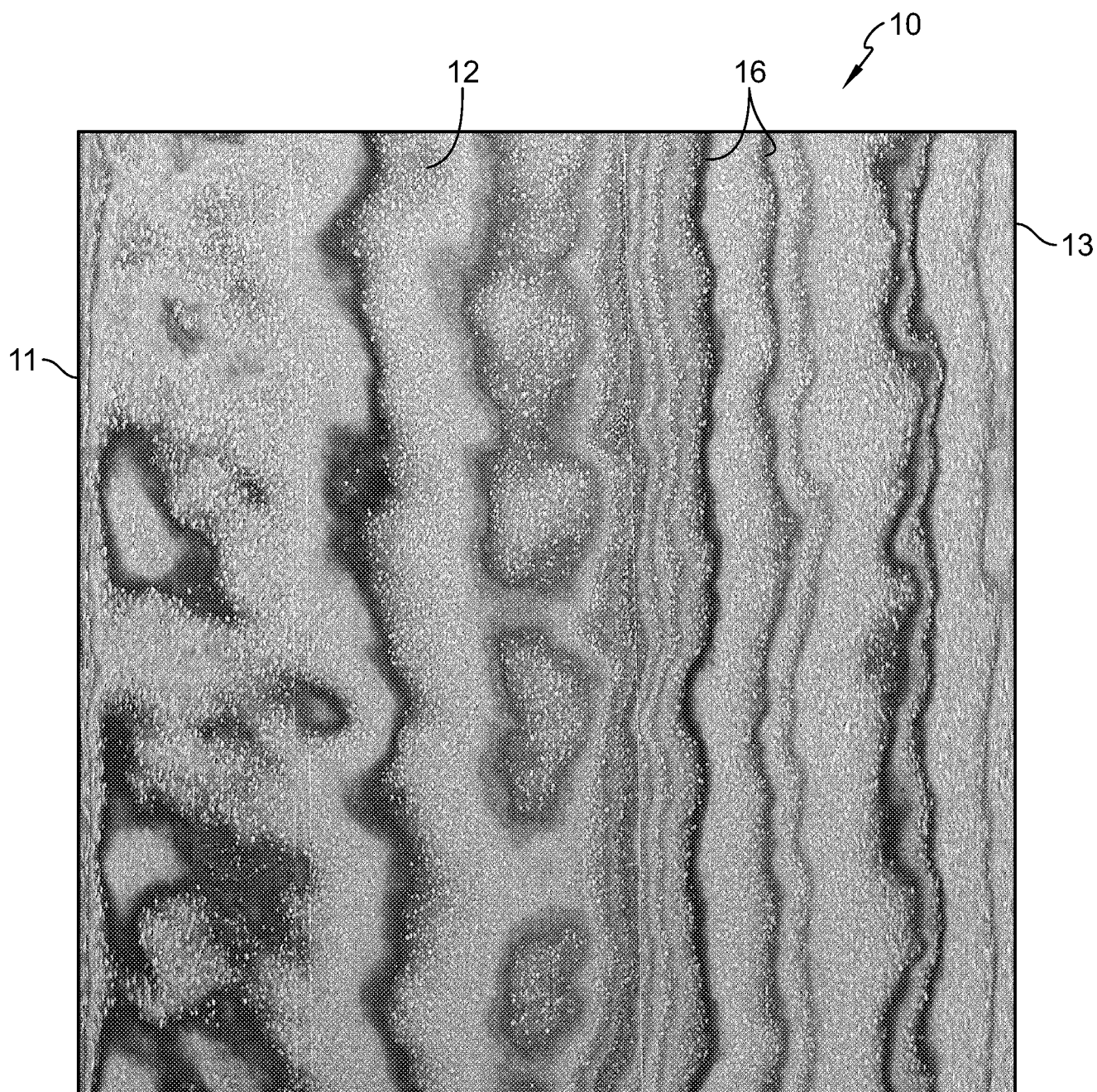


*FIG. 9*

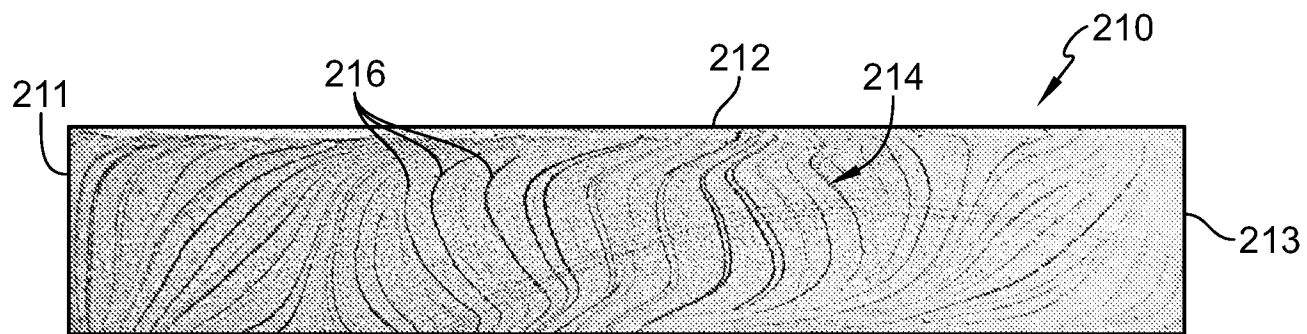


*FIG. 10*

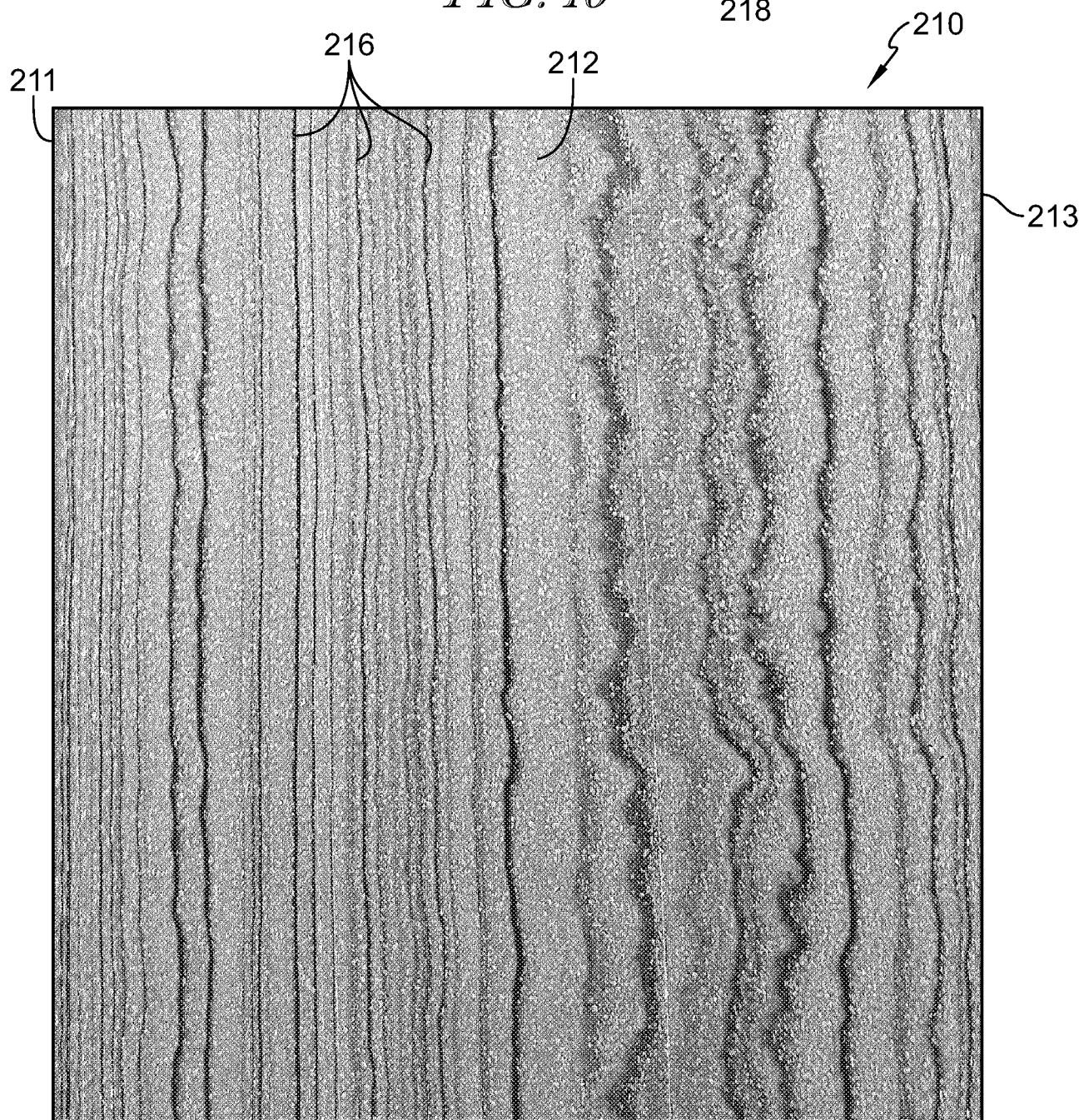


*FIG. 11*

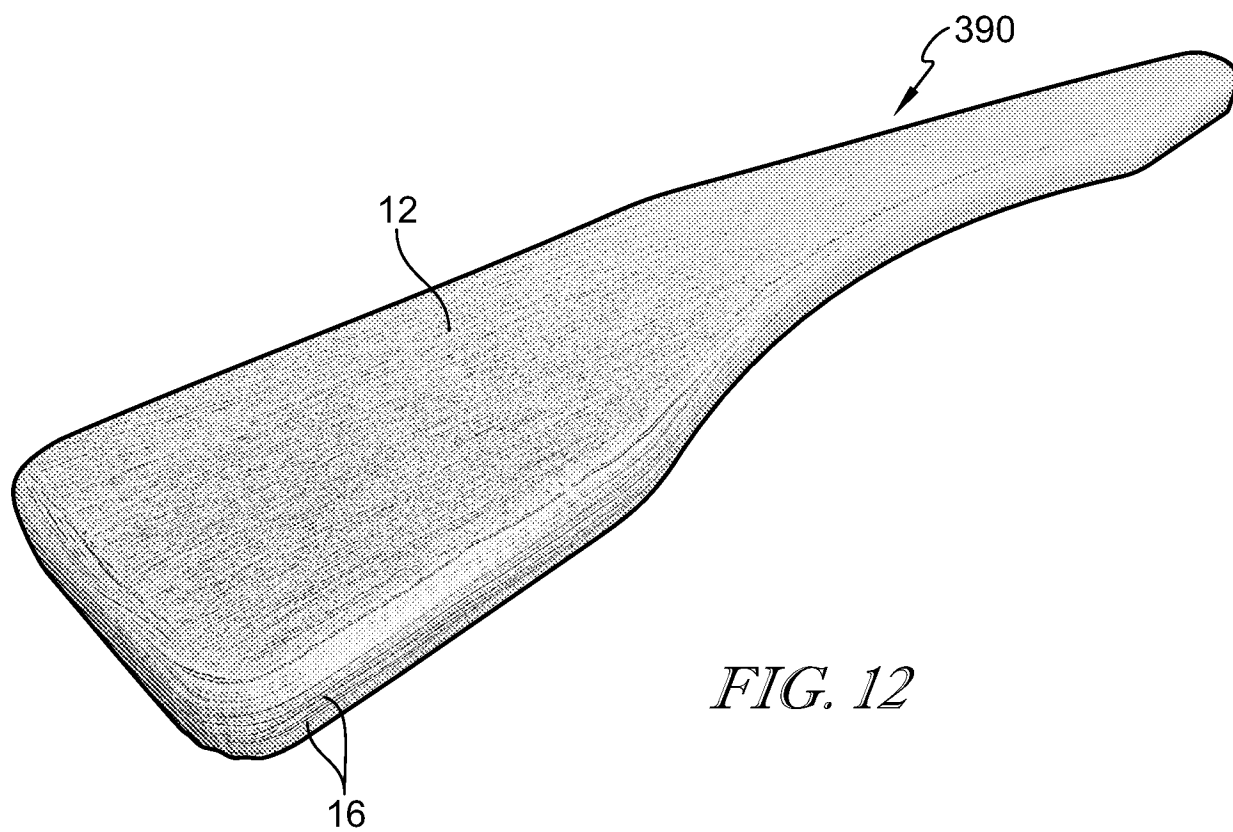


*FIG. 12*

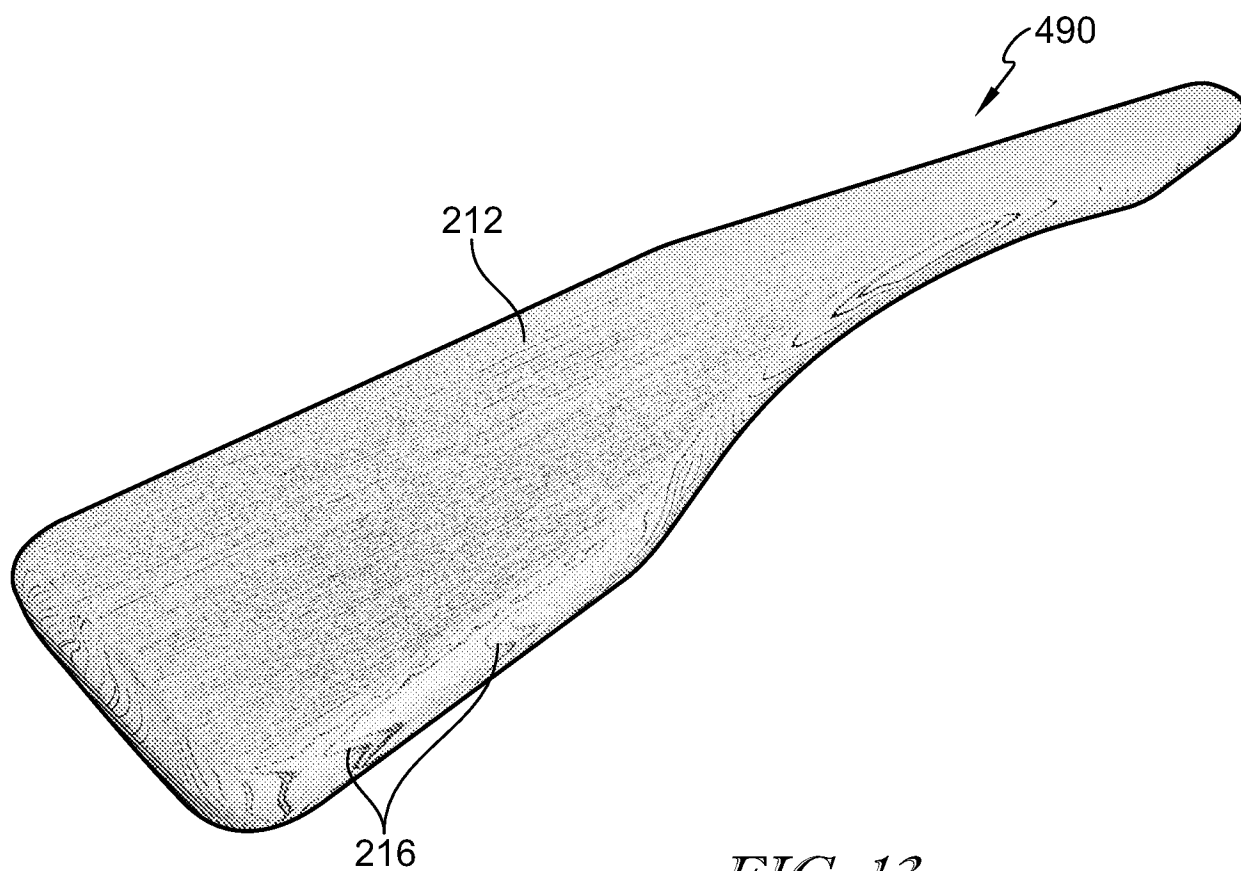
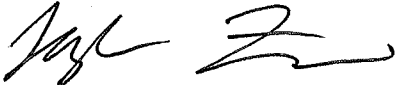


*FIG. 13*

|                                                                       |                        |                                |                 |
|-----------------------------------------------------------------------|------------------------|--------------------------------|-----------------|
| <b>NONPUBLICATION REQUEST<br/>UNDER<br/>35 U.S.C. 122(b)(2)(B)(i)</b> | First Named Inventor   |                                | Andrew Stephens |
|                                                                       | Title                  | WOOD-GRAINED POLYMER SUBSTRATE |                 |
|                                                                       | Attorney Docket Number |                                | 64844-256633    |

I hereby certify that the invention disclosed in the attached application **has not and will not be** the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

I hereby request that the attached application not be published under 35 U.S.C. 122(b).

|                                                                                                         |                                                      |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <br>_____<br>Signature | <u>8/29/16</u><br>_____<br>Date                      |
| Kyle A. Forgue<br>_____<br>Typed or printed name                                                        | 71457<br>_____<br>Registration Number, if applicable |
| 312-357-1313<br>_____<br>Telephone Number                                                               |                                                      |

This request must be signed in compliance with 37 CFR 1.33(b) and submitted with the application **upon filing**.

Applicant may rescind this nonpublication request at any time. If applicant rescinds a request that an application not be published under 35 U.S.C. 122(b), the application will be scheduled for publication at eighteen months from the earliest claimed filing date for which a benefit is claimed.

If applicant subsequently files an application directed to the invention disclosed in the attached application in another country, or under a multilateral international agreement, that requires publication of applications eighteen months after filing, the applicant **must** notify the United States Patent and Trademark Office of such filing within forty-five (45) days after the date of the filing of such foreign or international application. **Failure to do so will result in abandonment of this application (35 U.S.C. 122(b)(2)(B)(iii)).**

This collection of information is required by 37 CFR 1.213(a). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

## Electronic Patent Application Fee Transmittal

|                                                    |                                |                 |               |                             |
|----------------------------------------------------|--------------------------------|-----------------|---------------|-----------------------------|
| <b>Application Number:</b>                         |                                |                 |               |                             |
| <b>Filing Date:</b>                                |                                |                 |               |                             |
| <b>Title of Invention:</b>                         | WOOD-GRAINED POLYMER SUBSTRATE |                 |               |                             |
| <b>First Named Inventor/Applicant Name:</b>        | Andrew Stephens                |                 |               |                             |
| <b>Filer:</b>                                      | Kyle A. Forgue/Mark Sweetin    |                 |               |                             |
| <b>Attorney Docket Number:</b>                     | 64844-256633                   |                 |               |                             |
| Filed as Small Entity                              |                                |                 |               |                             |
| <b>Filing Fees for Utility under 35 USC 111(a)</b> |                                |                 |               |                             |
| <b>Description</b>                                 | <b>Fee Code</b>                | <b>Quantity</b> | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                               |                                |                 |               |                             |
| Utility filing Fee (Electronic filing)             | 4011                           | 1               | 70            | 70                          |
| Utility Search Fee                                 | 2111                           | 1               | 300           | 300                         |
| Utility Examination Fee                            | 2311                           | 1               | 360           | 360                         |
| <b>Pages:</b>                                      |                                |                 |               |                             |
| <b>Claims:</b>                                     |                                |                 |               |                             |
| <b>Miscellaneous-Filing:</b>                       |                                |                 |               |                             |
| Late Filing Fee for Oath or Declaration            | 2051                           | 1               | 70            | 70                          |
| <b>Petition:</b>                                   |                                |                 |               |                             |
| RPI1004                                            |                                |                 |               |                             |

| Description                       | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|-----------------------------------|----------|----------|--------|----------------------|
| Patent-Appeals-and-Interference:  |          |          |        |                      |
| Post-Allowance-and-Post-Issuance: |          |          |        |                      |
| Extension-of-Time:                |          |          |        |                      |
| Miscellaneous:                    |          |          |        |                      |
| Total in USD (\$)                 |          |          |        | 800                  |

## Electronic Acknowledgement Receipt

|                                             |                                |
|---------------------------------------------|--------------------------------|
| <b>EFS ID:</b>                              | 26737836                       |
| <b>Application Number:</b>                  | 15245948                       |
| <b>International Application Number:</b>    |                                |
| <b>Confirmation Number:</b>                 | 1690                           |
| <b>Title of Invention:</b>                  | WOOD-GRAINED POLYMER SUBSTRATE |
| <b>First Named Inventor/Applicant Name:</b> | Andrew Stephens                |
| <b>Customer Number:</b>                     | 23644                          |
| <b>Filer:</b>                               | Kyle A. Forgue/Mark Sweetin    |
| <b>Filer Authorized By:</b>                 | Kyle A. Forgue                 |
| <b>Attorney Docket Number:</b>              | 64844-256633                   |
| <b>Receipt Date:</b>                        | 24-AUG-2016                    |
| <b>Filing Date:</b>                         |                                |
| <b>Time Stamp:</b>                          | 16:18:37                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)    |

### Payment information:

|                                          |                 |
|------------------------------------------|-----------------|
| Submitted with Payment                   | yes             |
| Payment Type                             | Deposit Account |
| Payment was successfully received in RAM | \$800           |
| RAM confirmation Number                  | 2936            |
| Deposit Account                          | 120913          |
| Authorized User                          | FORGUE, KYLE    |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees) **RPI1004**

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

## File Listing:

| Document Number | Document Description                                | File Name                 | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|-----------------------------------------------------|---------------------------|------------------------------------------|------------------|------------------|
| 1               | Application Data Sheet                              | 256633_aiaADS.pdf         | 1822950                                  | no               | 9                |
|                 |                                                     |                           | affcb062887ba576c10fcfeb64848af50ad6b407 |                  |                  |
| Warnings:       |                                                     |                           |                                          |                  |                  |
| Information:    |                                                     |                           |                                          |                  |                  |
| 2               |                                                     | 256633_Application.pdf    | 72340                                    | yes              | 18               |
|                 |                                                     |                           | 6e78b8e7fa21c1ba85e3cf94bfbf559d59d9169d |                  |                  |
|                 | Multipart Description/PDF files in .zip description |                           |                                          |                  |                  |
|                 | Document Description                                |                           | Start                                    | End              |                  |
|                 | Specification                                       |                           | 1                                        | 13               |                  |
|                 | Claims                                              |                           | 14                                       | 17               |                  |
|                 | Abstract                                            |                           | 18                                       | 18               |                  |
| Warnings:       |                                                     |                           |                                          |                  |                  |
| Information:    |                                                     |                           |                                          |                  |                  |
| 3               | Drawings-other than black and white line drawings   | 256633_Drawings.pdf       | 4740507                                  | no               | 9                |
|                 |                                                     |                           | cffb56f468f6b93d0bc461cd089174db3dae612  |                  |                  |
| Warnings:       |                                                     |                           |                                          |                  |                  |
| Information:    |                                                     |                           |                                          |                  |                  |
| 4               | Nonpublication request from applicant               | 256633_NonPub_Request.pdf | 70007                                    | no               | 1                |
|                 |                                                     |                           | 9f3407be9ee04b7b673f08697d2f3d65c4a8130d |                  |                  |
| Warnings:       |                                                     |                           |                                          |                  |                  |
| Information:    |                                                     |                           |                                          |                  |                  |
| 5               | Fee Worksheet (SB06)                                | fee-info.pdf              | 37163                                    | no               | 2                |
|                 |                                                     |                           | 06d7f78fcf3b3b3da69d540405f74e9132db8299 |                  |                  |

RPI1004

**RPI1004**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |         |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 6742967 |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p> |         |



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| APPLICATION<br>NUMBER | FILING or<br>371(c) DATE | GRP ART<br>UNIT | FIL FEE REC'D | ATTY. DOCKET NO | TOT CLAIMS | IND CLAIMS |
|-----------------------|--------------------------|-----------------|---------------|-----------------|------------|------------|
| 15/245,948            | 08/24/2016               | 1715            | 800           | 64844-256633    | 16         | 3          |

CONFIRMATION NO. 1690

FILING RECEIPT

23644

Barnes & Thornburg LLP (CH)

P.O. Box 2786

Chicago, IL 60690-2786



0000000083584547

Date Mailed: 09/07/2016

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Andrew Stephens, Aurora, IL;  
Francisco Morales, Plano, IL;  
Tadeusz Rybka, Streamwood, IL;

**Applicant(s)**

TANGENT TECHNOLOGIES LLC, Aurora, IL

**Power of Attorney:** None

**Domestic Priority data as claimed by applicant**

This appln claims benefit of 62/208,928 08/24/2015

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**Permission to Access Application via Priority Document Exchange:** Yes

**Permission to Access Search Results:** Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

**If Required, Foreign Filing License Granted:** 09/02/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/245,948**

**Projected Publication Date:** Request for Non-Publication Acknowledged

**Non-Publication Request:** Yes

**Early Publication Request:** No

**\*\* SMALL ENTITY \*\***

**Title**

WOOD-GRAINED POLYMER SUBSTRATE

**Preliminary Class**

427

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## **PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 15/245,948         | 08/24/2016            | Andrew Stephens       | 64844-256633           |

**CONFIRMATION NO. 1690**

**INFORMAL NOTICE**



23644  
Barnes & Thornburg LLP (CH)  
P.O. Box 2786  
Chicago, IL 60690-2786

Date Mailed: 09/07/2016

**INFORMATIONAL NOTICE TO APPLICANT**

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):  
Andrew Stephens  
Francisco Morales  
Tadeusz Rybka

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/lvongxay/

| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |                    |              |                    | Application or Docket Number<br>15/245,948 |          |                               |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------|--------------|--------------------|--------------------------------------------|----------|-------------------------------|--|
| <b>APPLICATION AS FILED - PART I</b>                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                               |                                    |                    |              |                    |                                            |          |                               |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |                    | SMALL ENTITY |                    | OR<br>OTHER THAN SMALL ENTITY              |          |                               |  |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                        | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE(\$)           | FEE(\$)      |                    | RATE(\$)                                   | FEE(\$)  |                               |  |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                                                                           | N/A                                | N/A                | 70           |                    | N/A                                        |          |                               |  |
| SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                                                                                                                                                                                                                                                                                                                                | N/A                                                                                                                                                                                                                           | N/A                                | N/A                | 300          |                    | N/A                                        |          |                               |  |
| EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                                           | N/A                                                                                                                                                                                                                           | N/A                                | N/A                | 360          |                    | N/A                                        |          |                               |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                                           | 16                                                                                                                                                                                                                            | minus 20 = *                       | x 40 =             | 0.00         | OR                 |                                            |          |                               |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                             | minus 3 = *                        | x 210 =            | 0.00         |                    |                                            |          |                               |  |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                   | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |                    | 0.00         |                    |                                            |          |                               |  |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |                    | 0.00         |                    |                                            |          |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    | TOTAL              | 730          |                    | TOTAL                                      |          |                               |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               |                                    |                    |              |                    |                                            |          |                               |  |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                    |                    |              |                    |                                            |          |                               |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |                    | (Column 3)   |                    | SMALL ENTITY                               |          | OR<br>OTHER THAN SMALL ENTITY |  |
| AMENDMENT A                                                                                                                                                                                                                                                                                                                                                                                                | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA      | RATE(\$)     | ADDITIONAL FEE(\$) |                                            | RATE(\$) | ADDITIONAL FEE(\$)            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                  | Minus **           | =            | x =                | OR                                         | x =      |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                  | Minus ***          | =            | x =                | OR                                         | x =      |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                    |                    |              |                    | OR                                         |          |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                    |                    |              |                    | OR                                         |          |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    | TOTAL<br>ADD'L FEE |              | OR                 | TOTAL<br>ADD'L FEE                         |          |                               |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |                    | (Column 3)   |                    | SMALL ENTITY                               |          | OR<br>OTHER THAN SMALL ENTITY |  |
| AMENDMENT B                                                                                                                                                                                                                                                                                                                                                                                                | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA      | RATE(\$)     | ADDITIONAL FEE(\$) |                                            | RATE(\$) | ADDITIONAL FEE(\$)            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                  | Minus **           | =            | x =                | OR                                         | x =      |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                  | Minus ***          | =            | x =                | OR                                         | x =      |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                    |                    |              |                    | OR                                         |          |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                    |                    |              |                    | OR                                         |          |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    | TOTAL<br>ADD'L FEE |              | OR                 | TOTAL<br>ADD'L FEE                         |          |                               |  |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.<br>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".<br>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".<br>The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1. |                                                                                                                                                                                                                               |                                    |                    |              |                    |                                            |          |                               |  |

## PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1  
 Stylesheet Version v1.2

EPAS ID: PAT4231436

|                                                                                                                                                                                                 |                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>SUBMISSION TYPE:</b>                                                                                                                                                                         | NEW ASSIGNMENT                  |
| <b>NATURE OF CONVEYANCE:</b>                                                                                                                                                                    | ASSIGNMENT                      |
| <b>CONVEYING PARTY DATA</b>                                                                                                                                                                     |                                 |
| <b>Name</b>                                                                                                                                                                                     | <b>Execution Date</b>           |
| ANDREW STEPHENS                                                                                                                                                                                 | 10/17/2016                      |
| FRANCISCO MORALES                                                                                                                                                                               | 10/18/2016                      |
| TADEUSZ RYBKA                                                                                                                                                                                   | 10/21/2016                      |
| <b>RECEIVING PARTY DATA</b>                                                                                                                                                                     |                                 |
| <b>Name:</b>                                                                                                                                                                                    | TANGENT TECHNOLOGIES LLC        |
| <b>Street Address:</b>                                                                                                                                                                          | 1001 SULLIVAN ROAD              |
| <b>City:</b>                                                                                                                                                                                    | AURORA                          |
| <b>State/Country:</b>                                                                                                                                                                           | ILLINOIS                        |
| <b>Postal Code:</b>                                                                                                                                                                             | 60506                           |
| <b>PROPERTY NUMBERS Total: 1</b>                                                                                                                                                                |                                 |
| <b>Property Type</b>                                                                                                                                                                            | <b>Number</b>                   |
| <b>Application Number:</b>                                                                                                                                                                      | 15245948                        |
| <b>CORRESPONDENCE DATA</b>                                                                                                                                                                      |                                 |
| <b>Fax Number:</b>                                                                                                                                                                              | (312)759-5646                   |
| <i>Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.</i> |                                 |
| <b>Phone:</b>                                                                                                                                                                                   | 312-357-1313                    |
| <b>Email:</b>                                                                                                                                                                                   | msweetin@btlaw.com              |
| <b>Correspondent Name:</b>                                                                                                                                                                      | MARK J. NAHNSEN                 |
| <b>Address Line 1:</b>                                                                                                                                                                          | BARNES & THORNBURG LLP          |
| <b>Address Line 2:</b>                                                                                                                                                                          | P.O. BOX 2786                   |
| <b>Address Line 4:</b>                                                                                                                                                                          | CHICAGO, ILLINOIS 60690-2786    |
| <b>ATTORNEY DOCKET NUMBER:</b>                                                                                                                                                                  | 64844-256633                    |
| <b>NAME OF SUBMITTER:</b>                                                                                                                                                                       | MARK J. NAHNSEN, REG. NO. 51093 |
| <b>SIGNATURE:</b>                                                                                                                                                                               | /Mark J. Nahnsen/               |
| <b>DATE SIGNED:</b>                                                                                                                                                                             | 01/18/2017                      |
| This document serves as an Oath/Declaration (37 CFR 1.63).                                                                                                                                      |                                 |
| <b>Total Attachments: 3</b>                                                                                                                                                                     |                                 |
| source=256633_Declaration-Assignment#page1.tif                                                                                                                                                  |                                 |
| source=256633_Declaration-Assignment#page2.tif                                                                                                                                                  |                                 |

RPI1004



This document is being submitted for dual purposes

Attorney Docket No. 64844-256633

**COMBINED DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING  
AN APPLICATION DATA SHEET (37 CFR 1.76) AND ASSIGNMENT FOR SINGLE ASSIGNEE**

Title of  
Invention

**WOOD-GRAINED POLYMER SUBSTRATE**

As the below-named inventor, I hereby declare that:

This declaration is directed to:

- ☐ the attached application, or  
☒ United States Application or PCT International Application No. 15/245948,  
 filed on August 24, 2016.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in this application.

WHEREAS, TANGENT TECHNOLOGIES LLC,

a corporation (hereinafter referred to as "ASSIGNEE") having a place of business at  
1001 Sullivan Road, Aurora, IL 60506,

is desirous of acquiring the entire right, title, and interest in and to the above-referenced application and any inventions disclosed therein ("the INVENTION") and in and to any Letters Patent that may be granted therefrom in the United States and its territorial possessions and in any and all foreign countries;

NOW, THEREFORE, for good and valuable consideration, the sufficiency of which is acknowledged, I hereby sell, assign, and set over to ASSIGNEE, the full and exclusive right to the invention in the United States and its territorial possessions and in all foreign countries (including the right to claim priority under the terms of the International Convention and other relevant International Treaties and Arrangements from the application) and the entire right, title, and interest in and to any and all Letters Patent which may be granted therefrom in the United States and its territorial possessions and in any and all foreign countries and in and to any and all divisions, reissues, continuations, substitutions, and renewals thereof.

I hereby authorize and request the Patent Office officials in the United States and its territorial possessions and any and all foreign countries to issue any and all of said Letters Patent, when granted, to ASSIGNEE as the assignee of my entire right, title, and interest in and to the same, for the sole use and benefit of ASSIGNEE, its successors and assigns, to the full end of the term for which said Letters Patent may be granted, as fully and entirely as the same would have been held by me had this assignment and sale not been made and hereby covenants that I have full right to convey the interest herein assigned, and that the undersigned has not executed, and will not execute, any agreement in conflict herewith.

Further, I agree that I will communicate to ASSIGNEE or its representatives any facts known to me respecting the INVENTION and will testify in any legal proceeding, cooperate in every way possible in obtaining evidence, sign all lawful papers, execute all divisional, continuation, substitute, renewal, and reissue applications, execute all necessary assignment papers to cause any and all of the Letters Patent to be issued to ASSIGNEE, make all rightful oaths, and generally do everything possible to aid ASSIGNEE, its successors and assigns, to obtain and enforce proper protection for the INVENTION in the United States and its territorial possessions and in any and all foreign countries.

I hereby grant the attorney of record the power to insert on this assignment any further identification which may be necessary or desirable in order to comply with the rules of the United States Patent and Trademark Office for recordation of this assignment.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

LEGAL NAME OF INVENTOR: Andrew STEPHENS

Signature: \_\_\_\_\_

Date: 10/17/16

RPI1004

This document is being submitted for dual purposes

Attorney Docket No. 64844-256633

**COMBINED DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING  
AN APPLICATION DATA SHEET (37 CFR 1.76) AND ASSIGNMENT FOR SINGLE ASSIGNEE**

|                               |                                       |
|-------------------------------|---------------------------------------|
| <b>Title of<br/>Invention</b> | <b>WOOD-GRAINED POLYMER SUBSTRATE</b> |
|-------------------------------|---------------------------------------|

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 Arrangements from the application) and the entire right, title, and interest in and to any and all Letters Patent which may be granted  
 therefrom in the United States and its territorial possessions and in any and all foreign countries and in and to any and all divisions,  
 reissues, continuations, substitutions, and renewals thereof.

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 to issue any and all of said Letters Patent, when granted, to ASSIGNEE as the assignee of my entire right, title, and interest in and to the  
 same, for the sole use and benefit of ASSIGNEE, its successors and assigns, to the full end of the term for which said Letters Patent may be  
 granted, as fully and entirely as the same would have been held by me had this assignment and sale not been made and hereby covenants  
 that I have full right to convey the interest herein assigned, and that the undersigned has not executed, and will not execute, any agreement  
 in conflict herewith.

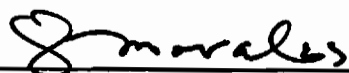
Further, I agree that I will communicate to ASSIGNEE or its representatives any facts known to me respecting the INVENTION and will  
 testify in any legal proceeding, cooperate in every way possible in obtaining evidence, sign all lawful papers, execute all divisional,  
 continuation, substitute, renewal, and reissue applications, execute all necessary assignment papers to cause any and all of the Letters  
 Patent to be issued to ASSIGNEE, make all rightful oaths, and generally do everything possible to aid ASSIGNEE, its successors and  
 assigns, to obtain and enforce proper protection for the INVENTION in the United States and its territorial possessions and in any and all  
 foreign countries.

I hereby grant the attorney of record the power to insert on this assignment any further identification which may be necessary or desirable  
 in order to comply with the rules of the United States Patent and Trademark Office for recordation of this assignment.

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 of not more than five (5) years, or both.

**LEGAL NAME OF INVENTOR: Francisco MORALES**

Signature: \_\_\_\_\_

Date: 10-18-2016

RPI1004

This document is being submitted for dual purposes

Attorney Docket No. 64844-256633

**COMBINED DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING  
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I believe that I am the original inventor or an original joint inventor of a claimed invention in this application.

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I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

**LEGAL NAME OF INVENTOR: Tadeusz RYBKA**

Signature: \_\_\_\_\_



Date: \_\_\_\_\_

10/21/2016



# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

**Complete if Known**

|                         |                  |
|-------------------------|------------------|
| Application Number:     | 15/245948        |
| Filing Date:            | August 24, 2016  |
| First Named Inventor:   | STEPHENS, Andrew |
| Group Art Unit:         | 1783             |
| Confirmation Number:    | 1690             |
| Examiner Name:          | Unassigned       |
| Attorney Docket Number: | 64844-256633     |

**U.S. PATENT DOCUMENTS**

| Examiner<br>Initials | U.S. Patent Document |                                 |           | Name of Patentee or Applicant | Date of Publication | Filing Date If<br>Appropriate |
|----------------------|----------------------|---------------------------------|-----------|-------------------------------|---------------------|-------------------------------|
|                      | Doc.<br>No.          | Application or<br>Patent Number | Kind Code |                               |                     |                               |
|                      | A A                  | 4280950                         |           | Nagata et al.                 | Jul. 28, 1981       |                               |
|                      | A B                  | 5126088                         |           | Andres                        | Jun. 30, 1992       |                               |
|                      | A C                  | 5866639                         |           | Dorchester et al.             | Feb. 2, 1999        |                               |
|                      | A D                  | 6083601                         |           | Prince et al.                 | Jul. 4, 2000        |                               |
|                      | A E                  | 6596784                         |           | King                          | Jul. 22, 2003       |                               |
|                      | A F                  | 7866758                         |           | Jang                          | Jan. 11, 2011       |                               |
|                      | A G                  | 2004/0038002                    |           | Franco et al.                 | Feb. 26, 2004       |                               |
|                      | A H                  | 2007/0104930                    |           | Grohman                       | May 10, 2007        |                               |
|                      | A I                  | 2008/0299351                    |           | Buchholtz et al.              | Dec. 4, 2008        |                               |
|                      | A J                  | 2011/0151193                    |           | Cantley et al.                | Jun. 23, 2011       |                               |
|                      | A K                  | 2011/0177291                    |           | Sudano et al.                 | Jul. 21, 2011       |                               |
|                      | A L                  | 2013/0224437                    |           | Park et al.                   | Aug. 29, 2013       |                               |

**FOREIGN PATENT DOCUMENTS**

| Examiner<br>Initials | Doc.<br>No. | Foreign Patent Document |                                 |              | Name of Patentee or Applicant | Date of Publication | Translation |      |
|----------------------|-------------|-------------------------|---------------------------------|--------------|-------------------------------|---------------------|-------------|------|
|                      |             | Office                  | Application or<br>Patent Number | Kind<br>Code |                               |                     | Yes         | No** |
|                      | A M         | DE                      | 1963161                         |              | Farbwerke Hoechst AG          | Jun. 24, 1971       |             | X+   |
|                      | A N         | FR                      | 2738768                         |              | Peytral                       | Dec. 3, 1999        |             | X+   |
|                      | A O         | JP                      | JPH07-214631                    |              | Echo Chem KK                  | Aug. 15, 1995       |             | X+   |
|                      |             |                         |                                 |              |                               |                     |             |      |
|                      |             |                         |                                 |              |                               |                     |             |      |

**OTHER - NON PATENT LITERATURE DOCUMENTS**

| Examiner<br>Initials | Doc.<br>No. | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number (s), publisher, city and/or country where published. | Translation |      |
|----------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|
|                      |             |                                                                                                                                                                                                                                                                  | Yes         | No** |
|                      | A P         | DeGroot, "Synthetic Decking Roundup," <i>Professional Deck Builder</i> 1-8 (2012).                                                                                                                                                                               |             |      |
|                      | A Q         | Koeplmayr et al., "Numerical and Experimental Modeling of a Multiflux Static Mixer for Continuous Extrusion of Layered Polymer Blends," <i>14th European Conference on Mixing, At Warsaw, Poland</i> , (September 2012).                                         |             |      |
|                      | A R         | Van der Hoeven et al., "Homogeneity of multilayers produced with a Static Mixer," <i>Polymer Engineering And Science</i> , 41(1): 1-18 (2001).                                                                                                                   |             |      |
|                      |             |                                                                                                                                                                                                                                                                  |             |      |
|                      |             |                                                                                                                                                                                                                                                                  |             |      |

EXAMINER

DATE CONSIDERED

\* A concise statement of relevance is being submitted in lieu of a translation. 37 CFR 1.98(a)(3).

+ An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or other document from a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of relevance under 37 CFR 1.98(a)(3).

RPT1004

**Espacenet****Bibliographic data: DE1963161 (A1) — 1971-06-24**

---

**Wood-grained plastics**

**Inventor(s):** JAUSS ERICH ± (JAUSS,ERICH)  
**Applicant(s):** HOECHST AG ± (FARBWERKE HOECHST AG)  
**Classification:** - international: **B29C45/16; B29C47/04**; (IPC1-7): B29F3/12  
- cooperative: **B29C45/1634; B29C47/046; B29C47/0009**  
**Application number:** DE19691963161 19691217  
**Priority number(s):** DE19691963161 19691217  
**Also published as:** DE1963161 (B2)

**Abstract of DE1963161 (A1)**

Wood-grained plastics, with the graining throughout the material, with an even graining, suitable for profiles, panels, hollow-ware or tubes are obtained by extruding together a powdered base material (pref. opt. pigmented PVC with = 20% (pref. ca 7%) of a granulated plastic (e.g. PVC or any other compatible polymer), which contains a much higher pigment content than the base and may also contain plasticiser. Powder/powder mixtures are not suitable and granule/granule mixtures require special equipment and do not give such good results.

(51)

BUNDESREPUBLIK DEUTSCHLAND

Int. Cl.:

B 29 f, 3/12

B 29 f, 1/00

DEUTSCHES PATENTAMT



(52)

Deutsche Kl.:

39 a4, 3/12

39 a4, 1/00

(10)

(11)

(21)

(22)

(43)

# Offenlegungsschrift 1 963 161

Aktenzeichen: P 19 63 161.0

Anmeldetag: 17. Dezember 1969Offenlegungstag: 24. Juni 1971

Ausstellungspriorität: —

(30)

Unionspriorität

(32)

Datum: —

(33)

Land: —

(31)

Aktenzeichen: —

(54)

Bezeichnung:

Verfahren zur Herstellung von Gegenständen  
mit holzmaserungsähnlicher Beschaffenheit  
aus thermoplastischen Kunststoffen

(61)

Zusatz zu: —

(62)

Ausscheidung aus: —

(71)

Anmelder:

Farbwerke Hoechst AG, vorm. Meister Lucius & Brüning,  
6230 Frankfurt-Höchst

Vertreter: —

(72)

Als Erfinder benannt:

Jauß, Erich, 8261 Burgkirchen

Benachrichtigung gemäß Art. 7 § 1 Abs. 2 Nr. 1 d. Ges. v. 4. 9. 1967 (BGBl. I S. 960): —

DT 1 963 161

FARBWERKE HOECHST AG. vormals Meister Lucius & Brüning  
Werk Gendorf

Aktenzeichen: Gd 1503  
Gendorf, den 8.12.1969 Dr. Hi/Ed

Verfahren zur Herstellung von Gegenständen mit holzmaserungs-  
ähnlicher Beschaffenheit aus thermoplastischen Kunststoffen

Es ist bekannt, Profile mit Holzmaserungseffekt herzustellen, indem man den zu verarbeitenden Kunststoff in Granulatform mit dem gewünschten Farbgranulat und in an sich bekannter Weise auf Schnecken, Blasformmaschinen und Spritzgußmaschinen weiterverarbeitet. So beschreibt das DBP 1 146 648 ein Verfahren, nach welchem verschiedenfarbige Granulate in an sich bekannten mehrgängigen Schneckenpressen eingespeist werden. Diese Arbeitsweise ist geeignet zur Herstellung grober Marmorierungseffekte; die erzielbare Maserung genügt nicht den gestellten Ansprüchen.

Nach DBP 1 170 616 wird beispielsweise das Farbkonzentrat als grobkörniges Granulat mit einem gegenüber den Grundwerkstoffen höheren Erweichungspunkt einem gepreßten Strang aus thermoplastischem Kunststoff, kurz vor dem Austritt aus einer Düsenmündung, aufgeschmolzen und die Bildung eines streifenartigen Musters auf dem aus der Düsenmündung austretenden Strang bewirkt.

Diese bekannten Verfahren erfordern einerseits eine Vorbehandlung des Thermoplasten, die Herstellung von Granulat andererseits die Verwendung spezieller maschineller Einrichtungen.

-2-

109826/1388

Es wurde nun gefunden, daß man Gegenstände aus thermoplastischen Kunststoffen mit holzmaserungsähnlicher Oberfläche und Durchfärbung des Produktes in der Masse nach an sich bekanntem Verfahren, vorzugsweise Extrusions- und Spritzverfahren, in vorteilhafter Weise herstellen kann, wenn man eine pulverförmige Kunststoff-Grundmischung mit Farbgranulaten auf Kunststoffbasis beliebiger Farbe und Zusammensetzung vermischt gemeinsam verarbeitet, wobei der Pigmentgehalt der Farbgranulate erheblich größer ist als der der Grundmischung und bis zu 20 Gew.% der Gesamtmischung beträgt. Überraschenderweise wurde festgestellt, daß man den erfindungsgemäßen Effekt nicht erhält, wenn thermoplastisches Kunststoffmaterial und Farbkomponente beide in Pulverform gemeinsam verarbeitet werden.

Zur Durchführung des erfindungsgemäßen Verfahrens werden der verarbeitungsfertigen pulverförmigen Grundmischung, welche bereits beliebig eingefärbt sein kann, Farbgranulate zugemischt, deren Pigmentgehalt vorteilhafterweise größer ist als der der Grundmischung. Gegenüber der Grundmasse liegt im Farbgranulat ein bereits plastifiziertes Gemisch vor, welches neben seinem erheblich höheren Pigmentgehalt gegenüber der Grundmasse außerdem noch Weichmacher oder Stabilisatoren enthalten kann, je nach der Art der verwendeten Grundmischung, beispielsweise ob als solche ein Hart- oder Weich-Polyvinylchlorid vorliegt. Wichtig ist, daß der Pigmentgehalt der Pulvermasse erheblich niedriger ist als der der Farbgranulate, da sonst keine klare Abgrenzung der Oberfläche erfolgt. Das erzielte Holzdekor ist durch Zusatz der Farbgranulate in weiten Grenzen variierbar, wobei neben der Farbe der Grundrezeptur Menge und Anzahl der Farben, die bereits der Grundmischung zugegeben wurden, Pigment und Weichmachergehalt der Farbgranulate, auch die Größe der Farbgranulate eine Rolle spielt.

Zur Erzielung spezieller Effekte kann man Mischungen von Farbgranulaten unterschiedlicher Pigmente vorteilhaft einsetzen.

Für die Herstellung von Gegenständen mit holzmaserungsähnlichen Oberflächen kommen grundsätzlich alle bekannten Thermoplasten und deren Mischpolymerisate in Betracht. Besonders geeignet sind für diesen Zweck Vinylchloridpolymerisate, Grundmasse und Farbgranulat müssen nicht in jedem Fall aus dem gleichen Polymerisat bestehen. Beispielsweise kann die Farbgranulatkomponente auch ein Polyolefin sein, das einem Polyvinylchlorid zugemischt wird; entscheidend ist lediglich die Verträglichkeit der Komponenten.

Die Herstellung der maserierten Profile erfolgt in an sich bekannten Extrusions- und Spritzguß-Einrichtungen. Spezielle Anordnungen, wie sie bei älteren Verfahren vielfach erforderlich sind, werden hier nicht gebraucht.

Überraschenderweise wurde festgestellt, daß bei einem Gemisch Pulver plus Granulat bei vorliegendem Unterschied in der Korngröße der Komponenten eine Entmischung derselben nicht eintritt. Vergleicht man die so erhaltenen Produkte mit den aus Kunststoffgranulaten und Farbgranulaten erzielten, so kann man feststellen, daß die Gegenstände aus dem erfindungsgemäßen Material eine wesentlich schönere, vor allem gleichmäßigere Maserung aufweisen, und zwar in einer bislang nicht erreichbaren Homogenität durch die Gesamtmasse hindurch.

Außer der bereits beschriebenen Verarbeitung des erfindungsgemäßen Materials durch an sich bekannte Extrusions- und Spritzgußverfahren zu Profilen, Platten, Hohlkörpern und Rohren, kann dasselbe infolge seiner durchgehenden, einwandfreien Maserung vorteilhaft auch der spanabhebenden Weiter-

verarbeitung unterworfen werden, wodurch weitere Anwendungsgebiete für derartige Kunststoffmaterialien erschlossen werden.

Eine Auswahl aus der Vielzahl der erfindungsgemäßen Möglichkeiten sei an Hand folgender Beispiele beschrieben, ohne daß die Anwendung der Erfindung auf dieselben beschränkt sei.

#### Beispiel 1

##### a) Herstellung der pulverförmigen Grundmischung:

Folgende Komponenten werden in einem schnell-laufenden Heizmischer bis auf ca. 120°C Mischungstemperatur gebracht und anschließend in einem Kühlmischer auf Raumtemperatur abgekühlt:

|                                            |        |       |
|--------------------------------------------|--------|-------|
| Masse-Polyvinylchlorid Hostalit® M VP 3067 | 100,00 | Teile |
| Di-basisches Bleiphosphit                  | 2,00   | "     |
| 51 %iges Bleistearat                       | 1,50   | "     |
| 28 %iges Bleistearat                       | 0,20   | "     |
| Calcium-Stearat                            | 0,50   | "     |
| Gleitmittel Hoechst® Wachs E               | 0,50   | "     |
| Gleitmittel Stenol® 1618                   | 0,50   | "     |

##### b) Herstellung des braunen Farbgranulates:

Folgende Komponenten werden wie vorher beschrieben im Schnellmischer gemischt und anschließend auf einem Einschneckenextruder plastifiziert und granuliert:

|                                      |        |       |
|--------------------------------------|--------|-------|
| Polyvinylchlorid Hostalit® M VP 4071 | 100,00 | Teile |
| Weichmacher Di-octylphthalat         | 43,00  | "     |
| Calcium-Stearat                      | 2,00   | "     |
| Titandioxyd Kronos® RN 57            | 28,00  | "     |
| PV echtgelb HR®                      | 21,00  | "     |
| PV echtrot B®                        | 9,00   | "     |
| Ruß                                  | 5,00   | "     |

100 Teile Grundmischung und 7,5 Teile Farbgranulat werden in einem üblichen Mischer vereinigt und in einem Einschneckenextruder von 45 mm Schneckendurchmesser extrudiert.

Man erhält einen hellen Holzton, wie er beispielsweise für Rolladenprofile gewählt wird.

## Beispiel 2

Nach der in Beispiel 1 beschriebenen Arbeitsweise werden hergestellt:

### a) Pulverförmige Grundmischung

|                                                           |              |
|-----------------------------------------------------------|--------------|
| Suspensions-Polyvinylchlorid Hostalit <sup>®</sup> S 3065 | 100,00 Teile |
| Stabilisatoren und Gleitmittel wie in Beispiel 1          | 1,00 "       |
| Titandioxyd Kronos <sup>®</sup> CL 220                    | 0,05 "       |
| PV echtgelb HR <sup>®</sup>                               | 0,0075 "     |
| PV echtrot B <sup>®</sup>                                 | 0,0021 "     |
| Ruß                                                       | 0,0008 "     |

### b) Weißes Farbgranulat

|                                                  |              |
|--------------------------------------------------|--------------|
| Polyvinylchlorid Hostalit <sup>®</sup> M VP 4071 | 100,00 Teile |
| Weichmacher Dioctylphthalat                      | 43,00 "      |
| Calcium-Stearat                                  | 2,00 "       |
| Titandioxyd Kronos <sup>®</sup> RN 57            | 15,00 "      |

### c) Schwarzes Farbgranulat

|                                                  |              |
|--------------------------------------------------|--------------|
| Polyvinylchlorid Hostalit <sup>®</sup> M VP 4071 | 100,00 Teile |
| Dioctylphthalat                                  | 43,00 "      |
| Calcium-Stearat                                  | 2,00 "       |
| Ruß                                              | 3,00 "       |

### d) Braunes Farbgranulat siehe Beispiel 1

Zur Erzielung eines gewünschten dunklen, eichenholzähnlichen Holztones werden die Komponenten im folgenden Verhältnis gemischt und wie in Beispiel 1 beschrieben extrudiert:

|                             |              |
|-----------------------------|--------------|
| Pulverförmige Grundmischung | 100,00 Teile |
| Farbgranulat weiß           | 0,60 "       |
| Farbgranulat schwarz        | 1,90 "       |
| Farbgranulat braun          | 7,50 "       |

### Beispiel 3

Nach der in Beispiel 1 beschriebenen Arbeitsweise werden hergestellt:

#### a) Pulverförmige Grundmischung

Gemisch aus schlagzäh eingestelltem Hart-Polyvinylchlorid und chloriertem Polyäthylen

|                                                    |              |
|----------------------------------------------------|--------------|
| (Hostalit <sup>®</sup> Z 2070)                     | 100,00 Teile |
| Barium-/Cadmium-Stabilisator Mark <sup>®</sup> WSX | 2,00 "       |
| Phosphit Mark <sup>®</sup> C                       | 0,50 "       |
| Epoxydiertes Sojabohnenöl                          | 2,00 "       |
| Calcium-Stearat                                    | 1,00 "       |
| Titandioxyd Kronos <sup>®</sup> OL 220             | 2,00 "       |

#### b) Braunes Farbgranulat

|                                                  |              |
|--------------------------------------------------|--------------|
| Polyvinylchlorid Hostalit <sup>®</sup> M VP 4071 | 100,00 Teile |
| Calcium-Stearat                                  | 2,00 "       |
| Titandioxyd Kronos <sup>®</sup> OL 220           | 28,00 "      |
| PV echtgelb HR <sup>®</sup>                      | 21,00 "      |
| PV echtrot B <sup>®</sup>                        | 9,00 "       |
| Ruß                                              | 5,00         |

100 Teile der pulverförmigen Grundmischung a) werden mit 7,5 Teilen Farbgranulat b) in einem Schnellmischer aufbereitet und nach Beispiel 1 extrudiert.

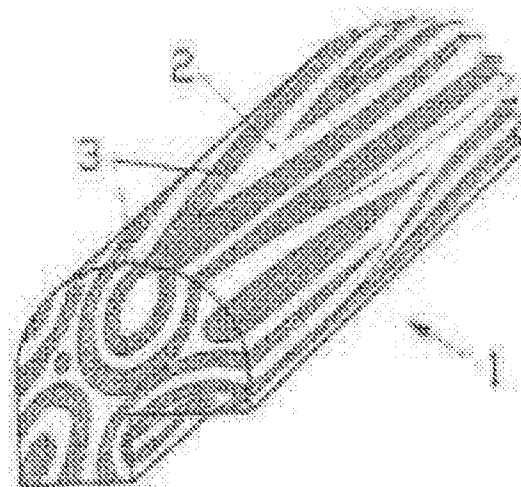
Man erhält Profile aus schlagzähem Hart-Polyvinylchlorid in hellem Holzton.

Patentansprüche:

- 1.) Verfahren zur Herstellung von Formteilen thermoplastischer Kunststoffe mit holzmaserungsähnlicher Oberfläche und Durchfärbung des Produktes in der Masse nach an sich bekannten Verfahren, dadurch gekennzeichnet, daß man eine pulverförmige Grundmischung mit Farbgranulaten auf Kunststoffbasis beliebiger Farbe und Zusammensetzung vermischt gemeinsam verarbeitet, wobei der Pigmentgehalt der Farbgranulate erheblich größer ist als der der Grundmischung.
- 2.) Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Farbgranulatgehalt bis zu 20 Gew.% der Gesamtmischung beträgt.
- 3.) Verfahren nach Anspruch 1 bis 2, dadurch gekennzeichnet, daß als thermoplastische Kunststoffe Polymerisate oder Copolymerisate des Vinylchlorids verwendet werden.
- 4.) Verfahren nach Anspruch 1 bis 3, dadurch gekennzeichnet, daß man der pulverförmigen Grundmischung eine Mehrzahl von Farbgranulaten zugibt.

**Espacenet****Bibliographic data: FR2738768 (A1) — 1997-03-21****Extruded plastic bar with simulated wood effect, e.g. for furniture****Inventor(s):****Applicant(s):** PEYTRAL GINA [FR] ± (PEYTRAL GINA)**Classification:** - international: **B29C47/04**; (IPC1-7): A47C5/12; B29C47/04; B29L31/44  
- cooperative: **B29C47/003**; **B29C47/046****Application number:** FR19950011120 19950915**Priority number(s):** FR19950011120 19950915**Also published as:** FR2738768 (B1)**Abstract of FR2738768 (A1)**

The extruded bar has a constant cross-section and is used in place of wooden components, e.g. in the manufacture of furniture. It is made from at least two compounds (2,3) based on synthetic thermoplastic resin in different colours, appearing on the surface of the bar in the veins shaped and coloured like those occurring in natural wood. The synthetic thermoplastic resin incorporates pigments and fillers which gives it a density and physical characteristics similar to those of natural wood. The compounds are, for example, PVC-based, and their fillers, especially mineral ones, are designed so that the material is totally recyclable, is resistant to heat and UV rays and can be worked with the same tools and in the same conditions as wood.



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⑫

## BREVET D'INVENTION

B1

⑤4 PROFILE MASSIF EXTRUDE EN MATIERE PLASTIQUE AYANT L'APPARENCE DU BOIS.

②2 Date de dépôt : 15.09.95.

③0 Priorité :

⑥0 Références à d'autres documents nationaux  
apparentés : Certificat d'utilité résultant de la  
transformation d'office de la demande de  
brevet déposée le 15/09/95 .

⑦1 Demandeur(s) : PEYTRAL GINA — FR.

④3 Date de mise à la disposition du public  
de la demande : 21.03.97 Bulletin 97/12.

④5 Date de la mise à disposition du public du  
brevet d'invention : 03.12.99 Bulletin 99/48.

⑦2 Inventeur(s) : PEYTRAL GINA.

⑤6 Liste des documents cités dans le rapport de  
recherche :

⑦3 Titulaire(s) :

*Se reporter à la fin du présent fascicule*

⑦4 Mandataire(s) : ROMAN.

FR 2 738 768 - B1



PROFILE MASSIF EXTRUDÉ EN MATIERE PLASTIQUE  
AYANT L'APPARENCE DU BOIS

La présente invention a pour objet un profilé  
5 massif extrudé en matière plastique, ayant l'apparence du  
bois.

Son champ d'application est extrêmement vaste.  
Il peut en effet dans de nombreux cas remplacer  
10 avantageusement le bois naturel. Il est plus  
particulièrement destiné à la fabrication d'éléments de  
mobilier aussi bien d'extérieur que d'intérieur,  
d'encadrements de tableaux ou de portes et de fenêtres,  
de tringles, de montants et, d'une façon générale de  
15 pièces de section constante de toute nature fabriquées  
habituellement en bois ou en profilés plastiques.

Les objets fabriqués traditionnellement en  
bois sont de plus en plus réalisés en matière synthétique  
20 ou en métal, plus facile à mettre en oeuvre, en  
particulier pour la fabrication en série, et nettement  
meilleur marché.

Les articles métalliques ou en plastique  
ont un aspect froid et impersonnel souvent ressenti par  
25 les utilisateurs pour lesquels certains fabricants  
proposent des succédanés imitant plus ou moins le bois et  
réalisés au moyen de décors imprimés ou appliqués sur  
leur surface. Les articles ainsi obtenus n'ont du bois  
naturel que l'aspect extérieur et ne présentent aucune  
30 des autre caractéristiques de celui-ci. En particulier,  
la densité du matériau, la texture de la surface, la  
sonorité produite en cas de heurts sont très différentes.  
En outre, le matériau ne peut évidemment pas être poncé  
et toute rayure ou écaillure est irréparable.

35

L'invention a pour but de remédier à ces inconvénients, en proposant un matériau d'un coût de fabrication peu élevé, ayant l'aspect extérieur et les propriétés physiques du bois, se travaillant dans les  
5 mêmes conditions et avec les mêmes moyens que lui, tout en pouvant de surcroît être façonné aisément.

Il est constitué de profilés massifs fabriqués par extrusion simultanée de plusieurs compositions à base  
10 de résines de synthèse thermoplastiques de couleurs différentes formant dans la masse de ces profilés des zones distinctes apparaissant à la surface sous forme de veines semblables dans leur forme et leur couleur à celles du bois, le matériau constitutif ayant par  
15 ailleurs une densité et des caractéristiques physiques proches de celle du bois naturel.

Sur les dessins annexés, donnés à titre d'exemples non limitatifs de formes de réalisation de  
20 l'objet de l'invention:

la figure 1 est une vue isométrique d'un élément de profilé,

la figure 2 montre dans les mêmes conditions le même élément de profilé après rabotage,

25 la figure 3 représente en perspective une carcasse de siège réalisée avec des profilés selon l'invention,

les figures 4 et 5 sont de coupes transversales d'exemples de profilés, respectivement un  
30 couvre joint et un montant de fenêtre.

Le dispositif, figures 1 à 5 est constitué d'un profilé 1 en matière plastique extrudé dont la section peut avoir une forme quelconque, adaptée aux multiples  
35 applications envisageables.

Le profilé est plein et fabriqué par extrusion simultanée de plusieurs (au moins deux) compositions 2, 3 de matière synthétique thermofusible de couleurs  
5 différentes, choisies en fonction du type de bois à imiter.

Les réglages de vitesse d'extrusion, de pression et de température sont ajustés de manière à ce que les différentes compositions s'amalgament entre elles  
10 sans se mélanger, en formant dans la masse du profilé 1 des zones distinctes formant à la surface du produit fini des dessins ayant l'apparence des veines du bois naturel.

Le choix du nombre de compositions 2, 3 et de leurs teintes respectives, ainsi que de la forme et de  
15 l'épaisseur des différentes zones, autorise une quantité illimitée de combinaisons différentes permettant d'imiter de manière parfaitement reproductible tous les types de bois, et même de créer de multiples produits de fantaisie ayant un aspect nouveau et original, en utilisant par  
20 exemple des couleurs vives.

En outre, ces différentes zones colorées auront dans l'épaisseur du profilé 1 une structure telle qu'en rabotant ou en ponçant le produit, la surface obtenue présente toujours des veines semblables à celles  
25 du bois (figure 2).

La matière première utilisée sera choisie parmi les résines de synthèse thermoplastiques extrudables. Elle consistera avantageusement en un  
30 polychlorure de vinyle incorporant des pigments appropriés et des charges, en particuliers minérales, déterminées de telle façon que le matériau extrudé soit totalement recyclable et que les profilés présentent une densité et une solidité voisines de celles du bois et  
35 soient en outre:

- résistants au feu suivant la norme ULV094,
  - autoextinguibles et ne propageant pas la flamme,
  - résistants aux rayons ultra-violets de
- 5 manière à permettre leur utilisation à l'extérieur,
- cintrables à chaud sans déformation, tout en pouvant être travaillé dans les mêmes conditions que le bois naturel (sciage, perçage, rabotage, ponçage, collage, etc) et avec les mêmes outillages.
- 10 La forme de leur section sera déterminée en fonction de leur destination. Ils pourront en particulier être utilisé pour réaliser des moulures pour encadrement, des cadres ou dormants de portes et de fenêtres, des lames de volets, des tringles à rideaux, des éléments de
- 15 meubles, etc.

Une application particulièrement intéressante de ces profilés est la fabrication de meubles de jardin.

- En raison du prix sans cesse croissant du
- 20 bois, et de sa mauvaise tenue aux intempéries, la quasi totalité du mobilier destiné à l'extérieur actuellement commercialisé à un prix abordable est réalisé en matière plastique courante injectée ou thermoformée.

- La résistance des profilés selon l'invention
- 25 aux conditions extérieures et la facilité de leur mise en oeuvre permet d'envisager la création, à un coût raisonnable, de différents meubles de jardin ayant l'aspect flatteur des meubles réalisés en rotin, en osier ou en bois massif, tout en ayant une tenue dans le temps
- 30 très supérieure et en demandant un entretien extrêmement réduit.

Par exemple, sur la figure 3 on peut voir la carcasse d'un siège 4 réalisé avec quatre profilés cintrés seulement, un profilé se section rectangulaire 5

pour le placet et trois profilés de section circulaire 6,  
7 pour les pieds les accoudoirs et le dossier.

Le positionnement des divers éléments  
5 constitutifs donne à l'objet de l'invention un maximum  
d'effets utiles qui n'avaient pas été, à ce jour, obtenus  
par des produits similaires.

## REVENDEICATIONS

1°. Profilé massif extrudé en matière  
plastique, ayant l'apparence du bois destiné à la  
5 fabrication de pièces de section constante de toute  
nature réalisées habituellement en bois ou en profilés  
plastiques, et en particulier d'éléments de mobilier  
aussi bien d'extérieur que d'intérieur, d'encadrements de  
tableaux ou de portes et de fenêtres, de tringles ou de  
10 montants, constitué d'au moins deux compositions (2, 3),  
à base de résine de synthèse thermoplastique, de couleurs  
différentes et formant dans la masse dudit profilé des  
zones colorées distinctes apparaissant à la surface sous  
forme de veines semblables dans leur forme et leur  
15 couleur à celles du bois naturel,

caractérisé en ce que les différentes zones  
colorées ont dans l'épaisseur du profilé (1) une  
structure telle qu'en rabotant ou en ponçant celui-ci, la  
surface obtenue présente toujours des veines semblables à  
20 celles du bois naturel, le matériau constitutif du  
profilé incorporant des pigments et des charges  
déterminés de telle façon qu'il présente une densité et  
des caractéristiques physiques proches de celle du bois  
naturel.

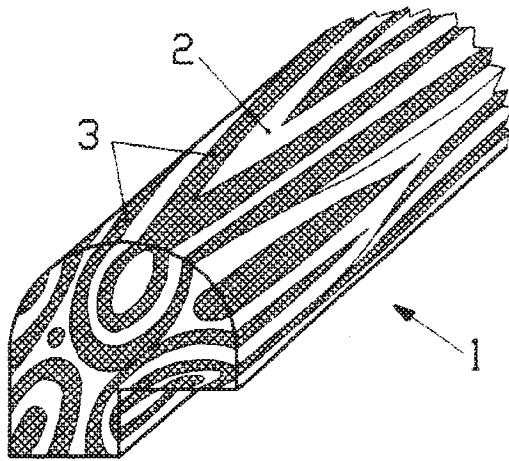
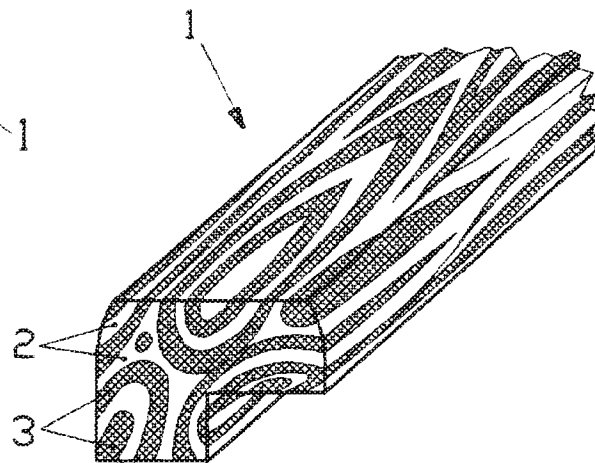
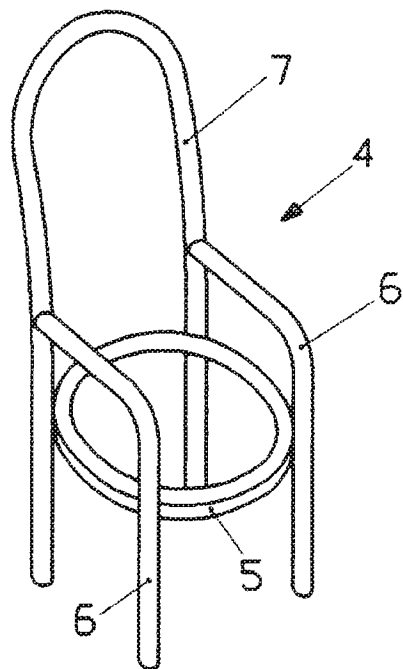
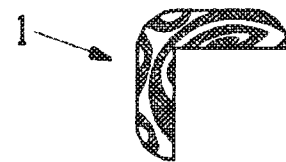
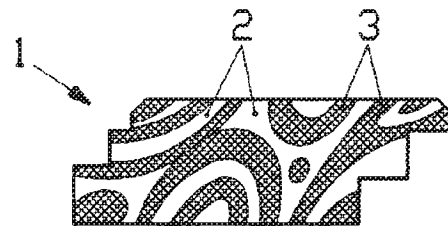
25

2°. Profilé selon la revendication 1, se  
caractérisant par le fait qu'il est constitué d'un  
matériau incorporant des charges, en particuliers  
minérales, déterminées de manière à ce que ledit matériau  
30 soit totalement recyclable et à ce que ledit profilé  
présente une résistance au feu suivant la norme ULV094,  
soit autoextinguible, ne propage pas la flamme, résiste  
aux rayons ultra-violets et soit cintrable à chaud sans  
déformation, tout en pouvant être travaillé dans les

mêmes conditions que le bois naturel et avec les mêmes outillages.

- 3°. Meubles de jardin caractérisés en ce
- 5 qu'ils sont réalisés au moyen de profilés massifs extrudés en matière plastique, selon les revendications précédentes, ayant l'apparence du bois naturel, constitué d'au moins deux compositions (2, 3), à base de résine de
- 10 synthèse thermoplastique, de couleurs différentes et formant dans la masse dudit profilé des zones colorées distinctes apparaissant à la surface sous forme de veines semblables dans leur forme et leur couleur à celles du bois naturel.

PL. 1/1

Fig. 1Fig. 2Fig. 3Fig. 4Fig. 5

# RAPPORT DE RECHERCHE

articles L.612-14, L.612-17 et R.612-53 à 69 du code de la propriété intellectuelle

## OBJET DU RAPPORT DE RECHERCHE

Après l'accomplissement de la procédure prévue par les textes rappelés ci-dessus, le brevet est délivré. L'Institut National de la Propriété Industrielle n'est pas habilité, sauf dans le cas d'absence **manifeste** de nouveauté, à en refuser la délivrance. La validité d'un brevet relève exclusivement de l'appréciation des tribunaux.

L'I.N.P.I. doit toutefois annexer à chaque brevet un "RAPPORT DE RECHERCHE" citant les éléments de l'état de la technique qui peuvent être pris en considération pour apprécier la brevetabilité de l'invention. Ce rapport porte sur les revendications figurant au brevet qui définissent l'objet de l'invention et délimitent l'étendue de la protection.

Après délivrance, l'I.N.P.I. peut, à la requête de toute personne intéressée, formuler un "AVIS DOCUMENTAIRE" sur la base des documents cités dans ce rapport de recherche et de tout autre document que le requérant souhaite voir prendre en considération.

## CONDITIONS D'ÉTABLISSEMENT DU PRÉSENT RAPPORT DE RECHERCHE

- ☒ Le demandeur a présenté des observations en réponse au rapport de recherche préliminaire.
- ☐ Le demandeur a maintenu les revendications.
- ☒ Le demandeur a modifié les revendications.
- ☐ Le demandeur a modifié la description pour en éliminer les éléments qui n' étaient plus en concordance avec les nouvelles revendications.
- ☐ Les tiers ont présenté des observations après publication du rapport de recherche préliminaire.
- ☐ Un rapport de recherche préliminaire complémentaire a été établi.

## DOCUMENTS CITÉS DANS LE PRÉSENT RAPPORT DE RECHERCHE

La répartition des documents entre les rubriques 1, 2 et 3 tient compte, le cas échéant, des revendications déposées en dernier lieu et/ou des observations présentées.

- ☒ Les documents énumérés à la rubrique 1 ci-après sont susceptibles d'être pris en considération pour apprécier la brevetabilité de l'invention.
- ☐ Les documents énumérés à la rubrique 2 ci-après illustrent l'arrière-plan technologique général.
- ☐ Les documents énumérés à la rubrique 3 ci-après ont été cités en cours de procédure, mais leur pertinence dépend de la validité des priorités revendiquées.
- ☐ Aucun document n'a été cité en cours de procédure.

| 1. ELEMENTS DE L'ETAT DE LA TECHNIQUE SUSCEPTIBLES D'ETRE PRIS EN CONSIDERATION POUR APPRECIER LA BREVETABILITE DE L'INVENTION                                               |                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Référence des documents<br>(avec indication, le cas échéant, des parties pertinentes)                                                                                        | Revendications du brevet concernées |
| DE 19 63 161 A (HOECHST AG)<br>24 Juin 1971<br>* page 2, ligne 1 - page 4, ligne 3 *<br>* revendications *                                                                   | 1 à 3                               |
| DATABASE WPI<br>Section Ch, Week 9541<br>Derwent Publications Ltd., London, GB ;<br>Class A32, AN 95-316629<br>XP002070816<br>& JP 07 214 631 A (ECCO CHEM KK)<br>* abrégé * | 1, 2                                |
| US 3 704 912 A (BEZARK RICHARD S)<br>5 Décembre 1972<br>* le document en entier *                                                                                            | 3                                   |
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| PATENT ABSTRACTS OF JAPAN<br>Vol. 006, no. 228 (M-171), 13 Novembre 1982<br>& JP 57 129733 A (KAZUHIKO OKADA), 11 Août 1982,<br>* abrégé *                                   | 1, 2                                |
| PATENT ABSTRACTS OF JAPAN<br>Vol. 007, no. 047 (M-196), 24 Février 1983<br>& JP 57 197131 A (KAZUHIKO OKADA), 3 Décembre 1982,<br>* abrégé *                                 | 1, 2                                |
| 2. ELEMENTS DE L'ETAT DE LA TECHNIQUE ILLUSTRANT L'ARRIERE-PLAN TECHNOLOGIQUE GENERAL                                                                                        |                                     |
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| NEANT                                                                                                                                                                        |                                     |

**Espacenet****Bibliographic data: JPH07214631 (A) — 1995-08-15****PRODUCTION OF SYNTHETIC WOOD**

**Inventor(s):** TAKAHASHI SATOSHI; KURAMOTO AKIRA ± (TAKAHASHI SATOSHI, ; KURAMOTO AKIRA)

**Applicant(s):** ECHO CHEM KK ± (ECHO CHEM KK, ; EKKO KEMIKARU KK)

**Classification:** - international: **B29C47/00; B29C47/04; B29C47/58; B29K27/06;**  
(IPC1-7): B29C47/00  
- cooperative:

**Application number:** JP19940008395 19940128

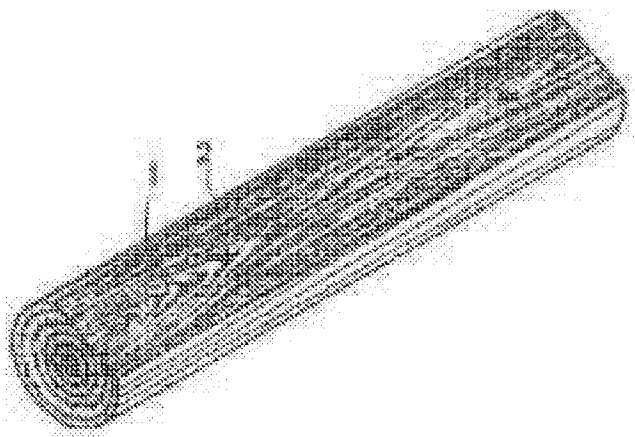
**Priority number(s):** JP19940008395 19940128

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**Abstract of JPH07214631 (A)**

**PURPOSE:** To obtain a synthetic wood having a grain pattern also in the inner part thereof by a method wherein a ring member having a through hole of a specific diameter is disposed between the tip of a screw and a die, and thermoplastic synthetic resin materials respectively colored correspondingly to a summerwood part and a winterwood part are supplied to an extruder and roughly kneaded to be melted.

**CONSTITUTION:** A ring member having one or more through holes of 5mm or more diameter is placed between a tip of a screw of an extruder and an extruder die without using a screen and a breaker plate used in an extruder or in replacement thereof. Thermoplastic synthetic resin materials respectively colored in tones corresponding to a summerwood part 1 and a winterwood part 2 of a relatively small quantity are supplied to an extruder.; Furthermore, the introduced resins are melted while being appropriately roughly kneaded by the screw. The melt resin is continuously extruded directly from the extruder die or through the ring member. In this manner, a grain pattern can be formed not only on the surface but also in the inner part thereof.



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(54) 【発明の名称】 合成木材の製造方法

(57) 【要約】 (修正有)

【構成】 押出機のスクリーンの先端と押出金型との間に、押出機に使用されるスクリーンとブレードプレートを用いることなく、又はそれらに換えて、径が5mm以上の貫通孔を1個又は複数個有するリング部材を配置し、木材の夏材部と相対的に少量の冬材部に対応するそれぞれの色調に着色した熱可塑性合成樹脂材料を前記押出機に供給して、溶融樹脂をそのまゝ又は前記リング部材通過させて押出金型から連続的に押出す木目模様を有する合成木材の製造方法。

【効果】 本発明の方法により、表面だけでなく内部にまで木目模様を有する熱可塑性樹脂製合成木材が効果的且つ工業的に有利に製造される。

## 【特許請求の範囲】

【請求項1】押出機のスクリーンの先端と押出金型との間に、押出機に使用されるスクリーンとブレイカープレートを用いることなく、又はそれらに換えて、径が5mm以上の貫通孔を1個又は複数個有するリング部材を配置し、木材の夏材部と相対的に少量の冬材部に対応するそれぞれの色調に着色した熱可塑性合成樹脂材料を前記押出機に供給して、そのスクリーンにおいて導入樹脂を熔融させるが適度に粗い混練を行わせ、熔融樹脂をそのまま又は前記リング部材通過させて押出金型から連続的に押出すことを特徴とする木目模様を有する合成木材の製造方法。

【請求項2】前記リング部材が、熔融樹脂の流路を狭めることができるリング状環体、又は円盤状体の内側に径が5mm以上の貫通孔2～8個を軸対称に形成して成る弱い乱流化部材である請求項1に記載の合成木材の製造方法。

【請求項3】熱可塑性合成樹脂が、平均重合度700～1300の塩化ビニル樹脂である請求項1に記載の合成木材の製造方法。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、熱可塑性合成樹脂を素材として木目模様を有する合成木材を製造する方法に関し、特に、押出機で押し出して表面部及び内部に木目模様を有する合成木材の製造方法に関する。

## 【0002】

【従来の技術】従来、熱可塑性合成樹脂を素材とする合成木材の製造には、発泡剤を混入した樹脂成形材料を押出機で押出して乾燥木材に近い比重を有する発泡体に形成する方法が広く採用されている。かかる合成木材は、触覚あるいは重量が木の感じを人に与え、また適度の物理的強度を有し、工具によって加工をしたり細工をすることができるという利点を有するが、視覚的な木材感覚は実質的に得られていない。一方、視覚的に木材の感じを与えるために木目を印刷した合成樹脂フィルムや合成樹脂含浸紙等を基材の表面に接合する方法が行われているが、それらは表面の印刷が擦れると見栄えが悪くなるだけでなく、視覚的な木材感覚は急激に低下して不快感を与えるので、そのような不利益の改善が求められている。

【0003】近年、熱帯雨林の木材の大量伐採や森林の開荒が生物の生息環境を破壊し、地球の生活環境を急激に悪化させる重大な事実に関連して、特に、日本の木材消費を低減させねばならないという要求が高まっている。このような社会的要望に沿って、また上記のような合成木材の実情に鑑み、本発明者らは、長期の使用においても木目模様が安定に確保され、また自由に切ったり削ったりする加工によっても視覚的な木材感が失われることのない、内部まで木目模様が形成された実用的に望ま

しい合成木材を製造する方法について鋭意研究を重ねた。

## 【0004】

【発明が解決しようとする課題】すなわち、本発明の課題は、表面部だけでなく内部まで木目模様が形成された熱可塑性樹脂を素材とする合成木材を提供することにある。また、本発明の他の課題は、そのような合成木材を押出機を用いて連続的且つ効果的に製造し得る工業的に極めて有利な合成木材の製造方法を提供することにある。本発明の更に他の課題は、木目模様、特に年輪を特徴付ける冬材部に関してその形成を大まかではあるがコントロールすることができる合成木材の製造方法を提供することにある。本発明のその他の目的ないし技術的特徴は、以下の記載から一層明らかとなるであろう。

## 【0005】

【課題を解決するための手段】本発明は、押出機のスクリーンの先端と押出金型との間に、押出機に使用されるスクリーンとブレイカープレートを用いることなく、又はそれらに換えて、径が5mm以上の貫通孔を1個又は複数個有するリング部材を配置し、木材の夏材部と相対的に少量の冬材部に対応するそれぞれの色調に着色した熱可塑性合成樹脂材料を前記押出機に供給して、そのスクリーンにおいて導入樹脂を熔融させるが適度に粗い混練を行わせ、熔融樹脂をそのまま又は前記リング部材通過させて押出金型から連続的に押出すことを特徴とする木目模様を有する合成木材の製造方法を要旨とするものである。

【0006】本発明の合成木材の製造に用いられる熱可塑性合成樹脂は、押出機のスクリーンで熔融混練して押出し成形することができる樹脂素材であれば何ら制限されないが、代表的に用いられる樹脂素材としては、例えば、塩化ビニル系樹脂、酢酸ビニル系樹脂、ポリオレフィン系樹脂、ABS樹脂、アクリル系樹脂及びスチレン系樹脂等が挙げられる。建築材料として適用される合成木材には、その使用対象に関連して要求される強度と適度の重さ、硬さ、難燃性及び工業的経済性を考慮して選択されるが、塩化ビニル系樹脂が極めて実用的である。かかる塩化ビニル系樹脂は、塩化ビニルの単独重合体及び塩化ビニルを主成分とする他の共重合性単量体との共重合体類を包含する。

【0007】一般に、押出機は、熔融樹脂を十分に且つ均一に混練するために、スクリーンと押出し金型の間にブレイカープレートと共に、例えば、30～120メッシュ程度のスクリーン1枚以上、通常、2枚ないし5枚が組合せ使用されるが、本発明の方法においては、そのスクリーンとブレイカープレートの使用は禁物である。本発明に用いられる押出機においては、スクリーンの先端部から押出機先端に装置される金型までの熔融樹脂通路は、障害のない、換言すれば、実質的に乱流を与えないストレートであってもよいし、また、その通路に、スク

リーンとブレイカープレートに換えて僅かに乱流を与える特殊なリング部材が取付けられる。リング部材の取付けは、スクリュースクリュー先端近傍ないし金型近傍の間のいずれの箇所であってもよく、その取付け固定手段は、従来知られたどんな方法も好都合に採用できる。また、リング部材は直接、金型に固定してもよい。

【0008】本発明方法に用いられる特殊なリング部材は、5mm以上の径の貫通孔が1個又は複数個形成された円盤状部材である。径が5mm以上の貫通孔とは、直径5mmの円の面積以上の大きな貫通孔であって、必ずしも円形である必要はないが、線状あるいはそれに近い形状の混練効果の良い貫通孔は不都合である。従って、別の観点からすれば、直径5mm以上、好ましくは、8~10mm以上の円又はそれに近い形状を含み得る円形、円類似形、多角形、台形、扇形それらの類似形やその他の各種異形の貫通孔であればよく、要するにスクリュースクリューから押出される熔融樹脂材料流をあまり乱さない貫通孔であれば、特に制限されない。直径が5mmより小さいと、押出機のスクリュースクリューから送られる熔融樹脂流が必要以上に乱れ、望ましい木目模様が得られないので好ましくない。

【0009】本発明の方法において、リング部材を取付けない場合には、押出機のスクリュースクリューから送られる熔融樹脂流は、押出機先端の金型まで殆ど付加的乱流が与えられることなくそのまま運ばれて木目模様の粗い成形物に押出される。また、リング部材が取付け使用される場合には、貫通孔を一個だけ有するリング部材では、熔融樹脂流をできるだけ乱さないような比較的充分大きな径貫通孔のものが好ましく用いられる。その貫通孔の形成位置は、中央部あるいはその近傍が望ましい。また、リング部材に設けられる複数個の貫通孔は、円盤状リング部材全面に平均して形成されるが、通常、リング部材の軸対称に形成することが実用的である。一個のリング部材に形成される複数個の貫通孔は、それぞれの大きさ（面積）及び形状を必ずしも同一にする必要はないが、押出される熔融樹脂に適度の弱い乱流を与えるように配慮される。

【0010】本発明の方法に用いられるリング部材の貫通孔の数は、リング部材の径、貫通孔の径等に関連して一概にいえないが、通常、例えば、2~8個程度が実用上有利に採用される。貫通孔の径を小さくし、その数を多くするほど熔融樹脂材料の混練が進行して木目模様が崩れ、所望の木目模様得られないので好ましくない。一般に、熔融樹脂材料の乱流の程度は、小さければ大きく明瞭な木目に、また大きければ細かな木目に形成されるので、押出し形成させようとするする木目模様（冬材部）の粗密あるいは濃淡等の程度によって適宜リング部材は選択される。その際、貫通孔の数、大きさが同じでもそれらの形成箇所、例えば中心寄りか周縁寄りかによっても形成模様が違ってくるので、その他の押出し条件と関連して最適の貫通孔をもつリング部材が選択使用さ

れる。

【0011】本発明の方法においては、意図する木材の本目に対応する夏材部樹脂材料と冬材部樹脂材料とが予め配合調製され、ペレットにされる。柔軟質の粗の夏材部を表現する樹脂材料は、通常、淡色に、また緻密な硬い冬材部材料は、通常、暗褐色に着色調製される。それらの着色料は、耐熱性及び耐候性を有するものであれば制限はないが、通常、多くの各種色調の顔料類が組合せ配合される。これらの調製された着色料は、通常、その所定量が発泡剤やその他の各種添加剤と共に合成樹脂パウダーに混合され、発泡剤が分解発泡しない温度でペレタイザーによって適当な長さのカットにされて、それらの混合ペレットが押出機に供給され、押出し成形されるが、夏材部用成形材料は、ペレットにすることなく、粉末状コンパウンドのまま、押出機に供給することができる。

【0012】本発明の方法においては、これらの夏材部用と冬材部用のペレットを予め所望の割合に混合し、押出機の供給口から押出機内に導入供給される。その混合割合は、通常、例えば、7:3~9:1の重量範囲であるが、表現しようとする木材の種類によってはこの範囲割合を多少変更することができる。一般に、各材部の発泡割合及び所望木目模様に関連して適切な割合が選択されるが、これに限定されない。また、本発明の方法において、冬材部の本目をより鮮明に表したい場合には、冬材部用ペレットの色調を濃くしたり、冬材部用樹脂として、より熔融粘度の高い樹脂を使用することがよく、あるいは更に、夏材部と冬材部を押出機に別々に供給し、特に冬材部形成用ペレットをスクリュースクリュー部のガス排出用ベント口より供給することが有利である。

【0013】また、木目模様を形成させる本発明の目的に関連して、スクリュースクリューにおける混練は、導入樹脂材料を十分に熔融させるが、適度に粗の混練となるような条件で行うことが重要であって、押出機の条件としてスクリュースクリューの長さ（L）とその直径（D）の比： $L/D$ が20~28の範囲内で行うことが望ましく、圧縮比は2.2~3.4の範囲内で行うことが望ましい。このような押出条件では、押出機のバックプレッシャーは比較的小さく、混練条件はマイルドとなって、冬材部による木目の形成が確保されるであろう。混練をマイルドに行わせるために、先細り状のコーン型スクリュースクリューを使用することも有利である。

【0014】 $L/D$ が20より小さいと混練不充分となり、また、28を超えると過混練となって木目が出にくくなるばかりでなく、発泡のコントロールが困難となるので不都合である。好ましい範囲は22~28である。また、圧縮比が2.2未満では、樹脂の混練が不足し、3.4を超えると、 $L/D$ と同様に混練が過剰となって木目が出にくくなり、発泡のコントロールも困難となるので不都合である。好ましい範囲は2.4~3.0である。これら

の押出条件は、本発明方法を実施するための好適条件であって、夏材部と冬材部それぞれの樹脂材料の溶融粘度、押出機の各部の設定温度及び出したい木目の模様状態に関連して、多少逸脱した範囲を採用することもできる。

【0015】冬材部用材料と夏材部用材料の形成に用いられる熱可塑性樹脂は、通常、同一種のものを使用することがよく、また実用的であるが、親和相溶性を有する樹脂同士であれば異なる種類の樹脂であっても組合せて使用することができる。しかし、冬材部用材料によって木目模様を形成させることに関連して、好ましくは冬材部用材料の樹脂は、夏材部用樹脂よりも溶融粘度の大きい樹脂が組合せ使用されるが、同程度の溶融粘度を有する樹脂を用いることができる。逆に、夏材部用樹脂よりも小さい溶融粘度の樹脂を用いることは歓迎できない。同一種類の樹脂では、重合度が高いほど溶融粘度が大きく、反対に重合度が低いほど溶融粘度は小さいので、重合度によって樹脂を好都合に選択することができる。

【0016】代表的である塩化ビニル樹脂を例に説明すれば、冬材部用として平均重合度が約700~1300のものが好都合に用いられ、他方、夏材部用としては、平均重合度が約700~1000程度のものが使用されるが、好ましくは、冬材部用には、夏材部用よりも高い重合度のものが用いられる。また、木目模様は、単一色の縞模様ではなく、適度にあるいは段階的に着色濃度に変化しているから、特に冬材部用樹脂には、単一の重合度ではなく、異なる重合度のものを混合使用することが実用上望ましく、夏材部も、通常重合度の異なる樹脂が混合使用される。

【0017】本発明の方法においては、通常の合成木材と同様に、その見掛け比重が0.6~1程度、最も一般的には0.75~0.85の範囲内の比重に調製される。そのような調製は、使用する樹脂によって多少異なるが、押出成形の際に発泡する発泡材の量に基づく発泡倍率を選択して行われる。また合成木材に触覚的及び視覚的木材感覚を与えるために押出材料に基づいて約10%以下の木粉を配合することがきる。木粉の配合は、強度を若干低下させるが、発泡剤や着色剤の使用量を減らすことができるだけでなく、木材感が顕著に増大する。また、強度を向上させるために他の強化用あるいは改質用樹脂や繊維補強材等を適宜添加することができる。

【0018】本発明の方法に用いる夏材部用材料と冬材部用材料は、熱可塑性樹脂を主素材成分として、その樹脂に通常配合される安定剤のほか難燃剤、発泡剤、発泡抑制剤、顔料その他の各種添加剤が添加配合される。木目模様は、特に褐色ないし暗褐色に着色される冬材部によって表現されるが、その冬材部年輪模様は、各種色料、例えば黒、青、赤、緑、黄色その他多くの耐熱性顔料類によって調合調製される。また、発泡剤は、合成木材用として通常使用されている周知の各種のものが好都合に使用できる。それら着色剤や発泡剤の使用量は、表現しようとする木材の種類に応じて、また使用する樹脂の種類によって選択されるが、簡単な押出実験によって、あるいは経験的に容易に決定することができる。

【0019】本発明方法は、製造しようとする合成木材の形状、例えば、棒状体や板状体に押出成形することができる。その形状や大きさは、押出機的能力、シリンダーの大きさ、あるいは押出容量等によって制限されるが、通常円形金型から押出して円柱状体のものが連続的に押出されるが、板状物は、この円柱状押し物を、例えばTダイに誘導して板状物に成形され、所望の厚さや幅の板状物が連続的に製造される。このように押出機から押出されたものは、使用したリング部材等に対応して木目模様が表面に形成されるだけでなく、その内部全体にわたって木目模様が形成される。

【0020】  
【作用】本発明の方法によれば、表面だけでなく内部まで木目模様を有し、切ったり削ったりする加工においても木目模様が失われることのない、いわゆる偽木材様の熱可塑性合成樹脂製合成木材が容易に且つ連続的に製造される。その木目模様は長期にわたって安定に保持される。

【0021】

【実施例】次に、本発明の方法を具体例により、更に詳細に説明する。

【0022】

【実施例 1】次に、本発明の方法を具体例により、更に詳細に説明する。

#### 実施例 1

| 夏材部材料 (コンパウンド)        | 重量(kg) |
|-----------------------|--------|
| ポリ塩化ビニル (重合度700~1000) | 100    |
| アクリル系樹脂改質材            | 6      |
| DOP                   | 3      |
| 炭酸カルシウム               | 20     |
| 鉛系複合安定剤               | 4.3    |
| カルシウム系安定剤             | 0.5    |
| 発泡剤                   | 0.32   |
| 顔料 (クリーム色)            | 適量     |

【0023】

| 冬材部材料 (コンパウンド)        | 重量(kg) |
|-----------------------|--------|
| ポリ塩化ビニル (重合度700~1300) | 100    |
| アクリル系樹脂改質材            | 6      |
| DOP                   | 3      |
| 炭酸カルシウム               | 20     |
| 鉛系複合安定剤               | 4.3    |
| カルシウム系安定剤             | 0.5    |
| 発泡剤                   | 0.32   |
| 顔料 (ブラウン)             | 適量     |

【0024】押出機の条件

スクリュウの長さ: 1438mm

同 直径: 65mm

L/D=22

シリンダーのホッパー側設定温度: 123℃±3℃

シリンダーの中央部の設定温度 :  $133^{\circ}\text{C} \pm 3^{\circ}\text{C}$   
 シリンダーの先端側の設定温度 :  $147^{\circ}\text{C} \pm 3^{\circ}\text{C}$   
 ダイスのシリンダー側設定温度 :  $147^{\circ}\text{C} \pm 1^{\circ}\text{C}$   
 ダイスの中央部の設定温度 :  $167^{\circ}\text{C} \pm 1^{\circ}\text{C}$   
 ダイス出口の設定温度 :  $181^{\circ}\text{C} \pm 1^{\circ}\text{C}$   
 スクリューの回転速度 :  $20\text{rpm}$   
 リング部材 : 十字型 (外径 $55\text{mm}$ の金属円盤の内側の直径約 $40\text{mm}$ の円部分が、約 $3\text{mm}$ 幅の十字状板帯を残して4等分された4つの扇形貫通孔が形成されたリング部材)  
 定格電流 :  $4.8\text{A}$

【0024】上記夏材部材料と冬材部材料をそれぞれペレタイザーで径が約 $3\text{mm}$ で長さが約 $3\text{mm}$ のペレットに成形し、各材部のペレットを9:1の重量割合で混合し、ホッパーから押出機に供給した。 $65\text{mm}$ のシリンダー部から押される粗混練溶融樹脂材料は、約 $24\text{mm}$ の径のダイス口から押出され、そのダイス口で発泡した約 $35\text{mm}$ の径の円柱状体をサイジングを用いて冷却しながら直径約 $35\text{mm}$ の円柱体を形成させ、適当な長さに切断した。得られた合成木材は、約0.85の比重を有し、その表面は全体として淡色の明るい木目模様であって切口は4つの年輪軸が存在した。冬材部によって形成される木目模様は表面から内部にまで連続形成され、実木材と実質的に同様な見栄えのよい合成木材が得られた。

【0025】実施例 2  
 実施例1において、押出機のダイスを下記のように設定した以外は同様の条件で押出加工し、且つそのダイスより押し出された直径約 $30\text{mm}$ の発泡した円柱状物を間隔が $8\text{mm}$ のTダイに誘導し、幅が約 $150\text{mm}$ の板状合成木材を連続的に押し出した。得られた板状合成木材の表面木目模様は淡色の杉材に類似し、実木材板と見紛うものであった。この板は鉋によって好適に削ることができ、その鉋がけによっても同様な感じの木目模様が現われた。このように内部まで類似の木目が連続形成されているから、木材として全く同様に加工使用することができる。

ダイスのシリンダー側設定温度 :  $148^{\circ}\text{C} \pm 3^{\circ}\text{C}$   
 ダイスの中央部の設定温度 :  $168^{\circ}\text{C} \pm 3^{\circ}\text{C}$   
 ダイス出口の設定温度 :  $180^{\circ}\text{C} \pm 3^{\circ}\text{C}$

【0026】実施例 3  
 実施例2において、夏材部組成物と冬材部組成物との混合重量割合を7:3にした以外は全く同様に操作して、全体が褐色味を帯びた実施例1と同様な感じの木目模様を表面及び内部に有する板状合成木材を得た。この板も実施例1と同様に、一見して材木板が想定されるものであり、鉋がけや鋸等による細工が可能な実用上望ましいものであった。

#### 【0027】実施例 4

リング部材を使用しないでスクリュー先端からダイスへストレートに溶融樹脂を誘導するようにした押出機を用い、シリンダーの各部の設定温度を下記のように設定し、押出機のスクリューの回転数を $15\text{rpm}$ 及び定格電流を $4.4\text{アンペア}$ にした以外は、実施例2と全く同様に操作して円柱状合成木材を連続的に押出成形した。得られた合成木材は、表面の木目模様は若干弱い、円柱軸を中心にした実木材に近い1つの年輪模様が形成された。これを軸方向に鉋で削ると表面より鮮明な木目模様が現われた。この切削合成木材片の表面及び削面の木目模様を図1に部分斜視図で示した。図において、夏材部1の中に冬材部2の模様が表れている状態が明瞭である。大きな押出機を用い、所望の太さの円柱状合成木材を作るときは、押出物をそのまま、日本家屋の柱材として使用することができるので極めて好都合且つ実用であることが理解できる。

シリンダーのホッパー側設定温度 :  $120^{\circ}\text{C} \pm 3^{\circ}\text{C}$   
 シリンダーの中央部の設定温度 :  $130^{\circ}\text{C} \pm 3^{\circ}\text{C}$   
 シリンダーの先端側の設定温度 :  $147^{\circ}\text{C} \pm 3^{\circ}\text{C}$

#### 【0028】実施例 5

実施例1において、長径が約 $20\text{mm}$ で短径が約 $10\text{mm}$ の楕円状貫通孔3個を軸対象に有するリング部材をブレードプレート固定位置に配置した押出機を用いて押し出した以外は同様に操作して円柱状合成木材を押し出し製造した。得られた木材の切口は、3つの年輪軸を有する年輪模様が観察され、実施例1と同様な木目模様を表面及び内部に有する円柱体を得られた。

#### 【0029】

【発明の効果】本発明の方法によって製造される熱可塑性樹脂を素材とする合成木材は、表面だけでなく内部にまで木目模様が形成されるので、実木材に代えて建築材料、装飾木材用として使用でき、使用目的に応じて強度を高めたり、装飾的要素を高めるために夏材部と冬材部及び押し出し加工条件を選択することにより、それぞれの適用範囲を大幅に拡大することができ、しかも長期にわたる適用寿命が保証される。従って、木材資源の節約、ひいては地球環境の保全に高度に貢献する。

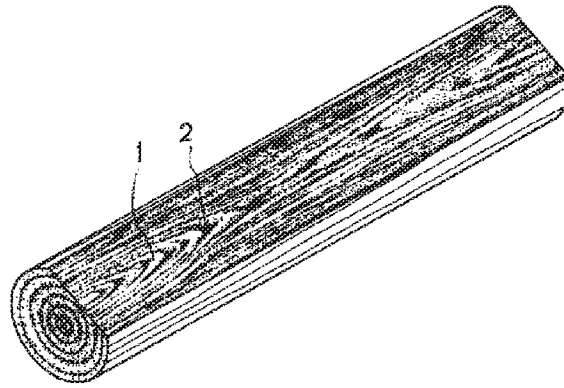
#### 【図面の簡単な説明】

図1は、実施例4で製造された合成木材の一部切削部分片の斜視図である。

#### 【符号の説明】

- 1 夏材部
- 2 冬材部

【図1】



## Electronic Acknowledgement Receipt

|                                             |                                |
|---------------------------------------------|--------------------------------|
| <b>EFS ID:</b>                              | 28297202                       |
| <b>Application Number:</b>                  | 15245948                       |
| <b>International Application Number:</b>    |                                |
| <b>Confirmation Number:</b>                 | 1690                           |
| <b>Title of Invention:</b>                  | WOOD-GRAINED POLYMER SUBSTRATE |
| <b>First Named Inventor/Applicant Name:</b> | Andrew Stephens                |
| <b>Customer Number:</b>                     | 23644                          |
| <b>Filer:</b>                               | Kyle A. Forgue/Mark Sweetin    |
| <b>Filer Authorized By:</b>                 | Kyle A. Forgue                 |
| <b>Attorney Docket Number:</b>              | 64844-256633                   |
| <b>Receipt Date:</b>                        | 08-FEB-2017                    |
| <b>Filing Date:</b>                         | 24-AUG-2016                    |
| <b>Time Stamp:</b>                          | 12:10:30                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)    |

### Payment information:

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| Submitted with Payment | no |
|------------------------|----|

### File Listing:

| Document Number | Document Description | File Name      | File Size(Bytes)/<br>Message Digest       | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|----------------|-------------------------------------------|------------------|------------------|
| 1               |                      | 256633_IDS.pdf | 31121                                     | yes              | 4                |
|                 |                      |                | 9044d887a750e8010afebbdbcb202424a5dc969fa |                  |                  |

RPI1004

|              | Multipart Description/PDF files in .zip description |                                          |                                          |     |    |
|--------------|-----------------------------------------------------|------------------------------------------|------------------------------------------|-----|----|
|              | Document Description                                |                                          | Start                                    | End |    |
|              | Transmittal Letter                                  |                                          | 1                                        | 3   |    |
|              | Information Disclosure Statement (IDS) Form (SB08)  |                                          | 4                                        | 4   |    |
| Warnings:    |                                                     |                                          |                                          |     |    |
| Information: |                                                     |                                          |                                          |     |    |
| 2            | Foreign Reference                                   | DE1963161A1.pdf                          | 1155667                                  | no  | 9  |
|              |                                                     |                                          | 46434003931ef9623369da35c07f76b10a480203 |     |    |
| Warnings:    |                                                     |                                          |                                          |     |    |
| Information: |                                                     |                                          |                                          |     |    |
| 3            | Foreign Reference                                   | FR2738768B1.pdf                          | 1246519                                  | no  | 12 |
|              |                                                     |                                          | 3c3dd788b1c8c915eee8597188220a3a3a5930f9 |     |    |
| Warnings:    |                                                     |                                          |                                          |     |    |
| Information: |                                                     |                                          |                                          |     |    |
| 4            | Foreign Reference                                   | JPH07214631A.pdf                         | 819426                                   | no  | 8  |
|              |                                                     |                                          | 374762126dff9098b1cf714cbb4dff57bbad4df5 |     |    |
| Warnings:    |                                                     |                                          |                                          |     |    |
| Information: |                                                     |                                          |                                          |     |    |
| 5            | Non Patent Literature                               | DeGroot_2012_SyntheticDeckingRoundup.pdf | 823717                                   | no  | 8  |
|              |                                                     |                                          | d6207b4dd095a0dde0e7343cd5353e95c9e5d7f  |     |    |
| Warnings:    |                                                     |                                          |                                          |     |    |
| Information: |                                                     |                                          |                                          |     |    |
| 6            | Non Patent Literature                               | vanderHoeven_2001_PolymerEngineering.pdf | 1208987                                  | no  | 18 |
|              |                                                     |                                          | 5554a41c3435807f3560949c3495a650615df68e |     |    |
| Warnings:    |                                                     |                                          |                                          |     |    |
| Information: |                                                     |                                          |                                          |     |    |
| 7            | Non Patent Literature                               | Kopplmayr_2012_14thEU_Conference.pdf     | 673395                                   | no  | 7  |
|              |                                                     |                                          | a13388b3f36d7911f9b98fd0945729031ae3d8c6 |     |    |
| Warnings:    |                                                     |                                          |                                          |     |    |

RPI1004

RPI1004

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| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |         |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 5958832 |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p> |         |

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

First Named Inventor:

STEPHENS, Andrew

Application No. 15/245948

Filed: August 24, 2016

Confirmation No. 1690

Group Art Unit: 1783

Examiner: Unassigned

For: WOOD-GRAINED POLYMER SUBSTRATE

**INFORMATION DISCLOSURE STATEMENT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Pursuant to 37 CFR 1.97 and 1.98, the references listed on the enclosed Form PTO-1449 and/or Substitute Form PTO-1449 ("Form 1449") are submitted for consideration by the Examiner in the examination of the above-identified patent application.

The full consideration of the references in their entirety by the Examiner is respectfully requested and encouraged. Also, it is respectfully requested that the references be entered into the record of the present application and that the Examiner place his or her initials in the appropriate area on the enclosed Form 1449, thereby indicating the Examiner's consideration of each of the references.

The submission of the references listed on the Form 1449 is for the purpose of providing a complete record and is not a concession that the references listed thereon are prior art to the invention claimed in the patent application. The right is expressly reserved to establish an invention date earlier than the above-identified filing date in order to remove any reference submitted herewith as prior art should it be deemed appropriate to do so.

Further, the submission of the references is not to be taken as a concession that any reference represents art that is relevant or analogous to the claimed invention. Accordingly, the right to argue that any reference is not properly within the scope of prior art relevant to an examination of the claims in the above-identified application is also expressly reserved.

The Information Disclosure Statement is being filed:

- ☒ **within** any one of the following time periods: (a) within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d); (b) within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 of an international application; (c) before the mailing date of a first

Office Action on the merits; or (d) before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

- ☐ **after** (a), (b), (c) or (d) above, but before the mailing date of a final action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an action that otherwise closes prosecution in the application, and includes *one* of:
- ☐ the Statement under 37 CFR 1.97(e) (see “Statement under 37 CFR 1.97(e)” below).
- or*
- ☐ the fee of \$180 set forth in 37 CFR 1.17(p) (see “Fees” below).
- ☐ **after** the mailing date of a final action under 37 CFR 1.113 or a Notice of Allowance under 37 CFR 1.311, or an action that otherwise closes prosecution in the application, and on or before payment of the issue fee, and includes the Statement under 37 CFR 1.97(e) (see “Statement under 37 CFR 1.97(e)” below), and the fee of \$180 as set forth in 37 CFR 1.17(p) (see “Fees” below).
- ☐ **after** the mailing date of a Notice of Allowance under 37 CFR 1.311, and on or before payment of the issue fee, and **within** thirty days of receiving each item of information contained in the Information Disclosure Statement, and includes the Statement under 37 CFR 1.704(d) (see “Statement under 37 CFR 1.704(d)” below), and the fee of \$180 as set forth in 37 CFR 1.17(p) (see “Fees” below).

NOTE: This is for original applications except applications for a design patent, filed on or after May 29, 2000, wherein a paper containing only an Information Disclosure Statement in compliance with 37 CFR 1.97 and 1.98 is being filed.

### Copies of the References

- ☒ Copies of all foreign patents and non-patent literature listed on the enclosed Form 1449 are enclosed herewith.
- ☐ Attached to each reference not in the English language is a concise explanation of the relevance pursuant to 37 CFR 1.98(a)(3). An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of the relevance pursuant to 37 CFR 1.98(a)(3).
- ☐ A copy of the international search report is enclosed herewith.
- ☐ The references listed on the enclosed Form 1449 were previously identified in the parent application(s) of the present application, and copies of the references were furnished at that time. Accordingly, additional copies of the references are not submitted herewith, so as not to burden the file with duplicate copies of references. The Examiner is respectfully requested to carefully review the references in accordance with the requirements set out in the Manual of Patent Examining Procedure. In accordance with 37 CFR 1.98(d), the

First Named Inventor: STEPHENS, Andrew  
Application No. 15/245948

details of the parent application(s) relied upon for an earlier filing date under 35 USC 120 in which copies of the references were previously furnished are set out below:

| U.S. APPLICATIONS |                  | Status ( <i>check one</i> ) |         |           |
|-------------------|------------------|-----------------------------|---------|-----------|
| U.S. APPLICATIONS | U.S. FILING DATE | PATENTED                    | PENDING | ABANDONED |
| 1.                |                  |                             |         |           |
| 2.                |                  |                             |         |           |
| 3.                |                  |                             |         |           |

#### Fees

- ☒ **No fee** is owed by the applicant(s).  
☐ Charge Deposit Account No. 12-0913 in the amount of \$0.00.

#### Authorization to Charge Additional Fees

- ☒ Please charge any additional required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

Respectfully submitted,

Date: February 8, 2017

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## INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

### Complete if Known

|                         |                   |
|-------------------------|-------------------|
| Application Number:     | 15/245948         |
| Filing Date:            | August 24, 2016   |
| First Named Inventor:   | STEPHENS, Andrew  |
| Group Art Unit:         | 1783              |
| Confirmation Number:    | 1690              |
| Examiner Name:          | Dillon, Daniel P. |
| Attorney Docket Number: | 64844-256633      |

### U.S. PATENT DOCUMENTS

| Examiner Initials | Doc. No. | U.S. Patent Document<br>Application or Patent Number | Kind Code | Name of Patentee or Applicant | Date of Publication | Filing Date If Appropriate |
|-------------------|----------|------------------------------------------------------|-----------|-------------------------------|---------------------|----------------------------|
|                   | A S      | 2332081                                              |           | Hunt                          | Oct. 1943           |                            |
|                   | A T      | 2632204                                              |           | Murray                        | Mar. 24, 1953       |                            |
|                   | A U      | 3247047                                              |           | Buckley                       | Apr. 1966           |                            |
|                   | A V      | 3422175                                              |           | Rowland                       | Jan. 14, 1969       |                            |
|                   | A W      | 3443278                                              |           | Nauta                         | May 13, 1969        |                            |
|                   | A X      | 3531828                                              |           | Nauta                         | Oct. 6, 1970        |                            |
|                   | A Y      | 3608261                                              |           | French et al.                 | Sep. 1971           |                            |
|                   | A Z      | 3792945                                              |           | Randall                       | Feb. 19, 1974       |                            |
|                   | B A      | 3920366                                              |           | Randall                       | Nov. 18, 1975       |                            |
|                   | B B      | 4661392                                              |           | Kapstad                       | Apr. 1987           |                            |
|                   | B C      | 4836814                                              |           | Bambara et al.                | Jun. 6, 1989        |                            |
|                   | B D      | 5110530                                              |           | Havens                        | May 5, 1992         |                            |
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|                   | B F      | 7137229                                              |           | Pervan                        | Nov. 2006           |                            |
|                   | B G      | 7204944                                              |           | Piedboeuf                     | Apr. 17, 2007       |                            |
|                   | B H      | 7588821                                              |           | Horwitz                       | Sep. 2009           |                            |
|                   | B I      | 8388331                                              |           | Osada et al.                  | Mar. 5, 2013        |                            |
|                   | B J      | 2003/0021915                                         |           | Rohatgi et al.                | Jan. 30, 2015       |                            |
|                   | B K      | D505467                                              |           | Marr                          | May 24, 2005        |                            |
|                   | B L      | D92186                                               |           | Little                        | May 1934            |                            |
|                   | B M      | D299793                                              |           | Yacovella                     | Feb. 1989           |                            |
|                   | B N      | D428500                                              |           | Wederski                      | Jul. 2000           |                            |
|                   | B O      | D531326                                              |           | Folliard                      | Oct. 2006           |                            |
|                   | B P      | D642287                                              |           | Poland                        | Jul. 2011           |                            |
|                   | B Q      | D653779                                              |           | Oamen                         | Feb. 2012           |                            |
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|                   | B S      | D668794                                              |           | Trudel                        | Oct. 2012           |                            |
|                   | B T      | D671230                                              |           | Lee                           | Nov. 2012           |                            |
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|                   | B V      | D710117                                              |           | Euna                          | Aug. 2014           |                            |
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|                   | B X      | D732192                                              |           | Price                         | Jun. 2015           |                            |
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|                   | B Z      | D732194                                              |           | Price                         | Jun. 2015           |                            |
|                   | C A      | D732195                                              |           | Price                         | Jun. 2015           |                            |
|                   | C B      | D732197                                              |           | Price                         | Jun. 2015           |                            |
|                   | C C      | D780333                                              |           | Davis                         | Feb. 2017           |                            |
|                   | C D      | D780335                                              |           | Davis                         | Feb. 2017           |                            |
|                   | C E      | D784566                                              |           | Davis                         | Apr. 2017           |                            |
|                   | C F      | D786457                                              |           | Metcalf                       | May 2017            |                            |

EXAMINER

DATE CONSIDERED

\* A concise statement of relevance is being submitted in lieu of a translation. 37 CFR 1.98(a)(3).

+ An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of relevance under 37 CFR 1.98(a)(3).

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## INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 2 of 2

### Complete if Known

|                         |                   |
|-------------------------|-------------------|
| Application Number:     | 15/245948         |
| Filing Date:            | August 24, 2016   |
| First Named Inventor:   | STEPHENS, Andrew  |
| Group Art Unit:         | 1783              |
| Confirmation Number:    | 1690              |
| Examiner Name:          | Dillon, Daniel P. |
| Attorney Docket Number: | 64844-256633      |

### FOREIGN PATENT DOCUMENTS

| Examiner<br>Initials | Doc.<br>No. | Foreign Patent Document |                                 |              | Name of Patentee or Applicant | Date of Publication | Translation |      |
|----------------------|-------------|-------------------------|---------------------------------|--------------|-------------------------------|---------------------|-------------|------|
|                      |             | Office                  | Application or<br>Patent Number | Kind<br>Code |                               |                     | Yes         | No** |
|                      | C G         | EP                      | 0532340                         |              | Horikawa Seisakusho Co. Ltd.  | Mar. 17, 1993       |             |      |
|                      |             |                         |                                 |              |                               |                     |             |      |
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### OTHER - NON PATENT LITERATURE DOCUMENTS

| Examiner<br>Initials | Doc.<br>No. | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number (s), publisher, city and/or country where published. | Translation |      |
|----------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|
|                      |             |                                                                                                                                                                                                                                                                  | Yes         | No** |
|                      | C H         | Thermally Fused Laminate (TFL) Panels (on-line), no date available. Retrieved from Internet 08/11/2017, URL: <a href="http://funderamerica.com/products/tfl-panels/">http://funderamerica.com/products/tfl-panels/</a> (3 pages)                                 |             |      |
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| EXAMINER |  | DATE CONSIDERED |  |
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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

First Named Inventor:

STEPHENS, Andrew

Application No. 15/245948

Filed: August 24, 2016

Confirmation No. 1690

Group Art Unit: 1783

Examiner: DILLON, Daniel P.

For: WOOD-GRAINED POLYMER SUBSTRATE

**INFORMATION DISCLOSURE STATEMENT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Pursuant to 37 CFR 1.97 and 1.98, the references listed on the enclosed Form PTO-1449 and/or Substitute Form PTO-1449 ("Form 1449") are submitted for consideration by the Examiner in the examination of the above-identified patent application.

The full consideration of the references in their entirety by the Examiner is respectfully requested and encouraged. Also, it is respectfully requested that the references be entered into the record of the present application and that the Examiner place his or her initials in the appropriate area on the enclosed Form 1449, thereby indicating the Examiner's consideration of each of the references.

The submission of the references listed on the Form 1449 is for the purpose of providing a complete record and is not a concession that the references listed thereon are prior art to the invention claimed in the patent application. The right is expressly reserved to establish an invention date earlier than the above-identified filing date in order to remove any reference submitted herewith as prior art should it be deemed appropriate to do so.

Further, the submission of the references is not to be taken as a concession that any reference represents art that is relevant or analogous to the claimed invention. Accordingly, the right to argue that any reference is not properly within the scope of prior art relevant to an examination of the claims in the above-identified application is also expressly reserved.

The Information Disclosure Statement is being filed:

- ☒ **within** any one of the following time periods: (a) within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d); (b) within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 of an international application; (c) before the mailing date of a first

First Named Inventor: STEPHENS, Andrew  
Application No. 15/245948

Office Action on the merits; or (d) before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

☐ **after** (a), (b), (c) or (d) above, but before the mailing date of a final action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an action that otherwise closes prosecution in the application, and includes *one* of:

☐ the Statement under 37 CFR 1.97(e) (see “Statement under 37 CFR 1.97(e)” below).

*or*

☐ the fee of \$180 set forth in 37 CFR 1.17(p) (see “Fees” below).

☐ **after** the mailing date of a final action under 37 CFR 1.113 or a Notice of Allowance under 37 CFR 1.311, or an action that otherwise closes prosecution in the application, and on or before payment of the issue fee, and includes the Statement under 37 CFR 1.97(e) (see “Statement under 37 CFR 1.97(e)” below), and the fee of \$180 as set forth in 37 CFR 1.17(p) (see “Fees” below).

☐ **after** the mailing date of a Notice of Allowance under 37 CFR 1.311, and on or before payment of the issue fee, and **within** thirty days of receiving each item of information contained in the Information Disclosure Statement, and includes the Statement under 37 CFR 1.704(d) (see “Statement under 37 CFR 1.704(d)” below), and the fee of \$180 as set forth in 37 CFR 1.17(p) (see “Fees” below).

NOTE: This is for original applications except applications for a design patent, filed on or after May 29, 2000, wherein a paper containing only an Information Disclosure Statement in compliance with 37 CFR 1.97 and 1.98 is being filed.

### Copies of the References

☒ Copies of all foreign patents and non-patent literature listed on the enclosed Form 1449 are enclosed herewith.

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☐ A copy of the international search report is enclosed herewith.

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First Named Inventor: STEPHENS, Andrew  
Application No. 15/245948

details of the parent application(s) relied upon for an earlier filing date under 35 USC 120 in which copies of the references were previously furnished are set out below:

| U.S. APPLICATIONS |                  | Status ( <i>check one</i> ) |         |           |
|-------------------|------------------|-----------------------------|---------|-----------|
| U.S. APPLICATIONS | U.S. FILING DATE | PATENTED                    | PENDING | ABANDONED |
| 1.                |                  |                             |         |           |
| 2.                |                  |                             |         |           |
| 3.                |                  |                             |         |           |

#### Fees

- ☒ **No fee** is owed by the applicant(s).  
☐ Charge Deposit Account No. 12-0913 in the amount of \$0.00.

#### Authorization to Charge Additional Fees

- ☒ Please charge any additional required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

Respectfully submitted,

Date: November 27, 2017

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(11) Publication number : **0 532 340 A2**

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## EUROPEAN PATENT APPLICATION

(21) Application number : **92308283.8**

(51) Int. Cl.<sup>5</sup> : **B44F 7/00, B29D 12/02, B44C 3/04**

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(54) **A synthetic resin decorative product and a process for manufacturing same.**

(57) A synthetic resin decorative product and a method for producing the product, the product including a leaf pigment in the synthetic resin material, the leaf pigment forming a leafing layer (L) which is deflected within the synthetic resin material in order to provide an optically three dimensional stereographic pattern which is visible through a surface of the product.

**FIG.3**

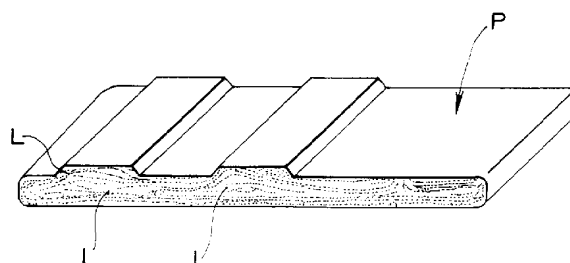
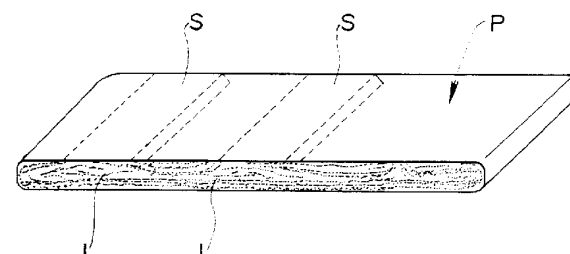


**FIG.4**



This invention relates to a synthetic resin decorative product and a process for manufacturing the product. The product includes a three dimensional stereographic pattern visible at a smooth surface of the product, and is suitable for use in a variety of applications using synthetic resin moldings, for example, parts of the frame of a pair of spectacles, or in decorative products for indoor or outdoor use.

In the past, patterns have been provided on synthetic resin products by embossing, laser machining (for example as described in Japanese HEISEI 1-222956 issued on 6 September 1989), or by cutting the surface of the products. A product of such processes includes a three dimensional surface pattern having the disadvantage that it may become stained due to the adhesion of grease or dust to the convex or concave parts of the pattern, resulting in the product having an unsightly appearance, and the product being unhygienic.

Plastic tiles and synthetic resin sheets (for use as decorative floor or wall coverings) have been produced by scattering pieces of coloured resin onto a synthetic substrate, and then bonding a transparent synthetic resin sheet to the substrate using a hot press technique. The resulting product includes a three dimensional pattern. However, only simple scattering patterns can be produced using this method. Plastic tiles or synthetic resin sheets produced using this method lack variety, and use of such products has been limited.

It is an object of the present invention to provide a synthetic resin product having a three dimensional pattern.

A primary object of the invention is for the product to include a stereographic pattern in and/or at a smooth plane or curved surface of the product.

Another object is to provide a process for manufacturing a synthetic resin product provided with a deep stereographic pattern at and/or beneath a smooth plane or curved surface thereof.

A further object is to provide a process whereby a variety of stereographic patterns can be provided so as to be visible at and/or beneath a smooth plane or curved surface of a small area, such as the surface of parts of the frame of a pair of spectacles.

Other objects and advantages of this invention will become apparent from the following description.

According to a first aspect of the present invention, there is provided a process for manufacturing a synthetic resin decorative product having an optically three-dimensional stereographic pattern, the process comprising the steps of:

molding a synthetic resin material including a leaf pigment, the leaf pigment forming a leafing layer (L) within the synthetic resin material,

deflecting the position of the leafing layer (L) within the synthetic resin material, and cutting or abrading the surface of the molded syn-

thetic resin material (P) so as to provided a smooth plane or curved surface at and/or through which the pattern is visible.

According to a second aspect of the invention there is provided a synthetic resin decorative product manufactured using the process of the first aspect, having an optically three dimensional stereographic pattern which is visible at a surface of the product.

The invention will further be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a sectional view of a metal mold for use in manufacturing the product of example 1 of the invention;

Figure 2 is a view of a stream of synthetic resin and leaf pigment when the synthetic resin material is injected into the metal mold of Figure 1;

Figure 3 is a partial sectional perspective view of the synthetic resin molding of Figure 2 removed from the metal mold;

Figure 4 is a partial sectional perspective view of the synthetic resin molding of Figure 3 after the surface of the molding has been cut and abraded;

Figure 5 is an enlarged sectional view of a stream of synthetic resin and leaf pigment in a cavity of the mold of Figure 1;

Figure 6 is a view of the synthetic resin molding of Figure 5 after the surface of the molding has been cut and abraded; and

Figure 7 is a schematic illustration of a manufacturing process according to example 2 of the invention.

The synthetic resin product of the invention can be produced by intentionally deflecting a leafing layer including leaf pigment in a synthetic resin molding so as to form a pattern, figure or character, and then cutting the synthetic resin molding so as to form a smooth surface.

Any transparent synthetic resin material may be used in the process, and the material may be either thermoplastic or thermosetting, so long as the material is capable of being molded whilst including a leaf pigment. Suitable synthetic resin materials include cellulose propionate resin, vinyl chloride resin, methacrylate resin, polycarbonate resin, polyamide resin, polyester resin, epoxy resin or silicone resin.

Any leaf pigment (a pigment wherein the particles are in the form of "leaves" or platelets) such as a graphite type leaf pigment (for example graphite), mica type leaf pigment (for example micaceous iron oxide) or a metal type leaf pigment may be used so long as it is capable of forming a leafing layer (a layer or stratum formed from the leaf pigment) within the synthetic resin material. The invention is most effective when a pearlescent leaf pigment, for example titanium dioxide coated mica, is used.

Any known molding techniques, for example injection molding, extrusion molding or casting, may be

used.

Three examples of the invention will be described in detail below.

#### Example 1.

A leaf pigment consisting of titanium dioxide coated mica of size 10 to 60  $\mu\text{m}$  and graphite of size 10 to 40  $\mu\text{m}$  is used. The leaf pigment is mixed with a transparent cellulose propionate resin so that the titanium dioxide coated mica concentration is approximately 10000 ppm and the graphite concentration is approximately 1000 ppm. The mixed resin is heated to a temperature of approximately 185°C, until molten, and the molten mixture is then injected into a mold M for forming the temple of the frame of a pair of spectacles, as shown in Figure 1.

The cavity of the mold M includes two cavities R. When the cellulose propionate resin flows and fills the mold, the leaf pigments 1 mixed in the resin form a leafing layer L which extends along the flow path of the resin, as shown in Figures 2 and 5. It is clear from Figure 2 that the leafing layer is deflected where the mold includes the cavities R.

After the synthetic resin has been injected into the mold M and allowed to cool and set, the synthetic resin molding P (Figures 3 and 6) is removed from the mold M and the convex parts of the molding P which extended into the cavities R during molding are cut away and abraded so as to form a smooth surface. The leafing layer is visible at and/or through the surface of the molding, the complex reflective property of the leaf pigment resulting in the production of a three dimensional stereographic pattern.

#### Example 2.

The leaf pigment used in example 2 comprises titanium dioxide coated mica of size 10 to 60  $\mu\text{m}$  and graphite of size 10 to 40  $\mu\text{m}$ . The leaf pigment is mixed with a transparent vinyl chloride resin so that the titanium dioxide coated mica concentration is approximately 10000 ppm and the graphite concentration is approximately 3000 ppm. The mixed resin is heated to approximately 173°C until molten, and is then extruded from an extrusion die M1, shown in Figure 7, so as to form a particular molding shape. The surface of the vinyl chloride resin is pressed whilst soft using an embossed roller ER, the embossing surface E of the roller ER having a continuous pattern of convex and concave regions, resulting in the leafing layer being deflected within the synthetic resin material. The pressed surface of the vinyl chloride resin is cooled and is then cut and abraded so as to form a smooth surface at, and/or beneath which a three dimensional stereographic pattern.

#### Example 3.

The leaf pigment used in example 3 comprises titanium dioxide coated mica of size 10 to 60  $\mu\text{m}$  and graphite of size 10 to 40  $\mu\text{m}$ . A cold setting epoxy resin is used, the resin having a viscosity of 500 to 800 cps, with a thixotropy agent (ultra fine particles of high purity silica gel anhydride).

The leaf pigments are compounded into the epoxy resin so that the titanium dioxide coated mica has a concentration of approximately 10000 ppm and the graphite has a concentration of approximately 1000 ppm, and then the resin is prepared for casting. The casting resin is then molded using a cast molding technique, the mold including a plate shaped cavity with a striped pattern cut into it. When completely set, the cast resin is removed, and the surface of the cast resin is abraded so as to form a smooth surface. The resulting product includes a striped stereographic pattern visible at and/or beneath the surface of the transparent resin produced by the leafing layer formed by the leaf pigment.

In some circumstances more than one leafing layer may form in the products.

Although the viscosity of the epoxy resin preferably in the range 500 to 800 cps, the above technique works with resin having a viscosity of approximately 10000 cps.

Conveniently the particle size of the titanium dioxide coated mica leafing pigment is within the ranges of length 5 to 150 micro-metre and thickness 0.06 to 0.17 micro-metre.

The products of the above described methods each include a three dimensional stereographic pattern visible at and/or through a smooth surface of the product. It will be recognised that generally the aim will be for the pattern to be below the surface of the product so as to be within the mass of the transparent material. However there can be situations in which sufficient of the product is cut away for the, some of, or all of the leafing layer(s) to break the final surface of the product such that parts of layer(s) may be exposed or removed resulting in the pattern being at and below the product surface. In the product there are no convex or concave regions to which grease or dust may adhere. There is also a much wider choice of designs than can be produced using the prior art technique of producing tiles or synthetic resin sheets described earlier.

#### Claims

1. A process for manufacturing a synthetic resin decorative product having an optically three-dimensional stereographic pattern, the process comprising the steps of:  
molding a synthetic resin material includ-

ing a leaf pigment, the leaf pigment forming a leafing layer (L) within the synthetic resin material,

deflecting the position of the leafing layer (L) within the synthetic resin material, and cutting or abrading the surface of the molded synthetic resin material (P) so as to provide a smooth plane or curved surface at and/or through which the pattern is visible.

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2. A process as claimed in Claim 1 characterized in that the molding step comprises injection molding the synthetic resin material using a mold (M), the wall defining the molding chamber thereof including at least one convex or concave region (R) for deflecting the leafing layer (L). 15
3. A process as claimed in Claim 1 or Claim 2 characterized in that the product (P) is a part of the frame of a pair of spectacles. 20
4. A process as claimed in Claim 1 characterized in that the molding step comprises extruding the synthetic resin material from an extruding die (M1), and embossing the extruded material so as to produce deflections in the location of a leafing layer within the extruded material. 25
5. A process as claimed in Claim 1 characterized in that the molding step comprises injecting the synthetic resin material into a casting mold, the wall of the mold defining the molding chamber including at least one convex or concave region for deflecting the leafing layer within the synthetic resin material. 30  
35
6. A process as claimed in Claim 5 characterized in that the casting resin comprises epoxy resin provided with a thixotropy agent, the epoxy resin having a viscosity in the range of 500 to 10000 cps. 40
7. A process as claimed in any one of the preceding claims characterized in that the leaf pigment comprises graphite and titanium dioxide coated mica. 45
8. A synthetic resin decorative product having an optically three dimensional stereographic pattern which is visible at and/or through a surface of the product, manufactured using the process claimed in any one of the preceding claims. 50
9. A synthetic resin decorative product as claimed in Claim 8 characterized in that the product comprises a part of the frame of a pair of spectacles. 55

FIG.1

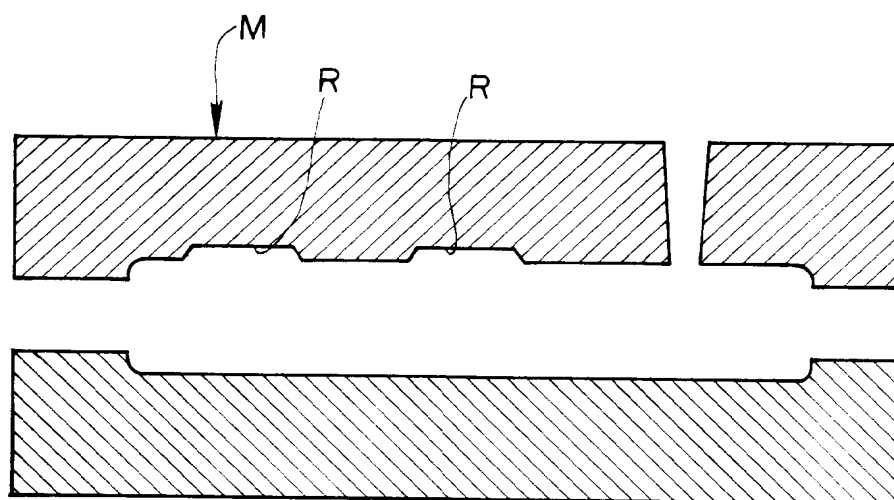


FIG.2

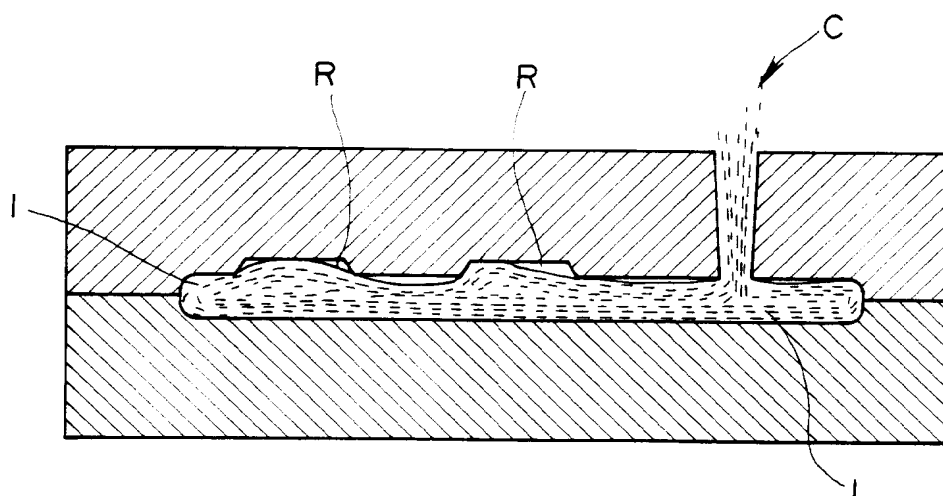


FIG.3

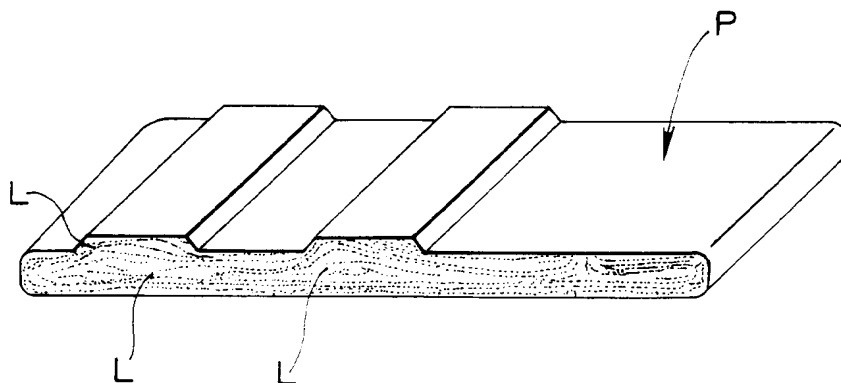


FIG.4

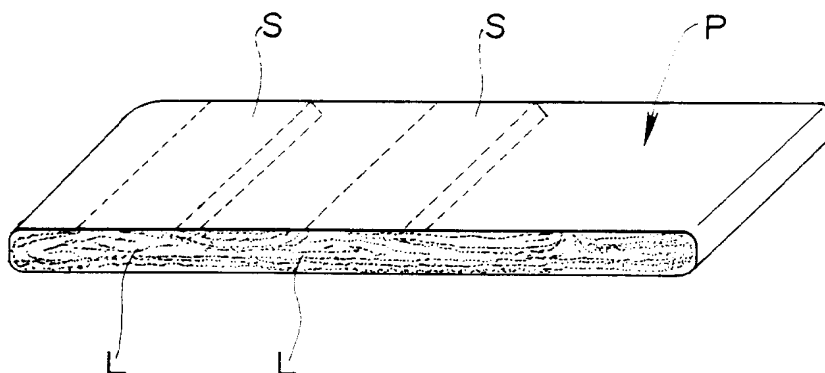


FIG.5

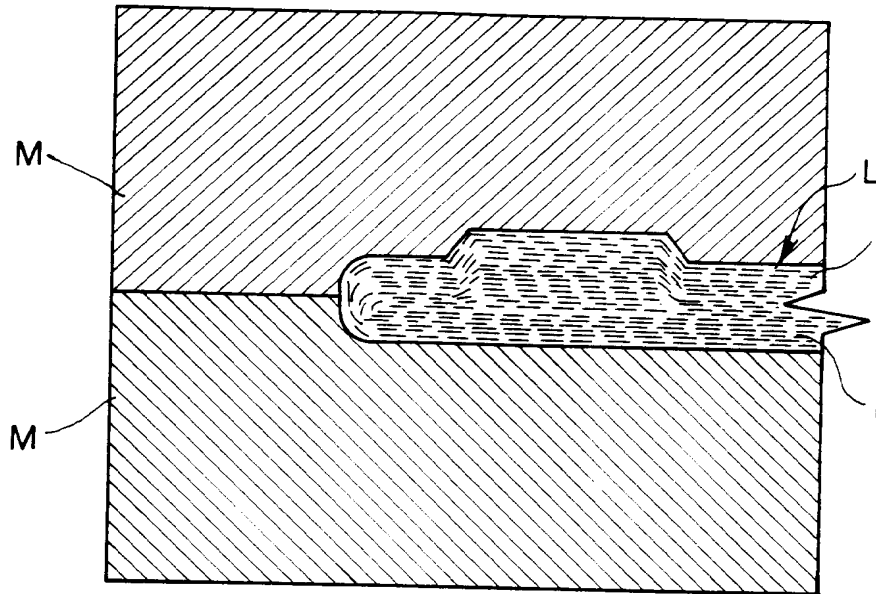


FIG.6

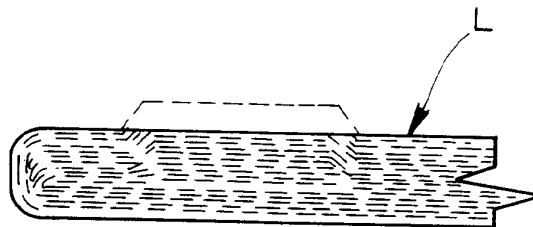
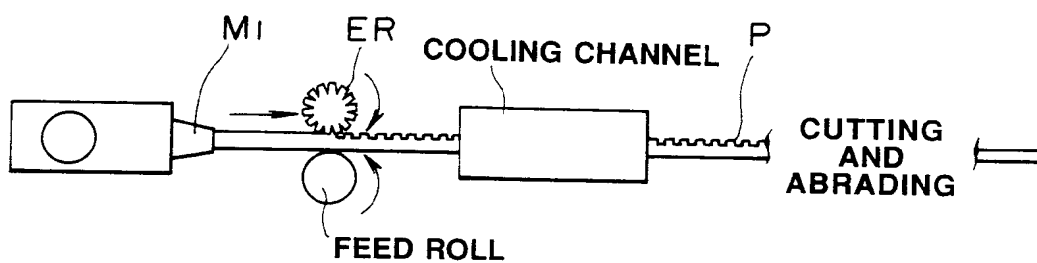


FIG.7



## Electronic Acknowledgement Receipt

|                                             |                                |
|---------------------------------------------|--------------------------------|
| <b>EFS ID:</b>                              | 31050612                       |
| <b>Application Number:</b>                  | 15245948                       |
| <b>International Application Number:</b>    |                                |
| <b>Confirmation Number:</b>                 | 1690                           |
| <b>Title of Invention:</b>                  | WOOD-GRAINED POLYMER SUBSTRATE |
| <b>First Named Inventor/Applicant Name:</b> | Andrew Stephens                |
| <b>Customer Number:</b>                     | 23644                          |
| <b>Filer:</b>                               | Kyle A. Forgue/Mark Sweetin    |
| <b>Filer Authorized By:</b>                 | Kyle A. Forgue                 |
| <b>Attorney Docket Number:</b>              | 64844-256633                   |
| <b>Receipt Date:</b>                        | 27-NOV-2017                    |
| <b>Filing Date:</b>                         | 24-AUG-2016                    |
| <b>Time Stamp:</b>                          | 16:49:31                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)    |

### Payment information:

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| Submitted with Payment | no |
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### File Listing:

| Document Number | Document Description | File Name           | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|---------------------|------------------------------------------|------------------|------------------|
| 1               |                      | 256633_Supp_IDS.pdf | 44935                                    | yes              | 5                |
|                 |                      |                     | 8fed37e1305748708ba882025aefb45f5a140f18 |                  |                  |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Document Description</b>                                |                                      | <b>Start</b>                                 | <b>End</b> |   |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Information Disclosure Statement (IDS) Form (SB08)         |                                      | 4                                            | 5          |   |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Transmittal Letter                                         |                                      | 1                                            | 3          |   |  |  |  |  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                            |                                      |                                              |            |   |  |  |  |  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                            |                                      |                                              |            |   |  |  |  |  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Non Patent Literature                                      | NPL_Thermally_Fused_Laminat<br>e.pdf | 421686                                       | no         | 3 |  |  |  |  |
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| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                            |                                      |                                              |            |   |  |  |  |  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                            |                                      |                                              |            |   |  |  |  |  |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Foreign Reference                                          | EP0532340A2.pdf                      | 334477                                       | no         | 7 |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                            |                                      | 419c7902b5534eb383726bf1564418b615a<br>0ed9f |            |   |  |  |  |  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                            |                                      |                                              |            |   |  |  |  |  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                            |                                      |                                              |            |   |  |  |  |  |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                            |                                      | 801098                                       |            |   |  |  |  |  |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p> |                                                            |                                      |                                              |            |   |  |  |  |  |

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# **INFORMATION DISCLOSURE STATEMENT BY APPLICANT**

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Sheet 1 of 2

## **Complete if Known**

|                         |                   |
|-------------------------|-------------------|
| Application Number:     | 15/245948         |
| Filing Date:            | August 24, 2016   |
| First Named Inventor:   | STEPHENS, Andrew  |
| Group Art Unit:         | 1783              |
| Confirmation Number:    | 1690              |
| Examiner Name:          | Dillon, Daniel P. |
| Attorney Docket Number: | 64844-256633      |

## **U.S. PATENT DOCUMENTS**

| Examiner Initials | Doc. No. | U.S. Patent Document<br>Application or Patent Number | Kind Code | Name of Patentee or Applicant | Date of Publication | Filing Date If Appropriate |
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|                   | C D      | D780335                                              |           | Davis                         | Feb. 2017           |                            |
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|                   | C F      | D786457                                              |           | Metcalfe                      | May 2017            |                            |

|          |                   |                 |            |
|----------|-------------------|-----------------|------------|
| EXAMINER | /DANIEL P DILLON/ | DATE CONSIDERED | 12/08/2017 |
|----------|-------------------|-----------------|------------|

\* A concise statement of relevance is being submitted in lieu of a translation. 37 CFR 1.98(a)(3).

+ An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of relevance under 37 CFR 1.98(a)(3).

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| Application Number:     | 15/245948         |
| Filing Date:            | August 24, 2016   |
| First Named Inventor:   | STEPHENS, Andrew  |
| Group Art Unit:         | 1783              |
| Confirmation Number:    | 1690              |
| Examiner Name:          | Dillon, Daniel P. |
| Attorney Docket Number: | 64844-256633      |

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| Examiner<br>Initials | Doc.<br>No. | Foreign Patent Document |                                 |              | Name of Patentee or Applicant | Date of Publication | Translation |      |
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|                      |             |                         |                                 |              |                               |                     |             |      |
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+ An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of relevance under 37 CFR 1.98(a)(3).

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|                                          |                                       |  |                                                               |             |
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| <b><i>Notice of References Cited</i></b> | Application/Control No.<br>15/245,948 |  | Applicant(s)/Patent Under<br>Reexamination<br>Stephens et al. |             |
|                                          | Examiner<br>DANIEL P DILLON           |  | Art Unit<br>1783                                              | Page 1 of 1 |

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|   | G |                                                  |                 |                |                    |                   |
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|   | O |                                                  |                 |         |      |                    |
|   | P |                                                  |                 |         |      |                    |
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|   | S |                                                  |                 |         |      |                    |
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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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| Application Number:     | 15/245948        |
| Filing Date:            | August 24, 2016  |
| First Named Inventor:   | STEPHENS, Andrew |
| Group Art Unit:         | 1783             |
| Confirmation Number:    | 1690             |
| Examiner Name:          | Unassigned       |
| Attorney Docket Number: | 64844-256633     |

## **U.S. PATENT DOCUMENTS**

| Examiner<br>Initials | U.S. Patent Document |                                 |           | Name of Patentee or Applicant | Date of Publication | Filing Date If<br>Appropriate |
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## **FOREIGN PATENT DOCUMENTS**

| Examiner<br>Initials | Foreign Patent Document |        |                                 |              | Name of Patentee or Applicant | Date of Publication | Translation |      |
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|                      | Doc.<br>No.             | Office | Application or<br>Patent Number | Kind<br>Code |                               |                     | Yes         | No** |
|                      | A M                     | DE     | 1963161                         |              | Farbwerke Hoechst AG          | Jun. 24, 1971       |             | X+   |
|                      | A N                     | FR     | 2738768                         |              | Peytral                       | Dec. 3, 1999        |             | X+   |
|                      | A O                     | JP     | JPH07-214631                    |              | Echo Chem KK                  | Aug. 15, 1995       |             | X+   |
|                      |                         |        |                                 |              |                               |                     |             |      |
|                      |                         |        |                                 |              |                               |                     |             |      |

## **OTHER - NON PATENT LITERATURE DOCUMENTS**

| Examiner<br>Initials | Doc.<br>No. | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number (s), publisher, city and/or country where published. | Translation |      |
|----------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|
|                      |             |                                                                                                                                                                                                                                                                  | Yes         | No** |
|                      | A P         | DeGroot, "Synthetic Decking Roundup," <i>Professional Deck Builder</i> 1-8 (2012).                                                                                                                                                                               |             |      |
|                      | A Q         | Koepplmayr et al., "Numerical and Experimental Modeling of a Multiflux Static Mixer for Continuous Extrusion of Layered Polymer Blends," <i>14th European Conference on Mixing, At Warsaw, Poland</i> , (September 2012).                                        |             |      |
|                      | A R         | Van der Hoeven et al., "Homogeneity of multilayers produced with a Static Mixer," <i>Polymer Engineering And Science</i> , 41(1): 1-18 (2001).                                                                                                                   |             |      |
|                      |             |                                                                                                                                                                                                                                                                  |             |      |
|                      |             |                                                                                                                                                                                                                                                                  |             |      |

|          |                   |                 |            |
|----------|-------------------|-----------------|------------|
| EXAMINER | /DANIEL P DILLON/ | DATE CONSIDERED | 12/08/2017 |
|----------|-------------------|-----------------|------------|

\* A concise statement of relevance is being submitted in lieu of a translation. 37 CFR 1.98(a)(3).

+ An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or a translation of a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of relevance under 37 CFR 1.98(a)(3).

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. Page 107 of 437

RPT1004



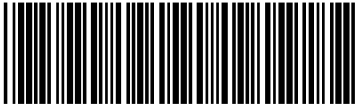
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## BIB DATA SHEET

CONFIRMATION NO. 1690

|                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                   |                               |                                                                                                                                                                                                                                                                           |                                            |                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------|
| <b>SERIAL NUMBER</b><br>15/245,948                                                                                                                                                                                                                                                                                                                                                                             | <b>FILING or 371(c) DATE</b><br>08/24/2016<br><b>RULE</b>                                                         | <b>CLASS</b><br>428           | <b>GROUP ART UNIT</b><br>1783                                                                                                                                                                                                                                             | <b>ATTORNEY DOCKET NO.</b><br>64844-256633 |                                |
| <b>APPLICANTS</b><br>TANGENT TECHNOLOGIES LLC, Aurora, IL<br><b>INVENTORS</b><br>Andrew Stephens, Aurora, IL;<br>Francisco Morales, Plano, IL;<br>Tadeusz Rybka, Streamwood, IL;<br><b>** CONTINUING DATA *****</b><br>This appln claims benefit of 62/208,928 08/24/2015<br><b>** FOREIGN APPLICATIONS *****</b><br><b>** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY **</b><br>09/02/2016 |                                                                                                                   |                               |                                                                                                                                                                                                                                                                           |                                            |                                |
| Foreign Priority claimed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>35 USC 119(a-d) conditions met <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Verified and Acknowledged <u>/DANIEL P DILLON/</u><br>Examiner's Signature                                                                                                                               | <input type="checkbox"/> Met after Allowance<br>Initials                                                          | <b>STATE OR COUNTRY</b><br>IL | <b>SHEETS DRAWINGS</b><br>9                                                                                                                                                                                                                                               | <b>TOTAL CLAIMS</b><br>16                  | <b>INDEPENDENT CLAIMS</b><br>3 |
| <b>ADDRESS</b><br>Barnes & Thornburg LLP (CH)<br>P.O. Box 2786<br>Chicago, IL 60690-2786<br>UNITED STATES                                                                                                                                                                                                                                                                                                      |                                                                                                                   |                               |                                                                                                                                                                                                                                                                           |                                            |                                |
| <b>TITLE</b><br>WOOD-GRAINED POLYMER SUBSTRATE                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                   |                               |                                                                                                                                                                                                                                                                           |                                            |                                |
| <b>FILING FEE RECEIVED</b><br>800                                                                                                                                                                                                                                                                                                                                                                              | FEES: Authority has been given in Paper<br>No. _____ to charge/credit DEPOSIT ACCOUNT<br>No. _____ for following: |                               | <input type="checkbox"/> All Fees<br><input type="checkbox"/> 1.16 Fees (Filing)<br><input type="checkbox"/> 1.17 Fees (Processing Ext. of time)<br><input type="checkbox"/> 1.18 Fees (Issue)<br><input type="checkbox"/> Other _____<br><input type="checkbox"/> Credit |                                            |                                |

|                                                                                                          |                                              |                                                                   |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b>Search Notes</b><br> | <b>Application/Control No.</b><br>15/245,948 | <b>Applicant(s)/Patent Under Reexamination</b><br>Stephens et al. |
|                                                                                                          | <b>Examiner</b><br>DANIEL P DILLON           | <b>Art Unit</b><br>1783                                           |

|                        |             |                 |
|------------------------|-------------|-----------------|
| <b>CPC - Searched*</b> |             |                 |
| <b>Symbol</b>          | <b>Date</b> | <b>Examiner</b> |
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| <b>CPC Combination Sets - Searched*</b> |             |                 |
| <b>Symbol</b>                           | <b>Date</b> | <b>Examiner</b> |
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|--------------------------------------|-----------------|-------------|-----------------|
| <b>US Classification - Searched*</b> |                 |             |                 |
| <b>Class</b>                         | <b>Subclass</b> | <b>Date</b> | <b>Examiner</b> |
|                                      |                 |             |                 |

\* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

|                              |             |                 |
|------------------------------|-------------|-----------------|
| <b>Search Notes</b>          |             |                 |
| <b>Search Notes</b>          | <b>Date</b> | <b>Examiner</b> |
| East Search History Provided | 12/11/2017  | /DD/            |

|                            |                              |             |                 |
|----------------------------|------------------------------|-------------|-----------------|
| <b>Interference Search</b> |                              |             |                 |
| <b>US Class/CPC Symbol</b> | <b>US Subclass/CPC Group</b> | <b>Date</b> | <b>Examiner</b> |
|                            |                              |             |                 |

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| APPLICATION NO.             | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------------------|-------------|----------------------|---------------------|------------------|
| 15/245,948                  | 08/24/2016  | Andrew Stephens      | 64844-256633        | 1690             |
| 23644                       | 7590        | 12/15/2017           | EXAMINER            |                  |
| Barnes & Thornburg LLP (CH) |             |                      | DILLON, DANIEL P    |                  |
| P.O. Box 2786               |             |                      | ART UNIT            | PAPER NUMBER     |
| Chicago, IL 60690-2786      |             |                      | 1783                |                  |
|                             |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                             |             |                      | 12/15/2017          | ELECTRONIC       |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent-ch@btlaw.com



## **DETAILED CORRESPONDENCE**

### ***Notice of Pre-AIA or AIA Status***

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

### ***Information Disclosure Statement***

The information disclosure statements (IDS) submitted on 2/8/2017 and 11/27/2017 have been considered by the examiner.

### ***Claim Objections***

Claim 16 objected to because of the following informalities:

-Line 3 of the claim reads "a first simulated" and should be corrected to "a second simulated"

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

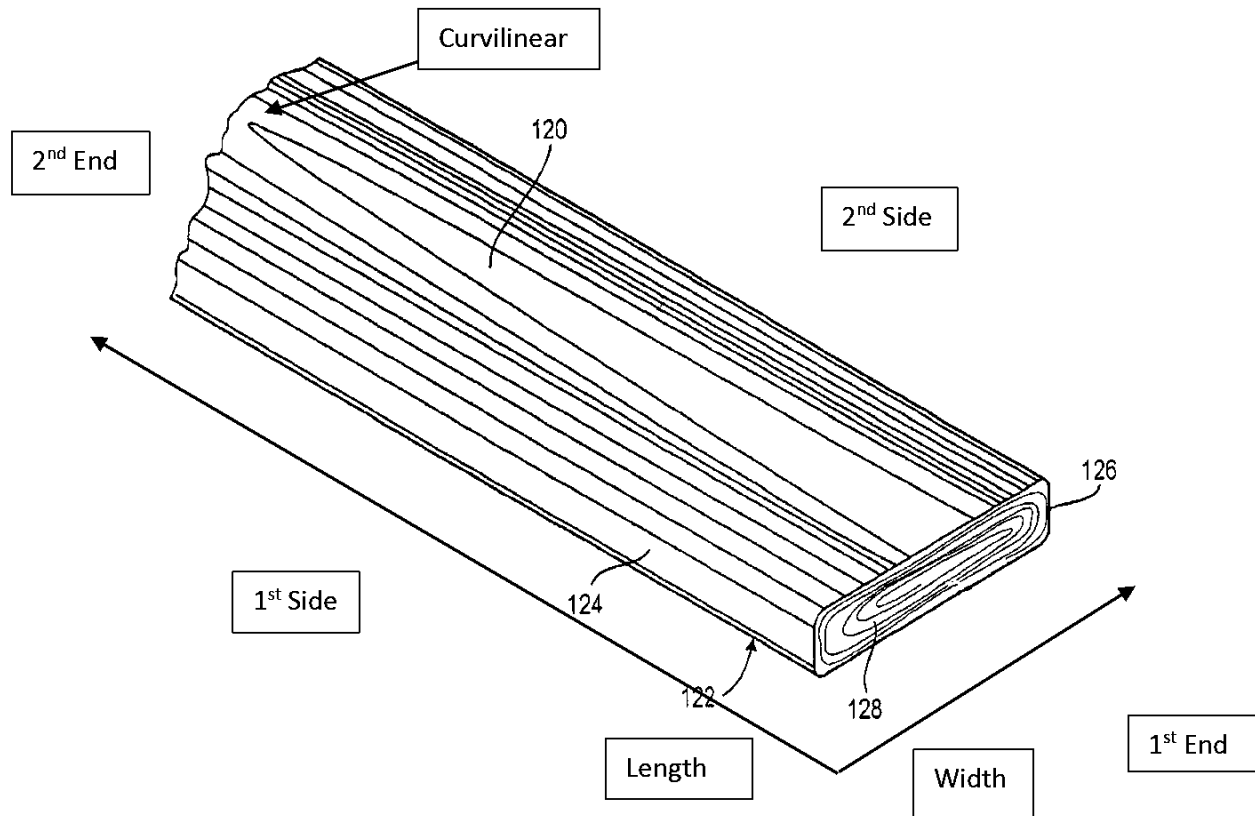
A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

**Claims 1, 3-10, and 12-16** are rejected under 35 U.S.C. 103 as being unpatentable over Rohatgi et al. (US 2003/0021915).

Regarding **claims 1, 10, and 16**, Rohatgi teaches composites of cellulosic fibers and polymers for the formation of wood-like boards (Pg. 1, Paragraph [0001]). Figure 3 shows a wood board formed from the composite shown below.



As shown, the board has a first end, a second end, a first, and a second side such that the sides, as defined by the examiner, define the width of the board and the ends define the length of the board with the core in between. The examiner defines the set of darkened lines as the first set of polymer layers and the whiter layers as the second set of polymer layers in that the darker lines have a different coloring than the whiter layers and that each of the layers extends in the length direction. Additionally, the layers alternate in the width direction of the board and the board may be imparted with curves ("curvilinear") as pointed out in the figure above along with the curve being *uninterrupted* at the curve.

Additionally, Rohatgi teaches the process of forming composites, such as the board above, by means of single extrusion or coextrusion either combining a first extruded sheet with a second or more in through a single extruder after the materials have been mixed forming the first and second extrudates (Pg. 5, Paragraph [0046]) or by means of forming a first extrudate, extruding that first extrudate, forming a second extrudate, extruding the second extrudate and combining the first and second extrudates or

groups of materials (Pg. 5, Paragraph [0047]). The methods of coextrusion would ultimately result in the formation of the two differing layers as shown in the figure above. As such, it would have been obvious that the formation of the composite as shown in the figure above would have been achieved by the methods of coextrusion as taught by Rohatgi thus resulting in two distinct colored layers as discussed above.

Additionally, regarding claim 16, Rohatgi teaches the composites may be used to make a variety of products including decking and fencing (Pg. 9, Paragraph [0078]). One of ordinary skill in the art would appreciate that decking and fencing requires the use of multiple boards coupled together to form the deck or the fencing.

Additionally, the terms *“generally” extending along the length direction* have been given the broadest reasonable interpretation such that the layers are shown as extending in the length direction of the boards.

Regarding **claims 3 and 4**, Rohatgi teaches the composites as discussed above with respect to claim 1. Additionally, the 1<sup>st</sup> end shown as #128 illustrates the two layers extending in the length direction and forming a burling grain pattern (*“wood grain pattern”*) which may be seen wherever the board is cut (*“exposed portion forms a burling grain pattern”*) (Pg. 6, Paragraph [0052]).

Regarding **claim 5**, Rohatgi teaches the composites as discussed above with respect to claim 1. Additionally, all sides of the decking product composite show a two-tone wood grain color (*“at least one of the first and second sides of the board is embossed with a wood grain pattern”*) (Pg. 6, Paragraph [0052]).

Regarding **claims 6-8**, Rohatgi teaches the composites as discussed above with respect to claim 1. Additionally, the composite may include HDPE as the polymer along with foaming agents and UV inhibitors (*“wherein the first and second sets of polymer layers are formed from high density*

polyethylene” & “wherein the sets of polymer layers further includes one of a UV inhibitor and a foaming agent and further a foaming agent”) (Pg. 3, Paragraph [0036]).

Regarding **claim 9**, Rohatgi teaches the composites as discussed above with respect to claim 1. Additionally, one of ordinary skill would appreciate that the board as shown above would have a cross-section in the shape of a rectangle along the length direction.

Regarding **claims 12-14**, Rohatgi teaches the composites as discussed above with respect to claim 10. Additionally, the composite may include HDPE as the polymer along with foaming agents and UV inhibitors (“wherein the first and second sets of polymer layers are formed from high density polyethylene” & “wherein the sets of polymer layers further includes one of a UV inhibitor and a foaming agent and further a foaming agent”) (Pg. 3, Paragraph [0036]).

Regarding **claim 15**, Rohatgi teaches the composites as discussed above with respect to claim 10. Additionally, one of ordinary skill would appreciate that the board as shown above would have a cross-section in the shape of a rectangle along the length direction.

**Claims 2 and 11** are rejected under 35 U.S.C. 103 as being unpatentable over Rohatgi et al. (US 2003/0021915) in view of Franco et al. (US 2004/0038002).

Regarding **claims 2 and 11**, Rohatgi teaches the composites as discussed above with respect to claims 1 and 10. Additionally, the board as shown above illustrates the two-tone finish and the three-dimensional embossment (Pg. 6, Paragraph [0052]; Pg. 7, Paragraph [0064]) that illustrates a wood grain-like or “streaking” appearance of the invention taught by Rohatgi (PG. 2, Paragraph [0012]).

Rohatgi is silent with respect to the darker lines in the figure above, which the examiner recognizes as the first set of polymer layers, being generally thinner than the whiter areas in the figure above, which the examiner considers as the second set of polymers

Franco teaches an extruded wood imitation component having contrasting veins throughout the core and the outer surfaces of the component (Pg. 1, Paragraph [0001]). The veins are incorporated in the component in order to further provide the simulation of natural wood (Pg. 2, Paragraph [0016]; Fig. 1). One of ordinary skill in the art would appreciate that the veins are thinner than the other portions of the component.

As such, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form the composites that form decking made by means of coextrusion to form a composite similar to the one shown above with respect to claims 1 and 10 as taught by Rohatgi, such that the darker areas are formed as veins in order to further provide the simulation of natural wood as taught by Franco in that one of ordinary skill in the art would appreciate that the darker areas formed as veins would be “generally” thinner than the whiter portions of the figure discussed above with respect to claims 1 and 10.

Additionally, the terms “*generally*” *thinner* have been given the broadest reasonable interpretation such that the first set of polymer layers are thinner than the second set of polymer layers.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL P DILLON whose telephone number is (571)270-5657. The examiner can normally be reached on Mon-Fri; 8 AM to 5 PM.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MARIA V EWALD can be reached on 571-272-8519. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

DANIEL P. DILLON  
Examiner  
Art Unit 1783

/MARIA V EWALD/  
Supervisory Patent Examiner, Art Unit 1783

EAST Search History

EAST Search History (Prior Art)

| Ref # | Hits | Search Query                                                                                                                                                | DBs                    | Default Operator | Plurals | Time Stamp       |
|-------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------|---------|------------------|
| S1    | 1    | ((("TANGENT") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.                                                                                                   | USPAT                  | OR               | OFF     | 2017/07/28 12:22 |
| S2    | 5    | ((("TANGENT") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.                                                                                                   | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:22 |
| S3    | 52   | ((("STEPHENS") near3 ("Andrew")).INV.                                                                                                                       | US-PGPUB; USPAT; USOCR | OR               | OFF     | 2017/07/28 12:22 |
| S4    | 47   | ((("MORALES") near3 ("Francisco")).INV.                                                                                                                     | US-PGPUB; USPAT; USOCR | OR               | OFF     | 2017/07/28 12:22 |
| S5    | 9    | ((("RYBKA") near3 ("Tadeusz")).INV.                                                                                                                         | US-PGPUB; USPAT; USOCR | OR               | OFF     | 2017/07/28 12:22 |
| S6    | 107  | S2 or S3 or S4 or S5                                                                                                                                        | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:23 |
| S7    | 0    | S6 and (polymer and colorant).clm.                                                                                                                          | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:24 |
| S8    | 0    | S6 and (polymer and color).clm.                                                                                                                             | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:24 |
| S9    | 590  | 428/151.ccls,icls.                                                                                                                                          | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:27 |
| S10   | 45   | S9 and (wood same polymer)                                                                                                                                  | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:27 |
| S11   | 0    | S10 and (layer same alterante)                                                                                                                              | US-PGPUB; USPAT        | OR               | ON      | 2017/07/28 12:29 |
| S12   | 1    | S10 and (layer same (alternate or alternating))                                                                                                             | US-PGPUB; USPAT        | OR               | ON      | 2017/07/28 12:31 |
| S13   | 11   | ("4280950"   "5126088"   "5866639"   "6083601"   "6596784"   "7866758"   "20040038002"   "20070104930"   "20080299351"   "20110151193"   "20110177291").PN. | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:31 |
| S14   | 320  | (wood same grain) and ("HDPE" or (high near density near polyethylene))                                                                                     | USPAT                  | OR               | OFF     | 2017/07/31 16:14 |
| S15   | 9    | S14 and ((alternate or alternating) with (layer or layers))                                                                                                 | USPAT                  | OR               | OFF     | 2017/07/31 16:16 |
|       |      |                                                                                                                                                             |                        |                  |         |                  |

|     |        |                                                                                    |                 |    |     |                  |
|-----|--------|------------------------------------------------------------------------------------|-----------------|----|-----|------------------|
| S16 | 725    | (wood same grain) and ("HDPE" or (high near density near polyethylene))            | US-PGPUB; USPAT | OR | OFF | 2017/07/31 16:16 |
| S17 | 24     | S16 and ((alternate or alternating) with (layer or layers))                        | US-PGPUB; USPAT | OR | OFF | 2017/07/31 16:16 |
| S18 | 1      | "20040038002".pn.                                                                  | US-PGPUB; USPAT | OR | OFF | 2017/12/04 12:05 |
| S19 | 590    | (428/151).CCLS.                                                                    | US-PGPUB; USPAT | OR | OFF | 2017/12/04 12:06 |
| S20 | 0      | S19 and ("HDPE") and (foaming near agent)                                          | US-PGPUB; USPAT | OR | OFF | 2017/12/04 12:06 |
| S21 | 3      | S19 and ("HDPE" or (high near density near polyethylene)) and (foaming near agent) | US-PGPUB; USPAT | OR | OFF | 2017/12/04 12:07 |
| S22 | 590    | (428/151).CCLS.                                                                    | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:12 |
| S23 | 97     | S22 and (layer with polymer)                                                       | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:12 |
| S24 | 0      | S22 and ((alternating or alternate) same (layer with polymer))                     | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:13 |
| S25 | 3      | S22 and ((alternating or alternate) same3 (layer with polymer))                    | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:13 |
| S26 | 589555 | (428/151).CCLS. or (wood or (imitation near5 wood))                                | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:14 |
| S27 | 1251   | (428/151).CCLS. or ((imitation or imitating) near5 wood)                           | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:14 |
| S28 | 0      | S27 and (alternating near layer) and (layer same (polymer))                        | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:15 |
| S29 | 189    | S27 and (layer same (polymer))                                                     | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:15 |
| S30 | 0      | S29 and (curvilinear)                                                              | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:15 |
| S31 | 21     | S29 and (curvilinear or curved)                                                    | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:17 |
| S32 | 8730   | (428/151).CCLS. or ((imitation or imitating) near5 wood) or (wood near grain)      | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:18 |
| S33 | 1031   | S32 and (layer same (polymer))                                                     | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:18 |
| S34 | 222    | S33 and (curvilinear or curved)                                                    | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:18 |

|     |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |    |     |                  |
|-----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----|-----|------------------|
| S35 | 8  | S34 and (alternating near layer) and (layer same (polymer))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:18 |
| S36 | 1  | S34 and ((428/151).CCLS. or ((imitation or imitating) near5 wood)).ab.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:21 |
| S37 | 1  | "6485800".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:25 |
| S38 | 1  | ("HDPE" or (high near density near polyethylene)) and ((428/151).CCLS. or ((imitation or imitating) near5 wood)).ab.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:26 |
| S39 | 4  | "6485800".pn. or "20060000173".pn. or "20040038002".pn. or "20140272303".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT | OR | OFF | 2017/12/07 14:30 |
| S40 | 40 | (US-0021915-\$   US-20030021915-\$   US-2332081-\$   US-2632204-\$   US-3247047-\$   US-3422175-\$   US-3443278-\$   US-3531828-\$   US-3608261-\$   US-3792945-\$   US-3920366-\$   US-4661392-\$   US-4836814-\$   US-5110530-\$   US-5232751-\$   US-7137229-\$   US-7204944-\$   US-7588821-\$   US-8388331-\$   US-D299793-\$   US-D428500-\$   US-D505467-\$   US-D531326-\$   US-D642287-\$   US-D653779-\$   US-D653780-\$   US-D668794-\$   US-D671230-\$   US-D678556-\$   US-D710117-\$   US-D732191-\$   US-D732192-\$   US-D732193-\$   US-D732194-\$   US-D732195-\$   US-D732197-\$   US-D780333-\$   US-D780335-\$   US-D784566-\$   US-D786457-\$).DID. | US-PGPUB; USPAT | OR | OFF | 2017/12/07 14:34 |
| S41 | 1  | "20030021915".pn. or "7137229".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | USPAT           | OR | OFF | 2017/12/08 12:00 |
| S42 | 2  | "20030021915".pn. or "7137229".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US-PGPUB; USPAT | OR | OFF | 2017/12/08 12:00 |

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| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><br><i>(Use as many sheets as necessary)</i> | <b>Complete if Known</b> |                  |
|                                                                                                          | Application Number:      | 15/245948        |
|                                                                                                          | Filing Date:             | August 24, 2016  |
|                                                                                                          | First Named Inventor:    | STEPHENS, Andrew |
|                                                                                                          | Group Art Unit:          | 1783             |
|                                                                                                          | Confirmation Number:     | 1690             |
| Examiner Name:                                                                                           | Dillon, Daniel P.        |                  |
| Attorney Docket Number:                                                                                  | 64844-256633             |                  |
| Sheet 1 of 1                                                                                             |                          |                  |

| U.S. PATENT DOCUMENTS |          |                                                      |           |                               |                     |                            |
|-----------------------|----------|------------------------------------------------------|-----------|-------------------------------|---------------------|----------------------------|
| Examiner Initials     | Doc. No. | U.S. Patent Document<br>Application or Patent Number | Kind Code | Name of Patentee or Applicant | Date of Publication | Filing Date If Appropriate |
|                       | C I      | D644340                                              |           | Canales et al.                | Aug. 30, 2011       |                            |
|                       | C J      | D782070                                              |           | Metcalf et al.                | Mar. 21, 2017       |                            |
|                       | C K      | 2016/0273228                                         |           | Metcalf et al.                | Sep. 22, 2016       |                            |
|                       |          |                                                      |           |                               |                     |                            |
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| FOREIGN PATENT DOCUMENTS |          |        |                              |           |                               |                     |             |      |
|--------------------------|----------|--------|------------------------------|-----------|-------------------------------|---------------------|-------------|------|
| Foreign Patent Document  |          |        |                              |           | Name of Patentee or Applicant | Date of Publication | Translation |      |
| Examiner Initials        | Doc. No. | Office | Application or Patent Number | Kind Code |                               |                     | Yes         | No** |
|                          |          |        |                              |           |                               |                     |             |      |
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|                          |          |        |                              |           |                               |                     |             |      |

| OTHER - NON PATENT LITERATURE DOCUMENTS |             |                                                                                                                                                                                                                                                                  |             |      |
|-----------------------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|
| Examiner<br>Initials                    | Doc.<br>No. | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number (s), publisher, city and/or country where published. | Translation |      |
|                                         |             |                                                                                                                                                                                                                                                                  | Yes         | No*+ |
|                                         |             |                                                                                                                                                                                                                                                                  |             |      |
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DMS 11661283v1

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| EXAMINER |  | DATE CONSIDERED |  |
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\* A concise statement of relevance is being submitted in lieu of a translation. 37 CFR 1.98(a)(3).  
+ An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of relevance under 37 CFR 1.98(a)(3).

## Electronic Patent Application Fee Transmittal

|                                                       |                                |                 |               |                             |
|-------------------------------------------------------|--------------------------------|-----------------|---------------|-----------------------------|
| <b>Application Number:</b>                            | 15245948                       |                 |               |                             |
| <b>Filing Date:</b>                                   | 24-Aug-2016                    |                 |               |                             |
| <b>Title of Invention:</b>                            | WOOD-GRAINED POLYMER SUBSTRATE |                 |               |                             |
| <b>First Named Inventor/Applicant Name:</b>           | Andrew Stephens                |                 |               |                             |
| <b>Filer:</b>                                         | Kyle A. Forgue/Mark Sweetin    |                 |               |                             |
| <b>Attorney Docket Number:</b>                        | 64844-256633                   |                 |               |                             |
| Filed as Small Entity                                 |                                |                 |               |                             |
| <b>Filing Fees for    Utility under 35 USC 111(a)</b> |                                |                 |               |                             |
| <b>Description</b>                                    | <b>Fee Code</b>                | <b>Quantity</b> | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                                  |                                |                 |               |                             |
| <b>Pages:</b>                                         |                                |                 |               |                             |
| <b>Claims:</b>                                        |                                |                 |               |                             |
| <b>Miscellaneous-Filing:</b>                          |                                |                 |               |                             |
| <b>Petition:</b>                                      |                                |                 |               |                             |
| <b>Patent-Appeals-and-Interference:</b>               |                                |                 |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>              |                                |                 |               |                             |
| <b>Extension-of-Time:</b>                             |                                |                 |               |                             |

RPI1004

| Description                             | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|-----------------------------------------|----------|----------|--------|----------------------|
| Miscellaneous:                          |          |          |        |                      |
| SUBMISSION- INFORMATION DISCLOSURE STMT | 2806     | 1        | 120    | 120                  |
| Total in USD (\$)                       |          |          |        | 120                  |

## Electronic Acknowledgement Receipt

|                                             |                                |
|---------------------------------------------|--------------------------------|
| <b>EFS ID:</b>                              | 31869449                       |
| <b>Application Number:</b>                  | 15245948                       |
| <b>International Application Number:</b>    |                                |
| <b>Confirmation Number:</b>                 | 1690                           |
| <b>Title of Invention:</b>                  | WOOD-GRAINED POLYMER SUBSTRATE |
| <b>First Named Inventor/Applicant Name:</b> | Andrew Stephens                |
| <b>Customer Number:</b>                     | 23644                          |
| <b>Filer:</b>                               | Kyle A. Forgue/Mark Sweetin    |
| <b>Filer Authorized By:</b>                 | Kyle A. Forgue                 |
| <b>Attorney Docket Number:</b>              | 64844-256633                   |
| <b>Receipt Date:</b>                        | 23-FEB-2018                    |
| <b>Filing Date:</b>                         | 24-AUG-2016                    |
| <b>Time Stamp:</b>                          | 11:46:08                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)    |

### Payment information:

|                                          |                       |
|------------------------------------------|-----------------------|
| Submitted with Payment                   | yes                   |
| Payment Type                             | CARD                  |
| Payment was successfully received in RAM | \$ 120                |
| RAM confirmation Number                  | 022318INTEFSW11470700 |
| Deposit Account                          | 120913                |
| Authorized User                          | Mark Sweetin          |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

**RPI1004**

| <b>File Listing:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                            |                            |                                          |                  |                  |
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| Document Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Document Description                                       | File Name                  | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                            | 256633_Supp_IDS_022318.pdf | 32755                                    | yes              | 4                |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Document Description</b>                                |                            | <b>Start</b>                             | <b>End</b>       |                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Transmittal Letter                                         |                            | 1                                        | 3                |                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Information Disclosure Statement (IDS) Form (SB08)         |                            | 4                                        | 4                |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                            |                            |                                          |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                            |                            |                                          |                  |                  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                            |                            | 0213d45e1a7bed39c6b9a99ac4502c46fa1a5b24 |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                            |                            |                                          |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                            |                            |                                          |                  |                  |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                            |                            | 63488                                    |                  |                  |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                                            |                            |                                          |                  |                  |

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

First Named Inventor:

STEPHENS, Andrew

Application No. 15/245948

Filed: August 24, 2016

Confirmation No. 1690

Group Art Unit: 1783

Examiner: DILLON, Daniel P.

For: WOOD-GRAINED POLYMER SUBSTRATE

**INFORMATION DISCLOSURE STATEMENT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Pursuant to 37 CFR 1.97 and 1.98, the references listed on the enclosed Form PTO-1449 and/or Substitute Form PTO-1449 ("Form 1449") are submitted for consideration by the Examiner in the examination of the above-identified patent application.

The full consideration of the references in their entirety by the Examiner is respectfully requested and encouraged. Also, it is respectfully requested that the references be entered into the record of the present application and that the Examiner place his or her initials in the appropriate area on the enclosed Form 1449, thereby indicating the Examiner's consideration of each of the references.

The submission of the references listed on the Form 1449 is for the purpose of providing a complete record and is not a concession that the references listed thereon are prior art to the invention claimed in the patent application. The right is expressly reserved to establish an invention date earlier than the above-identified filing date in order to remove any reference submitted herewith as prior art should it be deemed appropriate to do so.

Further, the submission of the references is not to be taken as a concession that any reference represents art that is relevant or analogous to the claimed invention. Accordingly, the right to argue that any reference is not properly within the scope of prior art relevant to an examination of the claims in the above-identified application is also expressly reserved.

The Information Disclosure Statement is being filed:



**within** any one of the following time periods: (a) within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d); (b) within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 of an international application; (c) before the mailing date of a first

First Named Inventor: STEPHENS, Andrew  
Application No. 15/245948

Office Action on the merits; or (d) before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

☒ **after** (a), (b), (c) or (d) above, but before the mailing date of a final action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an action that otherwise closes prosecution in the application, and includes *one* of:

☐ the Statement under 37 CFR 1.97(e) (see “Statement under 37 CFR 1.97(e)” below).

*or*

☒ the fee set forth in 37 CFR 1.17(p) (see “Fees” below).

☐ **after** the mailing date of a final action under 37 CFR 1.113 or a Notice of Allowance under 37 CFR 1.311, or an action that otherwise closes prosecution in the application, and on or before payment of the issue fee, and includes the Statement under 37 CFR 1.97(e) (see “Statement under 37 CFR 1.97(e)” below), and the fee set forth in 37 CFR 1.17(p) (see “Fees” below).

☐ **after** the mailing date of a Notice of Allowance under 37 CFR 1.311, and on or before payment of the issue fee, and **within** thirty days of receiving each item of information contained in the Information Disclosure Statement, and includes the Statement under 37 CFR 1.704(d) (see “Statement under 37 CFR 1.704(d)” below), and the fee set forth in 37 CFR 1.17(p) (see “Fees” below).

NOTE: This is for original applications except applications for a design patent, filed on or after May 29, 2000, wherein a paper containing only an Information Disclosure Statement in compliance with 37 CFR 1.97 and 1.98 is being filed.

### Copies of the References

☒ Copies of all foreign patents and non-patent literature listed on the enclosed Form 1449 are enclosed herewith.

☐ Attached to each reference not in the English language is a concise explanation of the relevance pursuant to 37 CFR 1.98(a)(3). An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of the relevance pursuant to 37 CFR 1.98(a)(3).

☐ A copy of the international search report is enclosed herewith.

☐ The references listed on the enclosed Form 1449 were previously identified in the parent application(s) of the present application, and copies of the references were furnished at that time. Accordingly, additional copies of the references are not submitted herewith, so as not to burden the file with duplicate copies of references. The Examiner is respectfully requested to carefully review the references in accordance with the requirements set out in the Manual of Patent Examining Procedure. In accordance with 37 CFR 1.98(d), the

First Named Inventor: STEPHENS, Andrew  
Application No. 15/245948

details of the parent application(s) relied upon for an earlier filing date under 35 USC 120 in which copies of the references were previously furnished are set out below:

| U.S. APPLICATIONS |                  | Status ( <i>check one</i> ) |         |           |
|-------------------|------------------|-----------------------------|---------|-----------|
| U.S. APPLICATIONS | U.S. FILING DATE | PATENTED                    | PENDING | ABANDONED |
| 1.                |                  |                             |         |           |
| 2.                |                  |                             |         |           |
| 3.                |                  |                             |         |           |

#### Fees

- ☐ No fee is owed by the applicant(s).  
☒ Charge Deposit Account No. 12-0913 in the amount of \$120.

#### Authorization to Charge Additional Fees

- ☒ Please charge any additional required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

Respectfully submitted,

Date: February 23, 2018

/Kyle A. Forgue/  
Kyle A. Forgue, Reg. No. 71457  
BARNES & THORNBURG LLP  
P.O. Box 2786  
Chicago, Illinois 60690-2786  
(312) 357-1313 (telephone)  
(312) 759-5646 (facsimile)  
**Customer No. 23644**

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## INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

### Complete if Known

|                         |                   |
|-------------------------|-------------------|
| Application Number:     | 15/245948         |
| Filing Date:            | August 24, 2016   |
| First Named Inventor:   | STEPHENS, Andrew  |
| Group Art Unit:         | 1783              |
| Confirmation Number:    | 1690              |
| Examiner Name:          | Dillon, Daniel P. |
| Attorney Docket Number: | 64844-256633      |

### U.S. PATENT DOCUMENTS

| U.S. Patent Document |          |                              |           |                               |                     |                            |
|----------------------|----------|------------------------------|-----------|-------------------------------|---------------------|----------------------------|
| Examiner Initials    | Doc. No. | Application or Patent Number | Kind Code | Name of Patentee or Applicant | Date of Publication | Filing Date If Appropriate |
|                      | C L      | 5869138                      |           | Nishibori                     | Feb. 9, 1999        |                            |
|                      | C M      | 6153293                      |           | Dahl et al.                   | Nov. 28, 2000       |                            |
|                      | C N      | 7410687                      |           | Dolinar                       | Aug. 12, 2008       |                            |
|                      | C O      | 7507464                      |           | Walrath                       | Mar. 24, 2009       |                            |
|                      | C P      | 8168104                      |           | Han et al.                    | May 1, 2012         |                            |
|                      | C Q      | 8197733                      |           | Sudano                        | Jun. 12, 2012       |                            |
|                      |          |                              |           |                               |                     |                            |
|                      |          |                              |           |                               |                     |                            |

### FOREIGN PATENT DOCUMENTS

| Foreign Patent Document |          |        |                              |           |                               |                     |     |      |
|-------------------------|----------|--------|------------------------------|-----------|-------------------------------|---------------------|-----|------|
| Examiner Initials       | Doc. No. | Office | Application or Patent Number | Kind Code | Name of Patentee or Applicant | Date of Publication | Yes | No** |
|                         | C R      | DE     | 2327512                      |           | BP Chem. Int. Ltd.            | Dec. 13, 1973       |     | X+   |
|                         | C S      | GB     | 1489591                      |           | John F. Rodman                | Oct. 19, 1977       |     |      |
|                         |          |        |                              |           |                               |                     |     |      |
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|                         |          |        |                              |           |                               |                     |     |      |

### OTHER - NON PATENT LITERATURE DOCUMENTS

| Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number (s), publisher, city and/or country where published. |          |                                                                                                                                                                                                                                                                                                                                                                                   |  |  | Translation |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|-------------|------|
| Examiner Initials                                                                                                                                                                                                                                                | Doc. No. |                                                                                                                                                                                                                                                                                                                                                                                   |  |  | Yes         | No** |
|                                                                                                                                                                                                                                                                  | C T      | StaMixCo, "Principles of Operation of Static Mixers," Static Mixer Products & Technology, accessed on the Internet at: <a href="https://web.archive.org/web/20081209081624/http://www.stamixco-usa.com:80/principles-of-operation/default.html">https://web.archive.org/web/20081209081624/http://www.stamixco-usa.com:80/principles-of-operation/default.html</a> (9 Dec. 2008). |  |  |             |      |
|                                                                                                                                                                                                                                                                  |          |                                                                                                                                                                                                                                                                                                                                                                                   |  |  |             |      |
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| EXAMINER |  | DATE CONSIDERED |  |
|----------|--|-----------------|--|

\* A concise statement of relevance is being submitted in lieu of a translation. 37 CFR 1.98(a)(3).

+ An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of relevance under 37 CFR 1.98(a)(3).

RPI1004

**Espacenet****Bibliographic data: DE2327512 (A1) — 1973-12-13**

Extruding thermoplastics foam section - to give smooth surface and uniform structure

**Inventor(s):** WYNTER JOHN WALTER [GB]; RODMAN JOHN FREDERICK [GB] ± (WYNTER, JOHN WALTER, ; RODMAN, JOHN FREDERICK)

**Applicant(s):** BP CHEM INT LTD ± (BP CHEMICALS INTERNATIONAL LTD., LONDON)

**Classification:** - international: **B29C44/50**; (IPC1-7): B29D27/00  
- cooperative: **B29C44/50**

**Application number:** DE19732327512 19730727

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Extruding lightweight thermoplastics foam, e.g. for window frames, in which foamable thermoplastics is extruded through a mould, expanded from the mould to a density  $\geq 160.2$  kg/m<sup>3</sup> and then pressed through a calibrating (shaping) unit to harden with an increase in density of is not 48 kg/m<sup>3</sup>. Pref. material is polystyrene esp. with pentane (0.2-5.0% wt) and/or CH<sub>3</sub>Cl as expanding agent (total 2-20%) and citric acid and NaHCO<sub>3</sub> as seeding agents.

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Verfahren zum Strangpressen von schäumfähigen thermo-  
plastischen Polymerisaten

Es ist bekannt, stranggepreßte Profile aus Schaumstoffen mit hohem Raumgewicht für Gegenstände wie Bilderrahmen, Formteile oder Fenster- und Türrahmen herzustellen. Die mechanischen Eigenschaften und der Griff von Schaumstoffen mit hohem Raumgewicht können so eingestellt werden, daß sie den entsprechenden Eigenschaften von Holz sehr nahe kommen, und das Polymerisat kann in geeigneter Weise gefärbt werden, um dem Holz zu gleichen.

Für das Extrudieren von Schaumstoffen mit hohem Raumgewicht wurde unter anderem ein Verfahren vorgeschlagen, bei dem der Schaumstoff aus einem Profilspritzwerkzeug unmittelbar in einen Profilformkasten oder eine Kalibriereinrichtung extrudiert wird, um die Außenabmessungen einzustellen. Das Spritzwerkzeug hat einen massiven Kern, so daß während der Ausdehnung des Polymerisats in der Kalibriervorrichtung die Außenabmessung durch die Kalibriervorrichtung begrenzt wird und der Kunststoff sich nach innen ausdehnt und hierbei den durch den Kern des Spritzwerkzeugs gebildeten Hohlraum ausfüllt. Bei einem solchen Verfahren wird ein ungleichmäßiges Produkt erhalten, bei dem die Mitte des Profils ein niedrigeres Raumgewicht und viel größere Zellen, als dies erwünscht ist, aufweist.

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Die Verwendung von Kalibriereinrichtungen, die mit Abstand vom Spritzwerkzeug angeordnet sind, ist bei Profilanlagen, mit denen feste thermoplastische Polymerisate extrudiert werden, wohlbekannt. Diese Kalibriervorrichtungen dienen zur Einstellung der Außenabmessungen des Profils während der Härtung des Polymerisats und haben im allgemeinen einen ähnlichen Querschnitt wie die Düse. Bei Anwendung dieses Systems auf die Herstellung von Profilen aus Schaumstoff mit niedrigem Raumgewicht läßt man den Kunststoff beim Austritt aus dem Spritzwerkzeug und vor dem Eintritt in die Kalibriervorrichtung ungehindert ausschäumen. Dies dient einfach dazu, dem Profil die äußere Form zu geben. Eine geringe Zusammendrückung ist unvermeidlich, aber unerwünscht, da das Ziel die Herstellung eines Produkts mit niedrigem Raumgewicht ist. Diese Zusammendrückung ist nur gering und bewirkt eine Erhöhung des Raumgewichts des Produkts um 16,02 bis 32,04 kg/m<sup>3</sup>.

Gegenstand der Erfindung ist ein verbessertes Verfahren zum Strangpressen von Schaumstoffen mit hohem Raumgewicht.

Das Verfahren gemäß der Erfindung zum Strangpressen von schäumfähigen thermoplastischen Polymerisaten ist dadurch gekennzeichnet, daß man ein schäumfähiges thermoplastisches Polymerisat durch eine Spritzform extrudiert, das Polymerisat aus der Spritzform heraus auf ein Raumgewicht von wenigstens 160,2 kg/m<sup>3</sup> expandieren läßt und das Polymerisat, während es noch im heißen erweichten Zustand ist, so in eine Kalibriervorrichtung preßt, in der das Polymerisat erhärtet, daß sein Raumgewicht im geschäumten Zustand um wenigstens 48,06 kg/m<sup>3</sup> erhöht wird.

Als thermoplastische Polymerisate kommen alle Thermoplaste infrage, die durch Einarbeitung eines Treibmittels schäum-

fähig gemacht werden können, jedoch wird vorzugsweise Polystyrol verwendet. Das Polymerisat kann dem Extruder in Form von schäumfähigen Perlen, die ein Treibmittel enthalten, zugeführt werden, oder ein Treibmittel kann unmittelbar in das Polymerisat während des Extrudierens gespritzt werden, oder eine Kombination dieser Methoden kann angewandt werden. Um Streifen, simulierte Holzmaserungseffekte und dgl. hervorzubringen, können Polymerperlen mit unterschiedlichen Farben dem Extruder zugeführt werden.

Zahlreiche Treibmittel sind bekannt. Im allgemeinen sind sie Gase oder Flüssigkeiten, die unter normalen Bedingungen flüchtig sind. Geeignet sind beispielsweise niedere aliphatische Kohlenwasserstoffe, z.B. Chloroform und Methylchlorid, und anorganische Gase, z.B. Stickstoff und Kohlendioxyd. Pentan und Methylchlorid allein oder in Mischung werden als Treibmittel für Polystyrol bevorzugt. Es ist auch möglich, ein chemisches Treibmittel, das ein Gas in situ bildet, z.B. Dinitrosopentamethyldiamin oder Bariumazodicarboxylat, zu verwenden.

Um gleichmäßige Schaumqualität und feine Zellen zu erreichen, ist es im allgemeinen zweckmäßig, ein Keimbildungsmittel zu verwenden. Besonders geeignet als Keimbildungsmittel ist ein Gemisch von Citronensäure und Natriumbicarbonat.

Die verwendete Menge des Treibmittels beträgt zweckmäßig 0,2 bis 20% des Gewichts des Polymerisats. Bei Verwendung von Pentan mit Polystyrol liegt die Menge des Treibmittels vorzugsweise im Bereich von 0,2 bis 5 Gew.-%, insbesondere im Bereich von 0,5 bis 2,0 Gew.-%. Im allgemeinen ist das Raumgewicht des Schaumstoffs umso höher, je weniger Treibmittel verwendet wird.

Die zum Strangpressen von geschäumten Thermoplasten üblichen Bedingungen können angewandt werden. Beispielsweise liegt die Temperatur für Polystyrol im Bereich von  $105^{\circ}$  bis  $190^{\circ}\text{C}$ . Das Spritzwerkzeug kann jedes beliebige gewünschte Profil haben. Das Profil sollte ähnlich sein wie das Profil des gewünschten Endprodukts, jedoch kann die Spritzform einen kleineren Querschnitt haben als das Endprodukt. Es erwies sich als zweckmäßig, eine Lochplatte unmittelbar vor der Spritzform, wo das thermoplastische Material in die Spritzform eintritt, zu verwenden. Die Perforationen können jede beliebige Querschnittsform haben. Vorzugsweise ist ihre Gesamtquerschnittsfläche geringer als die der Spritzform.

Beim Austritt aus der Düse läßt man das Polymerisat ausschäumen. Diese Ausschäumung findet vorzugsweise ungehindert an der Luft mit oder ohne zusätzliche Kühlung beispielsweise mit Hilfe eines geregelten Luftstroms statt. Die Treibmittelmenge und die Strangpressbedingungen sind so einzustellen, daß sichergestellt ist, daß das nach dem Ausschäumen erreichte Raumgewicht größer als  $160,2 \text{ kg/m}^3$  ist und bei geschäumten Polymerisaten, die als Holzersatz verwendet werden sollen, vorzugsweise im Bereich von  $320,4$  bis  $801 \text{ kg/m}^3$  liegt. Während das Polymerisat sich noch in dem durch Hitze erzeugten erweichten Zustand befindet, wird es in die Kalibriervorrichtung eingeführt, die das Profil und die Abmessungen des gewünschten Fertigprodukts hat. Um eine genügende Ausdehnung des Schaums in einer üblichen Extrusionsanlage, in der der Schaumstoff im wesentlichen waagrecht in Luft bei Umgebungstemperatur extrudiert wird, zu ermöglichen, jedoch die Aushärtung vor dem Erreichen der Kalibriervorrichtung zu verhindern, sollte der Eintritt zur Kalibriervorrichtung zum Düsenaustritt zweckmäßig einen Abstand von 12 bis 900 mm, vorzugsweise von 50 bis 200 mm haben. Dieser Abstand muß

möglicherweise verändert werden, wenn senkrecht nach unten extrudiert wird. Der erforderliche Grad der Zusammendrückung wird erreicht, indem der endgültige Querschnitt der Kalibriervorrichtung kleiner gehalten wird als der maximale Querschnitt, der erreicht wird, wenn der Schaum sich beim Austritt aus der Spritzform ausdehnt. Der Querschnitt der Kalibriervorrichtung kann sich gegebenenfalls von der Eintrittsstelle des Schaumstoffs bis zum endgültigen Querschnitt verjüngen, um den Eintritt des Schaumstoffs zu erleichtern. Die Zusammendrückung muß wenigstens genügen, um das Raumgewicht des Schaumstoffs um  $48 \text{ kg/m}^3$ , jedoch vorzugsweise um nicht mehr als  $160,2 \text{ kg/m}^3$  zu erhöhen. Bevorzugt wird eine Zusammendrückung, bei der das Raumgewicht um  $64,1$  bis  $96,1 \text{ kg/m}^3$  erhöht wird. Die Temperatur der Kalibriervorrichtung wird bei Polystyrol zweckmäßig im Bereich von  $25$  bis  $60^\circ\text{C}$  gehalten.

Vorzugsweise wird eine zweite Kalibriervorrichtung, die den gleichen Querschnitt wie die erste Kalibriervorrichtung hat, unmittelbar hinter der ersten Kalibriervorrichtung angeordnet und vorzugsweise bei einer niedrigeren Temperatur als die erste Kalibriervorrichtung gehalten. Es ist auch möglich, die Temperatur längs der Kalibriervorrichtung allmählich zu senken. Die Temperatur der zweiten Kalibriervorrichtung oder die Mindesttemperatur der Kalibriervorrichtung liegt für Polystyrol zweckmäßig im Bereich von  $0^\circ$  bis  $25^\circ\text{C}$ .

Beim Verfahren gemäß der Erfindung werden gleichmäßige Produkte mit guter Oberflächenbeschaffenheit erhalten. Die Erfindung wird durch die folgenden Beispiele weiter erläutert.

Beispiel 1

10 kg gewöhnliches Allzweckpolystyrol, das 0,5 Gew.-% n-Pentan enthielt, wurde 20 Minuten in einem geschlossenen Behälter mit 49,6 g Natriumbicarbonat und 20 g wasserfreier Zitronensäure gewälzt. Das erhaltene Gemisch wurde aus einer Einschnellenpresse mit einem Schneckendurchmesser von 50 mm durch eine bei 140°C gehaltene Stabspritzform von 19 mm Durchmesser extrudiert. Das Extrudat wurde einer rohrförmigen Kalibriervorrichtung zugeführt, die einen Durchmesser von 25 mm hatte, mit Wasser auf eine Temperatur von 25°C gekühlt wurde und so angeordnet war, daß ihr Eintritt einen Abstand von 75 mm zum Austritt der Spritzform hatte. Aus der Kalibriervorrichtung wurde das Extrudat durch ein Nachkühlbad geführt, das aus Luft und aufgesprühtem Wasser bestand, bevor es über eine Abzugsvorrichtung einer Schneidvorrichtung zugeführt wurde. Das Produkt hatte eine glatte Oberfläche, eine gleichmäßige Verteilung der Zellen und ein Raumgewicht von 400,5 kg/m<sup>3</sup>. Das Mindestraumgewicht, das beim Austritt aus dem Extruder erreicht wurde, betrug etwa 320,4 kg/m<sup>3</sup>.

Beispiel 2

10 kg gewöhnliches Allzweckpolystyrol, das 1,25 Gew.-% n-Pentan enthielt, wurde in einem geschlossenen Behälter 20 Minuten mit 25 g Natriumbicarbonat, 20 g wasserfreier Citronensäure und 50 g eines braunen Eisenoxydpigments gewälzt. Das Gemisch wurde durch eine Einschnellenpresse extrudiert, die einen Schneckendurchmesser von 50 mm hatte und mit einer Profilspritzform, die bei einer Temperatur von 160°C gehalten wurde, versehen war. Das erhaltene Extrudat wurde einer bei 25°C gehaltenen Kalibriervorrichtung zugeführt, deren Eintritt einen Abstand von 100 mm zum Austritt der Spritzform hatte. Die Spritzform hatte eine Querschnittsfläche von 0,945 cm<sup>2</sup>, während

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die Kalibriervorrichtung und demgemäß das fertige Profil eine Querschnittsfläche von  $3,13 \text{ cm}^2$  hatte. Nach dem Austritt aus der wassergekühlten Kalibriervorrichtung wurde das Extrudat über ein kurzes Wasserbad und eine Luftkühlung einer Gruppe von Abzugsrollen zugeführt.

Das erhaltene Produkt hatte ein glattes Aussehen und den Griff eines fein gemaserten Hartholzes. Es hatte eine annehmbar gleichmäßige Zellenverteilung und eine rötlich braune Farbe. Seine Dichte betrug  $657 \text{ kg/m}^3$ . Die kleinste Dichte, die beim Austritt aus dem Extruder erreicht wurde, betrug etwa  $577 \text{ kg/m}^3$ .

### Beispiel 3

Der in Beispiel 2 beschriebene Versuch wurde unter den gleichen Bedingungen wiederholt mit dem Unterschied, daß zwei Kalibriervorrichtungen verwendet wurden. Die erste Kalibriervorrichtung wurde bei einer Temperatur von  $50^\circ\text{C}$  und die zweite Kalibriervorrichtung, die unmittelbar hinter der ersten Kalibriervorrichtung angeordnet war, bei  $5^\circ\text{C}$  gehalten.

Ein Produkt mit ähnlichem Raumgewicht und hochglänzender Oberfläche wurde erhalten.

### Vergleichsbeispiel

Der in Beispiel 2 beschriebene Versuch wurde unter Verwendung einer Kalibriervorrichtung mit einer Querschnittsfläche von  $3,48 \text{ cm}^2$  wiederholt. Das erhaltene Profil hatte ein Raumgewicht von  $593 \text{ kg/m}^3$ . Das Profil war mißgestaltet, und scharfe Ecken im Profil waren abgerundet.

Dieses Beispiel zeigt, daß ein unbefriedigendes Profil erhalten wird, wenn mit einer Zusammendrückung, bei der die Zunahme des Raumgewichts weniger als  $48 \text{ kg/m}^3$  beträgt, gearbeitet wird.

Patentansprüche

1. Verfahren zum Strangpressen von schäumfähigen thermoplastischen Polymerisaten, dadurch gekennzeichnet, daß man ein schäumfähiges thermoplastisches Polymerisat durch eine Spritzform extrudiert, das Polymerisat aus der Spritzform heraus auf ein Raumgewicht von wenigstens  $160,2 \text{ kg/m}^3$  expandieren läßt und das Polymerisat, während es noch im heißen erweichten Zustand ist, so in wenigstens eine Kalibriervorrichtung preßt, in der das Polymerisat erhärtet, daß sein Raumgewicht im geschäumten Zustand um wenigstens etwa  $48 \text{ kg/m}^3$  erhöht wird.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß man Polystyrol verarbeitet.
3. Verfahren nach Ansprüchen 1 und 2, dadurch gekennzeichnet, daß Polymerperlen mit verschiedenen Farben der Strangpresse zugeführt werden.
4. Verfahren nach Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß Pentan oder Methylchlorid einzeln oder in Mischung als Treibmittel verwendet werden.
5. Verfahren nach Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß ein Gemisch von Citronensäure und Natriumbicarbonat als Keimbildungsmittel verwendet wird.
6. Verfahren nach Ansprüchen 1 bis 5, dadurch gekennzeichnet, daß das Treibmittel in einer Menge von 2 bis 20 % verwendet wird.
7. Verfahren nach Ansprüchen 1 bis 6, dadurch gekennzeichnet, daß 0,2 bis 5,0 Gew.-%, vorzugsweise 0,5 bis 2,0 Gew.-% Pentan als Treibmittel in Polystyrol verwendet werden.

8. Verfahren nach Ansprüchen 1 bis 7, dadurch gekennzeichnet, daß die Temperatur des Spritzwerkzeugs im Bereich von 105 bis 190° C liegt.
9. Verfahren nach Ansprüchen 1 bis 8, dadurch gekennzeichnet, daß eine Lochplatte unmittelbar vor der Spritzform verwendet wird.
10. Verfahren nach Anspruch 9, dadurch gekennzeichnet, daß die Gesamtquerschnittsfläche der Perforationen kleiner ist als die Querschnittsfläche der Spritzform.
11. Verfahren nach Ansprüchen 1 bis 10, dadurch gekennzeichnet, daß das beim Ausschäumen erreichte Raumgewicht im Bereich von 320,4 bis 800,9 kg/m<sup>3</sup> liegt.
12. Verfahren nach Ansprüchen 1 bis 11, dadurch gekennzeichnet, daß der Eintritt zur Kalibriervorrichtung einen Abstand von 50 bis 200 mm zum Austritt der Spritzform hat, wenn der Schaumstoff im wesentlichen waagrecht in Luft bei Umgebungstemperatur extrudiert wird.
13. Verfahren nach Ansprüchen 1 bis 12, dadurch gekennzeichnet, daß das Raumgewicht des Schaumstoffs um nicht mehr als 160,2 kg/m<sup>3</sup>, vorzugsweise um 64,1 bis 96,1 kg/m<sup>3</sup> erhöht wird.
14. Verfahren nach Ansprüchen 1 bis 13, dadurch gekennzeichnet, daß die Temperatur der Kalibriervorrichtung im Bereich von 25 bis 60° C gehalten wird.
15. Verfahren nach Ansprüchen 1 bis 14, dadurch gekennzeichnet, daß das extrudierte Material nach Passieren der ersten Kalibriervorrichtung durch eine zweite Kalibriervorrichtung, die den gleichen Querschnitt wie die erste Kalibriervorrichtung hat und bei einer niedrigeren Temperatur als diese gehalten wird, geführt wird.

16. Verfahren nach Ansprüchen 1 bis 15, dadurch gekennzeichnet, daß die Temperatur längs der Kalibriervorrichtung allmählich gesenkt wird.
17. Verfahren nach Ansprüchen 1 bis 16, dadurch gekennzeichnet, daß die Temperatur der zweiten Kalibriervorrichtung oder die niedrigste Temperatur der Kalibriervorrichtung, deren Temperatur allmählich gesenkt wird, im Bereich von 0 bis 25° C liegt.

## PATENT SPECIFICATION

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(72) Inventor JOHN FREDERICK RODMAN



## (54) PRODUCTION OF IMITATION WOOD MATERIAL

(71) We, P.S.F. (MONTE-CARLO) S.A., a body corporate organised under the laws of Monaco, of Le Millefiori, Monte Carlo, Monaco, do hereby declare, the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is concerned with the extrusion of thermoplastics foam articles, more particularly continuous sections or profiles constituting an imitation wood material.

The extrusion of thermoplastics foam sections is conventionally carried out with a screw extruder which has at its outlet, a die having an opening corresponding to the shape of the desired section. As the extrudate emerges from the die, it expands to a greater or lesser extent due to the release of pressure on the material and consequent expansion of the blowing agent present therein, which is normally an organic liquid having a boiling point lower than, normally substantially lower than, the softening point of the thermoplastic polymer.

Problems arise when this type of process is carried out with a die opening having substantial cross-sectional area (as would be required to produce a section having a substantial cross-sectional area). At the point of extrusion, the material in the central part of the die opening expands to the radially outer part of the opening and tends to impair the smooth appearance of the outer layer, that is the surface layer, of the extrudate. At the same time, there is over-rapid loss of blowing agent from the extrudate and a consequential undesirable increase in the viscosity of the polymer. This viscosity increase may be such that the flow rate of the outer layer is insufficient to prevent severe rupturing of the surface layer. The viscosity of the polymer may also become too high to ensure the formation of a cellular structure having a sufficiently uniform cell size and good mechanical properties.

It is conventional to pass thermoplastics foam extrudates, immediately they emerge from the die head, into and through a so-called shaping or calibrating box which is open at both ends and which has a section corresponding to the desired section of the product. When extruding square or rectangular sections, the tendency of the extrudate to adopt a more circular section on expansion beyond the die block necessitates the use of a high forming tension within the shaping box in order to return the extrudate to the desired square or rectangular section. Consequently the extrudate is considerably densified and the high contact pressure against the walls of the shaping box means that an excessive tension is required to pull the extrudate through the box. Unless the extrudate is sufficiently stiff and of adequate tensile strength, this tension can result either in breakage of the section within the shaping box, or stretching of the section which leads to variation in the cross-sectional size of the section along its length and/or a tendency to overfill the entrance to the shaping box.

We have now developed an improved method of extruding thermoplastics foam sections to form imitation wood material in which separate streams of the foamable thermoplastics melt are formed and are combined to form the surface layer and the central portion of the extrudate so as to obtain an extrudate with a smooth surface layer and a cellular core with a substantially uniform cell size and good mechanical strength. If such an extrudate is then passed through a shaping box, the smoothness of the surface layer allows the section to be passed through the shaping box at a reasonable rate and the strength of the extrudate enables a sufficient tension to be applied for this purpose.

According to the present invention we provide a method of making an imitation wood material, which comprises extruding a foamable thermoplastics melt comprising two or more colouring materials through a die insert block arranged in a die head

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extrusion passage, the block providing one or more peripheral passages and comprising a plurality of inner passages therethrough whereby the flow of the melt is divided respectively into one or more peripheral streams which, on emergence from the insert passage or passages into the die passage, form an outer cellular skin of relatively high density, and into a plurality of inner streams which, on emergence from the die insert block passages, form rod-like streams which expand and weld together and to the inside surface of the outer skin in the die passage to form a cellular core having a substantially uniform cell size and a relatively low density, the colouring materials being incompletely mixed prior to the extrusion of the melt whereby a grain-type pattern of colouration is obtained on the outer surface of the extrudate resembling that found in wood.

The extrudate formed in this may be passed, while still in the softened state, through a shaping box to complete the internal expansion and welding of the core and to obtain the desired final cross-sectional dimensions.

The method of the invention is particularly suited to the extrusion of polystyrene foam sections using a low boiling solvent, such as n-pentane or a polyhalogenated alkane, as the blowing agent. In the following description, particular reference will be made to the extrusion of polystyrene foams, but it should be understood that the invention is also applicable to the extrusion of other foamable thermoplastic polymers.

By means of the method according to the invention, both high and low density sections can be formed which comprise sharp corners.

As indicated, the method according to the invention intrinsically gives a product in which the outer skin has a higher density than the core. Products can be readily obtained in which the outer skin is of a sufficiently high density and of sufficient thickness for the product to be usable as a load bearing section and, in particular, sections having mechanical properties equivalent to or better than those of wood can be obtained. By suitable choice of the colouring materials and the amounts in which these are used, it is possible to simulate the grain patterns and general colouration of most natural types of wood. The outer surface of the section will normally also have a glossy surface generally similar to that of wood which has been lacquered. The use of such products as wood substitutes in the manufacture of furniture therefore avoids the necessity for the finishing operations which are conventionally applied to wooden

furniture; in addition such polystyrene foam sections can be worked with conventional woodworking tools, have uniform mechanical properties and are not subject to warping or fungal or insect attack.

The grade of polystyrene used for extrusion will depend on the properties required in the extruded product and selection of suitable grades for any particular purpose can readily be made by those skilled in the art. Similarly, the additives present with the polystyrene in the extruded composition may, in general, be those conventionally used in polystyrene foam compositions. We generally prefer to include in the polystyrene composition a nucleating agent, which is preferably a mixture of sodium bicarbonate and citric acid, and a finely divided filler, such as talc, as a processing aid. As previously mentioned, low boiling solvents, such as n-pentane and poly-halogenated alkanes containing 1 or 2 carbon atoms, are preferably used as the blowing agent.

In order that the invention may be more fully understood, the following examples, in which all proportions are by weight, are given by way of illustration. In these examples reference will be made to the drawings accompanying the Provisional Specification in which:

Figure 1 is an axial section of an extruder die head showing a first embodiment of die insert block located therein;

Figure 2 is a transverse view of the die insert block of Figure 1;

Figure 3 is an axial section of an extruder die head showing a second embodiment of die insert block located therein;

Figure 4 is an axial section of an extruder die head showing a third embodiment of die insert block comprising a feed plate and an exit plate located therein;

Figure 5 is a transverse view of the feed plate of the insert block of Figure 4;

Figure 6 is a transverse view of the exit plate of the die insert block of Figure 4; and

Figure 7 is a perspective view of a structural foam section suitable for use as a substitute for wood.

#### Example 1

Pigmented granules of high softening grade polystyrene containing 0.8% of n-pentane and 1.5% of talc and coated with 0.06% of anhydrous citric acid and 0.09% of sodium bicarbonate were supplied to a 60 mm diameter screw extruder operating at a screw speed of 35 r.p.m. The melt temperature of the polystyrene in the die head of the extruder was maintained at 135°C.

The die head of the extruder used is

diagrammatically shown in Figures 1 and 2; flow of the polystyrene was from right to left as shown in Figure 1 (and similarly for Figures 3 and 4 referred to below).

The die head 3 of the extruder is designed to produce a rectangular section extrudate and comprises a rectangular section bore 2 in which a die insert block 1 is located. The die block 1 is provided with spider legs 5 (see Figure 2) which are located in keyways 1A formed in the die head. The die block 1 is also rectangular in cross-section, its outer dimensions being such as to leave a clearance between the outside of the die block 1 and the walls of the bore 2 so as to provide an outer flow channel 4. The die block 1 is provided with a plurality of apertures 6 therethrough.

During extrusion of the polystyrene under the conditions mentioned above, a continuous outer skin was formed by material passing through the flow channel 4 and, at the same time, a plurality of rod-like streams were formed by the apertures 6 which expanded immediately downstream of the die block 1 and welded to each other and to the inside of the outer skin. On emerging from the die head, the extrudate was passed through a shaping box having a rectangular section corresponding to the desired final dimensions. The walls of a portion of the shaping box were apertured and connected to a vacuum pump, so that a vacuum was applied to the extrudate as it passed through this portion of the shaping box.

The product obtained at the exit from the shaping box is shown diagrammatically in Figure 7. It comprised a relatively high density skin 15 and a relatively low density core 16. Owing to a mixing of the pigments being incomplete, the outer surface showed a variation of colour, as indicated at 13 and 14, simulating a wood grain effect. The product has a width of 45 mm and a thickness of 20 mm; its overall density was 35 lbs/cu.ft. and it was suitable for use as a wood substitute.

#### Example 2

The procedure of Example 1 was repeated but using a die insert block as shown in Figure 3. This die block is generally similar to that shown in Figures 1 and 2, but the downstream side of the die block is provided at its periphery with a skirt 7 which considerably extends the flow channel 4 for the skin material of the extrudate.

A section similar to that of Example 1, but having a decreased surface shade variation and a smoother surface finish, was obtained.

#### Example 3

The procedure of Example 1 was

repeated but using a two-part die insert block as shown in Figures 4, 5 and 6.

The upstream part 9, or feed plate, of the die block (see Figure 5) is provided with a plurality of apertures 10 therethrough and its periphery is located against the bore of the die head so as not to leave any peripheral gap. The downstream part 8, or exit plate, of the die block (see Figure 6) is provided with a plurality of apertures 12 therethrough which are offset in relation to the apertures 10 in the part 9 (see Figure 5) and also with a plurality of peripheral passages 11.

The periphery of the part 8 is again located against the bore of the die head so as not to leave a continuous peripheral gap. The separation between the die parts 8 and 9 was 5 mm.

During extrusion, an interrupted outer skin was formed by passage of the polystyrene through the passages 11 in the die part 8, the elements of which fused together to form the outer skin of the extrudate downstream of the part 8. A section similar to that of Example 1, but having an increased surface shade variation, was obtained.

#### WHAT WE CLAIM IS:—

1. A method of making an imitation wood material, which comprises extruding a foamable thermoplastics melt comprising two or more colouring materials through a die insert block arranged in a die head extrusion passage, the block providing one or more peripheral passages and comprising a plurality of inner passages therethrough whereby the flow of the melt is divided respectively into one or more peripheral streams which, on emergence from the insert passage or passages into the die passage, form an outer cellular skin of relatively high density, and into a plurality of inner streams which, on emergence from the die insert block passages, form rod-like streams which expand and weld together and to the inside surface of the outer skin in the die passage to form a cellular core having a substantially uniform cell size and a relatively low density, the colouring materials being incompletely mixed prior to the extrusion of the melt whereby a grain-type pattern of colouration is obtained on the outer surface of the extrudate resembling that found in wood.

2. A method according to claim 1, in which the portion of the die insert block defining the peripheral passage(s) is extended in the downstream direction of extrusion beyond the outlets of the inner passages, to provide a substantially longer flow passage for the material forming the outer skin than is provided for the core material.

3. A method according to claim 1, in which the die insert block is in two parts, an upstream part which serves to subdivide the whole of the melt flow into a plurality of rod-like streams, and a downstream part which has peripheral passages therein for the outer skin material and inner passages therethrough for the core material.
4. A method according to any of claims 1 to 3, in which the thermoplastics is a high softening grade of polystyrene.
5. A method according to any of claims 1 to 4, in which the thermoplastics melt contains n-pentane or a polyhalogenated alkane containing 1 or 2 carbon atoms, as blowing agent.
6. A method according to any of claims 1 to 5, in which the thermoplastics melt contains, as nucleating agent, a mixture of sodium bicarbonate and citric acid.
7. A method according to any of claims 1 to 6, in which the thermoplastics melt contains finely divided talc as a processing aid.
8. A method of making an imitation wood material substantially as herein described in any of Examples 1 to 3.
9. Imitation wood material when produced by the method claimed in any of the preceding claims.
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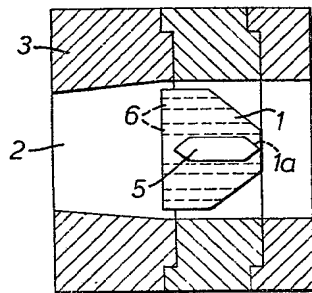


FIG. 1.

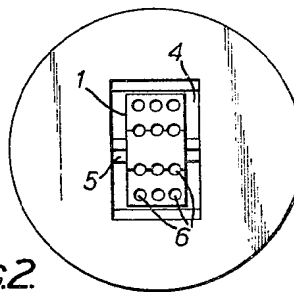


FIG. 2.

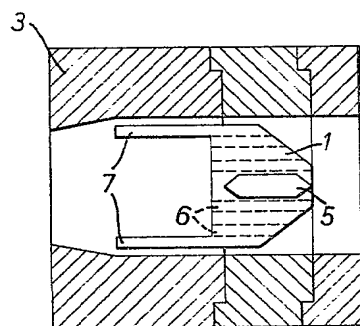


FIG. 3.

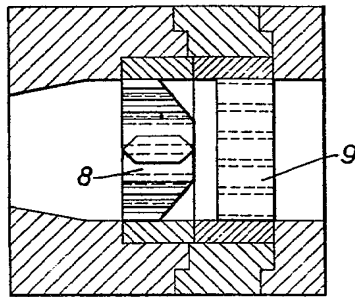


FIG. 4.

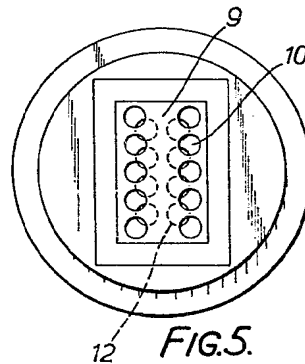


FIG. 5.

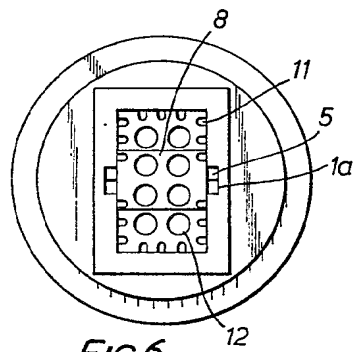


FIG. 6.

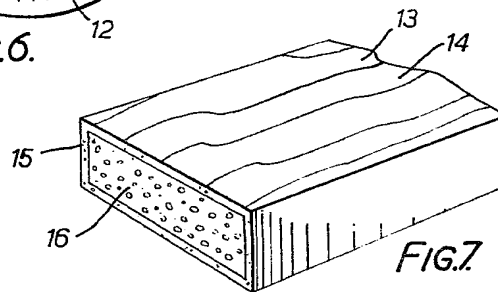


FIG. 7.

## Electronic Patent Application Fee Transmittal

|                                                       |                                |                 |               |                             |
|-------------------------------------------------------|--------------------------------|-----------------|---------------|-----------------------------|
| <b>Application Number:</b>                            | 15245948                       |                 |               |                             |
| <b>Filing Date:</b>                                   | 24-Aug-2016                    |                 |               |                             |
| <b>Title of Invention:</b>                            | WOOD-GRAINED POLYMER SUBSTRATE |                 |               |                             |
| <b>First Named Inventor/Applicant Name:</b>           | Andrew Stephens                |                 |               |                             |
| <b>Filer:</b>                                         | Kyle A. Forgue/Mark Sweetin    |                 |               |                             |
| <b>Attorney Docket Number:</b>                        | 64844-256633                   |                 |               |                             |
| Filed as Small Entity                                 |                                |                 |               |                             |
| <b>Filing Fees for    Utility under 35 USC 111(a)</b> |                                |                 |               |                             |
| <b>Description</b>                                    | <b>Fee Code</b>                | <b>Quantity</b> | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                                  |                                |                 |               |                             |
| <b>Pages:</b>                                         |                                |                 |               |                             |
| <b>Claims:</b>                                        |                                |                 |               |                             |
| <b>Miscellaneous-Filing:</b>                          |                                |                 |               |                             |
| <b>Petition:</b>                                      |                                |                 |               |                             |
| <b>Patent-Appeals-and-Interference:</b>               |                                |                 |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>              |                                |                 |               |                             |
| <b>Extension-of-Time:</b>                             |                                |                 |               |                             |

RPI1004

| Description                             | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|-----------------------------------------|----------|----------|--------|----------------------|
| <b>Miscellaneous:</b>                   |          |          |        |                      |
| SUBMISSION- INFORMATION DISCLOSURE STMT | 2806     | 1        | 120    | 120                  |
| <b>Total in USD (\$)</b>                |          |          |        | <b>120</b>           |

## Electronic Acknowledgement Receipt

|                                             |                                |
|---------------------------------------------|--------------------------------|
| <b>EFS ID:</b>                              | 31905842                       |
| <b>Application Number:</b>                  | 15245948                       |
| <b>International Application Number:</b>    |                                |
| <b>Confirmation Number:</b>                 | 1690                           |
| <b>Title of Invention:</b>                  | WOOD-GRAINED POLYMER SUBSTRATE |
| <b>First Named Inventor/Applicant Name:</b> | Andrew Stephens                |
| <b>Customer Number:</b>                     | 23644                          |
| <b>Filer:</b>                               | Kyle A. Forgue/Mark Sweetin    |
| <b>Filer Authorized By:</b>                 | Kyle A. Forgue                 |
| <b>Attorney Docket Number:</b>              | 64844-256633                   |
| <b>Receipt Date:</b>                        | 27-FEB-2018                    |
| <b>Filing Date:</b>                         | 24-AUG-2016                    |
| <b>Time Stamp:</b>                          | 17:03:23                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)    |

### Payment information:

|                                          |                       |
|------------------------------------------|-----------------------|
| Submitted with Payment                   | yes                   |
| Payment Type                             | CARD                  |
| Payment was successfully received in RAM | \$ 120                |
| RAM confirmation Number                  | 022818INTEFSW17041100 |
| Deposit Account                          | 120913                |
| Authorized User                          | Mark Sweetin          |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.21 (Miscellaneous fees and charges)

**RPI1004**

|                 |                                                     |                                                 |                                          |                  |                  |
|-----------------|-----------------------------------------------------|-------------------------------------------------|------------------------------------------|------------------|------------------|
|                 |                                                     |                                                 |                                          |                  |                  |
| File Listing:   |                                                     |                                                 |                                          |                  |                  |
| Document Number | Document Description                                | File Name                                       | File Size(Bytes)/ Message Digest         | Multi Part /.zip | Pages (if appl.) |
| 1               |                                                     | 256633_Supp_IDS_022718.pdf                      | 34191                                    | yes              | 4                |
|                 |                                                     |                                                 | a6e705164b488a463263cd480ac608bbacf34bde |                  |                  |
|                 | Multipart Description/PDF files in .zip description |                                                 |                                          |                  |                  |
|                 | Document Description                                |                                                 | Start                                    | End              |                  |
|                 | Transmittal Letter                                  |                                                 | 1                                        | 3                |                  |
|                 | Information Disclosure Statement (IDS) Form (SB08)  |                                                 | 4                                        | 4                |                  |
| Warnings:       |                                                     |                                                 |                                          |                  |                  |
| Information:    |                                                     |                                                 |                                          |                  |                  |
| 2               | Non Patent Literature                               | StaMixCo_Principles_Operation_Static_Mixers.pdf | 83658                                    | no               | 2                |
|                 |                                                     |                                                 | 4f691ccdb8415171c3a672740a2dbdf6589a2589 |                  |                  |
| Warnings:       |                                                     |                                                 |                                          |                  |                  |
| Information:    |                                                     |                                                 |                                          |                  |                  |
| 3               | Foreign Reference                                   | DE2327512A1.pdf                                 | 1583525                                  | no               | 12               |
|                 |                                                     |                                                 | fe9a21b333e0fed457d3b1ddf5132149c23e62fa |                  |                  |
| Warnings:       |                                                     |                                                 |                                          |                  |                  |
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| 4               | Foreign Reference                                   | GB1489591A.pdf                                  | 376592                                   | no               | 6                |
|                 |                                                     |                                                 | b0260f5871317bedd16165121fa656902ba16340 |                  |                  |
| Warnings:       |                                                     |                                                 |                                          |                  |                  |
| Information:    |                                                     |                                                 |                                          |                  |                  |
| 5               | Fee Worksheet (SB06)                                | fee-info.pdf                                    | 30733                                    | no               | 2                |
|                 |                                                     |                                                 | 6fe5e6f62579218a64fa638c830af91f531996e7 |                  |                  |
| Warnings:       |                                                     |                                                 |                                          |                  |                  |
| Information:    |                                                     |                                                 |                                          |                  |                  |
| RPI1004         |                                                     |                                                 |                                          |                  |                  |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

First Named Inventor:

STEPHENS, Andrew

Application No. 15/245948

Filed: August 24, 2016

Confirmation No. 1690

Group Art Unit: 1783

Examiner: DILLON, Daniel P.

For: WOOD-GRAINED POLYMER SUBSTRATE

**INFORMATION DISCLOSURE STATEMENT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Pursuant to 37 CFR 1.97 and 1.98, the references listed on the enclosed Form PTO-1449 and/or Substitute Form PTO-1449 ("Form 1449") are submitted for consideration by the Examiner in the examination of the above-identified patent application.

The full consideration of the references in their entirety by the Examiner is respectfully requested and encouraged. Also, it is respectfully requested that the references be entered into the record of the present application and that the Examiner place his or her initials in the appropriate area on the enclosed Form 1449, thereby indicating the Examiner's consideration of each of the references.

The submission of the references listed on the Form 1449 is for the purpose of providing a complete record and is not a concession that the references listed thereon are prior art to the invention claimed in the patent application. The right is expressly reserved to establish an invention date earlier than the above-identified filing date in order to remove any reference submitted herewith as prior art should it be deemed appropriate to do so.

Further, the submission of the references is not to be taken as a concession that any reference represents art that is relevant or analogous to the claimed invention. Accordingly, the right to argue that any reference is not properly within the scope of prior art relevant to an examination of the claims in the above-identified application is also expressly reserved.

The Information Disclosure Statement is being filed:



**within** any one of the following time periods: (a) within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d); (b) within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 of an international application; (c) before the mailing date of a first

First Named Inventor: STEPHENS, Andrew  
Application No. 15/245948

Office Action on the merits; or (d) before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

☒ **after** (a), (b), (c) or (d) above, but before the mailing date of a final action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an action that otherwise closes prosecution in the application, and includes *one* of:

☐ the Statement under 37 CFR 1.97(e) (see “Statement under 37 CFR 1.97(e)” below).

*or*

☒ the fee set forth in 37 CFR 1.17(p) (see “Fees” below).

☐ **after** the mailing date of a final action under 37 CFR 1.113 or a Notice of Allowance under 37 CFR 1.311, or an action that otherwise closes prosecution in the application, and on or before payment of the issue fee, and includes the Statement under 37 CFR 1.97(e) (see “Statement under 37 CFR 1.97(e)” below), and the fee set forth in 37 CFR 1.17(p) (see “Fees” below).

☐ **after** the mailing date of a Notice of Allowance under 37 CFR 1.311, and on or before payment of the issue fee, and **within** thirty days of receiving each item of information contained in the Information Disclosure Statement, and includes the Statement under 37 CFR 1.704(d) (see “Statement under 37 CFR 1.704(d)” below), and the fee set forth in 37 CFR 1.17(p) (see “Fees” below).

NOTE: This is for original applications except applications for a design patent, filed on or after May 29, 2000, wherein a paper containing only an Information Disclosure Statement in compliance with 37 CFR 1.97 and 1.98 is being filed.

### Copies of the References

☒ Copies of all foreign patents and non-patent literature listed on the enclosed Form 1449 are enclosed herewith.

☐ Attached to each reference not in the English language is a concise explanation of the relevance pursuant to 37 CFR 1.98(a)(3). An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of the relevance pursuant to 37 CFR 1.98(a)(3).

☐ A copy of the international search report is enclosed herewith.

☐ The references listed on the enclosed Form 1449 were previously identified in the parent application(s) of the present application, and copies of the references were furnished at that time. Accordingly, additional copies of the references are not submitted herewith, so as not to burden the file with duplicate copies of references. The Examiner is respectfully requested to carefully review the references in accordance with the requirements set out in the Manual of Patent Examining Procedure. In accordance with 37 CFR 1.98(d), the

First Named Inventor: STEPHENS, Andrew  
Application No. 15/245948

details of the parent application(s) relied upon for an earlier filing date under 35 USC 120 in which copies of the references were previously furnished are set out below:

| U.S. APPLICATIONS |                  | Status ( <i>check one</i> ) |         |           |
|-------------------|------------------|-----------------------------|---------|-----------|
| U.S. APPLICATIONS | U.S. FILING DATE | PATENTED                    | PENDING | ABANDONED |
| 1.                |                  |                             |         |           |
| 2.                |                  |                             |         |           |
| 3.                |                  |                             |         |           |

#### Fees

- ☐ No fee is owed by the applicant(s).  
☒ Charge Deposit Account No. 12-0913 in the amount of \$120.

#### Authorization to Charge Additional Fees

- ☒ Please charge any additional required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

Respectfully submitted,

Date: February 27, 2018

/Kyle A. Forgue/  
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Chicago, Illinois 60690-2786  
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(312) 759-5646 (facsimile)  
**Customer No. 23644**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

First Named Inventor:

Andrew Stephens

Application No. 15/245,948

Filed: August 24, 2016

For: WOOD-GRAINED POLYMER SUBSTRATE

Confirmation No. 1690

Group Art Unit: 1783

Examiner: DILLON, Daniel P.

**AMENDMENT AND RESPONSE TO OFFICE ACTION**

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Dear Commissioner:

In response to the Office Action mailed December 15, 2017, please consider the following:

**Amendments to the Claims** begin on page 2 of this paper; and

**Remarks** begin on page 7 of this paper.

**Amendments to the Claims:**

The following claims shall replace all previous versions of the claims:

1. (Original) A simulated natural wood-grained polymer board having a first side and a second side spaced apart from the first side along a width direction, the first and second sides defining a width of the board, the first and second sides extending along a length direction different than the width direction between a first end and a second end, the first and second ends defining a length of the board, a core of the board extending between the first and second sides and between the first and second ends, the board comprising:

a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers extending along the length of the entire board; and

a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers extending along the length of the entire board;

wherein individual layers of the first and second sets of polymer layers alternate within the core of the board to form a natural wood-grained appearance throughout the core of the board such that a plurality of the first and second sets of polymer layers extend along a curvilinear path in the width direction and are substantially uninterrupted from the first side to the second side.

2. (Currently Amended) The board of claim 1, wherein the layers of the first set of polymer layers are generally thinner than the layers of the second set of polymer layers.

3. (Original) The board of claim 1, wherein a portion of at least one of the first side and second side of the board is removed to expose portions of the first and second sets of polymer layers along the length direction.

4. (Original) The board of claim 3, wherein the exposed portions of the first and second sets of polymer layers form a burling grain pattern.

5. (Original) The board of claim 1, wherein at least one of the first and second sides of the board is embossed with a wood grain pattern.

6. (Currently Amended) The board of claim 1, wherein the first and second sets of polymer layers are formed from high density polyethylene.

7. (Original) The board of claim 6, wherein the first and second sets of polymer layers further include at least one of a UV inhibitor and a foaming agent.

8. (Original) The board of claim 6, wherein one of the first and second sets of polymer layers further includes a foaming agent.

9. (Original) The board of claim 1, wherein the board is formed to define a polygonal cross-section along a length of the board.

10. (Currently Amended) A simulated natural wood-grained polymer substrate extending along a first direction, the substrate having a first side and a second side spaced apart from the first side along a second direction different than the lengthfirst direction, the first and second sides defining a width of the substrate, the first and second sides extending along the lengthfirst direction, a core of the substrate extending between the first and second sides and along the lengthfirst direction, the substrate comprising:

a first set of polymer layers generally extending along the lengthfirst direction and containing a first colorant, a majority of the first set of polymer layers being substantially continuous along the lengthfirst direction; and

a second set of polymer layers generally extending along the lengthfirst direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers being substantially continuous along the lengthfirst direction;

wherein individual layers of the first and second sets of polymer layers alternate within the core of the substrate to form a natural wood-grained appearance throughout the core of the substrate such that a plurality of the first and second sets of polymer layers extend along a curvilinear path in the second direction and are substantially uninterrupted from the first side to the second side.

11. (Currently Amended) The substrate of claim 10, wherein the layers of the first set of polymer layers are generally thinner than the layers of the second set of polymer layers.

12. (Currently Amended) The substrate of claim 10, wherein the first and second sets of polymer layers are formed from high density polyethylene.

13. (Original) The substrate of claim 12, wherein the first and second sets of polymer layers further include at least one of a UV inhibitor and a foaming agent.

14. (Original) The substrate of claim 12, wherein one of the first and second sets of polymer layers further includes a foaming agent.

15. (Currently Amended) The substrate of claim 10, wherein the substrate is formed to define a polygonal cross-section along a length of the substrate.

16. (Cancelled)

17. (New) The board of claim 6, wherein the core is substantially free of natural wood materials.

18. (New) The board of claim 1, further comprising a third side and a fourth side spaced apart from the third side along a height direction different than the length direction and width direction, wherein the third and fourth sides define a height of the board, wherein the third

and fourth sides extend along the length direction between the first and second ends, wherein the core of the board extends between the first, second, third, and fourth sides and between the first and second ends, and wherein the individual layers of the first and second sets of polymer layers alternate within the core of the board along the height direction.

19. (New) The substrate of claim 12, wherein the core is substantially free of natural wood materials.

20. (New) The substrate of claim 10, further comprising a third side and a fourth side spaced apart from the third side along a third direction different than the first and second directions, wherein the third and fourth sides define a height of the substrate, wherein the third and fourth sides extend along the first direction, wherein the core of the substrate extends between the first, second, third, and fourth sides and along the first direction, and wherein individual layers of the first and second sets of polymer layers alternate within the core of the substrate along the third direction.

21. (New) A simulated natural wood-grained polymer substrate having a length defined along a first direction, a width defined along a second direction perpendicular to the first direction, and a height defined along a third direction perpendicular to both the first and second directions, the substrate comprising:

a first set of polymer layers generally extending along the first direction and containing a first colorant, a majority of the first set of polymer layers being substantially continuous along the first direction; and

a second set of polymer layers generally extending along the first direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers being substantially continuous along the first direction;

wherein individual layers of the first and second sets of polymer layers alternate within the substrate along the third direction to form a natural wood-grained appearance throughout the

substrate such that a plurality of the first and second sets of polymer layers extend along a curvilinear path in the second direction and are substantially uninterrupted across the substrate.

22. (New) The substrate of claim 21, wherein the layers of the first set of polymer layers are generally thinner than layers of the second set of polymer layers.

23. (New) The substrate of claim 21, wherein the first and second sets of polymer layers are formed from high density polyethylene.

24. (New) The substrate of claim 23, wherein the core is substantially free of natural wood materials.

## REMARKS

### **I. CLAIM STATUS**

Prior to this response, claims 1-16 were pending in this case. Claims 2, 6, 10-12, and 15 have been amended herein solely to correct informalities. Claim 16 has been cancelled without prejudice and may be explored in one or more continuation or divisional applications. New claims 17-24 have been added. No new matter has been added with these amendments and new claims. The amendments are fully supported by the specification and drawings as originally filed and as amended.

### **II. CLAIM OBJECTIONS**

Claim 16 is objected to for an informality. As noted above, claim 16 has been cancelled. Accordingly, withdrawal of the objection is respectfully requested.

### **III. CLAIM REJECTIONS UNDER 35 U.S.C. § 103**

Claims 1, 3-10, and 12-16 are rejected under 35 U.S.C. § 103 over U.S. Pat. App. Pub. No. 2003/0021915 to Rohatgi et al. (“Rohatgi”). Claims 2 and 11 are rejected under 35 U.S.C. § 103 over Rohatgi in view of U.S. Pat. App. Pub. No. 2004/0038002 to Franco et al. (“Franco”). The rejections are respectfully traversed.

As noted above, claim 16 has been cancelled herein. The Office Action states that Rohatgi teaches that “layers alternate in the width direction of the board and the board may be imparted with curves (“curvilinear”) . . . along with the curve being uninterrupted at the curve.” Office Action mailed December 15, 2017 at p. 4 (emphasis added). The bolded and underlined language does not appear in claims 1 or 10, and this also fails to account for the differences in language between claims 1 and 10. Thus, the Office Action fails to make a *prima facie* case of obviousness by not considering all of the claim limitations and misconstruing the same. *See* MPEP 2143.03.

In addition, the Office Action states that, based on the disclosure of paragraphs [0046]-

[0047] of Rohatgi, “[t]he methods of coextrusion would ultimately result in the formation of the two differing layers as shown in [Fig. 3]. As such, it would have been obvious that the formation of the composite . . . would have been achieved by the methods of coextrusion as taught by Rohatgi.” However, the cited paragraphs are specifically directed to techniques for “encapsulation” that provide different properties to the “skin and core” rather than the formation of different colored layers. Indeed, the teaching of Rohatgi runs contrary to the knowledge of one skilled in the art. Specifically, the process of Rohatgi uses “streaking” techniques (*see id.* at para. [0012]) where high melting point “color masterbatch concentrate pellets” are added during the extrusion process (*see id.* at para. [0052]). One skilled in the art would know that these pellets have a limited volume that produce short “streaks” in the composite product instead of continuous lines like those shown in Fig. 3 of Rohatgi. Indeed, the resulting short “streaks” are shown and described explicitly in Franco, and passing the mixture through a screw extruder as taught by Rohatgi does not cure this deficiency. Thus, the composite product depicted in Fig. 3 would not be the obvious result of the process described in Rohatgi. Fig. 3 is merely a draftsman’s imagined representation and not an actual image of a composite product produced by the disclosed process.

Therefore, Rohatgi and Franco, whether alone or in combination, fail to teach, show, or suggest, or otherwise make obvious, all of the elements of claims 1 and 10. Accordingly, withdrawal of the rejections and allowance of claims 1 and 10, and claims 2-9 and 11-15 dependent thereon, is respectfully requested.

#### **IV. NEW CLAIMS**

New claims 17-24 have been added. The cited references also fail to teach all of the elements of claims 17-24. Accordingly, allowance of claims 17-24 is respectfully requested.

#### **V. CONCLUSION**

In view of the forgoing, it is submitted that this application is in condition for allowance. Allowance is respectfully requested. If the Examiner believes that a telephonic interview would

First Named Inventor: Andrew Stephens  
Application No. 15/245,948

expedite the allowance of this application, the Examiner is requested to contact the undersigned for prompt resolution of any outstanding issues.

It is respectfully requested that this paper, if necessary, be considered as a Petition for Extension of Time sufficient to effect a timely response and that shortages in fees, if any, be charged, or any overpayment in fees credited, to the Account of Barnes & Thornburg, Deposit Account No. 12-0913 with reference to file 64844-256633.

Respectfully submitted,

Date: March 13, 2018

/Kyle A. Forgue/  
Kyle A. Forgue, Reg. No. 71,457  
One of the Attorneys for Applicant(s)  
BARNES & THORNBURG LLP  
P.O. Box 2786  
Chicago, Illinois 60690-2786  
Phone: 312-357-1313  
Facsimile: 312-759-5646  
**Customer No.: 23644**

## Electronic Patent Application Fee Transmittal

|                                                    |                                |                 |               |                             |
|----------------------------------------------------|--------------------------------|-----------------|---------------|-----------------------------|
| <b>Application Number:</b>                         | 15245948                       |                 |               |                             |
| <b>Filing Date:</b>                                | 24-Aug-2016                    |                 |               |                             |
| <b>Title of Invention:</b>                         | WOOD-GRAINED POLYMER SUBSTRATE |                 |               |                             |
| <b>First Named Inventor/Applicant Name:</b>        | Andrew Stephens                |                 |               |                             |
| <b>Filer:</b>                                      | Kyle A. Forgue/Mark Sweetin    |                 |               |                             |
| <b>Attorney Docket Number:</b>                     | 64844-256633                   |                 |               |                             |
| Filed as Small Entity                              |                                |                 |               |                             |
| <b>Filing Fees for Utility under 35 USC 111(a)</b> |                                |                 |               |                             |
| <b>Description</b>                                 | <b>Fee Code</b>                | <b>Quantity</b> | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                               |                                |                 |               |                             |
| <b>Pages:</b>                                      |                                |                 |               |                             |
| <b>Claims:</b>                                     |                                |                 |               |                             |
| CLAIMS IN EXCESS OF 20                             | 2202                           | 3               | 50            | 150                         |
| <b>Miscellaneous-Filing:</b>                       |                                |                 |               |                             |
| <b>Petition:</b>                                   |                                |                 |               |                             |
| <b>Patent-Appeals-and-Interference:</b>            |                                |                 |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>           |                                |                 |               |                             |

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 150                  |

## Electronic Acknowledgement Receipt

|                                             |                                |
|---------------------------------------------|--------------------------------|
| <b>EFS ID:</b>                              | 32037125                       |
| <b>Application Number:</b>                  | 15245948                       |
| <b>International Application Number:</b>    |                                |
| <b>Confirmation Number:</b>                 | 1690                           |
| <b>Title of Invention:</b>                  | WOOD-GRAINED POLYMER SUBSTRATE |
| <b>First Named Inventor/Applicant Name:</b> | Andrew Stephens                |
| <b>Customer Number:</b>                     | 23644                          |
| <b>Filer:</b>                               | Kyle A. Forgue/Mark Sweetin    |
| <b>Filer Authorized By:</b>                 | Kyle A. Forgue                 |
| <b>Attorney Docket Number:</b>              | 64844-256633                   |
| <b>Receipt Date:</b>                        | 13-MAR-2018                    |
| <b>Filing Date:</b>                         | 24-AUG-2016                    |
| <b>Time Stamp:</b>                          | 14:15:16                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)    |

### Payment information:

|                                          |                       |
|------------------------------------------|-----------------------|
| Submitted with Payment                   | yes                   |
| Payment Type                             | CARD                  |
| Payment was successfully received in RAM | \$ 150                |
| RAM confirmation Number                  | 031418INTEFSW14161700 |
| Deposit Account                          | 120913                |
| Authorized User                          | Mark Sweetin          |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

**RPI1004**

**File Listing:**

| Document Number              | Document Description                                  | File Name                           | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|------------------------------|-------------------------------------------------------|-------------------------------------|------------------------------------------|------------------|------------------|
| 1                            |                                                       | 256633_Response_NonFinal_031318.pdf | 37893                                    | yes              | 9                |
|                              |                                                       |                                     | f2c5aa4e3a1cf44444bdca3b79c6c3c945db5de7 |                  |                  |
|                              | Multipart Description/PDF files in .zip description   |                                     |                                          |                  |                  |
|                              | Document Description                                  |                                     | Start                                    | End              |                  |
|                              | Amendment/Req. Reconsideration-After Non-Final Reject |                                     | 1                                        | 1                |                  |
|                              | Claims                                                |                                     | 2                                        | 6                |                  |
|                              | Amendment/Req. Reconsideration-After Non-Final Reject |                                     | 7                                        | 9                |                  |
| Warnings:                    |                                                       |                                     |                                          |                  |                  |
| Information:                 |                                                       |                                     |                                          |                  |                  |
| 2                            | Fee Worksheet (SB06)                                  | fee-info.pdf                        | 30731                                    | no               | 2                |
|                              |                                                       |                                     | 6dd8b30000c1248a2a4e80657ff24980ee63a201 |                  |                  |
| Warnings:                    |                                                       |                                     |                                          |                  |                  |
| Information:                 |                                                       |                                     |                                          |                  |                  |
| Total Files Size (in bytes): |                                                       |                                     | 68624                                    |                  |                  |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

|                                                                                   |                                                   |                                  |                                       |
|-----------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|---------------------------------------|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875 | Application or Docket Number<br><b>15/245,948</b> | Filing Date<br><b>08/24/2016</b> | <input type="checkbox"/> To be Mailed |
|-----------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|---------------------------------------|

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

**APPLICATION AS FILED – PART I**

(Column 1)

(Column 2)

| FOR                                                                        | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA | RATE (\$) | FEE (\$) |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|----------|
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))        | N/A                                                                                                                                                                                                                           | N/A          | N/A       |          |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))       | N/A                                                                                                                                                                                                                           | N/A          | N/A       |          |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))  | N/A                                                                                                                                                                                                                           | N/A          | N/A       |          |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                           | minus 20 =                                                                                                                                                                                                                    | *            | X \$ =    |          |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                     | minus 3 =                                                                                                                                                                                                                     | *            | X \$ =    |          |
| <input type="checkbox"/> APPLICATION SIZE FEE<br>(37 CFR 1.16(s))          | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |              |           |          |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |              |           |          |
| * If the difference in column 1 is less than zero, enter "0" in column 2.  |                                                                                                                                                                                                                               |              | TOTAL     |          |

**APPLICATION AS AMENDED – PART II**

(Column 1)

(Column 2)

(Column 3)

| AMENDMENT       | 03/13/2018                                                                               | CLAIMS REMAINING AFTER AMENDMENT | MINUS | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE (\$)  | ADDITIONAL FEE (\$) |
|-----------------|------------------------------------------------------------------------------------------|----------------------------------|-------|------------------------------------|---------------|------------|---------------------|
|                 | Total (37 CFR 1.16(i))                                                                   | * 23                             | Minus | ** 20                              | = 3           | X \$50 =   | 150                 |
|                 | Independent (37 CFR 1.16(h))                                                             | * 3                              | Minus | ***3                               | = 0           | X \$230 =  | 0                   |
|                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                  |       |                                    |               |            |                     |
|                 | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |       |                                    |               |            |                     |
| TOTAL ADD'L FEE |                                                                                          |                                  |       |                                    |               | <b>150</b> |                     |

(Column 1)

(Column 2)

(Column 3)

| AMENDMENT       | CLAIMS REMAINING AFTER AMENDMENT                                                         | MINUS | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE (\$) | ADDITIONAL FEE (\$) |
|-----------------|------------------------------------------------------------------------------------------|-------|------------------------------------|---------------|-----------|---------------------|
|                 | Total (37 CFR 1.16(i))                                                                   | *     | Minus                              | **            | =         | X \$ =              |
|                 | Independent (37 CFR 1.16(h))                                                             | *     | Minus                              | ***           | =         | X \$ =              |
|                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |       |                                    |               |           |                     |
|                 | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |       |                                    |               |           |                     |
| TOTAL ADD'L FEE |                                                                                          |       |                                    |               |           |                     |

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

\*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE  
DIANE FLOYD

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

**RPI1004**



# UNITED STATES PATENT AND TRADEMARK OFFICE

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www.uspto.gov

| APPLICATION NO.              | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|------------------------------|-------------|----------------------|---------------------|------------------|
| 15/245,948                   | 08/24/2016  | Andrew Stephens      | 64844-256633        | 1690             |
| 23644                        | 7590        | 04/25/2018           | EXAMINER            |                  |
| Barnes & Thornburg LLP (CH)  |             |                      | DILLON, DANIEL P    |                  |
| P.O. Box 2786                |             |                      |                     |                  |
| Chicago, ILLINOIS 60690-2786 |             |                      |                     |                  |
| UNITED STATES OF AMERICA     |             |                      |                     |                  |
|                              |             |                      | ART UNIT            | PAPER NUMBER     |
|                              |             |                      | 1783                |                  |
|                              |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                              |             |                      | 04/25/2018          | ELECTRONIC       |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent-ch@btlaw.com

|                                                     |                                      |                                        |                          |
|-----------------------------------------------------|--------------------------------------|----------------------------------------|--------------------------|
| <b><i>Applicant-Initiated Interview Summary</i></b> | <b>Application No.</b><br>15/245,948 | <b>Applicant(s)</b><br>Stephens et al. |                          |
|                                                     | <b>Examiner</b><br>DANIEL P DILLON   | <b>Art Unit</b><br>1783                | <b>AIA Status</b><br>Yes |

All participants (applicant, applicants representative, PTO personnel):

(1) DANIEL P. DILLON.

(3) KYLE FORGUE.

(2) MARIA VERONICA EWALD.

(4) ANDREW STEPHENS.

Date of Interview: 20 April 2018.

Type: ☒ Telephonic ☐ Video Conference  
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.

If Yes, brief description: \_\_\_\_\_.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others

(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1-15 and 17-24.

Identification of prior art discussed: Rohatgi and Franco.

#### Substance of Interview

(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant discussed the invention in detail including the process of forming the simulated wood substrate and how the process differs from that of the prior art such that the prior art gives the simulated wood substrate of Rohatgi short streaks of polymer materials due to the pellets in the process instead of the longer streaks of applicant's invention. Additionally, the discussion revolved around how the applicant could submit claim amendments that further differentiate the invention from figure 3 of Rohatgi such that the end of the simulated wood includes stacked polymer layers terminating at the width ends of the board rather than a swirl..

**Applicant recordation instructions:** The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

**Examiner recordation instructions:** Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/DANIEL P DILLON/  
Examiner, Art Unit 1783

/MARIA V EWALD/  
Supervisory Patent Examiner, Art Unit 1783

## Summary of Record of Interview Requirements

### Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

### Title 37 Code of Federal Regulations (CFR) 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiners responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicants correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,-
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,  
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicants record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

### Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiners version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, Interview Record OK on the paper recording the substance of the interview along with the date and the examiners initials.

Doc Code: ECOMM.AUTH/ECOMM.WTDW

Doc Description: Internet Communications Authorized/Internet Communications Authorization Withdrawn

PTO/SB/439 (11-15)

**AUTHORIZATION FOR INTERNET  
COMMUNICATIONS IN A PATENT  
APPLICATION OR REQUEST TO  
WITHDRAW AUTHORIZATION FOR  
INTERNET COMMUNICATIONS**

|                         |                  |
|-------------------------|------------------|
| Application No.         | 15/245,948       |
| Filing Date             | 08/24/2016       |
| First Named Inventor    | Andrew Stephens  |
| Art Unit                | 1783             |
| Examiner Name           | Dillon, Daniel P |
| Practitioner Docket No. | 64644-256633     |

To: Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**I. To authorize permission for Internet Communications.**

☒ Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. I understand that a copy of these communications will be made of record in the application file. (MPEP 502.03)

**II. To withdraw authorization for Internet Communications.**

☐ The authorization given on \_\_\_\_\_, to the USPTO to communicate with the undersigned and any practitioner in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via Internet communications such as video conferencing, instant messaging, or electronic mail is hereby withdrawn. I understand that the withdrawal is effective when approved rather than when received.

I am the

☐ applicant.

☒ attorney or agent of record. Registration number 51,093.

☐ attorney or agent acting under 37 CFR 1.34. Registration number \_\_\_\_\_.

/Mark J. Nahnsen/  
Signature

04/30/2018  
Date

Mark J. Nahnsen  
Typed or printed name

312-214-4810  
Telephone Number

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Juristic entities must be represented by a patent practitioner (see 37 CFR 1.31, which is applicable to any paper filed on or after September 16, 2012, that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below\*.

☒ \* Total of 1 forms are submitted.

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

## Electronic Acknowledgement Receipt

|                                             |                                |
|---------------------------------------------|--------------------------------|
| <b>EFS ID:</b>                              | 32479836                       |
| <b>Application Number:</b>                  | 15245948                       |
| <b>International Application Number:</b>    |                                |
| <b>Confirmation Number:</b>                 | 1690                           |
| <b>Title of Invention:</b>                  | WOOD-GRAINED POLYMER SUBSTRATE |
| <b>First Named Inventor/Applicant Name:</b> | Andrew Stephens                |
| <b>Customer Number:</b>                     | 23644                          |
| <b>Filer:</b>                               | Mark J. Nahnsen/Mark Sweetin   |
| <b>Filer Authorized By:</b>                 | Mark J. Nahnsen                |
| <b>Attorney Docket Number:</b>              | 64844-256633                   |
| <b>Receipt Date:</b>                        | 30-APR-2018                    |
| <b>Filing Date:</b>                         | 24-AUG-2016                    |
| <b>Time Stamp:</b>                          | 10:46:34                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)    |

### Payment information:

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
|------------------------|----|

### File Listing:

| Document Number | Document Description               | File Name              | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|------------------------------------|------------------------|------------------------------------------|------------------|------------------|
| 1               | Internet Communications Authorized | sb0439_Form_256633.pdf | 86395                                    | no               | 2                |
|                 |                                    |                        | ea07193a67ca19b5f66eac023816e8b76b18a149 |                  |                  |

### Warnings:

RPI1004

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 86395 |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |       |

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

First Named Inventor:

Andrew Stephens

Application No. 15/245,948

Filed: August 24, 2016

Confirmation No. 1690

Group Art Unit: 1783

Examiner: DILLON, Daniel P.

For: WOOD-GRAINED POLYMER SUBSTRATE

**SUPPLEMENTAL AMENDMENT  
AND RESPONSE TO OFFICE ACTION**

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Dear Commissioner:

In response to the Office Action mailed December 15, 2017, please consider the following:

**Amendments to the Claims** begin on page 2 of this paper; and

**Remarks** begin on page 8 of this paper.

## Electronic Patent Application Fee Transmittal

|                                                    |                                |                 |               |                             |
|----------------------------------------------------|--------------------------------|-----------------|---------------|-----------------------------|
| <b>Application Number:</b>                         | 15245948                       |                 |               |                             |
| <b>Filing Date:</b>                                | 24-Aug-2016                    |                 |               |                             |
| <b>Title of Invention:</b>                         | WOOD-GRAINED POLYMER SUBSTRATE |                 |               |                             |
| <b>First Named Inventor/Applicant Name:</b>        | Andrew Stephens                |                 |               |                             |
| <b>Filer:</b>                                      | Mark J. Nahnsen/Mark Nahnsen   |                 |               |                             |
| <b>Attorney Docket Number:</b>                     | 64844-256633                   |                 |               |                             |
| Filed as Small Entity                              |                                |                 |               |                             |
| <b>Filing Fees for Utility under 35 USC 111(a)</b> |                                |                 |               |                             |
| <b>Description</b>                                 | <b>Fee Code</b>                | <b>Quantity</b> | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                               |                                |                 |               |                             |
| <b>Pages:</b>                                      |                                |                 |               |                             |
| <b>Claims:</b>                                     |                                |                 |               |                             |
| INDEPENDENT CLAIMS IN EXCESS OF 3                  | 2201                           | 1               | 230           | 230                         |
| <b>Miscellaneous-Filing:</b>                       |                                |                 |               |                             |
| <b>Petition:</b>                                   |                                |                 |               |                             |
| <b>Patent-Appeals-and-Interference:</b>            |                                |                 |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>           |                                |                 |               |                             |

RPI1004

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 230                  |

## Electronic Acknowledgement Receipt

|                                             |                                |
|---------------------------------------------|--------------------------------|
| <b>EFS ID:</b>                              | 32676798                       |
| <b>Application Number:</b>                  | 15245948                       |
| <b>International Application Number:</b>    |                                |
| <b>Confirmation Number:</b>                 | 1690                           |
| <b>Title of Invention:</b>                  | WOOD-GRAINED POLYMER SUBSTRATE |
| <b>First Named Inventor/Applicant Name:</b> | Andrew Stephens                |
| <b>Customer Number:</b>                     | 23644                          |
| <b>Filer:</b>                               | Mark J. Nahnsen/Mark Nahnsen   |
| <b>Filer Authorized By:</b>                 | Mark J. Nahnsen                |
| <b>Attorney Docket Number:</b>              | 64844-256633                   |
| <b>Receipt Date:</b>                        | 21-MAY-2018                    |
| <b>Filing Date:</b>                         | 24-AUG-2016                    |
| <b>Time Stamp:</b>                          | 14:09:37                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)    |

### Payment information:

|                                          |                       |
|------------------------------------------|-----------------------|
| Submitted with Payment                   | yes                   |
| Payment Type                             | CARD                  |
| Payment was successfully received in RAM | \$ 230                |
| RAM confirmation Number                  | 052218INTEFSW14102600 |
| Deposit Account                          | 120913                |
| Authorized User                          | Mark Sweetin          |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

**RPI1004**

**File Listing:**

| Document Number              | Document Description                                | File Name                               | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|------------------------------|-----------------------------------------------------|-----------------------------------------|------------------------------------------|------------------|------------------|
| 1                            |                                                     | 256633_Supplemental_Response_052118.pdf | 37454                                    | yes              | 9                |
|                              |                                                     |                                         | 84dfda97bfcc0520fef089c726fcc9d39d1e965e |                  |                  |
|                              | Multipart Description/PDF files in .zip description |                                         |                                          |                  |                  |
|                              | Document Description                                |                                         | Start                                    | End              |                  |
|                              | Applicant Arguments/Remarks Made in an Amendment    |                                         | 8                                        | 9                |                  |
|                              | Claims                                              |                                         | 2                                        | 7                |                  |
|                              | Supplemental Response or Supplemental Amendment     |                                         | 1                                        | 1                |                  |
| Warnings:                    |                                                     |                                         |                                          |                  |                  |
| Information:                 |                                                     |                                         |                                          |                  |                  |
| 2                            | Fee Worksheet (SB06)                                | fee-info.pdf                            | 30742                                    | no               | 2                |
|                              |                                                     |                                         | af322a68bdb50317314c77b5d5ca05c71b024fa8 |                  |                  |
| Warnings:                    |                                                     |                                         |                                          |                  |                  |
| Information:                 |                                                     |                                         |                                          |                  |                  |
| Total Files Size (in bytes): |                                                     |                                         | 68196                                    |                  |                  |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

## **REMARKS**

### **I. CLAIM STATUS**

Applicant thanks the examiner for the telephonic interview on April 20, 2018. Prior to this response, claims 1-16 were pending in this case. Claims 1, 4, 6, 10, 15, and 21 have been amended. Claim 25 has been added. No new matter has been added with these amendments and new claims. The amendments are fully supported by the specification and drawings as originally filed and as amended.

### **II. CLAIM REJECTIONS UNDER 35 U.S.C. § 103**

Claims 1, 3-10, and 12-16 were rejected under 35 U.S.C. § 103 over U.S. Pat. App. Pub. No. 2003/0021915 to Rohatgi et al. (“Rohatgi”). Claims 2 and 11 were rejected under 35 U.S.C. § 103 over Rohatgi in view of U.S. Pat. App. Pub. No. 2004/0038002 to Franco et al. (“Franco”). The rejections are respectfully traversed. Claims 1, 10 and 21 have been amended to require the plurality of individual layers of the first and second sets of polymer layers to alternate within the board and extend along a substantially uninterrupted curvilinear path originating proximate the first side of the board and terminating proximate the second side of the board. Rohatgi and Franco, whether alone or in combination, fail to teach, show, or suggest a plurality of individual layers that alternate within a board and extend along a substantially uninterrupted curvilinear path originating proximate the first side of the board and terminating proximate the second side of the board. Accordingly, withdrawal of the rejections and allowance of the pending claims is respectfully requested.

### **IV. NEW CLAIMS**

New claim 25 has been added. The cited references also fail to teach all of the elements of claims 25. Accordingly, allowance of claims 1-15 and 17-25 is respectfully requested.

First Named Inventor: Andrew Stephens  
Application No. 15/245,948

## V. CONCLUSION

In view of the forgoing, it is submitted that this application is in condition for allowance. Allowance is respectfully requested. If the Examiner believes that a telephonic interview would expedite the allowance of this application, the Examiner is requested to contact the undersigned for prompt resolution of any outstanding issues.

It is respectfully requested that this paper, if necessary, be considered as a Petition for Extension of Time sufficient to effect a timely response and that shortages in fees, if any, be charged, or any overpayment in fees credited, to the Account of Barnes & Thornburg, Deposit Account No. 12-0913 with reference to file 64844-256633.

Respectfully submitted,

Date: May 21, 2018

/Mark J. Nahnsen/  
Mark J. Nahnsen, Reg. No. 51,093  
One of the Attorneys for Applicant(s)  
BARNES & THORNBURG LLP  
P.O. Box 2786  
Chicago, Illinois 60690-2786  
Phone: 312-357-1313  
Facsimile: 312-759-5646  
**Customer No.: 23644**

**Amendments to the Claims:**

The following claims shall replace all previous versions of the claims:

1. (Currently Amended) A simulated natural wood-grained polymer board having a first side and a second side spaced apart from the first side ~~along a width direction~~, the spacing between the first and second sides defining one of a width or a height of the board, the first and second sides extending along a length direction ~~different than the width direction~~ between a first end and a second end, the first and second ends defining a length of the board, ~~a core of the board extending between the first and second sides and between the first and second ends~~, the board comprising:

a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers extending along the length of the entire board;

a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers extending along the length of the entire board; and

wherein a plurality of individual layers of the first and second sets of polymer layers alternate within ~~the core of the board to form a natural wood-grained appearance throughout the core of the board such that~~ and a plurality of the first and second sets of polymer layers extend along a substantially uninterrupted curvilinear path originating proximate the first side of the board in the width direction and are substantially uninterrupted from the first side and terminating proximate to the second side of the board.

2. (Previously Presented) The board of claim 1, wherein the layers of the first set of polymer layers are generally thinner than the layers of the second set of polymer layers.

3. (Original) The board of claim 1, wherein a portion of at least one of the first side and second side of the board is removed to expose portions of the first and second sets of polymer layers along the length direction.

4. (Currently Amended) The board of claim 3, wherein the exposed portions of the first and second sets of polymer layers form a burled ~~burling~~ grain pattern.

5. (Original) The board of claim 1, wherein at least one of the first and second sides of the board is embossed with a wood grain pattern.

6. (Currently Amended) The board of claim 1, wherein the first and second sets of polymer layers are formed from high density polyethylene.

7. (Original) The board of claim 6, wherein the first and second sets of polymer layers further include at least one of a UV inhibitor and a foaming agent.

8. (Original) The board of claim 6, wherein one of the first and second sets of polymer layers further includes a foaming agent.

9. (Original) The board of claim 1, wherein the board is formed to define a polygonal cross-section along a length of the board.

10. (Currently Amended) A simulated natural wood-grained polymer substrate extending along a first direction, the substrate having a first side and a second side spaced apart from the first side along a second direction different than the first direction, the first and second sides defining a width of the substrate, the first and second sides extending along the first direction, a core of the substrate extending between the first and second sides and along the first direction, the substrate comprising:

a first set of polymer layers generally extending along the first direction and containing a first colorant, a majority of the first set of polymer layers being substantially continuous along the first direction; and

a second set of polymer layers generally extending along the first direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers being substantially continuous along the first direction;

wherein individual layers of the first and second sets of polymer layers alternate within the core of the substrate to form a natural wood-grained appearance throughout the core of the substrate; and

wherein a plurality of the individual layers such that of one of the first and second sets of polymer layers extend along a substantially uninterrupted curvilinear path in the second direction originating proximate the first side and terminating proximate ~~are substantially uninterrupted from the first side to the second side.~~

11. (Previously Presented) The substrate of claim 10, wherein the layers of the first set of polymer layers are generally thinner than the layers of the second set of polymer layers.

12. (Previously Presented) The substrate of claim 10, wherein the first and second sets of polymer layers are formed from high density polyethylene.

13. (Original) The substrate of claim 12, wherein the first and second sets of polymer layers further include at least one of a UV inhibitor and a foaming agent.

14. (Original) The substrate of claim 12, wherein one of the first and second sets of polymer layers further includes a foaming agent.

15. (Currently Amended) The substrate of claim 10, wherein the substrate is formed to define a polygonal cross-section along a length of the substrate.

16. (Cancelled)

17. (Previously Presented) The board of claim 6, wherein the core is substantially free of natural wood materials.

18. (Previously Presented) The board of claim 1, further comprising a third side and a fourth side spaced apart from the third side along a height direction different than the length direction and width direction, wherein the third and fourth sides define a height of the board, wherein the third and fourth sides extend along the length direction between the first and second ends, wherein the core of the board extends between the first, second, third, and fourth sides and between the first and second ends, and wherein the individual layers of the first and second sets of polymer layers alternate within the core of the board along the height direction.

19. (Previously Presented) The substrate of claim 12, wherein the core is substantially free of natural wood materials.

20. (Previously Presented) The substrate of claim 10, further comprising a third side and a fourth side spaced apart from the third side along a third direction different than the first and second directions, wherein the third and fourth sides define a height of the substrate, wherein the third and fourth sides extend along the first direction, wherein the core of the substrate extends between the first, second, third, and fourth sides and along the first direction, and wherein individual layers of the first and second sets of polymer layers alternate within the core of the substrate along the third direction.

21. (Currently Amended) A simulated natural wood-grained polymer substrate having a length defined along a first direction, a width defined along a second direction perpendicular to the first direction, and a height defined along a third direction perpendicular to both the first and second directions, the substrate comprising:

a first set of polymer layers generally extending along the first direction and containing a first colorant, a majority of the first set of polymer layers being substantially continuous along the first direction; and

a second set of polymer layers generally extending along the first direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers being substantially continuous along the first direction;

wherein individual layers of the first and second sets of polymer layers alternate within the substrate along the third direction to form a natural wood-grained appearance throughout the substrate; and

wherein a plurality of the individual layers of one of the ~~such that~~ a plurality of the first and second sets of polymer layers extend along a substantially uninterrupted curvilinear path in the second direction originating proximate an outer surface of a first portion of the substrate and terminating proximate an outer surface of a second portion of ~~and are substantially uninterrupted across~~ the substrate.

22. (Previously Presented) The substrate of claim 21, wherein the layers of the first set of polymer layers are generally thinner than layers of the second set of polymer layers.

23. (Previously Presented) The substrate of claim 21, wherein the first and second sets of polymer layers are formed from high density polyethylene.

24. (Previously Presented) The substrate of claim 23, wherein the core is substantially free of natural wood materials.

25. (New) A simulated natural wood-grained polymer board comprising:  
a polymer core having a first side and a second side spaced apart from the first side, spacing between the first and second sides defining one of a width or a height of the core, the first and second sides extending along a length direction of the core between a first end and a second end, the first and second ends defining a length of the core;

a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers extending along the entire length of the core;

a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers extending along the entire length of the core; and

wherein a plurality of individual layers of the first and second sets of polymer layers alternate within the core and extend along a substantially uninterrupted curvilinear path originating from proximate the first side of the core and terminating proximate the second side of the core.

Document code: WFEE

United States Patent and Trademark Office  
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| CBETANCO | SALE | #00000004    | Mailroom Dt: | 05/21/2018 | 120913 | 15245948 |
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| APPLICATION NO.              | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|------------------------------|-------------|----------------------|---------------------|------------------|
| 15/245,948                   | 08/24/2016  | Andrew Stephens      | 64844-256633        | 1690             |
| 23644                        | 7590        | 07/13/2018           | EXAMINER            |                  |
| Barnes & Thornburg LLP (CH)  |             |                      | DILLON, DANIEL P    |                  |
| P.O. Box 2786                |             |                      |                     |                  |
| Chicago, ILLINOIS 60690-2786 |             |                      |                     |                  |
| UNITED STATES OF AMERICA     |             |                      |                     |                  |
|                              |             |                      | ART UNIT            | PAPER NUMBER     |
|                              |             |                      | 1783                |                  |
|                              |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                              |             |                      | 07/13/2018          | ELECTRONIC       |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent-ch@btlaw.com

**Office Action Summary****Application No.**

15/245,948

**Applicant(s)**

Stephens et al.

**Examiner**

DANIEL P DILLON

**Art Unit**

1783

**AIA Status**

Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) ☒ Responsive to communication(s) filed on 7/9/2018.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.

2a) ☐ This action is **FINAL**.

2b) ☒ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims\***

5) ☒ Claim(s) 1-15 and 17-25 is/are pending in the application.

5a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.

6) ☐ Claim(s) \_\_\_\_ is/are allowed.

7) ☒ Claim(s) 1-15 and 17-25 is/are rejected.

8) ☐ Claim(s) \_\_\_\_ is/are objected to.

9) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement

\* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

**Application Papers**

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a) ☐ All      b) ☐ Some\*\*      c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

3) ☐ Interview Summary (PTO-413)

Paper No(s)/Mail Date \_\_\_\_.

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)

4) ☐ Other: \_\_\_\_.

Paper No(s)/Mail Date 2/23/2018 and 2/27/2018.

## **DETAILED CORRESPONDENCE**

### ***Notice of Pre-AIA or AIA Status***

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

### ***Information Disclosure Statement***

The information disclosure statement (IDS) submitted on 2/23/2018 and 2/27/2018 have been considered by the examiner.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of 35 U.S.C. 112(b):

(b) **CONCLUSION.**—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**Claims 1, 10, 21, and 25** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. The terms "generally" and "substantially" in claims 1, 10, 21, and 25 are relative terms which renders the claims indefinite. The terms "generally" and "substantially" are not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Therefore, claims 1, 10, 21, and 25 are rejected for failing to point out and distinctly claim what is considered the subject matter that is

applicant's invention. For the purposes of examination the claims are to be interpreted as “the first/second set of polymer layers extending” and “along an uninterrupted curvilinear path.”

**Claims 2, 11, and 22** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. The term “generally” in claim 2, 11, and 11 is a relative term which renders the claims indefinite. The terms “generally” is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Therefore, claims 2, 11, and 22 are rejected for failing to point out and distinctly claim what is considered the subject matter that is applicant's invention. For the purposes of examination the claims are to be interpreted as “the first set of polymer layers are thinner than layers of the second set of polymer layers.”

**Claims 17, 19, and 24** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. The term “substantially” in claim 17, 19, and 24 is a relative term which renders the claims indefinite. The terms “substantially” is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Therefore, claims 17, 19, and 24 are rejected for failing to point out and distinctly claim what is considered the subject matter that is applicant's invention. For the purposes of examination the claims are to be interpreted as “the core is free of natural wood materials.”

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

**Claims 1, 10, 21, and 25** are rejected under 35 U.S.C. 103 as being unpatentable over Piedboeuf (US 7,204,944).

Regarding **claims 1, 10, 21, and 25**, Piedboeuf teaches processes for creating color effects in extrudable material (Col. 1, Line 8-10). The process includes the steps of providing a first and a second stream of viscous materials of different colors and combining those streams feeding them into a helical static mixer, shown in Fig. 3 (Col. 1, Lines 49-63). The system additionally includes a die, a feed block, and at least two extruders as shown below with the static mixer (Col. 1, Lines 64-66; Fig. 1).

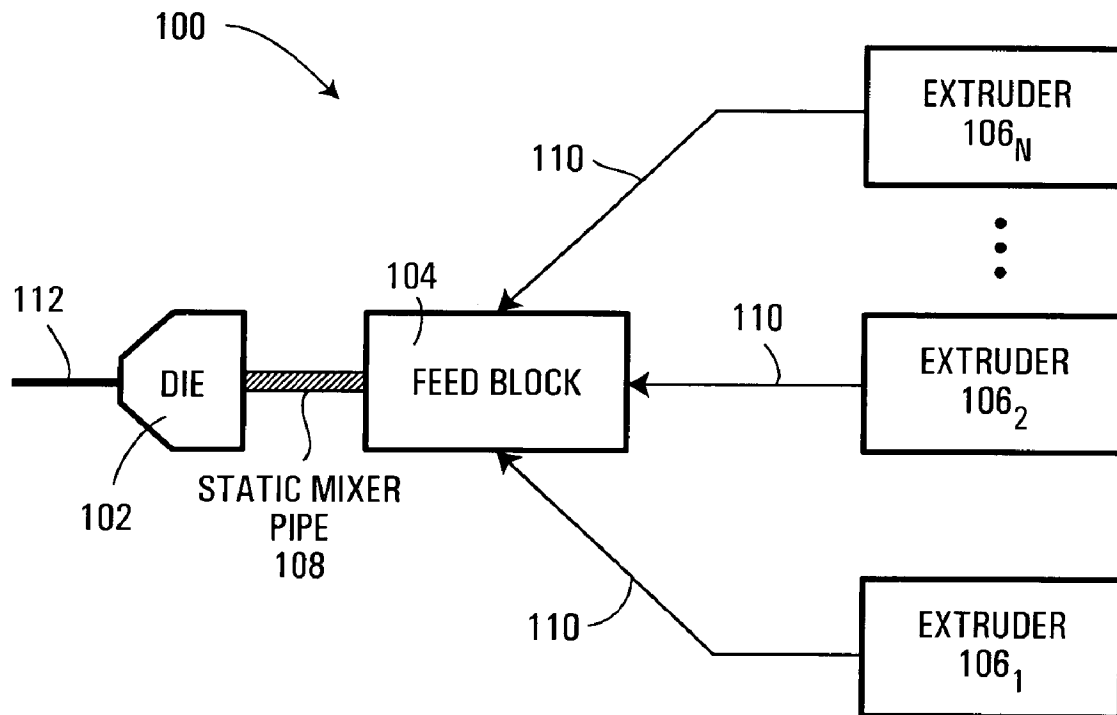


**FIG. 1**

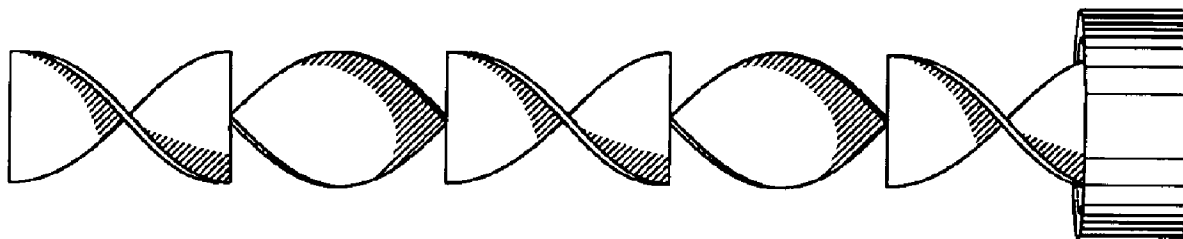


**FIG. 3**

The materials that are formed from the system are sheets or tubes of plastics that can be used in different applications (Col. 9, Lines 6-8). Additionally, the final product resulting from

the feed block of the system forms bands and layers, with the two being interchangeable, of at least two different colors with the two different colors being multi-layer or multi-band patterns of viscous plastic material (Col. 4, Lines 30-48).

It is noted that the system taught by Piedboeuf is nearly identical to the system which forms the simulated natural wood-grained polymer board as claimed by the applicant in that the system as defined by applicant's specification is formed by the input of two different materials having two differing colors which are then mixed through a static mixer similar to the one shown above taught by Piedboeuf, and then extruded to form the board as shown in Figures 1 and 5-5G. The examiner notes that the processing two polymer materials having differing colors taught by Piedboeuf would ultimately result in the in a plastic sheet having the shape of a board and would be formed of "a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers extending along the length of the entire board; a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers extending along the length of the entire board; and wherein a plurality of individual layers of the first and second sets of polymer layers alternate within the board and extend along a substantially uninterrupted curvilinear path originating proximate the first side of the board and terminating proximate to the second side of the board" as required by claim 1.

Piedboeuf is silent with respect to the formation of the sheet such that the colors of the polymer layers entering the system are those that resemble and result in a sheet that simulates a natural wood-grain appearance.

However, Piedboeuf teaches the extrusion process may a product that can be thermoformed into different shapes or items including watercraft such as kayaks and canoes

(Col. 9, Lines 6-21) with differing color variations. Additionally, the reference teaches that the technique of laminating various different layers of colored material joined together to form a multi-colored sheet can be costly and time consuming due to the requirement of treating the material (Col. 1, Lines 30-40). As such, the Examiner contends that when looking to the teachings in the reference, it would have been obvious to one of ordinary skill in the art to form an extruded product such as, for example, a canoe or surfboard, which may have a wood grain appearance for aesthetics depending on the user and additionally, the use of the process of Piedboeuf allows the manufacture of such a product to be more cost effective than prior laminating techniques.

**Claims 1-4, 6, 9, and 18** are rejected under 35 U.S.C. 103 as being unpatentable over Piedboeuf (US 7,204,944) in view of Sudano et al. (US 2011/0177291).

Regarding **claim 1**, Piedboeuf teaches processes for creating color effects in extrudable material (Col. 1, Line 8-10). The process includes the steps of providing a first and a second stream of viscous materials of different colors and combining those streams feeding them into a helical static mixer, shown in Fig. 3 (Col. 1, Lines 49-63). The system additionally includes a die, a feed block, and at least two extruders as shown below with the static mixer (Col. 1, Lines 64-66; Fig. 1).

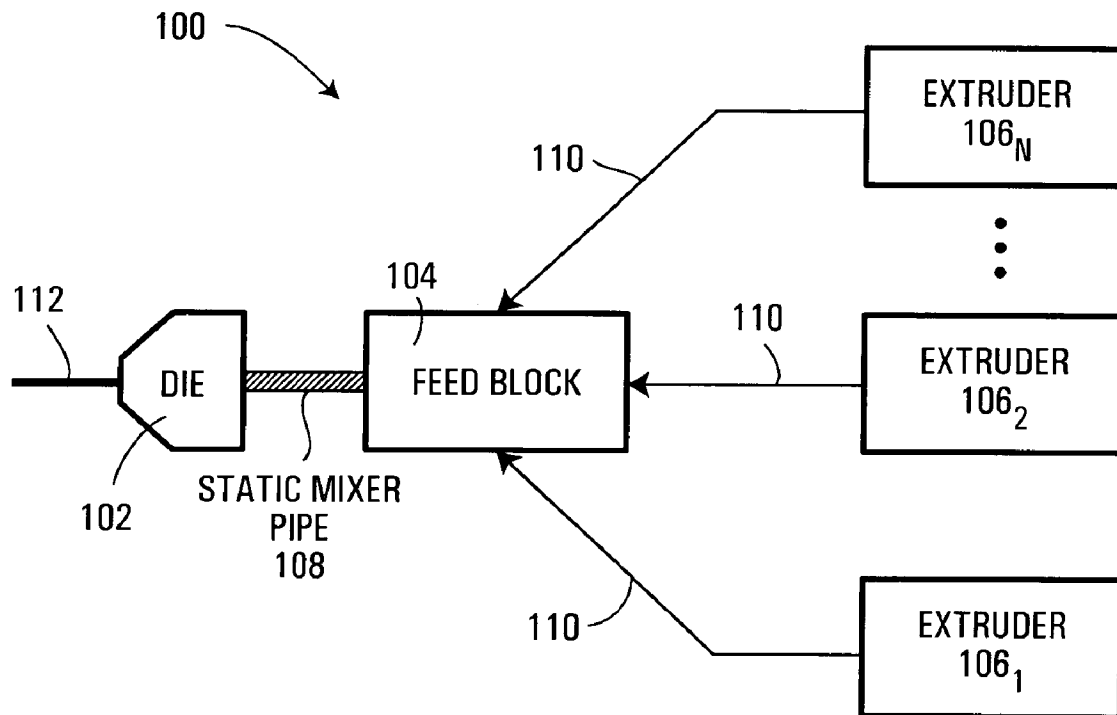


**FIG. 1**

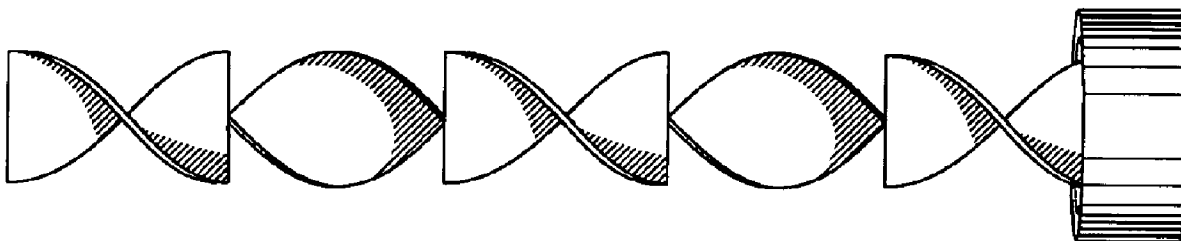


**FIG. 3**

The materials that are formed from the system are sheets or tubes of plastics that can be used in different applications (Col. 9, Lines 6-8). Additionally, the final product resulting from

the feed block of the system forms bands and layers, with the two being interchangeable, of at least two different colors with the two different colors being multi-layer or multi-band patterns of viscous plastic material (Col. 4, Lines 30-48).

It is noted that the system taught by Piedboeuf is nearly identical to the system which forms the simulated natural wood-grained polymer board as claimed by the applicant in that the system as defined by applicant's specification is formed by the input of two different materials having two differing colors which are then mixed through a static mixer similar to the one shown above taught by Piedboeuf, and then extruded to form the board as shown in Figures 1 and 5-5G. The examiner notes that the processing two polymer materials having differing colors taught by Piedboeuf would ultimately result in the in a plastic sheet having the shape of a board and would be formed of "a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers extending along the length of the entire board; a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers extending along the length of the entire board; and wherein a plurality of individual layers of the first and second sets of polymer layers alternate within the board and extend along a substantially uninterrupted curvilinear path originating proximate the first side of the board and terminating proximate to the second side of the board" as required by claim 1.

Piedboeuf is silent with respect to the formation of the sheet such that the colors of the polymer layers entering the system are those that resemble and result in a sheet that simulates a natural wood-grain appearance.

Sudano teaches a co-extrusion process for making mouldings that have a simulated wood appearance and the moldings thereof (Pg. 1, Paragraph [0006]). The method involves

mixing a base material and colored pellets of differing colors into a helical vein screw and then co-extruding the mixture onto a core of cellular polymer material (Pg. 1, Paragraph [0008]-[0012]). The formation of the simulated wood appearance without the use of actual wood material, but use polymers to simulate the natural appearance of wood in that the benefits of this include water and humidity resistance, insects/termite resistance, avoiding the use of chemicals for staining or painting, little to no maintenance, and easy installation due to lightweight and structural properties (Pg. 5, Paragraph [0073]-[0074]).

Therefore, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form a sheet like product utilizing the system taught by Piedboeuf which requires the combining and mixing of materials having different colors, subjecting them to mixing and extrusion, such that the colors simulate that of a wood appearance as taught by Sudano which teaches the combining of differing colors of materials and subsequent mixing and extruding such that this sheet would give the natural appearance of wood having the benefits as described by Sudano.

Regarding **claims 2-4**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 1.

Piedboeuf is silent with respect to the sheet having a first set of polymer layers that are generally thinner than the layers of the second set of polymers (claim 2), and wherein a portion of at least one of the first side and the second side of the board is removed to expose portions of the first and second sets of polymer layers along the length direction (claim 3) and wherein the exposed portions forming a burled grain pattern (claim 4).

However, one of ordinary skill in the art would appreciate that the nearly identical systems for forming the sheet and the board would result in nearly identical products as well

such that the extrusion of the final product of the sheet formed with a simulated wood grain pattern would result in one set of polymer layers being thinner than the other and the core or exposing the core would result in a burl pattern being visible. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In *reAUer*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) See MPEP 2144.05 (II).

Regarding **claim 6**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 1. Piedboeuf additionally teaches the use of various thermoplastic including HDPE (Col. 3, Lines 63-64).

Regarding **claim 9**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 1. Piedboeuf teaches the formation of sheets utilizing the system described above with respect to claim 1. One of ordinary skill in the art would appreciate that a sheet has a similar polygonal shape to that of a board.

Regarding **claim 18**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 1. One of ordinary skill in the art would appreciate that the sheet product of Piedboeuf would comprise a third side and a fourth side spaced apart from the third side along a height direction different than the length direction and width direction, wherein the third and fourth sides define a height of the board, wherein the third and fourth sides extend along the length direction between the first and

second ends, wherein the core of the board extends between the first, second, third, and fourth sides and between the first and second ends

Piedboeuf is silent with respect to the individual layers of the first and second sets of polymer layers alternate within the core of the board along the height direction.

However, one of ordinary skill in the art would appreciate that the nearly identical systems for forming the sheet and the board would result in nearly identical products as well such that the extrusion of the final product of the sheet formed with a simulated wood grain pattern would result in the individual layers of the first and second sets of polymer layers alternate within the core of the board along the height direction. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In *reAUer*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) See MPEP 2144.05 (II).

**Claims 7-8** are rejected under 35 U.S.C. 103 as being unpatentable over Piedboeuf (US 7,204,944) in view of Sudano et al. (US 2011/0177291) as applied to claim 1 above, and further in view of Rohatgi et al. (US 2003/0021915).

Regarding **claims 7-8**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 1.

Piedboeuf is silent with respect to the sheet further including a UV inhibitor or a foaming agent (claim 7) and a foaming agent (claim 8).

Rohatgi teaches the formation of wood-like boards formed from thermoplastics and cellulosic materials having low density and enhanced strength (Pg. 1, Paragraph [0001]). The board may include a UV-stabilizer to protect from ultraviolet degradation (Pg. 5, Paragraph

[0046]). A foaming agent may also be added causing the board to expand and thus reducing the density of the final product (Pg. 3, Paragraph [0037]).

Therefore, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form the sheet product having a wood appearance as taught by Piedboeuf in view of Sudano in which the starting materials of the system also include additives such as a UV stabilizer to protect from ultraviolet degradation and a foaming agent to cause the sheet to expand reducing the density of the sheet making the final product light weight as taught by Rohatgi.

**Claim 5** is rejected under 35 U.S.C. 103 as being unpatentable over Piedboeuf (US 7,204,944) in view of Sudano et al. (US 2011/0177291) as applied to claim 1 above, and further in view of Franco et al. (US 2004/0038002).

Regarding **claim 5**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 1.

Piedboeuf is silent with respect to the sheet further embossed with a wood grain pattern.

Franco teaches the formation of a colored thermoplastic polymer material that simulates natural wood (Pg. 1, Paragraph [0001]). The thermoplastic materials are mixed and extruded with the veins of the natural wood appearance being visible and then undergoes an embossment process on one or both sides to impress a pattern in the extrudate thus enhancing the veins in the extruded part (Pg. 3, Paragraph [0030]).

Therefore, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form the sheet product with a simulated wood appearance as taught by

Piedboeuf in view of Sudano in which the extruded product is then embossed to give the simulated wood appearance an enhancement by the impression of a pattern as taught by Franco.

**Claims 10-12, 15, 17, and 19-20** are rejected under 35 U.S.C. 103 as being unpatentable over Piedboeuf (US 7,204,944) in view of Sudano et al. (US 2011/0177291).

Regarding **claim 10**, Piedboeuf teaches processes for creating color effects in extrudable material (Col. 1, Line 8-10). The process includes the steps of providing a first and a second stream of viscous materials of different colors and combining those streams feeding them into a helical static mixer, shown in Fig. 3 (Col. 1, Lines 49-63). The system additionally includes a die, a feed block, and at least two extruders as shown below with the static mixer (Col. 1, Lines 64-66; Fig. 1).

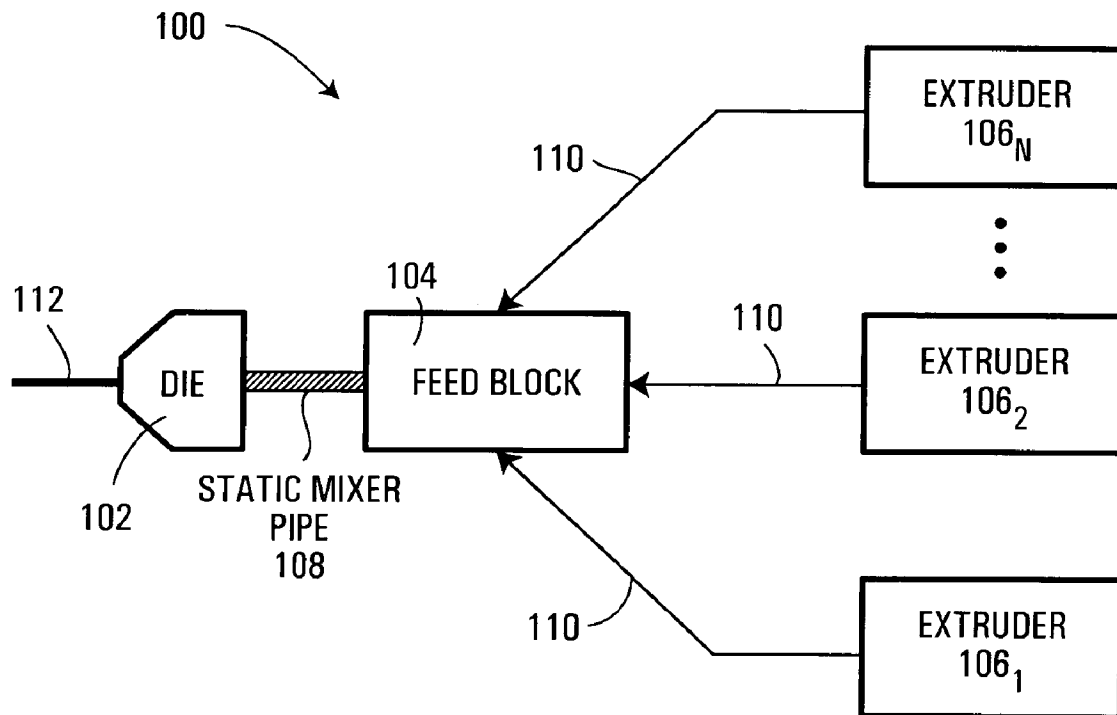


**FIG. 1**

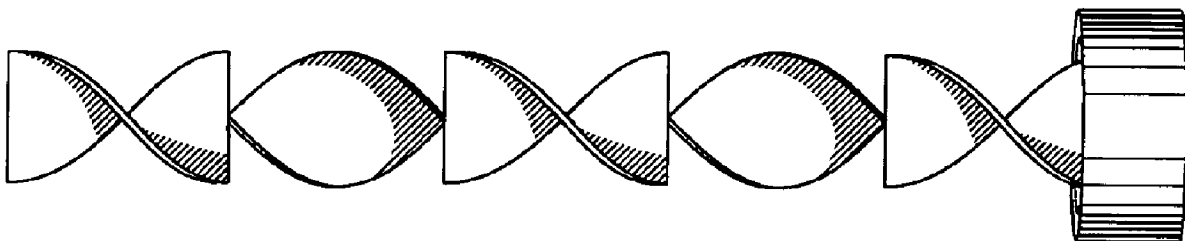


**FIG. 3**

The materials that are formed from the system are sheets or tubes of plastics that can be used in different applications (Col. 9, Lines 6-8).

It is noted that the system taught by Piedboeuf is nearly identical to the system which forms the simulated natural wood-grained polymer board as claimed by the applicant in that the system as defined by applicant's specification is formed by the input of two different materials having two differing colors which are then mixed through a static mixer similar to the one shown above taught by Piedboeuf, and then extruded to form the board as shown in Figures 1 and 5-5G. The examiner notes that the processing two polymer materials having differing colors taught by Piedboeuf would ultimately result in the in a plastic sheet having the shape of a board and would be formed of "a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers extending along the length of the entire board; a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers extending along the length of the entire board; and wherein a plurality of individual layers of one of the first and second sets of polymer layers alternate within the board and extend along a substantially uninterrupted curvilinear path originating proximate the first side of the board and terminating proximate to the second side of the board" as required by claim 1.

Piedboeuf is silent with respect to the formation of the sheet such that the colors of the polymer layers entering the system are those that resemble and result in a sheet that simulates a natural wood-grain appearance.

Sudano teaches a co-extrusion process for making mouldings that have a simulated wood appearance and the moldings thereof (Pg. 1, Paragraph [0006]). The method involves mixing a base material and colored pellets of differing colors into a helical vein screw and then co-extruding the mixture onto a core of cellular polymer material (Pg. 1, Paragraph [0008]-[0012]). The formation of the simulated wood appearance without the use of actual wood

material, but use polymers to simulate the natural appearance of wood in that the benefits of this include water and humidity resistance, insects/termite resistance, avoiding the use of chemicals for staining or painting, little to no maintenance, and easy installation due to lightweight and structural properties (Pg. 5, Paragraph [0073]-[0074]).

Therefore, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form a sheet like product utilizing the system taught by Piedboeuf which requires the combining and mixing of materials having different colors, subjecting them to mixing and extrusion, such that the colors simulate that of a wood appearance as taught by Sudano which teaches the combining of differing colors of materials and subsequent mixing and extruding such that this sheet would give the natural appearance of wood having the benefits as described by Sudano.

Regarding **claim 11**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 10.

Piedboeuf is silent with respect to the sheet having a first set of polymer layers that are generally thinner than the layers of the second set of polymers.

However, one of ordinary skill in the art would appreciate that the nearly identical systems for forming the sheet and the board would result in nearly identical products as well such that the extrusion of the final product of the sheet formed with a simulated wood grain pattern would result in one set of polymer layers being thinner than the other. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In reAUer, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) See MPEP 2144.05 (II).

Regarding **claim 12**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 10. Piedboeuf additionally teaches the use of various thermoplastic including HDPE (Col. 3, Lines 63-64).

Regarding **claim 15**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 10. Piedboeuf teaches the formation of sheets utilizing the system described above with respect to claim 1. One of ordinary skill in the art would appreciate that a sheet has a similar polygonal shape to that of a board.

Regarding **claim 17 and 19**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claims 10 and 12.

Piedboeuf is silent with respect to the core being substantially free of natural wood materials.

Sudano teaches the simulated wood extruded product as discussed above with respect to claim 10. Sudano additionally teaches including real wood material is problematic in terms of material and manufacturing cost, material compatibility, and the properties of the final product (Pg. 1, Paragraph [0003]).

Therefore, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form the sheet product simulating a wood appearance as taught above by Piedboeuf in view of Sudano, such that the materials are free of natural wood materials so as to avoid problems such as material and manufacturing cost, material compatibility, and the properties of the final product as further taught by Sudano.

Regarding **claim 20**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 1. One of ordinary skill in the art would appreciate that the sheet product of Piedboeuf would comprise a third side and a fourth side spaced apart from the third side along a height direction different than the length direction and width direction, wherein the third and fourth sides define a height of the board, wherein the third and fourth sides extend along the length direction between the first and second ends, wherein the core of the board extends between the first, second, third, and fourth sides and between the first and second ends

Piedboeuf is silent with respect to the individual layers of the first and second sets of polymer layers alternate within the core of the board along the height direction.

However, one of ordinary skill in the art would appreciate that the nearly identical systems for forming the sheet and the board would result in nearly identical products as well such that the extrusion of the final product of the sheet formed with a simulated wood grain pattern would result in the individual layers of the first and second sets of polymer layers alternate within the core of the board along the height direction. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In *reAUer*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) See MPEP 2144.05 (II).

**Claims 13-14** are rejected under 35 U.S.C. 103 as being unpatentable over Piedboeuf (US 7,204,944) in view of Sudano et al. (US 2011/0177291) as applied to claim 10 above, and further in view of Rohatgi et al. (US 2003/0021915).

Regarding **claims 13-14**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 1.

Piedboeuf is silent with respect to the sheet further including a UV inhibitor or a foaming agent (claim 13) and a foaming agent (claim 14).

Rohatgi teaches the formation of wood-like boards formed from thermoplastics and cellulosic materials having low density and enhanced strength (Pg. 1, Paragraph [0001]). The board may include a UV-stabilizer to protect from ultraviolet degradation (Pg. 5, Paragraph [0046]). A foaming agent may also be added causing the board to expand and thus reducing the density of the final product (Pg. 3, Paragraph [0037]).

Therefore, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form the sheet product having a wood appearance as taught by Piedboeuf in view of Sudano in which the starting materials of the system also include additives such as a UV stabilizer to protect from ultraviolet degradation and a foaming agent to cause the sheet to expand reducing the density of the sheet making the final product light weight as taught by Rohatgi.

**Claims 21-24** are rejected under 35 U.S.C. 103 as being unpatentable over Piedboeuf (US 7,204,944) in view of Sudano et al. (US 2011/0177291).

Regarding **claim 21**, Piedboeuf teaches processes for creating color effects in extrudable material (Col. 1, Line 8-10). The process includes the steps of providing a first and a second stream of viscous materials of different colors and combining those streams feeding them into a helical static mixer, shown in Fig. 3 (Col. 1, Lines 49-63). The system additionally includes a die, a

feed block, and at least two extruders as shown below with the static mixer (Col. 1, Lines 64-66;  
Fig. 1).

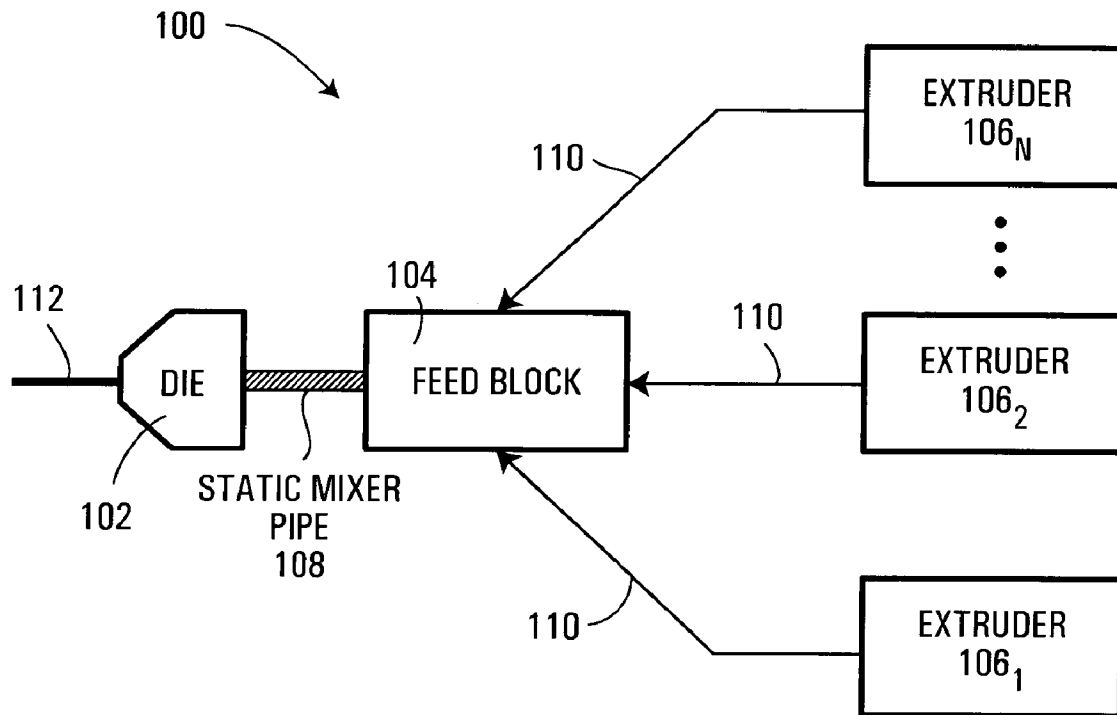


**FIG. 1**

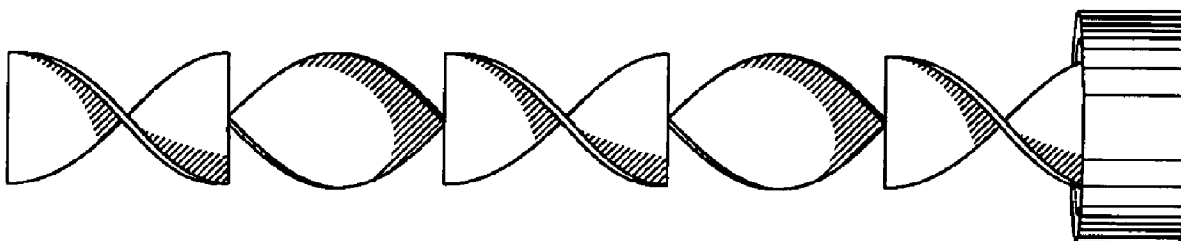


**FIG. 3**

The materials that are formed from the system are sheets or tubes of plastics that can be used in different applications (Col. 9, Lines 6-8).

It is noted that the system taught by Piedboeuf is nearly identical to the system which forms the simulated natural wood-grained polymer board as claimed by the applicant in that the system as defined by applicant's specification is formed by the input of two different materials having two differing colors which are then mixed through a static mixer similar to the one shown above taught by Piedboeuf, and then extruded to form the board as shown in Figures 1 and 5-5G. The examiner notes that the processing two polymer materials having differing colors taught by Piedboeuf would ultimately result in the in a plastic sheet having the shape of a board and would be formed of "a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers extending along the length of the entire board; a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers extending along the length of the entire board; and wherein a plurality of individual layers of one of the first and second sets of polymer layers alternate within the board and extend along a substantially uninterrupted curvilinear path originating proximate the first side of the board and terminating proximate to the second side of the board" as required by claim 1.

Piedboeuf is silent with respect to the formation of the sheet such that the colors of the polymer layers entering the system are those that resemble and result in a sheet that simulates a natural wood-grain appearance.

Sudano teaches a co-extrusion process for making mouldings that have a simulated wood appearance and the moldings thereof (Pg. 1, Paragraph [0006]). The method involves mixing a base material and colored pellets of differing colors into a helical vein screw and then

co-extruding the mixture onto a core of cellular polymer material (Pg. 1, Paragraph [0008]-[0012]). The formation of the simulated wood appearance without the use of actual wood material, but use polymers to simulate the natural appearance of wood in that the benefits of this include water and humidity resistance, insects/termite resistance, avoiding the use of chemicals for staining or painting, little to no maintenance, and easy installation due to lightweight and structural properties (Pg. 5, Paragraph [0073]-[0074]).

Therefore, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form a sheet like product utilizing the system taught by Piedboeuf which requires the combining and mixing of materials having different colors, subjecting them to mixing and extrusion, such that the colors simulate that of a wood appearance as taught by Sudano which teaches the combining of differing colors of materials and subsequent mixing and extruding such that this sheet would give the natural appearance of wood having the benefits as described by Sudano.

Regarding **claim 22**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 21.

Piedboeuf is silent with respect to the sheet having a first set of polymer layers that are generally thinner than the layers of the second set of polymers.

However, one of ordinary skill in the art would appreciate that the nearly identical systems for forming the sheet and the board would result in nearly identical products as well such that the extrusion of the final product of the sheet formed with a simulated wood grain pattern would result in one set of polymer layers being thinner than the other. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the

optimum or workable ranges by routine experimentation." In reAUer, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) See MPEP 2144.05 (II).

Regarding **claim 23**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claim 21. Piedboeuf additionally teaches the use of various thermoplastic including HDPE (Col. 3, Lines 63-64).

Regarding **claim 24**, Piedboeuf in view of Sudano teaches the formation of a sheet having a simulated wood appearance through a system that is nearly identical to that described in applicant's specification as discussed above with respect to claims 21.

Piedboeuf is silent with respect to the core being substantially free of natural wood materials.

Sudano teaches the simulated wood extruded product as discussed above with respect to claim 10. Sudano additionally teaches including real wood material is problematic in terms of material and manufacturing cost, material compatibility, and the properties of the final product (Pg. 1, Paragraph [0003]).

Therefore, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form the sheet product simulating a wood appearance as taught above by Piedboeuf in view of Sudano, such that the materials are free of natural wood materials so as to avoid problems such as material and manufacturing cost, material compatibility, and the properties of the final product as further taught by Sudano.

**Claim 25** is rejected under 35 U.S.C. 103 as being unpatentable over Piedboeuf (US 7,204,944) in view of Sudano et al. (US 2011/0177291).

Regarding **claim 25**, Piedboeuf teaches processes for creating color effects in extrudable material (Col. 1, Line 8-10). The process includes the steps of providing a first and a second stream of viscous materials of different colors and combining those streams feeding them into a helical static mixer, shown in Fig. 3 (Col. 1, Lines 49-63). The system additionally includes a die, a feed block, and at least two extruders as shown below with the static mixer (Col. 1, Lines 64-66; Fig. 1).

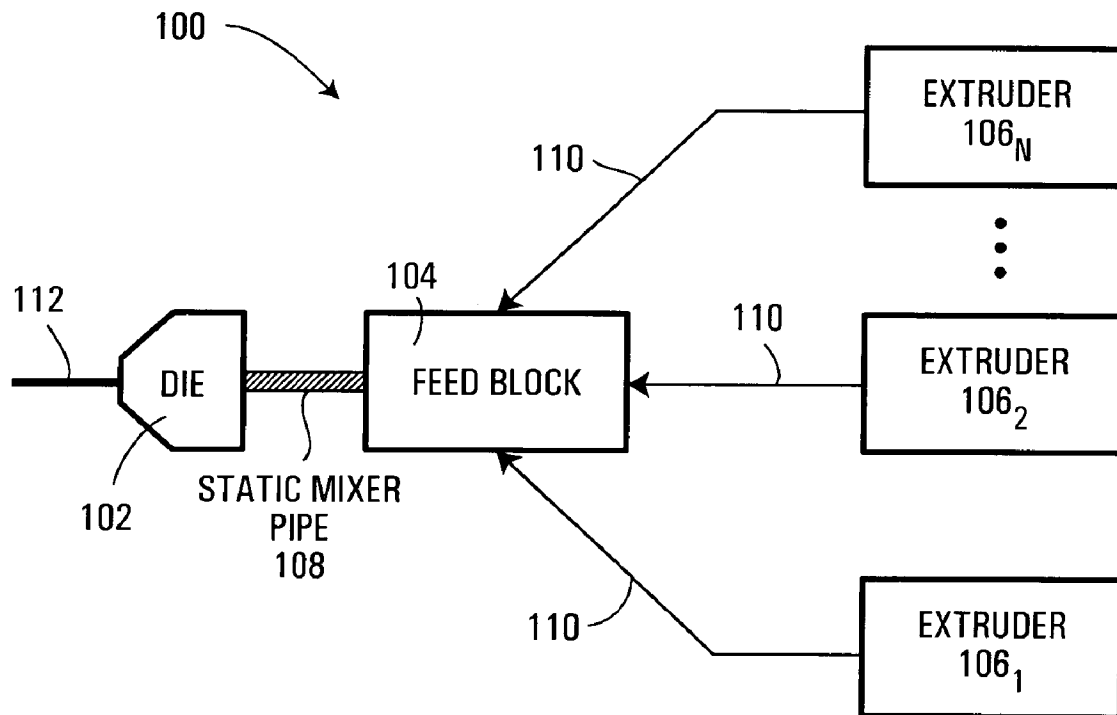


**FIG. 1**

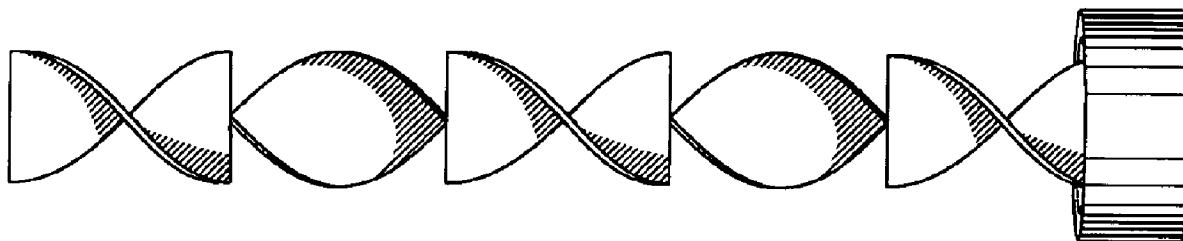


**FIG. 3**

The materials that are formed from the system are sheets or tubes of plastics that can be used in different applications (Col. 9, Lines 6-8).

It is noted that the system taught by Piedboeuf is nearly identical to the system which forms the simulated natural wood-grained polymer board as claimed by the applicant in that the system as defined by applicant's specification is formed by the input of two different materials having two differing colors which are then mixed through a static mixer similar to the one shown above taught by Piedboeuf, and then extruded to form the board as shown in Figures 1 and 5-5G. The examiner notes that the processing two polymer materials having differing colors taught by Piedboeuf would ultimately result in the in a plastic sheet having the shape of a board and would be formed of "a first set of polymer layers generally extending along the length direction and containing a first colorant, a majority of the first set of polymer layers extending along the length of the entire board; a second set of polymer layers generally extending along the length direction and containing a second colorant different than the first colorant, a majority of the second set of polymer layers extending along the length of the entire board; and wherein a plurality of individual layers of the first and second sets of polymer layers alternate within the board and extend along a substantially uninterrupted curvilinear path originating proximate the first side of the board and terminating proximate to the second side of the board" as required by claim 1.

Piedboeuf is silent with respect to the formation of the sheet such that the colors of the polymer layers entering the system are those that resemble and result in a sheet that simulates a natural wood-grain appearance.

Sudano teaches a co-extrusion process for making mouldings that have a simulated wood appearance and the moldings thereof (Pg. 1, Paragraph [0006]). The method involves mixing a base material and colored pellets of differing colors into a helical vein screw and then co-extruding the mixture onto a core of cellular polymer material (Pg. 1, Paragraph [0008]-[0012]). The formation of the simulated wood appearance without the use of actual wood

material, but use polymers to simulate the natural appearance of wood in that the benefits of this include water and humidity resistance, insects/termite resistance, avoiding the use of chemicals for staining or painting, little to no maintenance, and easy installation due to lightweight and structural properties (Pg. 5, Paragraph [0073]-[0074]).

Therefore, it would have been obvious to one of ordinary skill in the art before the filing of the invention to form a sheet like product utilizing the system taught by Piedboeuf which requires the combining and mixing of materials having different colors, subjecting them to mixing and extrusion, such that the colors simulate that of a wood appearance as taught by Sudano which teaches the combining of differing colors of materials and subsequent mixing and extruding such that this sheet would give the natural appearance of wood having the benefits as described by Sudano.

### ***Response to Arguments***

Applicant's arguments, see Pg. 8, filed 5/21/2018, with respect to the rejection(s) of claim(s) 1-16 under 35 U.S.C. 103 have been fully considered and are persuasive.

In particular, applicant argues that Rohatgi and Franco fail to teach a plurality of individual layers that alternate within a board and extend along a substantially uninterrupted curvilinear path originating proximate the first side of the board and terminating proximate the second side of the board.

The examiner concedes in that the spiral layer of Rohatgi only shows one continuous line extending from one side of the board to the second side and does not teach a plurality of these layers extending from side to side.

Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Piedboeuf in view of Sudano as discussed above and as a result the rejection is non-final.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL P DILLON whose telephone number is (571)270-5657. The examiner can normally be reached on Mon-Fri; 8 AM to 5 PM.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, a pplicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MARIA V EWALD can be reached on 571-272-8519. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

DANIEL P. DILLON  
Examiner

Art Unit 1783

/MARIA V EWALD/  
Supervisory Patent Examiner, Art Unit 1783

|                                          |                                       |  |                                                               |             |
|------------------------------------------|---------------------------------------|--|---------------------------------------------------------------|-------------|
| <b><i>Notice of References Cited</i></b> | Application/Control No.<br>15/245,948 |  | Applicant(s)/Patent Under<br>Reexamination<br>Stephens et al. |             |
|                                          | Examiner<br>DANIEL P DILLON           |  | Art Unit<br>1783                                              | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Name                       | CPC Classification | US Classification |
|---|---|--------------------------------------------------|-----------------|----------------------------|--------------------|-------------------|
| * | A | US-20110177291-A1                                | 07-2011         | Sudano; Angelo             | B29C47/0028        | 428/151           |
| * | B | US-20040038002-A1                                | 02-2004         | Franco, Sandro             | B29C47/0019        | 428/151           |
| * | C | US-20030021915-A1                                | 01-2003         | Rohatgi, Vivek             | B27N3/007          | 428/15            |
| * | D | US-7204944-B2                                    | 04-2007         | Piedboeuf, Marie-Christine | B01F5/0615         | 264/73            |
|   | E |                                                  |                 |                            |                    |                   |
|   | F |                                                  |                 |                            |                    |                   |
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| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Country | Name | CPC Classification |
|---|---|--------------------------------------------------|-----------------|---------|------|--------------------|
|   | N |                                                  |                 |         |      |                    |
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**NON-PATENT DOCUMENTS**

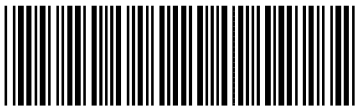
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\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Index of Claims</i></b><br> | <b>Application/Control No.</b><br>15/245,948 | <b>Applicant(s)/Patent Under Reexamination</b><br>Stephens et al. |
|                                                                                                                    | <b>Examiner</b><br>DANIEL P DILLON           | <b>Art Unit</b><br>1783                                           |

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|---|-----------------|---|-------------------|---|---------------------|---|-----------------|
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| = | <b>Allowed</b>  | ÷ | <b>Restricted</b> | I | <b>Interference</b> | O | <b>Objected</b> |

| CLAIMS                                                                                                                                                                            |          |            |            |  |  |  |  |  |  |  |
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| <input type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input type="checkbox"/> T.D. <input type="checkbox"/> R.1.47 |          |            |            |  |  |  |  |  |  |  |
| CLAIM                                                                                                                                                                             |          | DATE       |            |  |  |  |  |  |  |  |
| Final                                                                                                                                                                             | Original | 12/11/2017 | 07/09/2018 |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 1        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 2        | ✓          | ✓          |  |  |  |  |  |  |  |
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| <b><i>Search Notes</i></b><br> | <b>Application/Control No.</b><br>15/245,948 | <b>Applicant(s)/Patent Under Reexamination</b><br>Stephens et al. |
|                                                                                                                 | <b>Examiner</b><br>DANIEL P DILLON           | <b>Art Unit</b><br>1783                                           |

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| <b>CPC - Searched*</b> |             |                 |
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| <b>Class</b>                         | <b>Subclass</b> | <b>Date</b> | <b>Examiner</b> |
|                                      |                 |             |                 |

\* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

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| <b>Search Notes</b>          |             |                 |
| <b>Search Notes</b>          | <b>Date</b> | <b>Examiner</b> |
| East Search History Provided | 12/11/2017  | /DD/            |
| Updated EAST Search Provided | 07/07/2018  | /DD/            |

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| <b>Interference Search</b> |                              |             |                 |
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# **INFORMATION DISCLOSURE STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Sheet 1 of 1

## **Complete if Known**

|                         |                   |
|-------------------------|-------------------|
| Application Number:     | 15/245948         |
| Filing Date:            | August 24, 2016   |
| First Named Inventor:   | STEPHENS, Andrew  |
| Group Art Unit:         | 1783              |
| Confirmation Number:    | 1690              |
| Examiner Name:          | Dillon, Daniel P. |
| Attorney Docket Number: | 64844-256633      |

## **U.S. PATENT DOCUMENTS**

| Examiner<br>Initials | Doc.<br>No. | U.S. Patent Document            |           | Name of Patentee or Applicant | Date of Publication | Filing Date If<br>Appropriate |
|----------------------|-------------|---------------------------------|-----------|-------------------------------|---------------------|-------------------------------|
|                      |             | Application or<br>Patent Number | Kind Code |                               |                     |                               |
|                      | C I         | D644340                         |           | Canales et al.                | Aug. 30, 2011       |                               |
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|                      | C K         | 2016/0273228                    |           | Metcalf et al.                | Sep. 22, 2016       |                               |
|                      |             |                                 |           |                               |                     |                               |
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## **FOREIGN PATENT DOCUMENTS**

| Examiner<br>Initials | Doc.<br>No. | Foreign Patent Document |                                 |              | Name of Patentee or Applicant | Date of Publication | Translation |      |
|----------------------|-------------|-------------------------|---------------------------------|--------------|-------------------------------|---------------------|-------------|------|
|                      |             | Office                  | Application or<br>Patent Number | Kind<br>Code |                               |                     | Yes         | No** |
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## **OTHER - NON PATENT LITERATURE DOCUMENTS**

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|----------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|
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| EXAMINER | /DANIEL P DILLON/ | DATE CONSIDERED | 07/07/2018 |
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\* A concise statement of relevance is being submitted in lieu of a translation. 37 CFR 1.98(a)(3).

+ An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of relevance under 37 CFR 1.98(a)(3).

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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 1 of 1

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|-------------------------|-------------------|
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| Attorney Docket Number: | 64844-256633      |

**U.S. PATENT DOCUMENTS**

| U.S. Patent Document |          |                              |           |                               |                     |                            |
|----------------------|----------|------------------------------|-----------|-------------------------------|---------------------|----------------------------|
| Examiner Initials    | Doc. No. | Application or Patent Number | Kind Code | Name of Patentee or Applicant | Date of Publication | Filing Date If Appropriate |
|                      | C L      | 5869138                      |           | Nishibori                     | Feb. 9, 1999        |                            |
|                      | C M      | 6153293                      |           | Dahl et al.                   | Nov. 28, 2000       |                            |
|                      | C N      | 7410687                      |           | Dolinar                       | Aug. 12, 2008       |                            |
|                      | C O      | 7507464                      |           | Walrath                       | Mar. 24, 2009       |                            |
|                      | C P      | 8168104                      |           | Han et al.                    | May 1, 2012         |                            |
|                      | C Q      | 8197733                      |           | Sudano                        | Jun. 12, 2012       |                            |
|                      |          |                              |           |                               |                     |                            |
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**FOREIGN PATENT DOCUMENTS**

| Foreign Patent Document |          |        |                              |           |                               |                     |     |      |
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| Examiner Initials       | Doc. No. | Office | Application or Patent Number | Kind Code | Name of Patentee or Applicant | Date of Publication | Yes | No** |
|                         | C R      | DE     | 2327512                      |           | BP Chem. Int. Ltd.            | Dec. 13, 1973       |     | X+   |
|                         | C S      | GB     | 1489591                      |           | John F. Rodman                | Oct. 19, 1977       |     |      |
|                         |          |        |                              |           |                               |                     |     |      |
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**OTHER - NON PATENT LITERATURE DOCUMENTS**

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| Examiner Initials                       | Doc. No. | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number (s), publisher, city and/or country where published.                                                                                                                  |  |  | Yes         | No** |
|                                         | C T      | StaMixCo, "Principles of Operation of Static Mixers," Static Mixer Products & Technology, accessed on the Internet at: <a href="https://web.archive.org/web/20081209081624/http://www.stamixco-usa.com:80/principles-of-operation/default.html">https://web.archive.org/web/20081209081624/http://www.stamixco-usa.com:80/principles-of-operation/default.html</a> (9 Dec. 2008). |  |  |             |      |
|                                         |          |                                                                                                                                                                                                                                                                                                                                                                                   |  |  |             |      |
|                                         |          |                                                                                                                                                                                                                                                                                                                                                                                   |  |  |             |      |
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|                                         |          |                                                                                                                                                                                                                                                                                                                                                                                   |  |  |             |      |
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| EXAMINER | /DANIEL P DILLON/ | DATE CONSIDERED | 07/07/2018 |
|----------|-------------------|-----------------|------------|

\* A concise statement of relevance is being submitted in lieu of a translation. 37 CFR 1.98(a)(3).

+ An English-language equivalent/patent, or an English-language abstract, or an English-language version of the search report or action by a foreign patent office in a counterpart foreign application indicating the degree of relevance found by the foreign office is being submitted in lieu of a concise explanation of relevance under 37 CFR 1.98(a)(3).

RPI1004

EAST Search History

EAST Search History (Prior Art)

| Ref # | Hits | Search Query                                                                                                                                                | DBs                    | Default Operator | Plurals | Time Stamp       |
|-------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------|---------|------------------|
| S1    | 1    | ((("TANGENT") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.                                                                                                   | USPAT                  | OR               | OFF     | 2017/07/28 12:22 |
| S2    | 5    | ((("TANGENT") near3 ("TECHNOLOGIES") near3 ("LLC")).AANM.                                                                                                   | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:22 |
| S3    | 52   | ((("STEPHENS") near3 ("Andrew")).INV.                                                                                                                       | US-PGPUB; USPAT; USOCR | OR               | OFF     | 2017/07/28 12:22 |
| S4    | 47   | ((("MORALES") near3 ("Francisco")).INV.                                                                                                                     | US-PGPUB; USPAT; USOCR | OR               | OFF     | 2017/07/28 12:22 |
| S5    | 9    | ((("RYBKA") near3 ("Tadeusz")).INV.                                                                                                                         | US-PGPUB; USPAT; USOCR | OR               | OFF     | 2017/07/28 12:22 |
| S6    | 107  | S2 or S3 or S4 or S5                                                                                                                                        | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:23 |
| S7    | 0    | S6 and (polymer and colorant).clm.                                                                                                                          | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:24 |
| S8    | 0    | S6 and (polymer and color).clm.                                                                                                                             | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:24 |
| S9    | 590  | 428/151.ccls,icls.                                                                                                                                          | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:27 |
| S10   | 45   | S9 and (wood same polymer)                                                                                                                                  | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:27 |
| S11   | 0    | S10 and (layer same alterante)                                                                                                                              | US-PGPUB; USPAT        | OR               | ON      | 2017/07/28 12:29 |
| S12   | 1    | S10 and (layer same (alternate or alternating))                                                                                                             | US-PGPUB; USPAT        | OR               | ON      | 2017/07/28 12:31 |
| S13   | 11   | ("4280950"   "5126088"   "5866639"   "6083601"   "6596784"   "7866758"   "20040038002"   "20070104930"   "20080299351"   "20110151193"   "20110177291").PN. | US-PGPUB; USPAT        | OR               | OFF     | 2017/07/28 12:31 |
| S14   | 320  | (wood same grain) and ("HDPE" or (high near density near polyethylene))                                                                                     | USPAT                  | OR               | OFF     | 2017/07/31 16:14 |
| S15   | 9    | S14 and ((alternate or alternating) with (layer or layers))                                                                                                 | USPAT                  | OR               | OFF     | 2017/07/31 16:16 |
|       |      |                                                                                                                                                             |                        |                  |         |                  |

|     |        |                                                                                    |                 |    |     |                  |
|-----|--------|------------------------------------------------------------------------------------|-----------------|----|-----|------------------|
| S16 | 725    | (wood same grain) and ("HDPE" or (high near density near polyethylene))            | US-PGPUB; USPAT | OR | OFF | 2017/07/31 16:16 |
| S17 | 24     | S16 and ((alternate or alternating) with (layer or layers))                        | US-PGPUB; USPAT | OR | OFF | 2017/07/31 16:16 |
| S18 | 1      | "20040038002".pn.                                                                  | US-PGPUB; USPAT | OR | OFF | 2017/12/04 12:05 |
| S19 | 590    | (428/151).CCLS.                                                                    | US-PGPUB; USPAT | OR | OFF | 2017/12/04 12:06 |
| S20 | 0      | S19 and ("HDPE") and (foaming near agent)                                          | US-PGPUB; USPAT | OR | OFF | 2017/12/04 12:06 |
| S21 | 3      | S19 and ("HDPE" or (high near density near polyethylene)) and (foaming near agent) | US-PGPUB; USPAT | OR | OFF | 2017/12/04 12:07 |
| S22 | 590    | (428/151).CCLS.                                                                    | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:12 |
| S23 | 97     | S22 and (layer with polymer)                                                       | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:12 |
| S24 | 0      | S22 and ((alternating or alternate) same (layer with polymer))                     | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:13 |
| S25 | 3      | S22 and ((alternating or alternate) same3 (layer with polymer))                    | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:13 |
| S26 | 589555 | (428/151).CCLS. or (wood or (imitation near5 wood))                                | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:14 |
| S27 | 1251   | (428/151).CCLS. or ((imitation or imitating) near5 wood)                           | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:14 |
| S28 | 0      | S27 and (alternating near layer) and (layer same (polymer))                        | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:15 |
| S29 | 189    | S27 and (layer same (polymer))                                                     | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:15 |
| S30 | 0      | S29 and (curvilinear)                                                              | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:15 |
| S31 | 21     | S29 and (curvilinear or curved)                                                    | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:17 |
| S32 | 8730   | (428/151).CCLS. or ((imitation or imitating) near5 wood) or (wood near grain)      | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:18 |
| S33 | 1031   | S32 and (layer same (polymer))                                                     | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:18 |
| S34 | 222    | S33 and (curvilinear or curved)                                                    | US-PGPUB; USPAT | OR | OFF | 2017/12/05 12:18 |

|     |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |    |     |                  |
|-----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----|-----|------------------|
| S35 | 8  | S34 and (alternating near layer) and (layer same (polymer))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | US-PGPUB; USPAT        | OR | OFF | 2017/12/05 12:18 |
| S36 | 1  | S34 and ((428/151).CCLS. or ((imitation or imitating) near5 wood)).ab.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | US-PGPUB; USPAT        | OR | OFF | 2017/12/05 12:21 |
| S37 | 1  | "6485800".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT        | OR | OFF | 2017/12/05 12:25 |
| S38 | 1  | ("HDPE" or (high near density near polyethylene)) and ((428/151).CCLS. or ((imitation or imitating) near5 wood)).ab.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US-PGPUB; USPAT        | OR | OFF | 2017/12/05 12:26 |
| S39 | 4  | "6485800".pn. or "20060000173".pn. or "20040038002".pn. or "20140272303".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT        | OR | OFF | 2017/12/07 14:30 |
| S40 | 40 | (US-0021915-\$   US-20030021915-\$   US-2332081-\$   US-2632204-\$   US-3247047-\$   US-3422175-\$   US-3443278-\$   US-3531828-\$   US-3608261-\$   US-3792945-\$   US-3920366-\$   US-4661392-\$   US-4836814-\$   US-5110530-\$   US-5232751-\$   US-7137229-\$   US-7204944-\$   US-7588821-\$   US-8388331-\$   US-D299793-\$   US-D428500-\$   US-D505467-\$   US-D531326-\$   US-D642287-\$   US-D653779-\$   US-D653780-\$   US-D668794-\$   US-D671230-\$   US-D678556-\$   US-D710117-\$   US-D732191-\$   US-D732192-\$   US-D732193-\$   US-D732194-\$   US-D732195-\$   US-D732197-\$   US-D780333-\$   US-D780335-\$   US-D784566-\$   US-D786457-\$).DID. | US-PGPUB; USPAT        | OR | OFF | 2017/12/07 14:34 |
| S41 | 1  | "20030021915".pn. or "7137229".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | USPAT                  | OR | OFF | 2017/12/08 12:00 |
| S42 | 2  | "20030021915".pn. or "7137229".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US-PGPUB; USPAT        | OR | OFF | 2017/12/08 12:00 |
| S43 | 1  | (double near3 adhesive).ti. and ("UV" near5 (cure or cured or curing)) and ((heat or thermal) near5 (cure or cured or curing))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | USPAT                  | OR | OFF | 2017/12/08 14:45 |
| S44 | 4  | (double near3 adhesive).ti. and ("UV" near5 (cure or cured or curing)) and ((heat or thermal) near5 (cure or cured or curing))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-PGPUB; USPAT        | OR | OFF | 2017/12/08 14:47 |
| S45 | 7  | (double near3 adhesive).ti. and ("UV" or ultraviolet) near5 (cure or cured or curing)) and ((heat or thermal) near5 (cure or cured or curing))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-PGPUB; USPAT        | OR | OFF | 2017/12/08 14:54 |
| S46 | 1  | "7204944".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | USPAT                  | OR | OFF | 2018/07/05 11:47 |
| S47 | 33 | ("20030003283"   "2632204"   "2803041"   "2985556"   "3405425"   "3422175"   "3715420"   "3743250"   "3792945"   "3920366"   "4011292"   "4072791"   "4093188"   "4164385"   "4316868"   "4562023"   "4626187"   "4680155"                                                                                                                                                                                                                                                                                                                                                                                                                                               | US-PGPUB; USPAT; USOCR | OR | OFF | 2018/07/05 11:48 |

|     |        |                                                                                                                                                                                                                                                                                                                                                      |                                  |    |     |                     |
|-----|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----|-----|---------------------|
|     |        | "4753766"   "5232751"   "5998006"  <br>"6692683"   "6863967"   "6932591").PN.<br>OR ("7204944").URPN.                                                                                                                                                                                                                                                |                                  |    |     |                     |
| S48 | 344    | (428/151).CCLS. and (wood or grain or<br>burly)                                                                                                                                                                                                                                                                                                      | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>11:50 |
| S49 | 0      | (polymer same (wood or grain or burly))<br>and (helical) and (flow near adaptor)                                                                                                                                                                                                                                                                     | USPAT                            | OR | OFF | 2018/07/05<br>13:48 |
| S50 | 0      | (polymer same (wood or grain or burly))<br>and (helical) and (flow near adaptor)                                                                                                                                                                                                                                                                     | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:48 |
| S51 | 0      | (polymer same (wood or grain or burly))<br>and (helical) and (flow near adapter)                                                                                                                                                                                                                                                                     | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:48 |
| S52 | 4      | (polymer and (wood or grain or burly))<br>and (helical) and (flow near adapter)                                                                                                                                                                                                                                                                      | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:48 |
| S53 | 15595  | (polymer and (wood or grain or burly))<br>and (helical)                                                                                                                                                                                                                                                                                              | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:48 |
| S54 | 1586   | (polymer same (wood or grain or burly))<br>and (helical)                                                                                                                                                                                                                                                                                             | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:49 |
| S55 | 590    | (428/151).CCLS.                                                                                                                                                                                                                                                                                                                                      | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:49 |
| S56 | 1      | S54 and S55                                                                                                                                                                                                                                                                                                                                          | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:49 |
| S57 | 1      | "20160176230".pn.                                                                                                                                                                                                                                                                                                                                    | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:52 |
| S58 | 283536 | (428/\$).CCLS.                                                                                                                                                                                                                                                                                                                                       | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:54 |
| S59 | 130    | S54 and S58                                                                                                                                                                                                                                                                                                                                          | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:54 |
| S61 | 2      | (B01F5/0615 and B29C47/046 and<br>B29C47/56).CPC.                                                                                                                                                                                                                                                                                                    | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:57 |
| S62 | 33     | ("20030003283"   "2632204"   "2803041"<br>  "2985556"   "3405425"   "3422175"  <br>"3715420"   "3743250"   "3792945"  <br>"3920366"   "4011292"   "4072791"  <br>"4093188"   "4164385"   "4316868"  <br>"4562023"   "4626187"   "4680155"  <br>"4753766"   "5232751"   "5998006"  <br>"6692683"   "6863967"   "6932591").PN.<br>OR ("7204944").URPN. | US-<br>PGPUB;<br>USPAT;<br>USOCR | OR | OFF | 2018/07/05<br>13:58 |
| S63 | 2      | (B01F5/0615 and B29C47/046).CPC.                                                                                                                                                                                                                                                                                                                     | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:58 |
| S64 | 2      | (B01F5/0615 and B29C47/56).CPC.                                                                                                                                                                                                                                                                                                                      | US-<br>PGPUB;<br>USPAT           | OR | OFF | 2018/07/05<br>13:58 |
| S65 | 313    | (B01F5/0615).CPC.                                                                                                                                                                                                                                                                                                                                    | US-<br>PGPUB;                    | OR | OFF | 2018/07/05<br>13:58 |

|     |       |                                                                                                                                                                                                                                                                                                                              |                        |    |     |                  |
|-----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----|-----|------------------|
|     |       |                                                                                                                                                                                                                                                                                                                              | USPAT                  |    |     |                  |
| S66 | 20    | (B01F5/0615).CPC. and (wood or grain or burly)                                                                                                                                                                                                                                                                               | US-PGPUB; USPAT        | OR | OFF | 2018/07/05 13:58 |
| S67 | 29    | (B29C47/046 and B29C47/56).CPC.                                                                                                                                                                                                                                                                                              | US-PGPUB; USPAT        | OR | OFF | 2018/07/05 14:00 |
| S69 | 33    | ("20030003283"   "2632204"   "2803041"   "2985556"   "3405425"   "3422175"   "3715420"   "3743250"   "3792945"   "3920366"   "4011292"   "4072791"   "4093188"   "4164385"   "4316868"   "4562023"   "4626187"   "4680155"   "4753766"   "5232751"   "5998006"   "6692683"   "6863967"   "6932591").PN. OR ("7204944").URPN. | US-PGPUB; USPAT; USOCR | OR | OFF | 2018/07/05 16:12 |
| S70 | 2     | "20030021915".pn. or "20040038002".pn.                                                                                                                                                                                                                                                                                       | US-PGPUB; USPAT; USOCR | OR | OFF | 2018/07/05 16:13 |
| S71 | 1     | "8197733".pn.                                                                                                                                                                                                                                                                                                                | US-PGPUB; USPAT; USOCR | OR | OFF | 2018/07/05 16:13 |
| S72 | 1     | "5866639".pn.                                                                                                                                                                                                                                                                                                                | US-PGPUB; USPAT; USOCR | OR | OFF | 2018/07/05 16:17 |
| S73 | 1530  | extrusion and (wood near grain)                                                                                                                                                                                                                                                                                              | US-PGPUB; USPAT; USOCR | OR | OFF | 2018/07/06 11:32 |
| S75 | 2     | (B01F5/0615 and B29C47/046).CPC.                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:37 |
| S76 | 0     | (B01F5/0615).CPC. and (wood near grain)                                                                                                                                                                                                                                                                                      | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:38 |
| S77 | 18    | (B01F5/0615).CPC. and (wood)                                                                                                                                                                                                                                                                                                 | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:38 |
| S78 | 2     | (B01F5/0615).CPC. and grain                                                                                                                                                                                                                                                                                                  | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:40 |
| S79 | 35315 | (wood) same (polymer)                                                                                                                                                                                                                                                                                                        | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:40 |
| S80 | 954   | ((wood) same (polymer)).ab.                                                                                                                                                                                                                                                                                                  | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:41 |
| S81 | 12    | ((wood) same (polymer)).ab. and (helical)                                                                                                                                                                                                                                                                                    | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:41 |
| S82 | 9     | ((wood) same (polymer)).ab. and (multiple near5 extrusion)                                                                                                                                                                                                                                                                   | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:44 |
| S83 | 4     | ((wood) same (polymer)).ab. and (multiple near5 extruder)                                                                                                                                                                                                                                                                    | US-PGPUB;              | OR | OFF | 2018/07/06 11:47 |

|      |         |                                                                                                                                                             |                        |    |     |                  |
|------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----|-----|------------------|
|      |         |                                                                                                                                                             | USPAT                  |    |     |                  |
| S84  | 2981271 | ((wood) same (polymer))\ and (multiple near5 extruder)                                                                                                      | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:51 |
| S85  | 173     | ((wood) same (polymer)) and (multiple near5 extruder)                                                                                                       | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:51 |
| S86  | 590     | 428/151.ccls,icls.                                                                                                                                          | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:52 |
| S87  | 266     | 428/151.ccls,icls. and (wood)                                                                                                                               | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:53 |
| S88  | 22      | 428/151.ccls,icls. and (wood) and ((multiple or (first and second)) same (extruder\$1 or flow\$1))                                                          | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:55 |
| S89  | 8       | 428/151.ccls,icls. and (wood) and ((multiple or (first and second)) near5 (extruder\$1 or flow\$1))                                                         | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 11:56 |
| S90  | 41      | ("2803041"   "4094839"   "4183777"   "4649008"   "4810733"   "5053444"   "5387381").PN. OR ("5866639").URPN.                                                | US-PGPUB; USPAT; USOCR | OR | OFF | 2018/07/06 11:59 |
| S91  | 11      | ("20040038002"   "20070104930"   "20080299351"   "20110151193"   "20110177291"   "4280950"   "5126088"   "5866639"   "6083601"   "6596784"   "7866758").PN. | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 12:00 |
| S92  | 2       | "9527341".pn. or "20080093763".pn.                                                                                                                          | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 12:12 |
| S93  | 2       | "20110177291".pn. or "7204944".pn.                                                                                                                          | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 12:32 |
| S94  | 1       | "7204944".pn.                                                                                                                                               | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 14:11 |
| S95  | 2       | (B01F5/0619 and B29C47/046).CPC.                                                                                                                            | US-PGPUB; USPAT        | OR | OFF | 2018/07/06 14:11 |
| S96  | 2       | "7204944".pn. or "20110177291".pn.                                                                                                                          | US-PGPUB; USPAT        | OR | OFF | 2018/07/07 10:55 |
| S97  | 3       | "7204944".pn. or "20110177291".pn. or "20030021915".pn.                                                                                                     | US-PGPUB; USPAT        | OR | OFF | 2018/07/07 11:22 |
| S98  | 24      | (simulate\$3 near3 wood) with (emboss or embossment)                                                                                                        | USPAT                  | OR | OFF | 2018/07/07 11:36 |
| S99  | 44      | (simulate\$3 near3 wood) with (emboss or embossment)                                                                                                        | US-PGPUB; USPAT        | OR | OFF | 2018/07/07 11:38 |
| S100 | 4       | "7204944".pn. or "20110177291".pn. or "20030021915".pn. or "20040028002".pn.                                                                                | US-PGPUB; USPAT        | OR | OFF | 2018/07/07 12:14 |
| S101 | 4       | "7204944".pn. or "20110177291".pn. or "20030021915".pn. or "20040038002".pn.                                                                                | US-PGPUB; USPAT        | OR | OFF | 2018/07/07 12:14 |

**7/7/2018 12:15:48 PM**

**C:\Users\ddillon\Documents\ Applications\ 15\ 15245948-Wood grained polymer  
substrate\ EAST Search.w sp**