# PATENT ASSIGNMENT COVER SHEET

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| **SUBMISSION TYPE:** | NEW ASSIGNMENT |
| **NATURE OF CONVEYANCE:** | ASSIGNMENT |

**CONVEYING PARTY DATA**

| Name | Execution Date |
|---|---|
| COVESTRO DEUTSCHLAND AKTIENGESELLSCHAFT | 03/30/2017 |
| COVESTRO LLC | 03/29/2017 |

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| | |
|---|---|
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| **Postal Code:** | 95134 |

**PROPERTY NUMBERS Total: 2**

| Property Type | Number |
|---|---|
| **Application Number:** | 18107736 |
| **Application Number:** | 18107742 |

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| **ATTORNEY DOCKET NUMBER:** | 22773-826.312-313 |
| **NAME OF SUBMITTER:** | SELENA WHITAKER-PAQUIET |
| **SIGNATURE:** | /Selena Whitaker-Paquiet/ |
| **DATE SIGNED:** | 05/17/2023 |

**Total Attachments: 9**
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| CORPORATE TO CORPORATE ASSIGNMENT | Docket Number 22773-826.201 |
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WHEREAS Covestro Deutschland Aktiengesellschaft, Kaiser-Wilhelm Allee 60, D-51373 Leverkusen, Federal Republic of Germany (hereinafter "Assignor 1"), Covestro LLC, 1 Covestro Circle, Pittsburgh, Pennsylvania 15205, United States of America (hereinafter "Assignor 2") and Align Technology Inc., a corporation of the State of Delaware, having a place of business at 2560 Orchard Parkway, San Jose, California 95131, United States of America (hereinafter "Assignee"), and wherein [redacted], and wherein an application entitled:

**MULTILAYER DENTAL APPLIANCES AND RELATED METHODS AND SYSTEMS**

for which application serial number 13/470,681 was filed on May 14, 2012, in the United States Patent and Trademark Office [redacted].

Said application names inventors from Assignor 1, Assignor 2 and Assignee. These inventors have assigned their invention to their respective company.

WHEREAS the parties have determined [redacted] U.S. Ser. Appl. No. 13/470,681, U.S. Ser. Appl. No. 15/132,171, and the divisional application having Docket Number 22773-826.401 and continuation application having Docket Number 22773-826.302 to be filed according to the claims of Annex 1 (hereinafter together "Applications") belongs to Assignee.

WHEREAS in effect the ownership of said Applications to Assignee [redacted], Assignor 1 and 2 assign their respective share to Assignee and Assignee accepts such assignment.

NOW, THEREFORE, the parties agree as follows:

1. Assignor 1 and 2 hereby assign, all right, title and interests (a) in and to said Applications in the United States, including the right to claim priority to and from said Applications in and for the United States; (b) in and to each and every patent issuing or reissuing from said Applications in the United States; (c) in and to each and every reissue, reexamination, renewal or extension of any kind of any of the foregoing; and (d) in and to all claims for past, present and future infringement of the patent(s) issuing or reissuing from said Applications in the United States, including all rights to sue for and to receive and recover for Assignee's own use all past, present, and future lost profits, royalties, and damages of whatever nature recoverable from an infringement of the patent(s) in the United States. No other rights are hereby assigned or transferred to Assignee by Assignor 1 or Assignor 2 than those set forth in this paragraph 1.

2. Assignor 1 and 2 hereby covenant and agree to cooperate with said Assignee to enable said Assignee to enjoy to the fullest extent the right, title and interest herein conveyed in the United States. Such cooperation by the Assignor 1 and 2 shall include prompt production of pertinent facts and documents, giving of testimony, execution of petitions, oaths, specifications, declarations or other papers, and other assistance all to the extent reasonable necessary (a) for perfecting in said Assignee the right, title and interest herein conveyed; (b) for prosecuting said Applications in the United States (c) for filing and prosecuting substitute, divisional or continuing applications claiming priority on said Applications in the United States; (d) for filing and prosecuting applications for reissuance of any patent(s) issuing from said Applications in the United States; (e) for interference or other priority proceedings involving said Applications in the United States; Assignee shall reimburse Assignor 1 and Assignor 2 for costs incurred by Assignor 1 and Assignor 2 in providing assistance and support to Assignee in connection with this paragraph 2.

3. The terms and covenants of this assignment shall inure to the benefit of said Assignee, its successors, assigns and other legal representatives, and shall be binding upon the Assignor 1 and 2, its successors, assigns and other legal representatives.

4. Assignor 1 and 2 hereby warrant, represent and covenant that said Assignor 1 and 2 have not entered and will not enter into any assignment, contract, or understanding in conflict herewith.

5. Assignor 1 and 2 hereby request that any patent(s) issuing in the United States, be issued in the name of the Assignee, or its successors and assigns, for the sole use of said Assignee, its successors, legal representatives and assigns.

6. This instrument will be interpreted and construed in accordance with the laws of the State of Delaware, without regard to conflict of law principles. If any provision of this instrument is found to be illegal or unenforceable, the other provisions shall remain effective and enforceable to the greatest extent permitted by law. This instrument may be executed in counterparts, each of which is deemed an original, but all of which together constitute one and the same agreement.

IN WITNESS WHEREOF, said Assignor 1 and 2 have executed and delivered this instrument to said Assignee as of the date written below.

**ASSIGNOR 1**

Date: 30. MRZ. 2017

By: Dr. Gilbert Voorimans, LLM
Name: Vice President
Title: Head of Intellectual Property Rights

Date: 2017-03-30

By: i.V. Joschek
Name: Dr. Katrin Joschek
Title: IP Counsel

| CORPORATE TO CORPORATE ASSIGNMENT | Docket Number 22773-826.201 |
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Date: 3/29/2017

ASSIGNOR 2

By: _____ 3/29/17

Name: Scott G. Brown

Title: Vice President, General Counsel and Secretary

RECEIVED AND AGREED TO BY ASSIGNEE:

Date: March 30, 2017

By: _____

Name: Roger E. George

Title: Vice President, Corporate & Legal Affairs, General Counsel & Corporate Secretary

Annex 1

## DIVISIONAL CLAIMS

1. A method of making a dental appliance for positioning a patient's teeth, the method comprising:

providing a sheet comprising a hard polymer layer of polymeric material disposed between a first soft polymer layer and a second soft polymer layer;

providing a positive model of the patient's teeth in a target position; and

fabricating an appliance as a negative of the positive model comprising thermoforming the sheet over the positive model.

2. The method of claim 1, wherein the hard polymer layer comprises a layer of a polyester, a co-polyester, a polycarbonate, a thermoplastic polyurethane, a polypropylene, a polyethylene, a polypropylene and polyethylene copolymer, an acrylic, a cyclic block copolymer, a polyetheretherketone, a polyamide, a polyethylene terephthalate, a polybutylene terephthalate, a polyetherimide, a polyethersulfone, a polytrimethylene terephthalate, or a combination thereof.

3. The method of claim 1, wherein the hard polymer layer comprises at least two layers and the at least two layers are independently selected from a group consisting of a polyester, a co-polyester, a polycarbonate, a thermoplastic polyurethane, a polypropylene, a polyethylene, a polypropylene and polyethylene copolymer, an acrylic, a cyclic block copolymer, a polyetheretherketone, a polyamide, a polyethylene terephthalate, a polybutylene terephthalate, a polyetherimide, a polyethersulfone, and a polytrimethylene terephthalate.

4. The method of claim 1, wherein each of the first soft polymer layer and the second soft polymer layer independently comprises a layer of a styrenic block copolymer (SBC), a silicone rubber, an elastomeric alloy, a thermoplastic elastomer (TPE), a thermoplastic vulcanizate (TPV) elastomer, a polyurethane elastomer, a block copolymer elastomer, a polyolefin blend elastomer, a thermoplastic co-polyester elastomer, a thermoplastic polyamide elastomer, or a combination thereof.

5. The method of claim 1, wherein at least one of the first soft polymer layer and the second soft polymer layer comprises at least two layers, and wherein the at least two layers are independently selected from the group consisting of a styrenic block copolymer (SBC), a silicone rubber, an elastomeric alloy, a thermoplastic elastomer (TPE), a thermoplastic vulcanizate (TPV) elastomer, a polyurethane elastomer, a block copolymer elastomer, a polyolefin blend elastomer, a thermoplastic co-polyester elastomer, or a thermoplastic polyamide elastomer.

6. The method of claim 1, wherein the hard polymer layer comprises at least one of a tensile strength at yield of between about 4000 pounds psi and 6500 psi, an elongation at yield of greater than about 4%, an elongation at break of greater than about 70%, a tensile modulus of greater than about 150,000 psi, a flexural modulus greater than about 150,000 psi, a stress relaxation at 24 hours testing in a wet environment greater than about 10%, and a light transmission between 400 nm and 800 nm of greater than about 75%.

7. The method of claim 1, wherein the first soft polymer layer and the second soft polymer layer each independently comprise at least one of a hardness of about 60A to about 85D, an ultimate tensile strength of greater than about 5000 psi, an elongation at break of greater than about 200 %, a compression set at about 70 °C of greater than 40% after 24 hours, a flexural modulus of greater than about 35,000 psi, and a light transmission between 400 nm and 800 nm of greater than about 75%.

8. The method of claim 1, further comprising fabricating a plurality of appliances corresponding to different arrangements of the patient's teeth.

9. The method of claim 8, wherein fabricating the plurality of appliances comprises digitally staging a plurality of digital models of the patient's teeth and generating a plurality of physical models from the digital models.

10. The method of claim 8, wherein two or more of the plurality of appliances comprise a sheet comprising a hard polymer layer of polymeric material disposed between a first soft polymer layer and a second soft polymer layer.

11. The method of claim 1, wherein the hard polymer layer comprises a plurality of co-extruded or laminated polymer layers.

## CONTINUATION CLAIMS

1. A removable orthodontic tooth positioning appliance having teeth receiving cavities shaped to directly receive at least some of a patient's teeth and apply a resilient positioning force to the patient's teeth, the appliance comprising:

a first soft outer polymer layer comprising a first soft polymeric material and a second soft outer polymer layer comprising a second soft polymeric material, each of the first and second soft polymer layers having a flexural modulus of greater than about 35,000 psi, a hardness of about 60A to about 85D, and a thickness in a range from 25 μm to 100 μm; and

a hard inner polymer layer comprising a co-polyester disposed between the first soft outer polymer layer and the second soft outer polymer layer so as to reduce degradation of the resilient positioning force applied to the teeth when the appliance is worn.

2. The appliance of claim 1, wherein the first and second soft polymeric material each respectively comprise a material selected from the group consisting of: a thermoplastic polyurethane elastomer, a silicone rubber, an elastomeric alloy, a thermoplastic elastomer (TPE), a thermoplastic vulcanizate (TPV) elastomer, a block copolymer elastomer, a polyolefin blend elastomer, a thermoplastic co-polyester elastomer, a thermoplastic polyamide elastomer, or a combination thereof.

3. The appliance of claim 2, wherein the first and second soft polymeric materials each comprise the same material.

4. The appliance of claim 2, wherein the first and second soft polymeric materials comprise different materials.

5. The appliance of claim 2, wherein the first and second soft polymeric materials each comprise a blend of polymeric materials, each respective blend including two or more materials selected from the group consisting of: a thermoplastic polyurethane elastomer, a silicone rubber, an elastomeric alloy, a thermoplastic elastomer (TPE), a thermoplastic vulcanizate (TPV) elastomer, a block copolymer elastomer, a polyolefin blend elastomer, a thermoplastic co-polyester elastomer, and a thermoplastic polyamide elastomer.

6. The appliance of claim 2, wherein at least one of the first soft outer polymer layer and the second soft outer polymer layer comprises at least two layers.

7. The appliance of claim 1, wherein the hard inner polymer layer comprises a blend of

polymeric materials including the co-polyester and one or more of: a polyester, a thermoplastic polyurethane, a polypropylene, a polyethylene, a polypropylene and polyethylene copolymer, an acrylic, a polyetheretherketone, a polyamide, a polyethylene terephthalate, a polybutylene terephthalate, a polyetherimide, a cyclic block copolymer, a polyethersulfone, a polytrimethylene terephthalate, or a combination thereof.

8. The appliance of claim 1, wherein the hard inner polymer layer comprises at least two layers including a first layer comprising the co-polyester and a second layer comprising one or more of: a polyester, a co-polyester, a thermoplastic polyurethane, a polypropylene, a polyethylene, an acrylic, a polyetheretherketone, a polyamide, a polyethylene terephthalate, a polybutylene terephthalate, a polyetherimide, a cyclic block copolymer, a polyethersulfone, or a polytrimethylene terephthalate.

9. The appliance of claim 1, wherein the hard inner polymer layer has a thickness in a range from 400 μm to 1100 μm.

10. The appliance of claim 1, wherein the hard inner polymer layer, the first soft outer polymer layer, and the second soft outer polymer layer combined have a thickness of 500 μm to 1200 μm.

11. The appliance of claim 1, wherein the hard inner polymer layer comprises at least one of: a tensile strength at yield of between about 4000 pounds per square inch (psi) and 6500 psi, an elongation at yield of greater than about 4%, an elongation at break of greater than about 70%, a tensile modulus of greater than about 150,000 psi, a flexural modulus greater than about 150,000 psi, a stress relaxation at 24 hours testing in a high humidity environment of greater than about 10%, or a light transmission between 400 nm and 800 nm of greater than about 75%.

12. The appliance of claim 1, wherein the first soft outer polymer layer and the second soft outer polymer layer each independently comprise at least one of: an ultimate tensile strength of greater than about 5000 psi, an elongation at break of greater than about 200%, a compression set at about 70 °C of greater than 40% after 24 hours, or a light transmission between 400 nm and 800 nm of greater than about 75%.

13. A plurality of incremental position adjustment appliances having teeth receiving cavities shaped to directly receive at least some of the patient's teeth and apply a resilient positioning force to the patient's teeth, wherein the appliances are shaped to move teeth from one arrangement to a successive arrangement when successively worn by a patient, and wherein at least one of the appliances comprises a

removable orthodontic tooth positioning appliance having teeth receiving cavities shaped to directly receive at least some of a patient's teeth and apply a resilient positioning force to the patient's teeth, the appliance comprising:

a first soft outer polymer layer comprising a first soft polymeric material and a second soft outer polymer layer comprising a second soft polymeric material, each of the first and second soft polymer layers having a flexural modulus of greater than about 35,000 psi, a hardness of about 60A to about 85D, and a thickness in a range from 25 μm to 100 μm; and

a hard inner polymer layer comprising a co-polyester disposed between the first soft outer polymer layer and the second soft outer polymer layer so as to reduce degradation of the resilient positioning force applied to the teeth when the appliance is worn.

14. The plurality of appliances of claim 13, wherein the first and second soft polymeric material each respectively comprise a material selected from the group consisting of: a thermoplastic polyurethane elastomer, a silicone rubber, an elastomeric alloy, a thermoplastic elastomer (TPE), a thermoplastic vulcanizate (TPV) elastomer, a block copolymer elastomer, a polyolefin blend elastomer, a thermoplastic co-polyester elastomer, a thermoplastic polyamide elastomer, or a combination thereof.

15. A method of moving a patient's teeth from an initial configuration to a target configuration, the method comprising providing a removable orthodontic tooth positioning appliance having teeth receiving cavities shaped to directly receive at least some of a patient's teeth and apply a resilient positioning force to the patient's teeth, the appliance comprising:

a first soft outer polymer layer comprising a first soft polymeric material and a second soft outer polymer layer comprising a second soft polymeric material, each of the first and second soft polymer layers having a flexural modulus of greater than about 35,000 psi, a hardness of about 60A to about 85D, and a thickness in a range from 25 μm to 100 μm; and

a hard inner polymer layer comprising a co-polyester disposed between the first soft outer polymer layer and the second soft outer polymer layer so as to reduce degradation of the resilient positioning force applied to the teeth when the appliance is worn.

16. The method of claim 15, wherein providing the removable orthodontic tooth positioning appliance comprises placing the removable orthodontic tooth positioning appliance on the teeth of a patient.

17. The method of claim 15, wherein providing the removable orthodontic tooth positioning appliance comprises providing a series of incremental position adjustment appliances, said series of incremental position adjustment appliances including the removable orthodontic tooth positioning

appliance.

18. The method of claim 17, wherein providing the series of incremental position adjustment appliances comprisses placing said series of incremental position adjustment appliances over the patient's teeth.

19. The method of claim 15, wherein the first and second soft polymeric material each respectively comprise a material selected from the group consisting of: a thermoplastic polyurethane elastomer, a silicone rubber, an elastomeric alloy, a thermoplastic elastomer (TPE), a thermoplastic vulcanizate (TPV) elastomer, a block copolymer elastomer, a polyolefin blend elastomer, a thermoplastic co-polyester elastomer, a thermoplastic polyamide elastomer, or a combination thereof.

20. The method of claim 18, wherein the first and second soft polymeric materials comprise different materials.

21. The method of claim 18, wherein the first and second soft polymeric materials each comprise a blend of polymeric materials, each respective blend including two or more materials selected from the group consisting of: a thermoplastic polyurethane elastomer, a silicone rubber, an elastomeric alloy, a thermoplastic elastomer (TPE), a thermoplastic vulcanizate (TPV) elastomer, a block copolymer elastomer, a polyolefin blend elastomer, a thermoplastic co-polyester elastomer, and a thermoplastic polyamide elastomer.

22. The method of claim 18, wherein the first and second soft polymeric materials each comprise a thermoplastic polyurethane elastomer.

23. The method of claim 15, wherein the hard inner polymer layer comprises a blend of polymeric materials including the co-polyester and one or more of: a polyester, a thermoplastic polyurethane, a polypropylene, a polyethylene, a polypropylene and polyethylene copolymer, an acrylic, a polyetheretherketone, a polyamide, a polyethylene terephthalate, a polybutylene terephthalate, a polyetherimide, a cyclic block copolymer, a polyethersulfone, a polytrimethylene terephthalate, or a combination thereof.

24. The method of claim 15, wherein the hard inner polymer layer comprises at least two layers including a first layer comprising the co-polyester and a second layer comprising one or more of: a polyester, a co-polyester, a thermoplastic polyurethane, a polypropylene, a polyethylene, an acrylic, a

polyetheretherketone, a polyamide, a polyethylene terephthalate, a polybutylene terephthalate, a polyetherimide, a cyclic block copolymer, a polyethersulfone, or a polytrimethylene terephthalate.

25. The method of claim 15, wherein the first soft outer polymer layer and the second soft outer polymer layer each independently comprise at least one of: an ultimate tensile strength of greater than about 5000 psi, an elongation at break of greater than about 200%, a compression set at about 70 °C of greater than 40% after 24 hours, or a light transmission between 400 nm and 800 nm of greater than about 75%.

26. The method of claim 15, further comprising fabricating the removable orthodontic tooth positioning appliance.

27. A method of moving a patient's teeth from an initial configuration to a target configuration, the method comprising the steps of:

providing a removable orthodontic tooth positioning appliance having teeth receiving cavities shaped to directly receive at least some of a patient's teeth;

applying a resilient positioning force to the patient's teeth; and

moving the teeth into the target configuration, wherein the appliance comprises:

a first soft outer polymer layer comprising a first soft polymeric material and a second soft outer polymer layer comprising a second soft polymeric material, each of the first and second soft polymer layers having a hardness of about 60A to about 85D, and a thickness in a range from 25 μm to 100 μm; and

a hard inner polymer layer comprising a co-polyester disposed between the first soft outer polymer layer and the second soft outer polymer layer so as to reduce degradation of the resilient positioning force applied to the teeth when the appliance is worn.

28. The method of claim 27, wherein the first and second soft polymeric material each respectively comprise a material selected from the group consisting of: a thermoplastic polyurethane elastomer, a silicone rubber, an elastomeric alloy, a thermoplastic elastomer (TPE), a thermoplastic vulcanizate (TPV) elastomer, a block copolymer elastomer, a polyolefin blend elastomer, a thermoplastic co-polyester elastomer, a thermoplastic polyamide elastomer, or a combination thereof.