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(54) **METHODS AND COMPONENT PARTS FOR MANUFACTURING FOAM PAINT ROLLERS**

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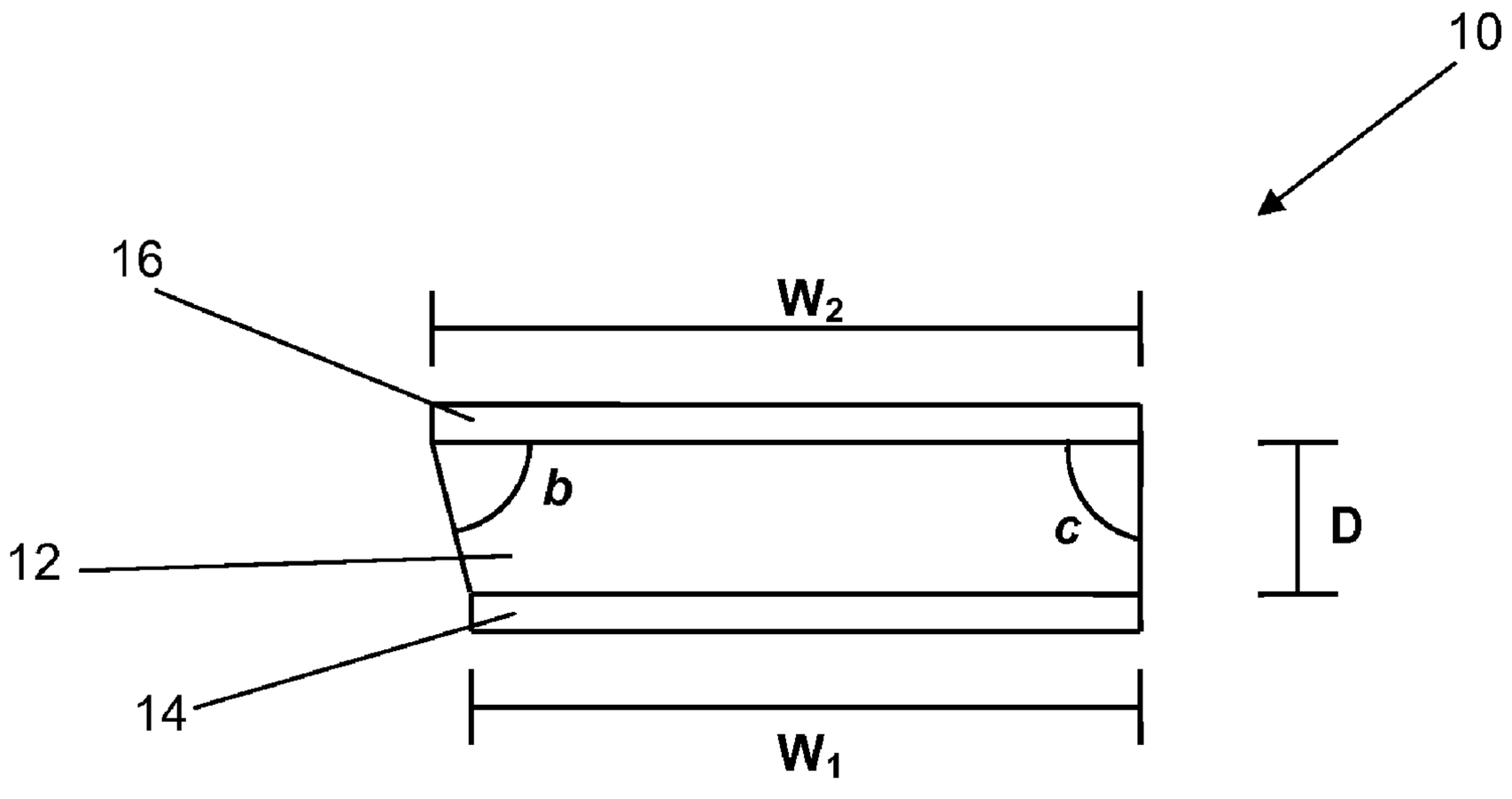
(57) **ABSTRACT**

Described is a paint roller cover strip for use in manufacturing paint rollers. The paint roller cover strip being formed from a length of foam base shaped in a trapezoidal cross section with two parallel sides, the foam base having a scrim affixed along the length of the narrower one of the two parallel sides. The paint roller cover optionally comprising a microfiber lamination along the length of the wider of the two parallel sides. Also described are methods of making a paint roller having a foam cover. On or two strips of material are helically advanced about a mandrel, a layer of adhesive is placed on the strip(s), and a cover material having the trapezoidal cross section is helically wound about the adhesive. Prior to permitting the layer of adhesive to set, the cover material having the trapezoidal cross section is helically wrapped around the outer strip, and an inward compressive force is applied upon the cover material urging the cover material and the strip(s) toward the mandrel, forming the paint roller having a foam cover. The materials can be assembled in a continuous manufacturing process and the foam base has the shape of a trapezoid with one or more angles sufficient to eliminate gaps between the outer surface of successive helical winds on a finished paint roller.



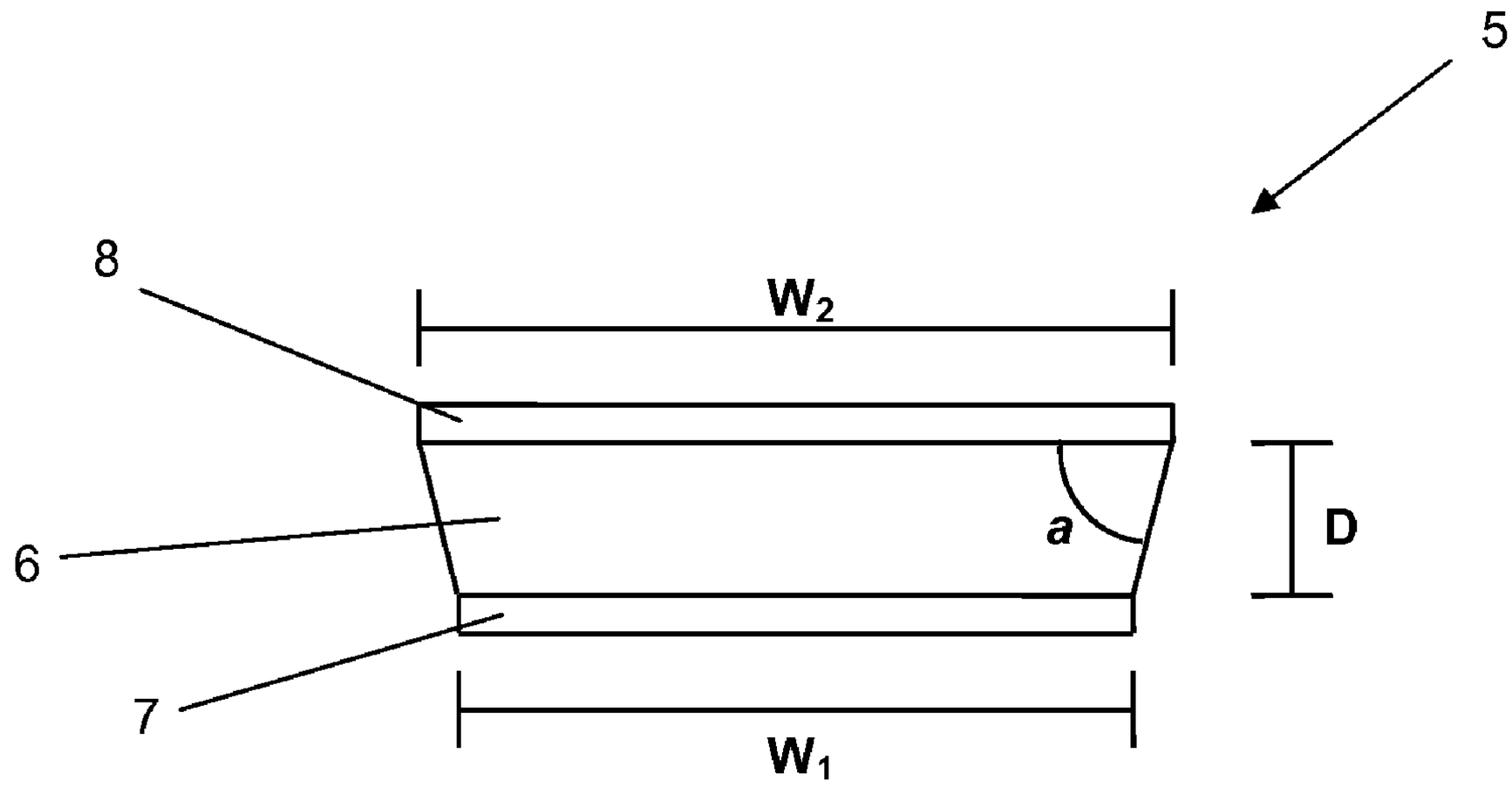


FIG. 1a

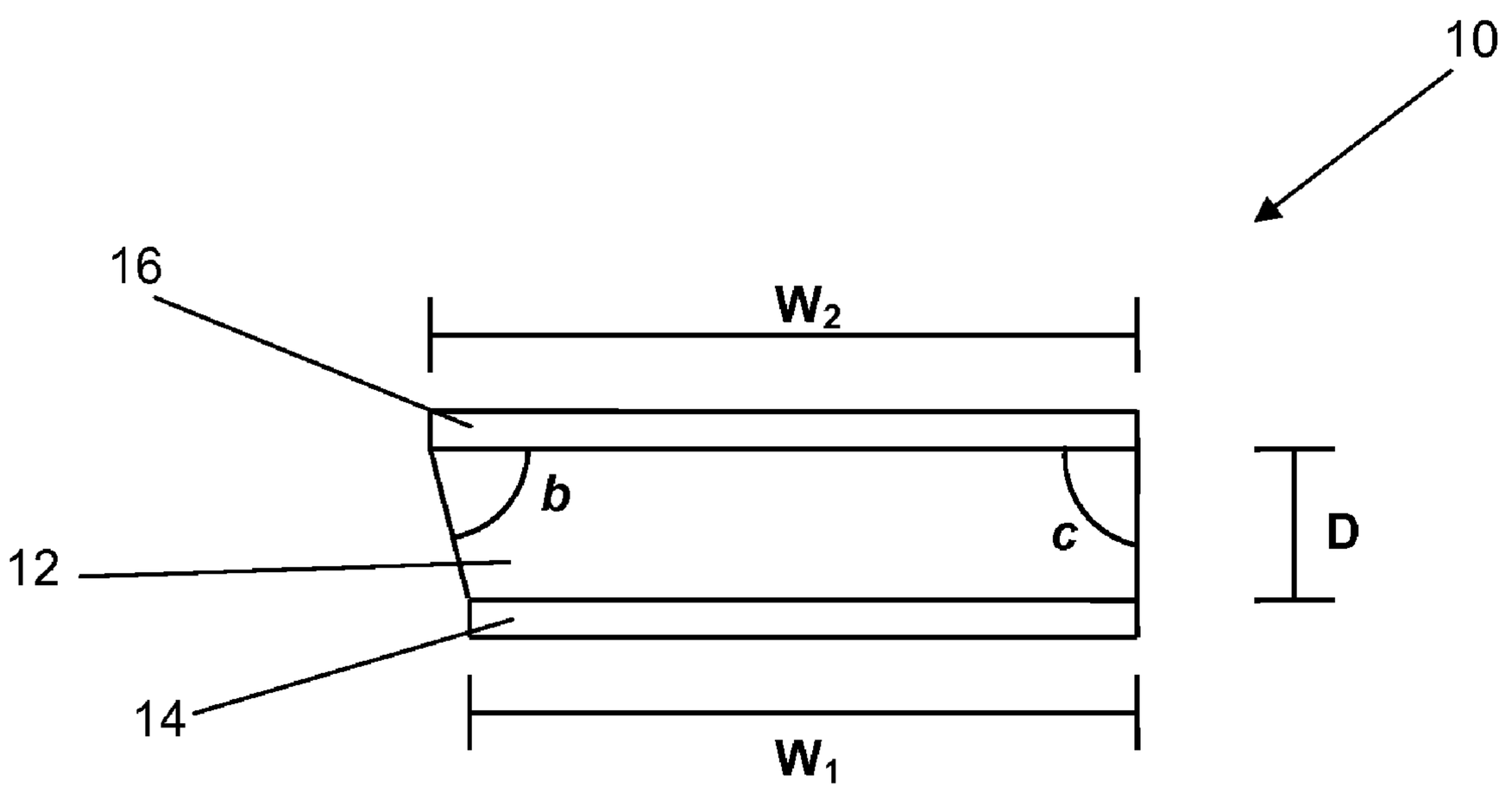


FIG. 1b

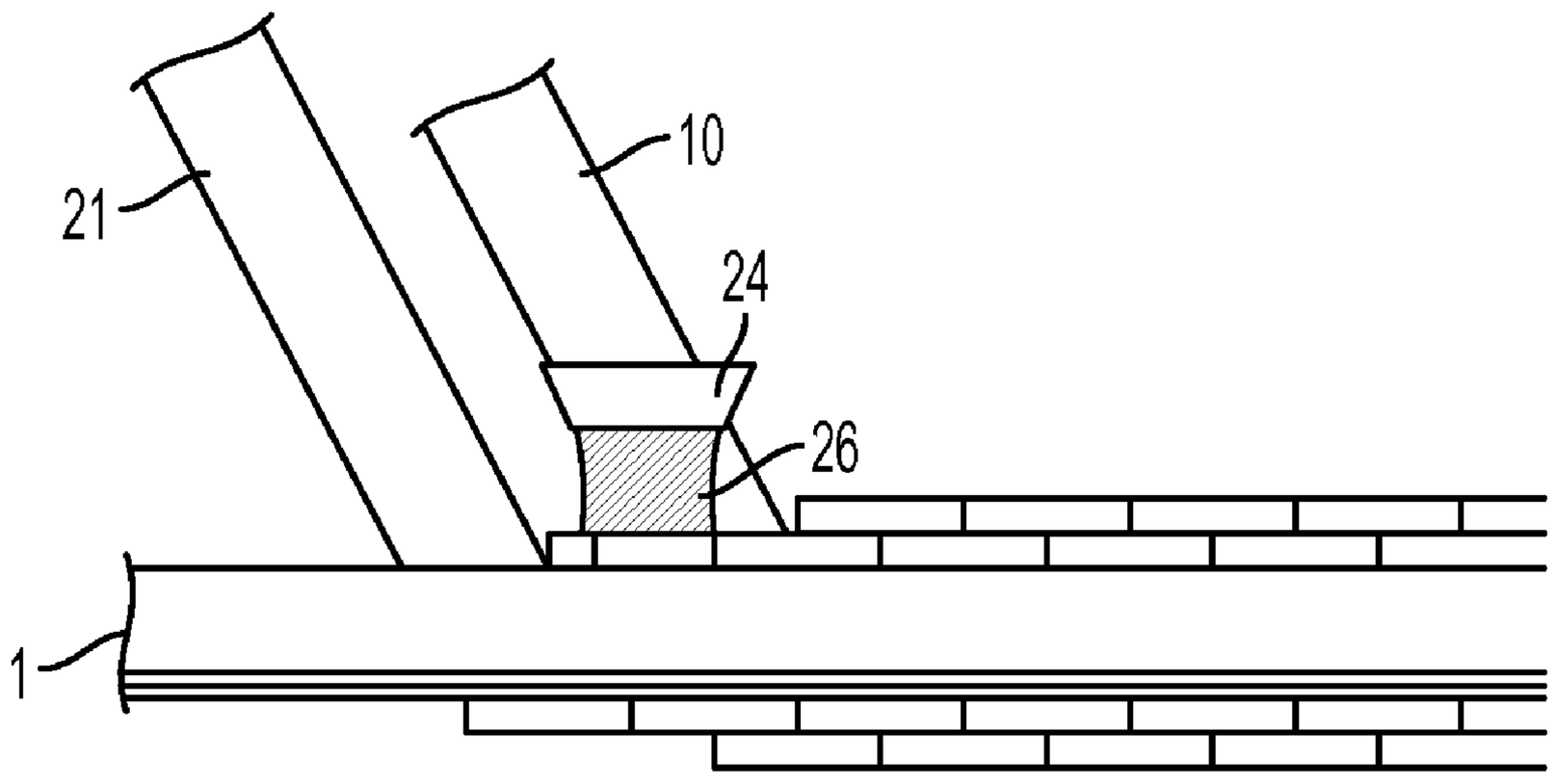


FIG. 2

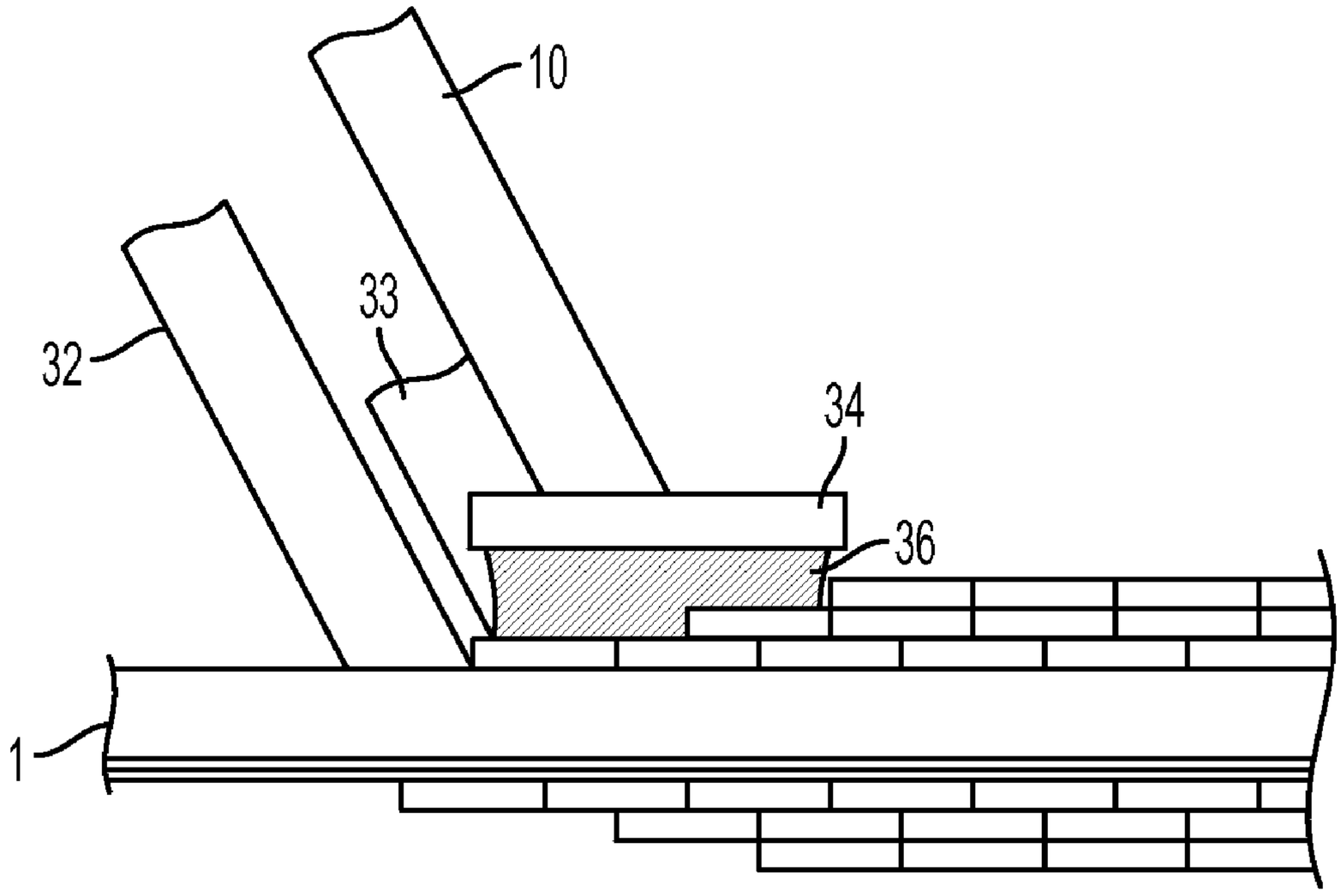


FIG. 3

METHODS AND COMPONENT PARTS FOR MANUFACTURING FOAM PAINT ROLLERS

FIELD OF THE INVENTION

[0002] This document pertains to methods for making foam paint rollers of the type used for applying paint to walls and the like. More specifically, to new methods of making paint rollers having a foam exterior painting surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] In the accompanying drawings forming a part of this specification, and in which like reference characters are employed to designate like parts throughout the same:

[0004] FIG. **1***a* is a cross sectional approximation of an exemplary cover material for use in the method of making foam paint rollers disclosed herein.

[0005] FIG. **1***b* is a cross sectional approximation of another exemplary cover material for use in the method of making foam paint rollers disclosed herein.

[0006] FIG. **2** is a diagrammatic cross-section representation of selected portions of an in use, single-strip paint roller manufacturing apparatus for making paint rollers in accordance with the methods disclosed herein.

[0007] FIG. **3** is a diagrammatic cross-section representation of selected portions of an in use multi-strip paint roller manufacturing apparatus for making paint rollers in accordance with the methods disclosed herein.

DETAILED DESCRIPTION OF THE INVENTION AND EMBODIMENTS THEREOF

[0008] A paint roller, as is known in the art, is a generally cylindrical paint applicator usually having an open inner diameter that accepts insertion of a cage (also known as a cage frame) or other support to enable its use in painting. A paint roller can be formed by having a strip comprising a clickable foam circumscribed about a core in a helical fashion—that is as a general helix or cylindrical helix. To the extent that the foam circumscribed about the core has a thickness D, the diameter circumscribed by an inner surface of the foam is necessarily smaller than the diameter circumscribed by the outer surface of the foam. The depth D of the foam is equal to ½ of the difference in those diameters.

[0009] As an example, where a paint roller having a 1.5" inner diameter of the core is manufactured using two core-forming strips having a 0.025" thickness, and two layers of adhesive having a thickness of 0.020, and a cover material strip, the diameter at the point of contact between the cover material strip and the adhesive is approximately 1.590". In such an embodiment, exemplary cover material strip, may be approximately 2.875". The following table shows the approximate difference between the circumference at the inner surface of a cover material and at the outer surface of the cover material for several different exemplary cover material depths D:

Cover Thickness - "D"	Inner Circumference	Outer Circumference	Difference
0.125	4.995	5.781	0.785
0.250	4.995	6.566	1.571
0.375	4.995	7.351	2.356
0.500	4.995	8.137	3.142

Accordingly, it can be seen that with a cover material having a depth of just ½", the difference in the circumference from the inner surface to its outer surface is more than 3". In an typical 1.5" paint roller (meaning a 1.5" inner diameter) having a ½" cover material, the 3" difference represents almost 60% of the circumference the inner surface of the cover material. In other words, the circumference measured at the outer surface of a ½" cover material is about 1.6× as much, or about 60% longer, than the circumference at the inner surface.

[0010] In another example, for a 1.5" inner diameter paint roller having a core thickness of 0.075" using a ¼" cover material, the circumference measured at the outer surface of the cover material is about 6.519", while the circumference at the inner surface is about 4.948". Where the cover is ½", the circumference measured at the outer surface of the cover material is about 8.090", while the circumference at the inner surface is still about 5.948".

[0011] For the purpose of this disclosure, the term trapezoid shall have its common meaning, includes having exactly one pair of parallel sides, thereby excluding from the definition of trapezoid parallelograms, e.g., the rhomboid, rhombus, rectangle and square.

[0012] FIG. **1***a* shows a cross sectional approximation of an exemplary cover material **5** for use in the method of making foam paint rollers disclosed herein. The cover material **5** is formed from a continuous strip of foam base **6**. The foam base **6** comprises a clickable foam. The foam may consist substantially entirely of clickable polyurethane foam or clickable polyester foam, or may consist of any other suitable clickable foam material. In an embodiment the foam has sponge-like qualities that permit absorption and retention of paint on a paint roller, and ready application of paint to a surface. Plastic foams of the polyurethane class have been found to possess such sponge-like characteristics.

[0013] The cross section of the foam base **6** of the continuous strip of cover material **5** forms an isosceles trapezoid. The isosceles trapezoid has a depth D defining the thickness of the foam base **6**, a first width W_1 defining the width of a first surface or inner surface, and a second width W_2 defining the width of a second surface or outer surface. The width of the inner surface W_1 is smaller than the width of the outer surface W_2.

[0014] By shaping the cross section of the foam base **6** of the cover material **5** in an isosceles trapezoid, the helically wrapped cover material **5** will not have substantial gaps between the helical winds of the cover material. The difference in the isosceles trapezoid widths, i.e., the width of the inner surface W_1 and the width of the outer surface W_2, is thus provided to make accommodation for the differing circumferences between the inner and outer surfaces. More specifically, the foam base **6** has the shape of a isosceles trapezoid with angles sufficient to reduce or eliminate gaps between the outer surface of successive helical winds on a finished paint roller.

[0015] In an embodiment, a backing **7** is secured to the inner surface of the foam base **6**. The backing **7** may be secured to the foam base **6** using an adhesive (not shown.) The thickness (e.g., depth) of the backing **7** is generally insubstantial or small when compared to the depth D of the foam base **6**. Accordingly, the backing **7** need not (but may) have a cross section forming an isosceles trapezoid. Where it is in the form of an isosceles trapezoid, it's longer width would be substantially the same as the width of the inner surface W_1.

[0016] The backing **7** may add stability and/or reduce the stretchiness of the foam base **6**. The backing **7** can be any suitable material such as, for example, scrim, fiberglass, polyester or polypropylene. Where the backing **7** is formed from polypropylene, the polypropylene can be extruded directly onto the foam base **6** and thus not require a separate adhesive to be bonded thereto.

[0017] In an embodiment, the outer surface of foam base **6** has an outer layer **8**. In an embodiment, the outer layer **8** comprises a microfiber lamination. The outer layer **8** may be laminated to the foam base **6** by electrostatic bonding or any other suitable bonding method, including the use of liquid adhesives. The thickness (e.g., depth) of the outer layer **8** is generally insubstantial when compared to the depth D of the foam base **6**. Accordingly, the outer layer **8** need not (but may) have a cross section forming an isosceles trapezoid. Where it is in the form of an isosceles trapezoid, it's shorter width would be substantially the same as the width of the outer surface W_2.

[0018] Turning to FIG. **1***b* a cross sectional approximation of another exemplary cover material **10** for use in the method of making foam paint rollers disclosed herein is shown. The cover material **10** is formed from a continuous strip of foam base **12**. The foam base **12** comprises a clickable foam. The foam may consist substantially entirely of clickable polyurethane foam or clickable polyester foam, or may consist of any other suitable clickable foam material. In an embodiment the foam has sponge-like qualities that permit absorption and retention of paint on a paint roller, and ready application of paint to a surface. Plastic foams of the polyurethane class have been found to possess such sponge-like characteristics.

[0019] The cross section of the foam base **12** of the continuous strip of cover material **10** forms a trapezoid having one pair of parallel sides. One side of the trapezoid formed by the cross section cover material **10** is perpendicular to the parallel sides as shown by angle b, while the other side is not perpendicular to the parallel sides as shown by angle c. In an embodiment, angle c is in the range of between 45 degrees and 80 degrees. While many different angles c will yield good results, experimentation has revealed that on foam of between ¼ and ½", angle c yields good results within the range of between about 55 and 65 degrees, and specifically at 61 degrees. The trapezoid has a depth D defining the thickness of the foam base **12**, a first width W_1 defining the width of a first surface or inner surface, and a second width W_2 defining the width of a second surface or outer surface. The width of the inner surface W_1 is smaller than the width of the outer surface W_2.

[0020] When wrapped around a mandrel in the process of manufacturing a paint roller (as discussed in more detail below), the diameter of the inner surface of the foam base **12** is smaller than the diameter of the outer surface of the foam base **12**.

[0021] As above, for example, where a paint roller having a 1.5" inner diameter of the core is manufactured using two strips comprising of material having a 0.025" thickness, and two layers of adhesive having a thickness of 0.020, and a cover material **10**, the diameter at the point of contact between the cover material **10** and the adhesive is approximately 1.590". In such an embodiment, W_1 for exemplary cover material **10** is approximately 2.875" wide. The foam can be any suitable thickness and angle c may be in the range of 45 to 80 degrees. In an exemplary embodiment where the foam is ½ inch and angle c is selected to be 61 degrees, W_2 would be approximately 3.117". A specific efficiency may arise in forming the foam base **12** because only one non-perpendicular cut is needed. Specifically, a foam strip of width W_1+W_2 can be cut and the specified angle, i.e., between 45 and 80 degrees, thus forming two separate strips bearing the same angular cut. For example, for the exemplary ½ inch foam cut at an angle of 61 degrees, a single cut can be made in a foam strip having a rectangular cross section measuring ½ inch by just less than 6" (i.e., approximately 5.992 inches).

[0022] By shaping the cross section of the foam base **12** of the cover material **10** in a trapezoid as described above in connection with FIG. **1***b*, the helically wrapped cover material **10** will not have substantial gaps between the helical winds of the cover material. For the foam base **12** described above in connection with FIG. **1***b*, as with the foam base **6** discussed above, the difference in the width of the inner surface W_1 and the width of the outer surface W_2, are provided to accommodate the differing circumferences between the inner and outer surfaces. More specifically, the foam base **12** has the shape of a trapezoid with one side perpendicular to the parallel sides and the other side cut at an angle sufficient to reduce or eliminate gaps between the outer surface of successive helical winds on a finished paint roller.

[0023] In an embodiment, a backing **14** is secured to the inner surface of the foam base **12**. The backing **14** may be secured to the foam base **6** using an adhesive (not shown.) The thickness (e.g., depth) of the backing **14** is generally insubstantial or small when compared to the depth D of the foam base **12**. Accordingly, the backing **14** need not (but may) have a cross section forming a trapezoid. Where it is in the form of a trapezoid, it's longer width would be substantially the same as the width of the inner surface W_1.

[0024] The backing **14** may add stability and/or reduce the stretchiness of the foam base **12**. The backing **14** can be any suitable material such as, for example, scrim, fiberglass, polyester or polypropylene. Where the backing **14** is formed from polypropylene, the polypropylene can be extruded directly onto the foam base **12** and thus not require a separate adhesive to be bonded thereto.

[0025] In an embodiment, the outer surface of foam base **12** has an outer layer **16**. In an embodiment, the outer layer **16** comprises a microfiber lamination. The outer layer **16** may be laminated to the foam base **12** by electrostatic bonding or any other suitable bonding method, including the use of liquid adhesives. The thickness (e.g., depth) of the outer layer **16** is generally insubstantial when compared to the depth D of the foam base **12**. Accordingly, the outer layer **16** need not (but may) have a cross section forming an isosceles trapezoid. Where it is in the form of an isosceles trapezoid, it's shorter width would be substantially the same as the width of the outer surface W_2.

[0026] Turning now to FIG. **2**, an exemplary method of manufacturing a single-strip foam-covered paint roller is described. FIG. **2** is a not-to-scale diagrammatic cross-section representation of selected portions of an in use, single-

strip paint roller manufacturing apparatus for making paint rollers in accordance with the methods disclosed herein. A strip of material **21** is wrapped helically about a mandrel **1** held on a base (not shown). The mandrel may be cooled by a cooler (not shown). An adhesive **26** is applied to an outer surface of the strip **21** by applicator **24**. A cover material **10** comprising a foam base—the foam base having a cross section substantially in the form of an isosceles trapezoid—is wrapped around the mandrel **1** over the strip **21** and the adhesive **26**. The angles of the isosceles trapezoid are selected to accommodate stretch that will occur as a result of the differing diameters between the inside and the outside surface of the cover material when wrapped about the mandrel and over the strip and adhesive as described. A helical belt (not shown) driven by rollers (not shown) can be used to apply a compressive force on the cover material **10** and advances the tubular assembly including the strip **21**, adhesive **26** and cover material **10** down the mandrel **1**. A flyaway saw (not shown) can be used to cut the tubular assembly into lengths that can be used, or cut and used to produce finished paint rollers.

[0027] Turning now to FIG. **3**, an exemplary method of manufacturing a multi-strip foam-covered paint roller is described. FIG. **2** is a not-to-scale diagrammatic cross-section representation of selected portions of an in use multi-strip paint roller manufacturing apparatus for making paint rollers in accordance with the methods disclosed herein. A first strip of material **32** is wrapped helically about a mandrel **1** held on a base (not shown). The mandrel may be cooled by a cooler (not shown). A second strip of material **33** is wrapped helically about a mandrel **1** and about the first strip. An adhesive **36** is applied to an outer surface of the strips **32**, **33** by applicator **34** such that the adhesive forms a substantially complete layer between the first strip **32** and the second strip **33**, and forms a substantially complete layer outside of the second strip **33**. A cover material **10** comprising a foam base—the foam base having a cross section substantially in the form of an isosceles trapezoid—is wrapped around the mandrel **1** over the strips **32**, **33** and the adhesive **36**. The angles of the isosceles trapezoid are selected to accommodate stretch that will occur as a result of the differing diameters between the inside and the outside surface of the cover material when wrapped about the mandrel and over the strip and adhesive as described. A helical belt (not shown) driven by rollers (not shown) can be used to apply a compressive force on the cover material **10** and advances the tubular assembly including the strips **32**, **33**, adhesive **36** and cover material **10** down the mandrel **1**. A flyaway saw (not shown) can be used to cut the tubular assembly into lengths that can be used, or cut and used to produce finished paint rollers.

Materials

[0028] With reference to FIGS. **2** and **3**, in an embodiment, the any of the strips **21**, **32**, **33** can consist substantially entirely of polypropylene, or can be formed from other thermoplastics, or from compounds of thermoplastics with other thermoplastics or with non-thermoplastics such as calcium carbonate, mica or talc. In an embodiment, one or more of the strips is formed from a compound of polypropylene and calcium carbonate. Similarly the adhesive **26**, **36** can consist substantially entirely of polypropylene, or can be formed from other thermoplastics, or from compounds of thermoplastics with other thermoplastics or with non-thermoplastics such as calcium carbonate, mica or talc. In an embodiment, the adhesive is formed from a compound of polypropylene and calcium carbonate.

[0029] Where polypropylene is used in the strips **21**, **32**, **33** or adhesive **26**, **36**, either alone, or in combination with other thermoplastics or non-thermoplastic materials, including calcium carbonate, a nucleated polypropylene may be used.

1. A method for continuously producing a multi-strip laminate paint roller having a foam cover, the method comprising the steps of:

helically advancing an inner strip and an outer strip of material about a mandrel in offset relation;

applying a layer of adhesive between the two strips and on the outer surface of the outer strip;

prior to permitting the layer of adhesive to set, wrapping a cover material comprising a foam base, the foam base having a trapezoidal cross section, around the outer strip and applying a compressing force upon the cover material urging the cover material and the two strips toward the mandrel, thereby creating the continuous multi-strip laminated paint roller having a foam cover;

wherein the foam base has an inner surface and an outer surface, and wherein the method further comprises a step of extruding a layer of polypropylene such that it is in molten form when applied onto the inner surface of the foam base prior to wrapping the cover material about the wound strip and over the layer of adhesive.

2. The method for continuously producing a multi-strip laminate paint roller having a foam cover claimed in claim **1**, wherein the foam base has a inner surface and an outer surface, the width of the inner surface being smaller than the width of the outer surface, and wherein the cover material further comprises scrim bonded to the inner surface of the foam base.

3. The method for continuously producing a multi-strip laminate paint roller having a foam cover claimed in claim **2**, wherein the cover material further comprises microfiber lamination on the outer surface of the foam base.

4. The method for continuously producing a multi-strip laminate paint roller having a foam cover claimed in claim **1**, wherein the foam base has a inner surface and an outer surface, the width of the inner surface being smaller than the width of the outer surface, wherein the cover material further comprises microfiber lamination on the outer surface of the foam base.

5. The method for continuously producing a multi-strip laminate paint roller having a foam cover claimed in claim **1**, wherein

the trapezoidal cross section has one pair of parallel sides, and one pair of non-parallel sides, and

the one pair of non-parallel sides has a perpendicular side and a non-perpendicular side,

the perpendicular side being perpendicular to the pair of parallel sides, and

the non-perpendicular side is not perpendicular to the one pair of parallel sides.

6. The method for continuously producing a multi-strip laminate paint roller having a foam cover claimed in claim **5**, wherein

the one pair of parallel sides have a outer side and an inner side, and

the outer side is wider than the inner side, and

the non-perpendicular side is angled at between 45 and 80 degrees with respect to the outer side.

7. The method for continuously producing a multi-strip laminate paint roller having a foam cover claimed in claim **6**, wherein the non-perpendicular side is angled at between 50 and 55 degrees with respect to the outer side.

8. A method of making a paint roller having a foam cover, comprising the steps of:

helically winding a strip of material around a mandrel so as to form a helically wound strip;

advancing the wound strip along the mandrel;

applying a layer of adhesive onto an outer surface of the wound strip; and

helically wrapping a strip of cover material comprising a foam base, the foam base having a cross section of a trapezoid, about the wound strip and over the layer of adhesive, thereby bonding the strip of cover material to the wound strip for forming the paint roller;

wherein the foam base has an inner surface and an outer surface, and wherein the method further comprises a step of extruding a layer of polypropylene such that it is in molten form when applied onto the inner surface of the foam base prior to helically wrapping the cover material about the wound strip and over the layer of adhesive.

9. The method of making a paint roller having a foam cover claimed in claim **8**, wherein the foam base has an inner surface and an outer surface, the width of the inner surface being smaller than the width of the outer surface, and wherein the cover material further comprises scrim bonded to the inner surface of the foam base.

10. The method of making a paint roller having a foam cover claimed in claim **9**, wherein the cover material further comprises microfiber lamination on the outer surface of the foam base.

11. The method of making a paint roller having a foam cover claimed in claim **8**, wherein the foam base has a inner surface and an outer surface, the width of the inner surface being smaller than the width of the outer surface, wherein the cover material further comprises microfiber lamination on the outer surface of the foam base.

12. The method of making a paint roller having a foam cover claimed in claim **8**, wherein

the trapezoidal cross section has one pair of parallel sides, and one pair of non-parallel sides,

the one pair of non-parallel sides has a perpendicular side and a non-perpendicular side,

the perpendicular side being perpendicular to the pair of parallel sides; and

the non-perpendicular side not being perpendicular to the one pair of parallel sides.

13. The method of making a paint roller having a foam cover claimed in claim **12**, wherein

the one pair of parallel sides have a outer side and an inner side, and

the outer side is wider than the inner side, and

the non-perpendicular side is angled at between 45 and 80 degrees with respect to the outer side.

14. The method of making a paint roller having a foam cover claimed in claim **13**, wherein the non-perpendicular side is angled at between 50 and 55 degrees with respect to the outer side.

15. A paint roller cover strip for use in manufacturing paint rollers, the paint roller cover strip comprising:

a length of foam base having a trapezoidal cross section, the foam base having an outer side, an inner side a perpendicular side and a non-perpendicular side, wherein the outer side wider than the inner side, the perpendicular side is perpendicular with the outer side and the inner side and the non-perpendicular side is not perpendicular with the outer side or the inner side; and

a length of scrim affixed along the length of the inner side of the foam base.

16. The paint roller cover strip for use in manufacturing paint rollers claim in claim **15**, further comprising a microfiber lamination on the outer surface of the foam base.

17. The method of making a paint roller having a foam cover claimed in claim **8**, wherein the foam base has an inner surface and an outer surface, and wherein the cover material further comprises a layer of polypropylene bonded to the inner surface of the foam base.

18. (canceled)

19. The method of making a paint roller having a foam cover claimed in claim **8**, wherein the foam base has an inner surface and an outer surface, and wherein the cover material further comprises a layer of fiberglass bonded to the inner surface of the foam base.

20. The method of making a paint roller having a foam cover claimed in claim **8**, wherein the foam base has an inner surface and an outer surface, and wherein the cover material further comprises a layer of polyester bonded to the inner surface of the foam base.

21. The method of making a paint roller having a foam cover claimed in claim **8**, wherein the foam base has a cross section of an isosceles trapezoid.

22. The method of making a paint roller of claim **8**, wherein said step of extruding the layer of polypropylene comprises a step of extruding the layer of polypropylene directly onto the inner surface of the foam base.

23. The method of making a paint roller of claim **1**, wherein said step of extruding the layer of polypropylene comprises a step of extruding the layer of polypropylene directly onto the inner surface of the foam base.

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