

SPECIFICATION

Method of manufacture of brush components

5 This invention relates to improved methods of manufacturing brush components, the components themselves, and brushes made from the components.

10 According to the present invention, we provide a method of manufacturing a brush component comprising feeding a plurality of predetermined lengths of synthetic resinous brush bristle from a supply into the nip of at least one pair of endless haul-off belts so that said bristles are arranged in an adjacent array substantially parallel to each other with their ends substantially in line, the array being of substantially uniform thickness and density, extruding synthetic resinous material onto both sides of the array along its length so as to fuse the bristles together in the area of the extrusion, and folding or slitting the bristles substantially along the centre of the array after they emerge from the nip of the endless haul-off belts to provide said brush component.

25 Preferably, the ends of the bristles are tamped to give a uniform width and to align them prior to passing them from a feeder into the nip of the haul-off belts.

30 Preferably, the synthetic resinous material is a thermoplastic material which is cooled so as to set prior to the slitting operation taking place.

35 In one form of the invention, a single pair of haul-off belts grips the array of bristles centrally so that the ends of the bristles project beyond the edges of the belt and a strip of synthetic resinous material is extruded along and around the two side edges of the array so as to hold the respective ends of the bristles together, whereupon on emergence from the nip, the bristles are slit centrally to form two continuous brush components.

40 According to a second form of the invention, the bristles are fed into the nip of two spaced pairs of haul-off belts which respectively support the array of bristles along the two edges of the array, that is support the two ends of the bristles, whereupon two beads of synthetic resinous material of different widths are extruded along the centre line of the array of bristles, one bead being located on one side of the array and the other on the opposite side, and while the synthetic resinous beads are still molten, the array of bristles is folded upon itself along the line of the beads with the wider bead outermost, the folded bristle array and beads being passed through a forming roller, whereupon the molten material is allowed to harden.

55 According to a third form of the invention, the bristles are fed into the nip of two spaced pairs of haul-off belts which support the ends of the bristles, whereupon equal volumes of synthetic resinous material are extruded onto the two faces of the bristle array along its centre line between the pairs of haul-off belts at a pressure and temperature sufficient to penetrate and fuse together the array of bristles, whereupon the synthetic resinous material is allowed to cool and the array is then slit centrally down the centre line of the synthetic resinous

material so as to provide two continuous brush components.

70 If desired, a strengthening material may be incorporated in the extruded synthetic resinous material. This may comprise at least one length of wire, which itself may be coated with synthetic resinous material.

75 It will be appreciated that as the array of bristles passes through the extrusion die, the bristles will be heated, and dependent on the temperature of the die, the bristles will actually be fused together immediately before or during the extrusion step.

80 Instead of relying upon extruded molten polymer to fuse together the bristles, they can be combined together by fusion alone. Furthermore, both methods of fusion can be used together to complement each other.

85 The invention also extends to brush components when made by any of the above-described methods and to brushes formed from said brush components, and to manufacturing apparatus.

The invention is now described by way of example with reference to the accompanying schematic drawings, in which:

90 *Figure 1* is a perspective view of an array of bristles;

Figure 2 is a perspective view showing the array of bristles passing into the nip of a pair of haul-off belts in accordance with a first form of the invention;

95 *Figure 3* is a perspective view showing a split extrusion die extruding beads of material onto and around the two edges of the array;

Figure 4 is a perspective view showing the array being slit centrally, and

100 *Figure 5* is a perspective view of one of the bristle components manufactured in accordance with the steps shown in Figures 1-4.

Figure 6 is a view similar to *Figure 3* showing an alternative extrusion operation in accordance with a second form of the invention;

105 *Figure 7* is an end view showing the array of bristles after a subsequent folding operation;

Figure 8 is an end view showing the folded array of bristles being passed through forming rollers, and

110 *Figure 9* is an end view showing the brush component formed by the method of Figures 6-8.

Figure 10 is a perspective view showing the array of bristles passing through two spaced pairs of haul-off belts suitable for the second and a third form of the invention;

115 *Figure 11* is an end view of an array of bristles after beads of material have been extruded centrally of the array of bristles in accordance with the third form of the invention, and

120 *Figure 12* shows two brush components which result after the array shown in *Figure 11* has been slit in two.

Referring to the drawings, and in particular to Figures 1-5, a plurality of brush bristles formed of synthetic resinous material of predetermined length are fed from a hopper (not shown) into a channel (not shown) so as to form an array of bristles of uniform thickness and density as shown in *Figure 1*. If necessary the edges of the bristles can be tamped so that they are all in alignment. The bristles are then

hauled out of the channel and into the nip of a pair of endless haul-off belts 3, 5, of known construction.

The belts 3, 5 have a width less than the length of the bristles so that the ends of the bristles project

5 beyond the side edges of the belts as shown in Figure 2, and while still in the nip of the haul-off belts 3, 5, the array is passed through a split extrusion die 9 and a bead of synthetic resinous material 7, e.g. a thermoplastic bead, is extruded onto the two projecting ends of the bristles. Immediately prior to, or during the extrusion step, the ends of the bristles will fuse to adjacent bristle ends due to the heated die. What happens exactly will of course depend on the material of the bristles and the temperature of the extrusion die through which the edges of the array pass. The beads 7 are subsequently cooled, and the individual bristles become locked into a permanent fixed position in the array, and after passing out of the nip of the belts 3, 5, the bristle array with both edges held firm by the thermoplastic beads is passed through a slitting machine and the bristles are cut centrally down the length of the array as shown in Figure 4 to form two continuous lengths of brush component 13 (see Figures 4 and 5).

25 In the alternative form of the invention shown in Figures 6-9, an array of bristles is formed in the same manner as described with reference to the previous form of the invention and the array is hauled from the channel by means of two spaced pairs of haul-off belts 17, 19 (see Figure 10), so that just the two edges of the array, i.e. the ends of the bristles, are contacted by the belt nips. A wide bead of synthetic resinous material 21 is extruded centrally on one face of the array and on the opposite face a narrow bead 23 is extruded (see Figure 6), both the beads being of thermoplastic material. This extrusion operation fuses together the bristles. While the thermoplastic beads are still molten, the array of bristles is folded upon itself as shown in Figure 7 into a generally U-shaped form so that the wide bead is on the outside and the narrow bead on the inside, whereupon the folded array is passed through the nip of a pair of forming rollers 25, 27 so as to form the two beads into the shape shown in Figure 9. The beads are subsequently allowed to cool and harden. Effectively, the two beads fuse with the bristles and become a single bead 29 suitably shaped to locate the subsequent brush component 31 in a suitable channel. Of course, as in the previous construction, the bristles may be fused together in the vicinity of the beads, prior to or during the extrusion steps.

In the third form of the invention, the array of bristles is formed and hauled off from the feeder channel in the same manner as for the second form of the invention and equal volumes of synthetic resinous material 33 are extruded from the extrusion die shown in Figure 10 onto the top and bottom surfaces of the array of bristles along the centre line of the bristles, as shown in Figure 11, at a pressure and temperature sufficient to penetrate and fuse the bristles in the array. After the extrusion operation, the extrusions are allowed to cool, whereupon the bristle array is slit centrally down the centre of the extrusions 33 using a slitting knife 11. It will thus be appreciated that the extrusions 33 are shaped and

sized so that the resultant locking beads 35 are of sufficient height and the correct shape to locate the thus formed brush components in a re-entrant holding channel.

70 It will be appreciated that in all forms of the present invention, the shape of the extrusions can be chosen for locating the brush component in a suitable locking groove, for example, on a brush body with a handle or in a domestic appliance such as a vacuum cleaner, and that the required length of brush component can be obtained merely by cutting it off from the endless length of component.

If desired, the brush component can be strengthened and be caused to conform to various shapes by inserting a length of wire (coated or uncoated) or other coated or uncoated strengthening material, e.g. yarn, polymer rods, strips or the like which could be resiliently deformable, into the extrusions. Where the extrusions are down the side edges of the bristle arrays it would be a simple matter to insert a length of wire internally of the extrusion and in the second form of the invention the wire could be provided in the bead 21 or in the bead 23 or possibly in both beads. In the third form of the invention, it is envisaged that at least two wires would be required suitably located so that at least one wire was arranged in one of the brush components and at least one was arranged in the other brush component after the slitting operation.

95 While extrusion has been described as the method by which the bristle arrays are held together, it will be appreciated that since the bristles are formed of a synthetic resinous, e.g. thermoplastic or thermosetting material, they could be held together by fusing alone. In this instance a fusion head would replace the extrusion head, and instead of extruding strips along the length of the array of bristles, they would be fused together. It is preferred that the bristles are formed from polymer monofilament, although other forms of polymeric materials could be used.

CLAIMS

1. A method of manufacturing a brush component comprising feeding a plurality of predetermined lengths of brush bristle formed of synthetic resinous material from a supply into the nip of at least one pair of endless haul-off belts so that said bristles are arranged in an adjacent array substantially parallel to each other with their ends substantially in line, the array being of substantially uniform thickness and density, extruding synthetic resinous material onto both sides of said area along the length of the array of bristles so as to fuse the bristles together in the area of the extrusion, and slitting the bristles substantially along the centre of the array after they emerge from the nip of the endless haul-off belts to provide said brush component.

2. A method as claimed in claim 1 wherein a single pair of haul-off belts grip the array of bristles centrally so that the ends of the bristles project beyond the edges of the belts and wherein the synthetic resinous material is extruded along and around the two side edges of the array so as to fix



hauled out of the channel and into the nip of a pair of endless haul-off belts 3, 5, of known construction.

The belts 3, 5 have a width less than the length of the bristles so that the ends of the bristles project

- 5 beyond the side edges of the belts as shown in Figure 2, and while still in the nip of the haul-off belts 3, 5, the array is passed through a split extrusion die 9 and a bead of synthetic resinous material 7, e.g. a thermoplastic bead, is extruded onto the two projecting ends of the bristles. Immediately prior to, or during the extrusion step, the ends of the bristles will fuse to adjacent bristle ends due to the heated die. What happens exactly will of course depend on the material of the bristles and the temperature of the
- 15 extrusion die through which the edges of the array pass. The beads 7 are subsequently cooled, and the individual bristles become locked into a permanent fixed position in the array, and after passing out of the nip of the belts 3, 5, the bristle array with both
- 20 edges held firm by the thermoplastic beads is passed through a slitting machine and the bristles are cut centrally down the length of the array as shown in Figure 4 to form two continuous lengths of brush component 13 (see Figures 4 and 5).

- 25 In the alternative form of the invention shown in Figures 6-9, an array of bristles is formed in the same manner as described with reference to the previous form of the invention and the array is hauled from the channel by means of two spaced pairs of haul-off
- 30 belts 17, 19 (see Figure 10), so that just the two edges of the array, i.e. the ends of the bristles, are contacted by the belt nips. A wide bead of synthetic resinous material 21 is extruded centrally on one face of the array and on the opposite face a narrow
- 35 bead 23 is extruded (see Figure 6), both the beads being of thermoplastic material. This extrusion operation fuses together the bristles. While the thermoplastic beads are still molten, the array of bristles is folded upon itself as shown in Figure 7 into a
- 40 generally U-shaped form so that the wide bead is on the outside and the narrow bead on the inside, whereupon the folded array is passed through the nip of a pair of forming rollers 25, 27 so as to form the two beads into the shape shown in Figure 9. The
- 45 beads are subsequently allowed to cool and harden. Effectively, the two beads fuse with the bristles and become a single bead 29 suitably shaped to locate the subsequent brush component 31 in a suitable channel. Of course, as in the previous construction,
- 50 the bristles may be fused together in the vicinity of the beads, prior to or during the extrusion steps.

- In the third form of the invention, the array of bristles is formed and hauled off from the feeder channel in the same manner as for the second form
- 55 of the invention and equal volumes of synthetic resinous material 33 are extruded from the extrusion die shown in Figure 10 onto the top and bottom surfaces of the array of bristles along the centre line of the bristles, as shown in Figure 11, at a pressure
- 60 and temperature sufficient to penetrate and fuse the bristles in the array. After the extrusion operation, the extrusions are allowed to cool, whereupon the bristle array is slit centrally down the centre of the extrusions 33 using a slitting knife 11. It will thus be
- 65 appreciated that the extrusions 33 are shaped and

sized so that the resultant locking beads 35 are of sufficient height and the correct shape to locate the thus formed brush components in a re-entrant holding channel.

- 70 It will be appreciated that in all forms of the present invention, the shape of the extrusions can be chosen for locating the brush component in a suitable locking groove, for example, on a brush body with a handle or in a domestic appliance such as a vacuum cleaner, and that the required length of brush component can be obtained merely by cutting
- 75 if off from the endless length of component.

- If desired, the brush component can be strengthened and be caused to conform to various shapes by inserting a length of wire (coated or uncoated) or other coated or uncoated strengthening material, e.g. yarn, polymer rods, strips or the like which could be resiliently deformable, into the extrusions. Where the extrusions are down the side edges of the bristle
- 80 arrays it would be a simple matter to insert a length of wire internally of the extrusion and in the second form of the invention the wire could be provided in the bead 21 or in the bead 23 or possibly in both beads. In the third form of the invention, it is
- 85 envisaged that at least two wires would be required suitably located so that at least one wire was arranged in one of the brush components and at least one was arranged in the other brush component after the slitting operation.

- 95 While extrusion has been described as the method by which the bristle arrays are held together, it will be appreciated that since the bristles are formed of a synthetic resinous, e.g. thermoplastic or thermosetting material, they could be held together by fusing alone. In this instance a fusion head would replace the extrusion head, and instead of extruding strips along the length of the array of bristles, they would be fused together. It is preferred that the bristles are formed from polymer monofilament, although other
- 100 forms of polymeric materials could be used.

CLAIMS

1. A method of manufacturing a brush component comprising feeding a plurality of predetermined lengths of brush bristle formed of synthetic resinous material from a supply into the nip of at least one pair of endless haul-off belts so that said bristles are arranged in an adjacent array substantially parallel to each other with their ends substantially in line, the array being of substantially uniform thickness and density, extruding synthetic resinous material onto both sides of said area along the length of the array of bristles so as to fuse the bristles together in the area of the extrusion, and slitting the bristles substantially along the centre of the array after they emerge from the nip of the endless haul-off belts to provide said brush component.
2. A method as claimed in claim 1 wherein a single pair of haul-off belts grip the array of bristles centrally so that the ends of the bristles project beyond the edges of the belts and wherein the synthetic resinous material is extruded along and around the two side edges of the array so as to fix



the respective ends of the bristles to adjacent bristle ends, whereupon, on emergence from the nip, the bristles are slit centrally to form two continuous brush components.

- 5 3. A method according to claim 1 wherein the bristles are fed into the nip of two spaced pairs of haul-off belts which support the ends of the bristles, whereupon the synthetic resinous material is extruded onto the two faces of the bristle array along
10 its centre line between the pairs of haul-off belts at a pressure sufficient to penetrate and fuse the array of bristles, whereupon the synthetic resinous material is allowed to cool and the array is then slit centrally down the centre line of the synthetic resinous
15 material so as to provide two continuous brush components.

4. A method of manufacturing a brush component comprising feeding a plurality of predetermined lengths of synthetic resinous brush bristle
20 from a supply into the nip of at least one pair of endless haul-off belts so that said bristles are arranged in an adjacent array substantially parallel to each other with their ends substantially in line, the array being of substantially uniform thickness and
25 density, extruding synthetic resinous material on both surfaces centrally of the array along its length so as to fuse together the bristles in the area of the extrusion, and subsequently folding the bristles substantially along the centre of the array after they
30 emerge from the nip of the endless haul-off belts to provide said brush component.

5. A method according to claim 4 wherein the synthetic resinous material is extruded in two beads of different widths along the centre line of the array
35 of bristles, one bead being located on one side of the array and the other on the opposite side, and while the synthetic resinous beads are still molten, the array of bristles is folded upon itself along the line of the beads with the wider bead outermost, the folded
40 bristle array and beads being passed through a forming roller, whereupon the molten material is cooled.

6. A method as claimed in any one of the preceding claims wherein the ends of the bristles are
45 tamped to give a uniform width and to align them prior to passing them from a feeder into the nip of the haul-off belts.

7. A method according to any one of the preceding claims wherein a strengthening material is
50 incorporated in the extruded resinous material so that strengthening material is incorporated in each brush component.

8. A method according to claim 7 wherein the strengthening material is wire.

- 55 9. A method according to claim 8 wherein the wire is coated with a synthetic resinous polymeric material prior to its incorporation in the or each extruded layer.

10. A method of manufacturing a brush component comprising feeding a plurality of predetermined lengths of synthetic resinous brush bristle from a supply into the nip of at least one pair of endless haul-off belts so that said bristles are arranged in an adjacent array substantially parallel
65 to each other with their ends substantially in line, the

array being of substantially uniform thickness and density, heating the array of bristles along its length so as to fuse together the bristles so as to hold them together and folding or slitting the bristles substantially along the centre of the array after they emerge from the heating step, and allowing the fused bristles to cool so as to provide said brush component.

- 75 11. A method as claimed in claim 10 wherein the array is heated along its two side edges so as to hold the respective ends of the bristles to adjacent bristle ends, whereupon, on emergence from the nip, the bristles are slit centrally to form two continuous brush components.

- 80 12. A method according to claim 10 wherein the bristles are fed into the nip of two spaced pairs of haul-off belts which respectively support the array of bristles along the two edges of the array, whereupon the array is heated along its centre line, and while
85 the synthetic resinous bristles are still molten, the array is folded upon itself along the line of heating, the folded bristle array then being passed through a forming roller, whereupon the molten bristles are cooled.

- 90 13. A method according to claim 10 wherein the bristles are fed into the nip of two spaced pairs of haul-off belts which support the ends of the bristles, whereupon the array is heated centrally along its length so as to cause the bristles to fuse together,
95 whereupon the synthetic resinous bristles are allowed to cool and the array is then slit centrally down the centre line of the synthetic resinous materials so as to provide two continuous brush components.

- 100 14. A method of manufacturing brush components substantially as hereinbefore described with reference to the accompanying drawings.

15. A brush component when made by the method of any one of claims 1-14.

- 105 16. Apparatus for carrying out the method of brush manufacture claimed in any one of claims 1-14.

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