June 12, 1934. F. J. BICKEL 1,963,045

APPARATUS AND METHOD FOR MAKING BRUSHES

Original Filed Sept. 18, 1930 2 Sheets-Sheet 1

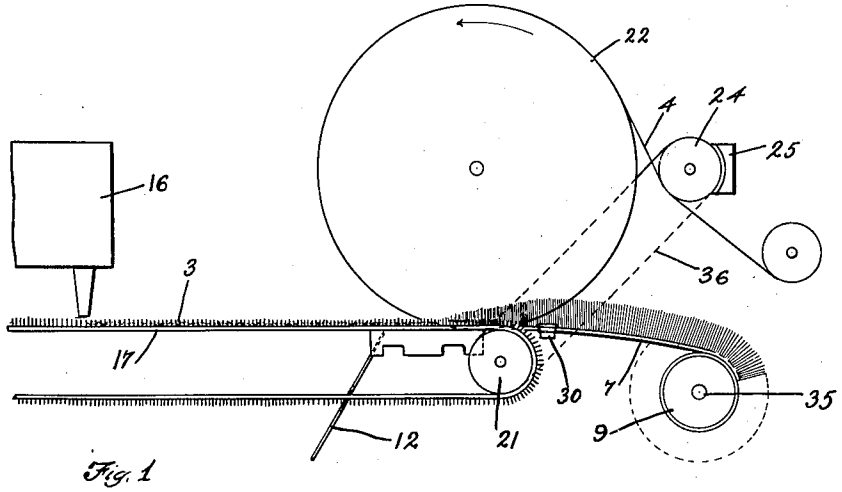


Fig. 1

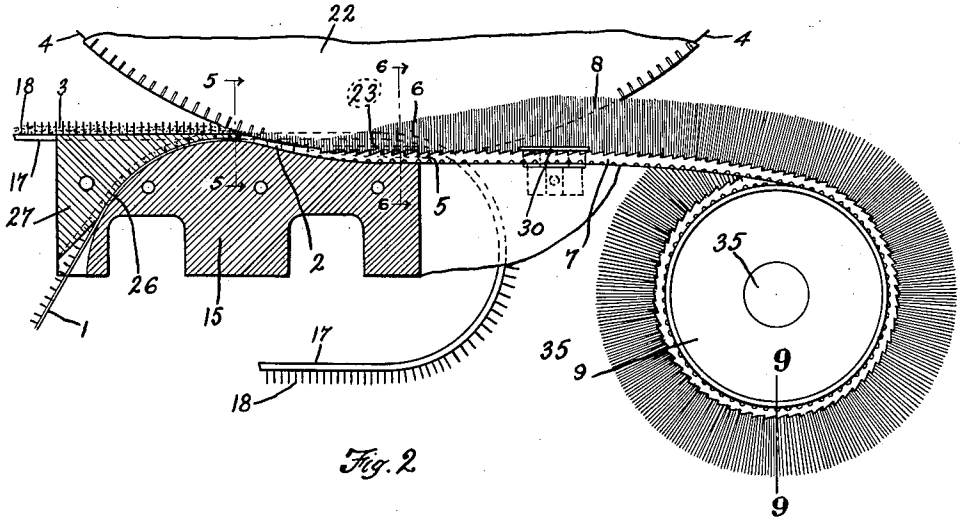


Fig. 2

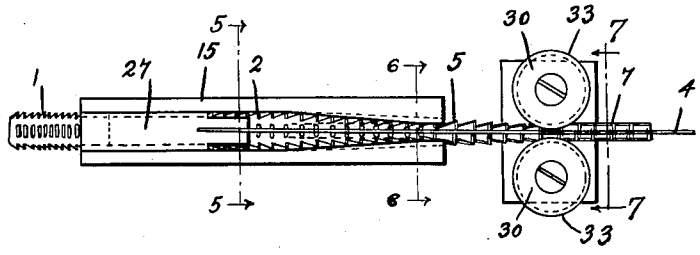


Fig. 3

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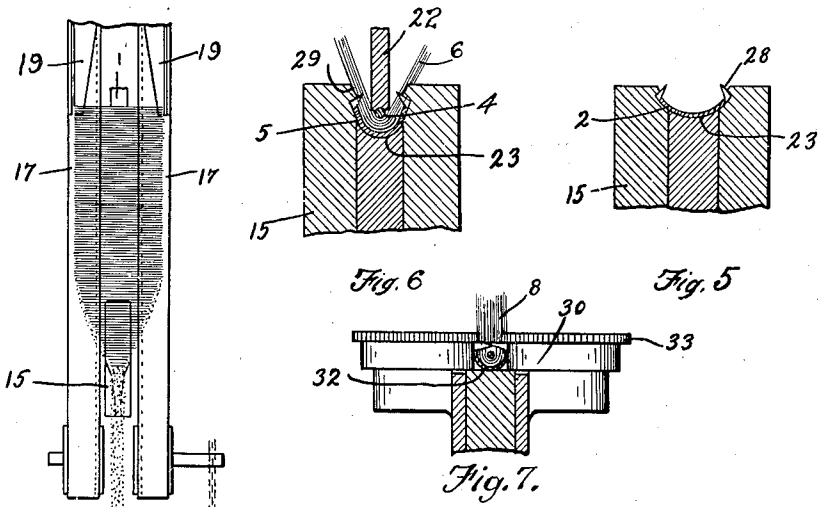


Fig. 6 Fig. 5

Fig. 7.

Fig. 4

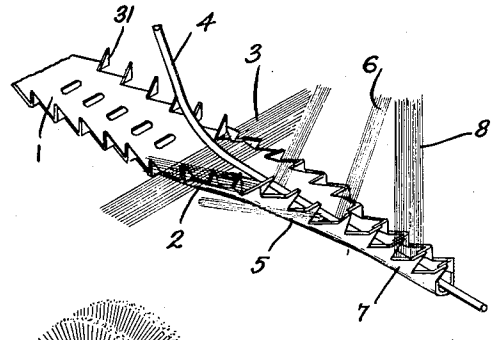


Fig. 8

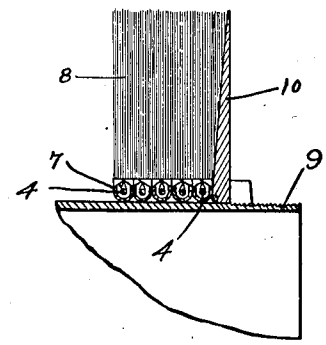


Fig. 9

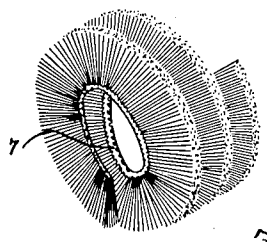


Fig. 10

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APPARATUS AND METHOD FOR MAKING BRUSHES

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Original application September 18, 1930, Serial No. 482,790. Divided and this application May 14, 1932, Serial No. 611,388

24 Claims. (Cl. 300—2)

The invention relates to a method of and apparatus for forming brushes, particularly of the rotary type in which a continuous strip of bristles held in a suitable back is produced as an article of manufacture and ordinarily wound into cylindrical forms. The method and apparatus are particularly adapted for the formation of such completed cylindrical brushes, although the brush strip may be separately produced by suitable changes in the winding step.

This application, as regards its method claims, is a division of my co-pending application Serial No. 482,790, filed September 18, 1930. As regards its apparatus claims it is a continuation in part of said application Serial No. 482,790.

The invention aims to produce a brush strip or a brush of the character described, in which the backing material for the bristles is stiff enough to be self-sustaining under conditions of handling and of assembly into completed brushes of appropriate forms, although sufficiently flexible to be readily wound upon a mandrel or otherwise arranged upon a suitable support. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

The accompanying drawings illustrate in somewhat diagrammatic style both the steps of the method and an apparatus suitable for carrying out the method.

Fig. 1 is a diagrammatic side elevation of the apparatus in general; Fig. 2 is an enlarged detail from Fig. 1, slightly modified and partly in section; Fig. 3 is a plan view of a part of Fig. 2, omitting certain elements; Fig. 4 is substantially a plan view of Fig. 1 together with a plan view of other details; Figs. 5 and 6 are cross sections on the lines 5—5 and 6—6 respectively of Fig. 2, looking in the direction of the arrows; Fig. 7 is an elevation of certain details in Fig. 3, the view being taken on the line 7—7 of Fig. 3 looking in the direction of the arrows; Fig. 8 is a perspective view, illustrating in a diagrammatic manner the successive steps of the method; Fig. 9 is a detail of a completed brush, being the section approximately on the line 9—9 of Fig. 2; and Fig. 10 shows a piece of the completed brush strip, not made into a brush.

The method, briefly, consists in forming a brush strip by disposing bristles across a backing strip, preferably of metal, holding the bristles down on this backing strip by a longitudinal wire, and bending or folding the edges of the strip toward one another about the wire, thus bringing the bristles up into a position with their centers held between the wire and the now channeled strip, with their ends parallel. The brush strip may then be formed into a tight helix on a mandrel, as shown in Fig. 9, or left in a looser arrangement, as in Fig. 10. These stages are approximately shown in Fig. 8, where a backing strip of material which can be flexed but is stiff enough to retain the position into which it is bent, preferably a sheet metal strip, is indicated at 1. At 2 the strip is being bent up at the edges, bristles such as 3 are being placed thereon and a wire such as 4 is being brought to bear on top of the bristles. At 5 the strip 1 is being folded further, bringing the ends of the bristles parallel as at 6. At 7 the folding has been completed, bringing the bristles closer as shown at 8. In Fig. 9 the completed brush strip 7 is shown as wound in successive tight turns upon a mandrel 9. In this particular winding, as a matter of convenience, an extending end of the wire 4 has been fastened to the mandrel in advance of the brush strip 7. An end collar 10 is here shown as holding the end of the brush, and this may be fastened to the mandrel by any suitable means.

The process will now be described in greater detail in connection with a suitable form of apparatus as illustrated in Figs. 1 to 7 inclusive. In Fig. 1 the backing strip, either in the flat form indicated at 1 in Fig. 8 or in the shallow channel form indicate at 2 in Fig. 8, is generally indicated by the reference character 12. This strip is brought up over a forming shoe 15, a preferred embodiment of which is shown in greater detail in Fig. 2, and passes partly through and partly over the shoe 15. In the preferred practice of the process the backing strip is brought up in the flat form 1, Fig. 2, and bent by the shoe into the gradually deepening channel forms 2 and 5, as shown by Figs. 5 and 6. At about the point where the shoe begins its bending action, a layer of bristles 3 is placed across the backing strip, being supplied from a hopper 16 by a split conveyor 17. This conveyor may be of any suitable nature, the one shown being two parallel separated belts running on either side of the shoe 15, the belts having spikes 18 and running between fingers 19. The spikes 18 act to distribute the

bristles evenly and the fingers 19 act to align the bristle ends. Each of the belts 17 passes over and is moved by a wheel 21, conveniently placed. A large wheel or disc 22, having a thin edge, is mounted above the shoe 15, and in the plane of the shoe. This wheel cooperates with a groove 23 in the shoe and assists in folding the backing strip 12.

In detail the form of shoe shown in Fig. 2 and designated as 15 includes a curved track 26 up which the strip in the form 1 is brought. This trackway is preferably in the form of a hole or passage through the plate, being covered by a block 27 which prevents the strip 1 from rising. Where the strip is supplied in the flat form 1, the trackway 26 begins to change from flat to channel form about at the line 5—5, Fig. 2, this form being shown in Fig. 5. This is approximately the point where the block 27 discontinues and the track 26 comes up to the surface. From this point on a successively deepening channel, generally indicated by the reference character 23, is formed in the top edge of the plate 15, as shown by a comparison of Figs. 5 and 6. The backing strip is held down in the channel partly by the action of the wheel 22 and partly by flanges such as 28 and 29. From slightly to the right of the line 5—5, Fig. 2, to the end of the block 15, the channel is approximately concentric with the rim of the wheel 22.

The wheel 22 is also grooved on its periphery, as best seen in Fig. 6. The wire 4 is carried around in this groove and placed within the strip at about the point indicated by the reference character 2 in Figs. 2 and 8. In order to maintain this wire 4 under proper tension it is passed from a reel (not shown) around a tension drum 24 which is regulated by a brake 25 and is carried around about three-fourths of the circumference of the wheel 22. After the strip, formed to the shape indicated by the reference character 5, Fig. 8, leaves the shoe 15 it passes between rollers 30 which bring up the sides of the strip 1 parallel, keeping the channel formation. In case the process is used with a backing strip 12 having edged teeth such as 31, the final folding by the rollers 30 closes these teeth over the top of the channel, as best seen in Fig. 7 and in the portion 7 of Fig. 8. This feature is not essential with the present invention, although the present invention is adapted to form a brush strip having such teeth. Such a strip is described in detail in my co-pending application Serial No. 482,790, to which reference has already been made. The brush strip rides between the rollers 30 on a bottom roll 32 and is held down thereon by flanges 33, which flanges are sufficiently spaced to allow the bristles, now in the condition shown at 8, Fig. 8, to pass between them.

The completed strip 7 is wound on a mandrel 9, which is carried by a shaft 35 which moves axially thereon as the successive turns of the brush strip are added.

In order to synchronize the entire apparatus it is preferable that all the driving power be applied to the shaft 35, which accordingly pulls the wire 4 and the backing strip 7, thus turning the wheel 22. In the apparatus shown the bristle conveyor wheels 21 are driven by a chain 36 from the tension drum 24.

In order to wind the completed brush strip 7 in close axial contact on the mandrel, as shown in Fig. 9, the strip is wound on past a stationary side plate 37. The successive turns of the brush strip move the mandrel axially, to the right in Fig. 4, against pressure, which may be applied by any preferred means, the means shown being a cable 38 fastened to the end of the shaft 35, whereby a weight (not shown) is raised as the mandrel 9 and shaft 35 move to the right. Suitable driving means for the shaft are provided, such as the wheel 39 to which power may be applied.

It is contemplated that the process will be chiefly employed for the direct manufacture of circular brushes, as shown in Fig. 9 of the drawings, but the completed brush strip is also capable of being used separately and may be an article of commerce in the form shown in Fig. 10, such strip being intended for winding on a mandrel at any time subsequent to the manufacture of the strip or for arrangement upon other suitable backing as circumstances may require.

The backing strip, generally indicated at 12 in Fig. 2, may be either of the form disclosed in detail in my co-pending application Serial No. 482,790 or may be any other suitable form, such as a plain strip, or one having inturned edge flanges or any others of a variety of possibilities.

Similarly the exact shape of the channels is subject to variation, those shown in the various figures of the drawing being representative rather than limiting for illustrating simply the channel forms which have been found most suitable for the type of backing strip illustrated. Similarly the strand 4, although preferably a wire, may be made of other material, according to circumstances. The invention does not exclude the use of glue in securing the bristles, although in the commercial application of this process glue has not been found necessary inasmuch as the clamping effect of the backing strip upon the bristles against the wire has furnished sufficient holding power.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A method of brush making which comprises forming a brush strip by placing tufts of bristles between continuous holding elements, and folding one of said elements about the other and about the bristles simultaneously with placing said bristles.

2. A method of making a brush strip which comprises disposing bristles transversely with relation to one side of a strip of self-sustaining flexible material, placing an elongated holding element upon said bristles and along said strip coincidentally with folding said strip of material longitudinally along and over said holding element.

3. A method of making a brush strip which comprises placing a layer of bristles transversely along one side of a strip of self-sustaining flexible material, said strip having a toothed edge, placing an elongated holding element upon said bristles and along said strip, and folding said strip of material longitudinally along and over said holding element, with the edge teeth having flat faces transversely disposed, dividing said bristles into tufts and supporting said tufts against displacement longitudinally of the strip.

4. A method of making a brush strip which comprises placing bristles across a moving strip of metal or the like, placing a wire or the like

upon said bristles and lengthwise of said strip, and folding said metal strip lengthwise to compress said bristles against said wire, and winding said brush strip into a helix, with bristles radially disposed to the axis of winding, said winding pulling said strip through its forming steps.

5. A method of making a brush strip which comprises forming a plurality of teeth having flat faces transversely disposed upon an edge of a strip of metal or the like, placing bristles across the toothed face of said metal strip, placing a wire or the like upon said bristles and lengthwise of said strip, and folding said metal strip lengthwise to surround said wire.

6. A method of manufacturing brushes which comprises fastening bristles side by side continuously upon a continuous self-sustaining flexible backing strip while winding another portion of said strip in an axially pressed spiral.

7. Apparatus for making brushes comprising a wheel, means for supplying a layer of bristles transversely to the circumference of said wheel, means for supplying a strip of self-sustaining flexible material to the circumference of said wheel outside of said bristles, means for supplying a continuous strand to the circumference of said wheel between said circumference and said bristles, and stationary means cooperating with the circumference of said wheel for bending the edges of said strip about said strand.

8. Apparatus for making brushes comprising a wheel, means for supplying a layer of bristles transversely to the circumference of said wheel, means for supplying a strip of self-sustaining flexible material to the circumference of said wheel outside of said bristles, means for supplying a continuous strand to the circumference of said wheel between said circumference and said bristles, and means cooperating with the circumference of said wheel for bending the edges of said strip about said strand, and means for winding said strip, as formed, under axial pressure into a helix.

9. Apparatus for making brushes comprising a wheel, means for supplying a layer of bristles to the circumference of said wheel transversely, means for supplying a strip of self-sustaining flexible material to the circumference of said wheel outside of said bristles, means for supplying a continuous strand to the circumference of said wheel between said circumference and said bristles, means cooperating with the circumference of said wheel for bending the edges of said strip about said strand thereby looping said bristles about the strand, other means for further clamping the edges of said strip about said strand, and means for pulling said strip with bristles and strand through all said previously-named means by winding said strip.

10. Apparatus for making brushes comprising a wheel, a conveyor for supplying a layer of bristles tangentially to the circumference of said wheel with the bristles transversely placed, a guide tangential to said wheel at the point of application of the bristle layer for supplying a strip of self-sustaining flexible material beneath said bristles, tension means for supplying a continuous strand to the circumference of said wheel and for applying said strand to the bristles upon said strip at the point of application of the bristle layer, elements in said guide for bending said strip into channel formation and bending the bristles therewith about said strand, rollers beyond said bending means for crimping said bent strip about said wire, pulling means for moving the elements of said strip into and said formed strip away from said wheel, said pulling means including a mandrel for winding said strip, and means for pressing said strip axially during winding.

11. Apparatus for making continuous brush strips comprising a rotating wheel, means for supplying bristles in a continuous layer transversely to the edge of said wheel, means on the edge of said wheel for engaging said bristles, a shoe adjacent the edge of said wheel and partly overlapping both sides of said edge by a groove, means for supplying a continuous flat strip to said shoe beneath said bristles, means for supplying a strand to the edge of said wheel above said bristles, the edge of said wheel being adapted to press said wire along the middle of said bristles against said strip as a backing, said groove having sides which rise and tend to close in the direction of travel of the edge of said wheel, thereby forming said strip during its advance into channel formation.

12. Apparatus for making continuous brush strips comprising a rotating wheel, means for supplying bristles in a continuous layer transversely to the edge of said wheel, means on the edge of said wheel for engaging said bristles, a shoe adjacent the edge of said wheel and partly overlapping both sides of said edge by a groove, means for supplying a continuous flat strip to said shoe beneath said bristles, means for supplying a strand to the edge of said wheel above said bristles, the edge of said wheel being adapted to press said wire along the middle of said bristles against said strip as a backing, said groove having sides which rise and tend to close in the direction of travel of the edge of said wheel, thereby forming said strip during its advance into the channel formation, and compressing rollers operable on opposite sides of said brush strip beyond said wheel.

13. Apparatus for making continuous brush strips comprising a rotating wheel, means for supplying bristles in a continuous layer transversely to the edge of said wheel, means on the edge of said wheel for engaging said bristles, a shoe adjacent the edge of said wheel and partly overlapping both sides of said edge by a groove, means for supplying a continuous flat strip to said shoe beneath said bristles, means for supplying a strand to the edge of said wheel above said bristles, the edge of said wheel being adapted to press said wire along the middle of said bristles against said strip as a backing, said groove having sides which rise and tend to close in the direction of travel of the edge of said wheel, thereby forming said strip during its advance into the channel formation, compressing rollers operable on opposite sides of said brush strip beyond said wheel and winding means taking said strip from said wheel.

14. Apparatus for making continuous brush strips comprising a rotating wheel, means for supplying bristles in a continuous layer transversely to the edge of said wheel, means on the edge of said wheel for engaging said bristles, a shoe adjacent the edge of said wheel and partly overlapping both sides of said edge by a groove, means for supplying a continuous flat strip to said shoe beneath said bristles, means for supplying a strand to the edge of said wheel above said bristles, the edge of said wheel being adapted to press said wire along the middle of said bristles against said strip as a backing, said groove having sides which rise and tend to close in the direction

of travel of the edge of said wheel, thereby forming said strip during its advance into the channel formation, compressing rollers operable on opposite sides of said brush strip beyond said wheel and winding means taking said strip from said wheel, said means including a mandrel, means for rotating said mandrel, and means for applying pressure axially of said mandrel to said strip during the winding operation.

15. Apparatus for making cylindrical brushes having U-shaped bristle holding means of helical form, comprising in combination with a conveyor for the bristles, means for rotating and moving transversely of the conveyor said holding means disposed in spaced relationship with said conveyor, means disposed parallel to the travel of said conveyor for guiding said holding means into position adjacent said conveyor, means for folding said bristles and for inserting a wire between the folds thereof while said holding means and said bristles are on said guiding means, and means for pressing the sides of the holding means towards one another after the bristles and wire have been fed thereto.

16. Brush making apparatus comprising a wheel, a shoe overlapping a portion of the circumference of said wheel, parallel conveyor means on each side of said shoe and of said wheel, said shoe including means for guiding a strip of self-sustaining flexible material through a position tangent to said wheel and for closing said strip from flat to U-shaped cross section.

17. Brush making apparatus comprising a wheel, a shoe approximately tangential thereto, parallel conveyor belts for bristles on either side of said shoe, guiding means on said shoe for bringing a flat strip of flexible self sustaining material to the surface of said wheel and for bending said strip longitudinally, and means on said wheel for transferring said bristles from said conveyor belts to said support, folding them within said support, and applying a wire to the surface of said bristles opposite to said support.

18. Brush making apparatus comprising a wheel, a shoe approximately tangential thereto, parallel conveyor belts for bristles on either side of said shoe, guiding means on said shoe for bringing a flat strip of flexible self sustaining material to the surface of said wheel and for bending said strip longitudinally, and means on said wheel for transferring said bristles from said conveyor belts to said support, folding them within said support, and applying a wire to the surface of said bristles opposite to said support, and an arbor for winding said formed strip with bristles therein and thereby pulling said strip through said guiding means.

19. Apparatus for making brushes comprising a wheel, means for supplying a layer of bristles transversely to the circumference of said wheel, means for supplying a strip of self-sustaining flexible material to the circumference of said wheel outside of said bristles, means for supplying a continuous strand to the circumference of said wheel between said circumference and said bristles, and means cooperating with the circumference of said wheel for bending the edges of said strip about said strand, and means for winding said strip, as formed, into a helix.

20. Apparatus for making brushes comprising means for feeding a continuous layer of bristles, means for supplying a continuous flat strip to one side of said layer of bristles, means for simultaneously and continuously folding said strip and said layer of bristles and means for permanently securing the folded layer of bristles in folded condition.

21. Apparatus for making brushes comprising means for feeding a continuous layer of bristles, means for supplying a continuous strip to one side of said layer of bristles, means for simultaneously and continuously folding said strip and said layer of bristles, means for permanently securing the folded layer of bristles in folded condition, and means for forming said folded layer into a helix with the bristles outward.

22. A method of making brushes which comprises continuously forming a bristle strip in a U-shaped self-sustaining support and winding said strip on a mandrel, and thereafter removing said strip in helical form and placing said strip in one or more helical convolutions on another mandrel.

23. A method of manufacturing brushes which comprises fastening bristles side-by-side continuously upon a continuous self-sustaining flexible backing channel while winding another portion of said strip into a helix.

24. A method of making brushes which comprises continuously forming a bristle strip in a U-shaped self-sustaining support concurrently with winding such strip into a helix.

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