Nov. 17, 1936. A. A. ANGELL 2,061,129

BRUSH AND METHOD OF MAKING SAME

Filed Feb. 12, 1934 2 Sheets-Sheet 1

Fig. 1.

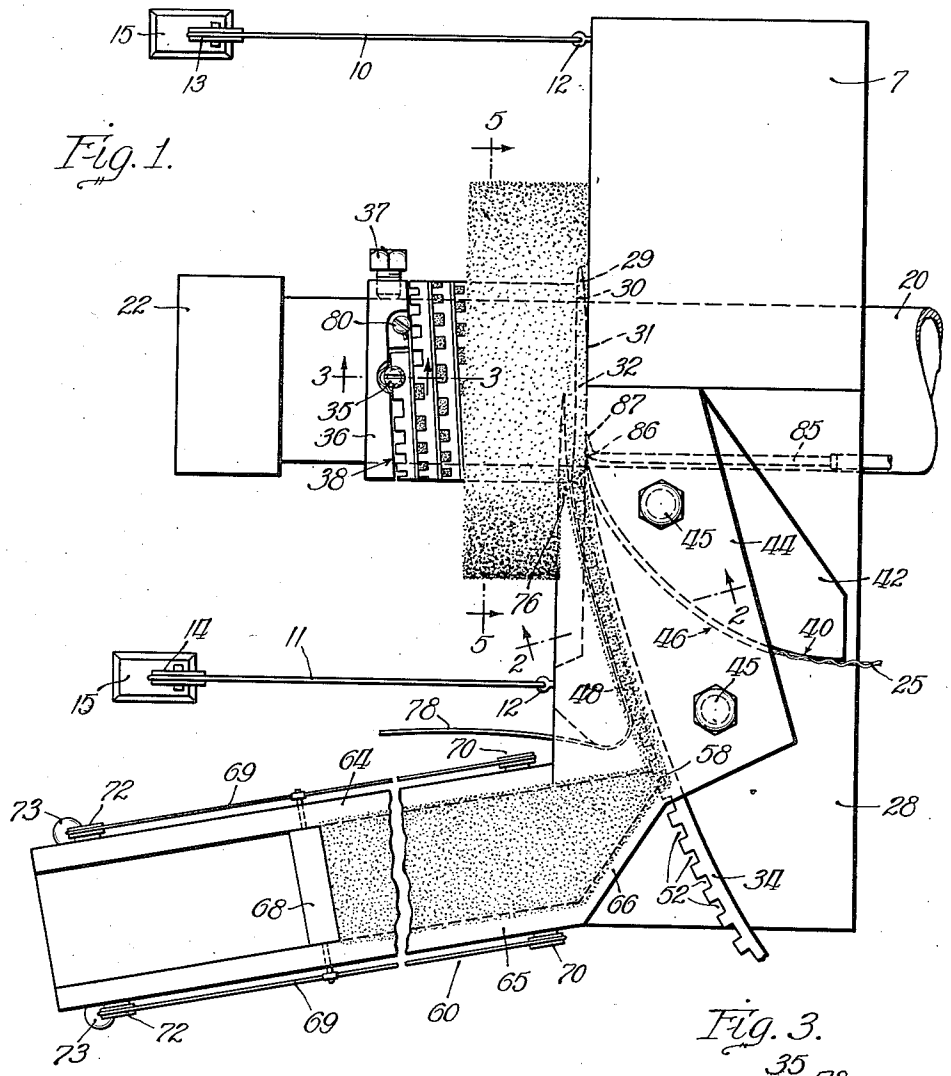


Fig. 3.

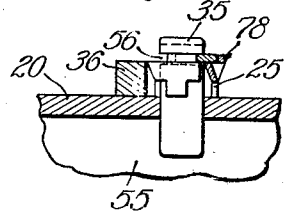
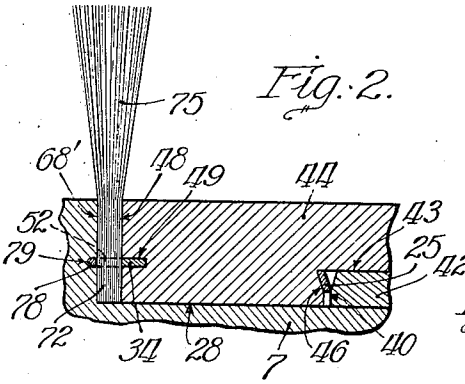


Fig. 2.



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Fig. 4.

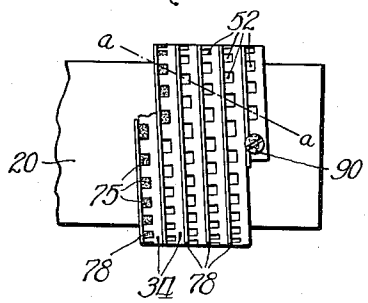


Fig. 5.

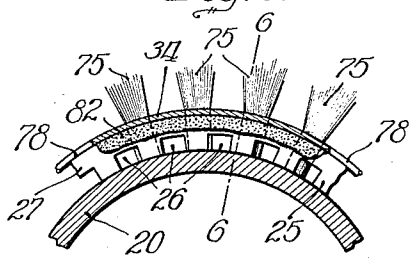


Fig. 6.

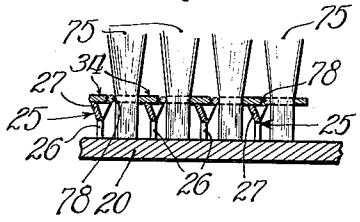


Fig. 8.

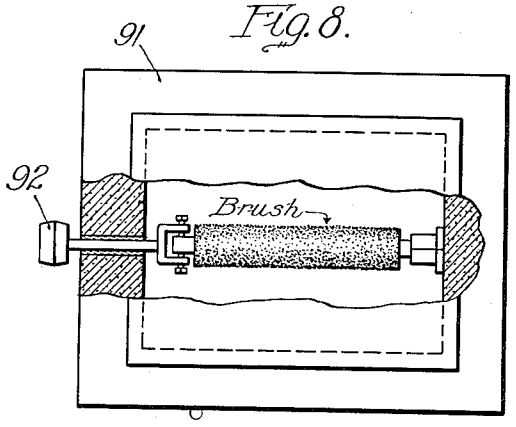


Fig. 7.

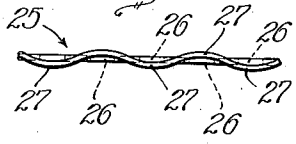


Fig. 11.

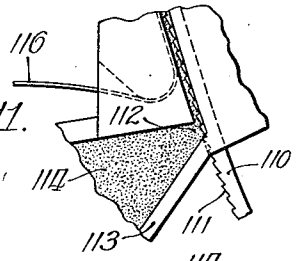


Fig. 9.

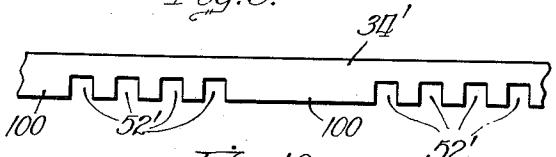


Fig. 10.

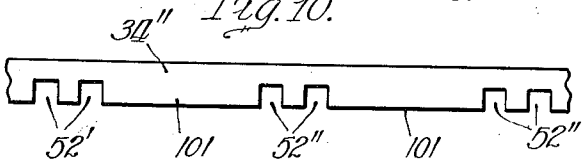
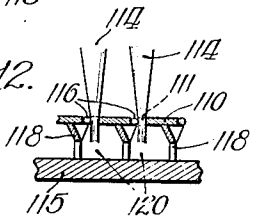


Fig. 12.



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Patented Nov. 17, 1936

2,061,129

UNITED STATES PATENT OFFICE

2,061,129

BRUSH AND METHOD OF MAKING SAME

Arnold A. Angell, Oak Park, Ill.

Application February 12, 1934, Serial No. 710,841

21 Claims. (Cl. 300—21)

My invention relates to an improved brush and method of making the same.

The invention relates particularly to cylindrical brushes of the type disclosed in my copending application, Serial No. 336,484, filed January 31, 1929, which has matured into Patent No. 1,950,379, patented March 13, 1934, and is illustrated and described in connection with such a brush, but it is to be understood that variations and different embodiments are contemplated within the spirit and scope of the appended claims.

The brush disclosed in the above identified application comprises a base or core and an inner coil wound helically around this core. A bristle tufting strand is wound helically about the coil, preferably with the winding of the coil, and this strand has laterally opening notches into which the bristles are introduced, preferably in the delivery of the strand to the core. These notches form separate tufts of bristles along the strand in its movement to the core, which tufts are positioned helically about the core with the winding of the strand.

The base ends of the tufts of bristles not only fit in the notches in the tufting strand, but preferably extend inwardly between the convolutions of the inner coil, and a permanent binder for the bristle tufts is introduced preferably in plastic or fluid condition and hardened around the base ends of the bristles within the helical space defined between the convolutions of the inner coil and between the tufting strand and the base or core of the brush. The binder, preferably, is introduced as the coil and tufting strand, with the bristles tufted in the notches thereof, are wound upon the base or core.

I have found a rubber cement admirably suited for anchorage of the bristles. It provides not only mechanical anchorage, but vulcanizes itself to the surfaces of the bristles and provides better cohesion. And its strength is not impaired by alkaline solutions and the like commonly employed for cleaning brushes of this sort.

The use of a rubber cement binder, however, involves excessive shrinkage and the liberation of volatile gases during vulcanizing, and the present invention is concerned principally with providing for this excessive shrinkage and also for the escape of these volatile gases liberated during vulcanization. The provisions which I make to this end, while particularly suitable where a rubber cement binder is employed, may be used with other binders as suitable or desired, particularly with any other binder involving the liberation of volatile gases and excessive shrinkage, and the appended claims are to be construed accordingly. The particular binder and the manner of its association with the other elements of the brush herein disclosed are also important aspects of the present invention.

In addition to the broad feature of a rotary brush with the bristles anchored by means of a rubber cement and the broad provisions for the escape of the volatile gases liberated during vulcanization in a brush in which such gases would otherwise be confined against liberation, with possible loosening of the bristles and discharge of binder out along the bristles, one of the more specific features of my present invention resides in the manner of applying the binder material and positioning the same away from the core to form a space for the escape of the volatile gases.

Another feature of the present invention resides in the use of an auxiliary strand, preferably of small round section, fed into position along the notched edge of the outer strand and delivered to the core with this strand. This auxiliary strand closes the open sides of the notches in the outer strand after these notches are supplied with bristles, and keeps the bristles in place while the notched strand is travelling to the core and entering upon it. It also serves the very important purpose of cutting off any bristles that are not in the notches but have gotten between the strand of small section and the edge of the notched strand.

Another feature resides in the construction of the inner strand of flat form with one edge notched to provide openings adjacent the core for freedom of passage of the volatile gases driven off from the rubber cement in vulcanizing. And with the other edge crimped to provide, with a thin inner strand, sufficient width along the outer periphery of the strand to support the small auxiliary outer strand and the main notched outer strand which rest upon the inner strand.

Further features and advantages of the present invention will be apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a fragmentary and more or less diagrammatic top plan view of a machine for making brushes embodying the present invention;

Figure 2 is a fragmentary detail section taken on the line **2—2** of Figure 1;

Figure 3 is a fragmentary detail section taken on the line **3—3** of Figure 1;

Figure 4 is a fragmentary elevational view of the right-hand end of the finished brush before

removing the extra turns of the helically wound coils which constitute a temporary end structure for the right-hand end of the brush;

Figure 5 is a fragmentary transverse section through the brush structure taken on the line 5—5 of Figure 1;

Figure 6 is a fragmentary detail section taken on the line 6—6 of Figure 5;

Figure 7 is a fragmentary top plan view of the strand forming the inner coil of the brush;

Figure 8 shows more or less diagrammatically the step of rotating the brush in a heated chamber to force centrifugally the binder out away from the core;

Figures 9 and 10 are fragmentary views of modified forms of tufting strips;

Figure 11 is a fragmentary plan view of a modification in which the bristles are introduced in the form of a continuous fringe; and

Figure 12 is a fragmentary detail section similar to Figure 6 through a brush formed by the means shown in Figure 11.

Referring to the drawings, the bed of the machine (not shown) may be similar to the bed illustrated and described in my copending application Serial No. 336,484, filed January 31, 1929, and in my prior Patent No. 1,721,062 patented July 16, 1929. It has parallel tracks, and, supported upon the bed, for sliding movement longitudinally thereof is a block or carriage 7 having ways in which the tracks engage and guide the block 7 in its sliding movement on the bed.

The block 7 is urged to the left in Figure 1, as by means of a pair of cables or other flexible elements 10 and 11, anchored or attached to the block 7 at 12. These cables 10 and 11 pass over pulleys or sheaves 13 and 14, respectively, and have at their opposite ends weights 15, which tension the cables 10 and 11 and tend to pull the block 7 to the left as viewed in Figure 1. This constant pull on the block 7 subjects the brush, which is wound ahead of the block 7, to continuous pressure in the direction of its axis during formation. The foregoing details, which are more fully disclosed in my prior Patent No. 1,721,062, patented July 16, 1929, may be varied widely within the scope of the present invention.

In the illustrated embodiment of the invention, the core of the brush comprises a suitable metallic tube 20. The tube 20 passes through, and is supported by, the block 7, and is free to rotate therein, the block 7 and parts carried thereby sliding longitudinally along the tube 20 toward the right (Figure 1) as the brush is formed upon the tube. In addition to forming a support for the other parts, the block 7 thereby forms a support and guide for the free end of the core forming tube 20.

For the purpose of rotating the tube 20, suitable turning or rotating means is indicated at 22. This means may comprise a chuck provided with jaws in which the adjacent end of the tube 20 is clamped, and the tube or rotating means 22 may be connected with or be a part of a suitable driving spindle. Suitable means for this purpose is shown in my prior patent, above identified, and, in that this means forms no part of the present invention, further disclosure thereof will be omitted here. Suffice it to say that the chuck or driving part 22 may be driven or rotated by a belt or any other suitable form of drive.

The strand 25, which forms the inner helical coil of the preferred form of the brush, preferably is in the form of a flat, hard, drawn copper wire or other hard material which, preferably, is non-corrosive, although it need not be non-corrosive, particularly in oiling brushes and elsewhere where the non-corrosive character is not necessary. One edge of this strand 25 has notches 26 punched therein, and the other edge is crimped to sinuous form, as indicated at 27 to provide ample width for supporting the strands 34 and 78, as will hereinafter appear.

From a spool or other suitable source of supply, the strand 25 passes over the upper surface 28 of the block or table 7, and is guided helically onto the brush core 20 by a generally helical surface 29 at the forward end of the block 7. The guide surface 29 constitutes the outer face of a hub-like portion 30 formed integral with the block 7, and the helical surface 29 starts, for example, at the position 31 (Figure 1) and extends helically about the tube or brush core receiving bore of the block 7 terminating at the position 32. Between the positions 31 and 32 the slope or pitch of the helical surface 29 preferably corresponds with the pitch of the coil which is formed by the tufting strand 34, plus the strand 78, and preferably has a uniform helical advancement, although the pitch may be increased slightly at the point of entrance of the strand 25 with the tufting strand 34 and bristles to form a throat for the easy admission of the bristles and other elements onto the core 20.

The free end of the strand 25 may be anchored or secured to the tubular core 20, as by means of a pin or post 35 secured to the core 20 adjacent the inner or first turns of the strands 25 and 34. The collar 36 may be fixed upon the core 20 by means of a set screw 37, and has a helical end surface 38 corresponding with the pitch of the windings of the brush and cooperating endwise with the first convolution of the brush.

As the first convolution of the brush is wound or laid upon the core 20 it, preferably, is pressed endwise against the surface 38 by the pull on the cables or flexible elements 10 and 11 which urges the block 7 to the left (Figure 1). In this manner, the first turn, as well as the succeeding turns, may be subjected to continuous pressure in the direction of the axis of the brush during formation, but this may be varied so far as the present invention is concerned.

The strand 25 is guided over the block 7, around the curved or rounded edge 40 of a plate 42 which is mounted upon the block 7 and fits between the upper surface 28 thereof and the upwardly offset and downwardly facing surface 43 of a block 44 which is clamped or secured upon the block 7, as by means of bolts 45, one of which is shown as passing through the underlying plate 42. Following and conforming in curvature with the edge 40 of the plate 42, the block 44 has a curved edge 46, between which and the edge 40 the strand 25 is confined in its passage over the block 7 to the core 20.

The edge of the block 44 to the left, as viewed in Figure 1, is curved at 48, and this curved edge 48 is provided with a correspondingly curved groove 49 through which the strand 34 passes and is guided to the core 20. The strand 34, preferably, is in the form of a flat metallic strip of suitable resiliency and strength, and this strip constitutes the tuft forming strip for the brush. A copper strip has been used with good results for this purpose, and copper, as well as galvanized coil forming strands 25, have also been used with good results.

The strip 34 has notches 52 which, in the embodiment illustrated in Figures 1 to 7, inclusive, are spaced uniformly and open laterally from the edge of the strip 34 presented toward the left as viewed in Figure 1. The notches 52, which are preferably uniform in contour and dimensions, are preferably of generally rectangular configuration. This rectangular configuration of the notches 52 forms the bristles in generally rectangular tufts, and I find that this is highly desirable in that it presents in each tuft uniform yieldability over the entire tuft in the direction of application of the material by the brush. With a round tuft there is less yieldability at the center than at the edges, and tufts of this sort tend to leave streaks in the work which is avoided with the present tuft formation. In addition, by tufting the bristles between the turns of the tufting strand, these tufts take up by capillarity a charge of the material to be applied and give the ability to pick up the filler and dressing materials by capillary action in a manner not obtained with a brush in which the bristles are arranged in a continuous fringe. It is to be understood, however, that the present invention is not limited to tufted brushes, but may be employed in connection with and embodied in brushes in which the bristles are arranged in the form of a continuous fringe. It is to be further understood that where the invention is embodied in a tufted brush, the tufts need not be of rectangular form, but may be of other forms as suitable or desired within the scope of the appended claims.

The tufting strand 34 is guided helically upon the core 20 with the strand 25 by the helical surface 29, and is wound helically upon the strand 25 as shown in Figures 5 and 6. The end of the strand 34 may be anchored upon the core 20 by means of the post 35 which is shown driven into place through the core 20 and into the end member 55 secured within the left-hand end of the core. The post 35 has a notch 56 squared to receive and engage in the end notch 52 in the strand 34 to anchor the end of this strand in place. The width of the notches 52 transversely of the strand 34 may be proportioned to dispose the long dimensions of the notches and thereby the long dimensions of the flat or generally rectangular tufts parallel with the axis of the brush, or as in the embodiment shown in which the notches 52 and, thereby, the tufts are of generally square configuration, or with the circumferential dimension slightly longer than the axial or longitudinal dimension.

In its passage to the core 20 the tufting strand 34 passes across the outlet 58 of the bristle hopper 60 with the open sides of the notches 52 presented thereto. The bristle hopper 60 preferably is carried by the block 7, and the bristles are disposed upright and preferably with their butt ends downwardly upon the base of the hopper 60 between the side walls 64 and 65 thereof. The side wall 65 is shown as being inclined at 66 to taper the hopper toward the relatively restricted outlet 58, which preferably is of a width substantially corresponding with the dimensions of the individual notches 52 longitudinally of the strand 34.

For the purpose of pressing the bristles toward the outlet 58 and into the notches 52 as the strand 34 passes the outlet 58, the bristle hopper has suitable means shown in the form of a follower 68, which is urged to the right (Figure 1), with the bristles ahead of it, by suitable cables or other flexible elements 69 attached to the follower 68 and trained over sheaves or pulleys 70 and 72 and tensioned by weights 73. This keeps the bristles properly compacted at all times, and forces same through the outlet 58 and into the notches 52 as the strand 34 passes the outlet 58.

The bristles are generally supplied to the brush manufacturer tied up in bundles with the butt ends all one way, and with the string or other binding means wrapped close to the butt ends. To supply the bristle hopper with bristles, such a bundle may be placed within the hopper ahead of the follower 68, and the binding means may then be removed. Then as the tufting strip 34 passes across the outlet 58 of the hopper the notches 52 are successively filled with bristles which are thus arranged in generally rectangular tufts by the strip 34, and then as the strip advances it carries these tufts, designated at 75, with it over the block 7 and to the core 20. The butt or base ends of the bristle tufts 75 may travel over the surface 28 of the block 7 as shown in Figure 2, and this block 7 may be offset upwardly to provide a vertical shoulder 68' between which and the edge 48 of the block 44 the bristle tufts 75 pass to the core 20. The upstanding or upwardly offset portion of the block which bears the surface 68' is tapered toward the core 20 and is shown in Figure 1 as terminating at 76. The surface 68' follows and conforms with the edge 48 in spaced relation thereto.

Referring to Figure 2, it will be seen that the slot 49 is spaced above the surface 28 and that the base ends 72 of the bristle tufts project downwardly beneath the tufting strip 34. As the strip 34 is wound upon or around the coil 25 the downwardly projecting base ends of the tufts 75 are laid or disposed between the turns of the coil 25, as shown in Figure 6.

An auxiliary outer strand 78, preferably in the form of a wire of small round section, although this may vary, is fed into a groove 79 in the face of the curved surface 68' opposite the notched edge of the strand 34 at a point just after the notches 52 of the strand 34 have received their bristles. This small round wire strand 78, which passes to the core 20 in tight engagement with the notched side of the strand 34, closes the open sides of the notches 52 and keeps the bristles in place in these notches while the strand 34 is travelling to the core 20 and entering upon it. This strand 78 also serves the very important purpose of cutting off any bristles that are not in the notches 52 but have gotten between the strand 78 and the adjacent edge of the strand 34. Due to the pull of the weights 15 on cables 19 there is sufficient pressure to cut off any bristles that are outside the notches 52 in strand 34 and between the edge of strand 34 and strand 78. The strand 78 may be anchored to the collar 36 by means of a round head screw 80. The turns of the strand 78 are wound alternately with the turns of the strand 34, and these strands are wound tightly together by the continuous pressure in the direction of the axis of the brush during formation.

The tufts 75, preferably, are staggered uniformly as they are laid helically upon the core 20. This disposes the tufts in the diagonal or helical convolutions, and it is understood that the tufts of adjacent turns may overlap uniformly if desired. The upper or outer ends of the bristles of each tuft will spread or flare outwardly providing, in effect, a substantially continuous outer

brush surface. The outer flared ends of the bristles form a substantially continuous spiral effect providing a continuous wiping cooperation with the work, which is highly desirable. A smooth and uniform spreading of the material over the work is obtained without some tufts leaving the work before others take hold. The spiral effect may be relatively long, as indicated by the dot and dash line *a*—*a* in Figure 4.

For the purpose of securely binding the bases of the bristle tufts together and between the turns of the coil **25**, a suitable binding base **82** is preferably provided. This base **82** preferably comprises a rubber cement which I find is admirably suited for anchorage of the bristles. It provides not only mechanical anchorage, but vulcanizes itself to the surfaces of the bristles, and provides better cohesion. And its strength is not impaired by alkaline solutions, and the like, commonly employed for cleaning brushes of this sort.

This binder **82** is preferably introduced in fluid condition brought to the desired consistency through a tube or conduit **85** which is provided with a nozzle **86** directed inwardly and generally tangentially with respect to the core **20**, and provided with an outlet **87** for delivering the binder or base material **82** into the helical space between the turns of the coil **25** and between the outer strands **34** and **78** and the core **20**. The rubber cement may be heated to bring it to the desired consistency, and may be mixed with a liquid or combination of liquids in the proportions which will maintain the desired consistency or desired plastic or fluid condition of the material so that it may be discharged from the nozzle outlet between the turns of the coil **25**, preferably simultaneously with the initial formation of the brush, and this introduction preferably continues as the brush is wound to provide a continuous binder between the turns of the coil **25** from one end of the bristles of the brush to the other. The binder or base supply may be delivered from the outlet **87** by a pump or other suitable pressure means which may be operated, for example, by the winding machine itself, or by any other suitable means. Constant pressure may be maintained in the binder supply system by any suitable means. The space between the strand **34** and the core **20** is only partially filled with rubber cement for a purpose which will appear presently.

Upon completion of the winding of the bristle portion of the brush, the right-hand end of the brush may be finished by winding four or any other desired number of turns of coil strands **25**, **34** and **78** without bristles and without cement, and these strands may be anchored to the core **20** by means of a screw **90** which may be engaged in a tapped opening in the core **20**.

In the winding of the brush, I run in only enough rubber cement to fill partially the space between the strand **34** and the core. Then after completion of the winding, the brush is placed in an oven **91** (Figure 8) and rotated in a horizontal position, as by means designated at **92**, and at sufficient speed so that the centrifugal force will cause all the rubber cement to fill the space under the strand **34** only as far in as the tops of the notches **26** provided along the inner edge of the coil **25**. Thus these notches **26** along the inner edge of the coil **25** are left free of cement the full length of the brush and the volatile gases driven off from the rubber while vulcanizing can find freedom of passage through these notches the full length of the brush and out of its opposite ends.

In the operation shown in Figure 8, the rotation of the brush is preferably started in a cold oven and the temperature is gradually brought up over a period of from six to eight hours to a temperature about 250° to 260° F. The temperature of from 250° to 260° F. is preferably maintained for about two to three hours with the brush continuing to rotate in the oven at this temperature and at a speed sufficient to produce the centrifugal force referred to.

As the brush is rotated in the oven or chamber at the temperatures above described, the binder is forced out away from the core and sets and hardens with its inner periphery substantially flush with the outer ends of the openings **26**. Then when the rubber cement is set and hardened, the collar **36** and the extra strands at the right-hand end of the brush may be removed and replaced with suitable permanent collars. If desired, the tufting strand **34** and strand **78** may be unwound or removed from the brush, or these strands may remain as a permanent part of the brush. The brush may be wound to the desired length or to relatively great length which may be divided into the desired lengths later. Where the strands **34** and **78** are removed after completion of the brush the rubber, preferably, is made harder than where this strand remains as a permanent part of the finished brush.

The operation may be summarized briefly, as follows:

With the machine at rest, the tube **20**, which is to form the core of the brush, is secured in the chuck **22**, and the collar **36** is secured upon the tube adjacent the chuck **22**. Extending the tube **20** through the opening in the block **7**, the block and entire carriage are moved longitudinally along the tube on the bed of the machine to close proximity to the collar **36**. The strands **25**, **34** and **78** are then led in from the reels or other sources of supply through the paths previously pointed out, around the helical surface **29**, and secured to the core **20**, as already explained. The core is then rotated to wrap the strands around the same one complete turn without any bristles.

The bristle hopper and source of binder or base material having been properly supplied and the driving connections properly set, the bristle feeding means is rendered effective to feed the bristles into the notches **52** so that after the first turn without bristles the bristles will be positioned helically about the core. The rotation of the core draws the strands onto the core, wrapping the same helically about the core and, at the same time and with the supply of the strands to the core, the bristles are tufted into the notches **52** and the bristle tufts laid helically upon the core. Also, at the same time, the binder or base material is introduced through the outlet **87** in fluid or liquid condition between the turns of the strand **25** and between the strand **34** and the core **20**, and this process continues until the brush reaches the desired length, whereupon the brush is completed as already described.

I have found it desirable in certain brushes to provide the notches in the strand **34** in groups of two, three or four notches to a group, as shown in Figures 9 and 10. In Figure 9, the strand **34'** has four notches **52'** to a group, which groups

are spaced apart at 100. In Figure 10, there are two notches 52'' to a group in the strand 34'', and these groups of notches are spaced apart at 101. When punching these notches in the strand, I preferably govern the spacing between the groups of notches along the length of the strand so that each group will bear the proper relation to the group in the preceding coil on the core so as to develop rows of bristles the length of the brush. Such rows of bristles have a width determined by the two, three or four notches in the group, and these rows of bristles may be laid parallel to the axis of the core in straight lines, or may be laid to form a helical curve of any desired pitch, such as indicated by the line *a—a* in Figure 4.

In the modification shown in Figure 11, the strand 110, which corresponds with the strand 34 shown in Figures 1 to 7, has, instead of notches, relatively shallow serrations 111 along one edge. The serrated edge of the strand 110 travels past the outlet 112 of the bristle hopper 113 and picks up and feeds the loose bristles helically around the core 115 (Figure 12) in the form of a continuous fringe. The small section strand 116, which corresponds with the strand 78 of the previous embodiment, is fed in as before, but in this case travels parallel and in spaced relation to the serrated edge 111 of the strand 110 to assist in guiding the bristles to the core 115.

As the continuous fringe of bristles travels between the serrated edge 111 of the strand 110 and the small section strand 116 the bristles are clamped firmly between these strands and fed helically between the turns of the underlying strand 118, which corresponds with the strand 25 of the previous embodiment. The binder is introduced between the strand 110 and the core 115 and between the turns of the inner strand 118 and positioned outwardly of the core 115 in the manner described in connection with the preceding embodiment, but in this case the base ends of the bristles 114, instead of extending to the core 115, are preferably spaced therefrom as shown at 120 in Figure 12. The bristles being laid in continuous turns and without spaces between separate tufts of bristles as in the previous embodiment, this spacing 120 is provided to place the space between the strand 110 and the core 115 in communication on opposite sides of the turns of bristles. The spacing at 120 may be obtained by elevating the bottom of the bristle hopper 113 above the bottom surface, similar to the bottom surface 26 of the previous embodiment, over which the bristles are fed to the core, so that the base ends of the bristles will be held above the surface corresponding with the surface 28 of the previous embodiment and will be fed to the core with the spaces 120 between the base ends of the bristles and the core. The bristles are gripped by the strands and are held in the desired spaced relation in their travel to the core and their helical movement into position about the core.

I do not intend, of course, to be limited to the precise details and steps shown or described.

I claim:

1. The method of making a brush which comprises winding about a core an inner strand having openings adjacent the core, winding a notched outer strand helically about said inner strand, introducing bristles into the notches in said outer strand and positioning same helically about the core with their base ends between the turns of said inner strand, introducing a binder between the turns of the inner strand and between the outer strand and the core, and spacing said binder from the core for the escape of volatile gases through the openings in the inner strand and lengthwise of the brush.

2. The method of making a brush which comprises winding about a core an inner strand having openings adjacent the core, winding a notched outer strand helically about said inner strand, introducing bristles into the notches in said outer strand and positioning same helically about the core with their base ends between the turns of said inner strand, introducing a binder between the turns of the inner strand and between the outer strand and the core, and rotating the brush in a heated chamber at sufficient speed to force centrifugally said binder out from the core to form a space between the binder and the core.

3. The method of making a brush which comprises winding about a core an inner strand, winding a notched outer strand helically upon said inner strand, introducing bristles into the notches in said outer strand and positioning same helically about the core with their base ends between the turns of said inner strand, and winding a strand of small section upon said inner strand and along the notched margin of said notched outer strand.

4. The method of making a brush which comprises winding about a core, an inner strand, winding a notched outer strand helically upon said inner strand, introducing bristles into the notches in said outer strand and positioning same helically about the core with their base ends between the turns of said inner strand, winding a strand of small section upon said inner strand and along the notched margin of said outer strand, introducing a binder between the turns of the inner strand and between the outer strand and the core, and forming a space between said binder and the core.

5. The method of making a brush which comprises winding a strand helically about a core, introducing bristles between the turns of the strand and positioning same helically upon the core, introducing a binder between the strand and the core, rotating the brush with the binder in fluid condition to space said binder outwardly from the periphery of the core and setting the binder in spaced relation to the core for the escape of volatile gases.

6. The method of making a brush which comprises positioning bristles helically about a core, applying a binder to said bristles, and rotating the brush with the binder in fluid condition to form a space between the binder and the core for the escape of volatile gases.

7. The method of making a brush which comprises positioning bristles upon a core, forming an enclosure about the core ends of the bristles and spaced from the core, partially filling the space between the core and said enclosure with a binder, and rotating the brush at a speed to force centrifugally said binder out away from the core.

8. The method of making a brush which comprises positioning bristles upon a core, laying between the bristles a separator having openings, forming an enclosure about the core ends of the bristles and spaced from the core, partially filling the space between the core and enclosure with a binder, and rotating the brush at a speed to force centrifugally said binder out away from

the core to form spaces connected by the openings in said separator.

9. The method of making a brush which comprises winding a strand helically about a core, introducing bristles between the turns of the strand and positioning same helically upon the core, introducing a binder between the strand and the core, and forming between the binder and the core an annular space vented to atmosphere for the escape of volatile gases.

10. The method of making a brush which comprises rotating a brush core, delivering a strand having laterally opening spaced notches to said core, introducing tufts of bristles into said laterally opening spaced notches in the delivery of the strand to the core, winding the strand with the bristles tufted therein helically upon the core, and closing said laterally opening notches with a strand of small section wound with its turns alternating with the turns of said first strand.

11. As an article of manufacture, a brush comprising a core, an inner strand of flat section wound helically on said core, said strand having openings therethrough and crimped to sinuous form along its outer margin, a notched strand wound helically upon said inner strand, and bristles disposed in the notches in said outer strand and positioned helically about said core.

12. As an article of manufacture, a brush comprising a core, an inner strand of flat section wound helically on said core, said strand having openings therethrough and crimped to sinuous form along its outer margin, a notched strand wound helically upon said inner strand, bristles disposed in the notches in said outer strand and positioned helically about said core, and an auxiliary outer strand of small section closing the notches in said first outer strand and wound upon said inner strand with its turns alternating with the turns of the notched strand.

13. As an article of manufacture, a brush comprising a core, an inner strand of flat section wound helically on said core, said strand having openings therethrough and crimped to sinuous form along its outer margin, a notched strand wound helically upon said inner strand, bristles disposed in the notches in said outer strand and positioned helically about said core, and a binder partially filling the space between the core and said outer strand and spaced outwardly from the core to form spaces connected by the openings in said inner strand.

14. As an article of manufacture, a brush comprising a helical notched strand, bristles positioned in the notches in said strand, and a helical strand of small section closing the notches in said first strand and having its turns alternating with the turns of said first strand.

15. A strand for a brush of the class described having bristle receiving notches spaced irregularly to dispose the same in groups along one margin of the strand.

16. In a brush of the class described a strand of flat section with openings extending therethrough and crimped to sinuous form along one margin, a notched strand on the crimped margin of said first strand, bristles in the notches in said last strand, and a strand of small section closing said notches and positioned on said first strand.

17. As an article of manufacture, a brush comprising a core, bristles surrounding the core, and a vulcanized rubber cement binder anchoring the core ends of said bristles, said binder being positioned outwardly of the core to form a space vented to atmosphere for the escape of volatile gases in vulcanization of said binder.

18. The method of making a brush which comprises winding a strand helically about a core, introducing bristles between the turns of the strand and positioning same in the form of a continuous fringe helically about the core with the base ends of the bristles spaced from the core, introducing a binder between the strand and the core, and forming a space between said binder and the core.

19. The method of making a brush which comprises winding a strand helically about a core, introducing bristles and delivering the bristles to the core by the movement of the strand, and positioning the bristles helically about the core in the form of a helically continuous fringe and with the butts of the bristles helically continuous.

20. In combination, a brush core, an inner strand of flat section wound helically with its inner edge against the core and crimped to sinuous form along its outer edge to form a helical support, a notched outer strand wound about the helical support formed by the crimped outer edge of said inner strand and supported thereby, bristles disposed in the notches in said outer strand with their core ends extending inwardly into position between the turns of the inner strand, and a binder anchoring the core ends of said bristles.

21. In combination, a brush core, an inner strand of flat section wound helically with its inner edge against the core and crimped to sinuous form along its outer edge to form a helical support, a notched outer strand wound about the helical support formed by the crimped outer edge of said inner strand and supported thereby, bristles disposed in the notches in said outer strand with their core ends extending inwardly into position between the turns of the inner strand, a strand of small section wound helically upon the crimped outer edge of the inner strand and along the notched margin of said notched outer strand, and a binder anchoring the core ends of said bristles.

ARNOLD A. ANGELL.