Feb. 25, 1958 W. C. VAN CLIEF, JR 2,824,327

BRUSH OF HIGH BRISTLE DENSITY

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FIG. 1

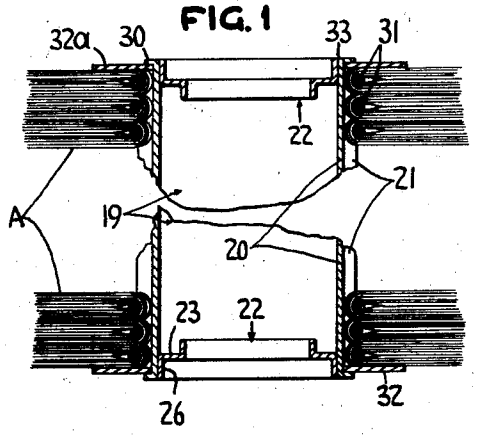


FIG. 2

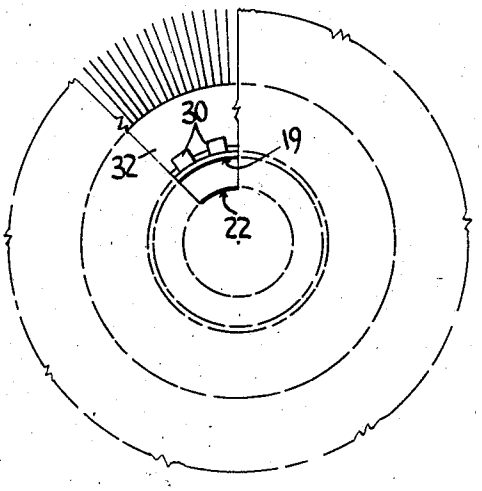


FIG. 3

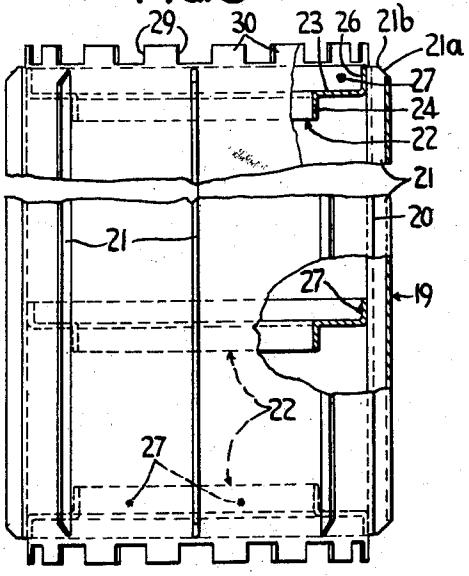
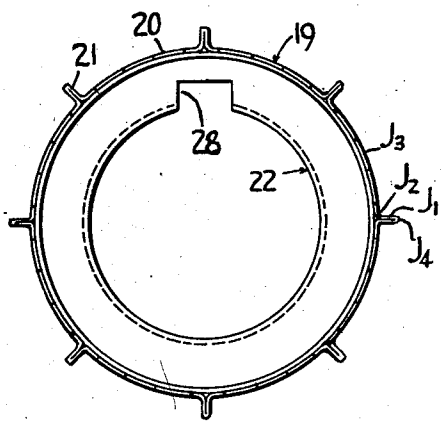


FIG. 4



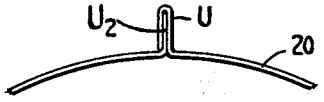


FIG. 11

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BRUSH OF HIGH BRISTLE DENSITY

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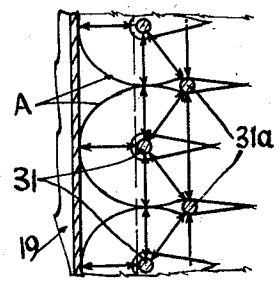


FIG. 13

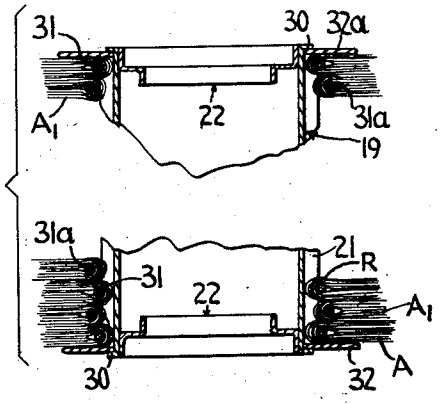


FIG. 5

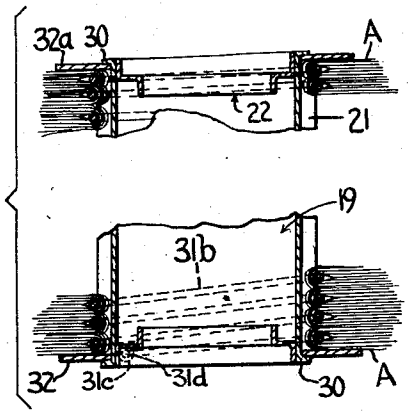


FIG. 6

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FIG. 7

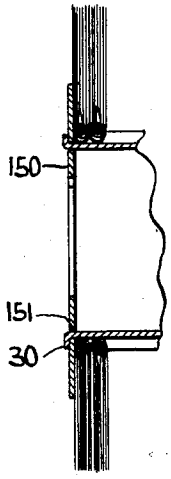


FIG. 8

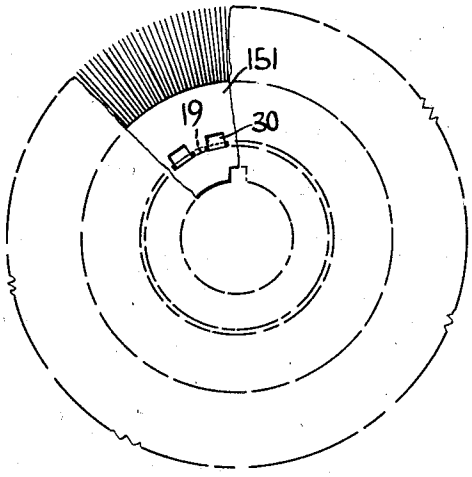


FIG. 9

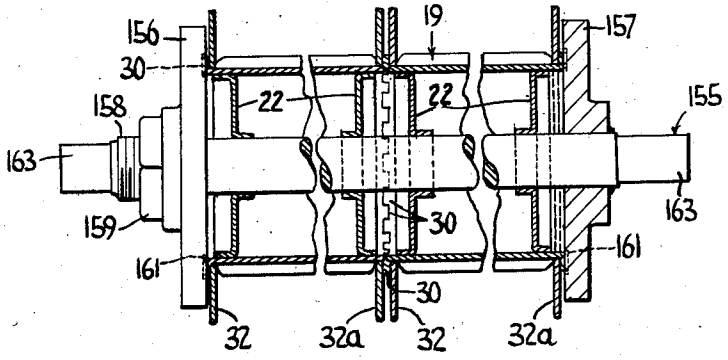


FIG. 10

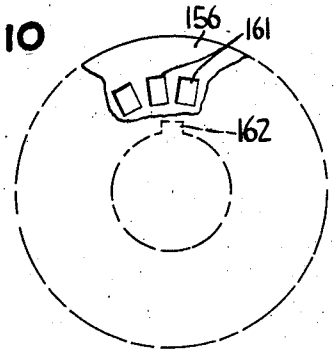
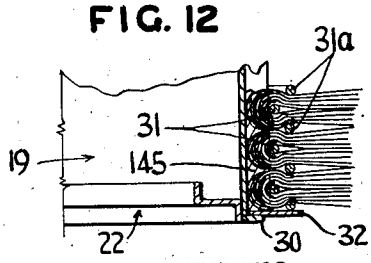


FIG. 12



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2,824,327

BRUSH OF HIGH BRISTLE DENSITY

William C. Van Clief, Jr., Baltimore, Md., assignor to Pittsburgh Plate Glass Company, Allegheny County, Pa., a corporation of Pennsylvania

Application October 11, 1954, Serial No. 461,302

7 Claims. (Cl. 15—181)

This invention relates to a rotary cylindrical brush and it has particular relation to a power-driven brush having an exceptionally high count of bristles per unit area.

Rotary cylindrical, power-driven brushes suitable for various scrubbing and brushing operations have heretofore been formed by a number of different methods such as:

(A) by spirally winding brush strips comprising channels crimped about the butts of double ended bristles, which bristles are in turn looped, or replicately folded about filamentary cores that key the bristles in the channels; and

(B) by stacking annular laminae or basic sections concentrically upon a supporting core.

In the formation of the laminae or basic units, it is customary to secure double ended bristles by replicately bending them about a retaining ring and by axially compressing the sides of the bristles between a pair of spaced annular rings or discs, which are appropriately held together upon the bristles by an eyelet-like structure or by some other type of interconnection that can not readily be compressed.

In either of the foregoing methods of forming cylindrical power-driven brushes, it will be manifest that considerable bodies of metal are interposed at intervals between portions of the bristles. For example, where the brush is formed by spirally winding a channel strip upon a core or mandrel, it will be obvious that the sides of the channel strip constitute such body and this metal, of necessity, must replace considerable numbers of bristles, thus materially reducing the bristle count per given unit of brush surface. The reduction in the bristle count, of course, reduces the overall stiffness of the brush, thus permitting a high degree of flexing of the bristles during brushing operations, imposing a heavy load upon the bristle units and otherwise producing effects which impair the efficiency or shorten the length of life of a given brush unit. This is especially true in those instances where the brush is employed for scrubbing sheet metal, as for instance as a preliminary operation in the galvanizing of sheet metal with molten zinc. This is often a heavy-duty operation and the brushes employed therein are subjected to heavy wear.

In similar manner, in brushes assembled from annular sections or laminae, the rings employed between the units of laminations, of necessity, must replace considerable amounts of bristle stock. The lives of cylindrical brushes assembled from such laminations, of necessity, is shortened by this reduction of bristle material. Needless to say, the metal employed in either type of conventional brush is expensive and the cost thereof must be imposed upon the purchaser.

It may also be pointed out that where a cylindrical brush is formed by helically winding a channel strip upon a core or by assembling a series of preformed laminations involving rigidly held discs or annular rings, it is difficult, or impossible substantially axially to compact or compress the bristle material by application of longitudinal pressure upon the assembly, without actually distorting the metallic structures employed to retain the bristles. The difficulty in thus axially compressing the strips or laminations upon a core, constitutes another reason for reduced bristle count per unit area in the resultant brushes.

In either of the conventional types of power-driven brush structures the loss of a few bristles at a given point will tend to loosen the pressure on contiguous bristles, they in turn, may be lost and the disintegrating action can progress chain-like along the entire spiral or about the entire base section. In the event the brush is formed of annular sections, breakdown of a section will loosen the longitudinal pressure on the entire stack.

In accordance with one feature, the present invention comprises a rotary cylindrical brush structure which is assembled from laminae which are strung upon a retaining core without the interposition of the metallic separators of the conventional laminar brush between laminae and without the use of metallic channels of a spirally wound brush. In accordance with the provisions of this invention, the laminae are assembled only with retaining rings in the looped portions of the bristles and the laminae are held from axial displacement by a pair of annular rings which are locked directly to the ends of the brush core.

As a further feature, the invention comprises the provision of one or more radially projecting longitudinal fins upon a core of a cylindrical rotary brush, which fins are common to all of the laminae or sections and act as seats for the retaining rings for the looped double ended bristles, provide means securing the brush laminae from creeping peripherally as the brush rotates and which assist in limiting progressive loosening and shedding of bristles from a row, or unit, in event that a small number of bristles should be lost from a localized area.

As a still further feature, the invention comprises the provision of a tubular brush bristle core in which the ends of the core are castellated so that they can conveniently be bent over to clamp annular end retaining rings upon the core and the cutaway portions of the metal in the castellations provide detents meshing with the castellations of a contiguous unit, in event that a plurality of brushes are strung or ganged together upon a common mandrel. All of these features need not necessarily be associated in each brush.

For a better understanding of the principles of the invention, reference may now be had to the accompanying drawings in which like numerals refer to like parts throughout.

In the drawings:

Fig. 1 is a sectional view illustrating the construction of a brush formed in accordance with the present invention;

Fig. 2 is an end view of the construction shown in Fig. 1;

Fig. 3 is a view partially in elevation and partially in section of the core structure of the brush;

Fig. 4 is a plan view of the construction shown in Fig. 3;

Figs. 5 and 6 are sectional views of modified forms of brush;

Fig. 7 is a sectional view of a still further form of the brush;

Fig. 8 is an end view of the brush shown in Fig. 7;

Fig. 9 is a sectional view of a gang of brush units on a common mandrel;

Fig. 10 is a face view of a clamping plate for the mandrel shown in Fig. 9;

Fig. 11 is a segment of a modified core structure.

Fig. 12 is a fragmentary section of a further modified form of brush; and

Fig. 13 is a diagrammatical view illustrating the direction of forces acting upon the bristles to clamp them in position upon the brush core.

A brush constructed in accordance with this invention comprises a core **19**, which includes sidewalls **20** of sheet metal and radially extending longitudinal fins **21**, which are formed by replicately folding narrow longitudinally extending sections of the metal constituting the tubular walls **20**. Any number of fins desired may be provided but for purposes of illustration eight are shown. These may be evenly spaced so that they assist in centering the retaining rings with respect to the core. Within the core are disposed a plurality of bushings **22** each of which comprises a web portion **23** and edge flanges **24** and **26** extending axially but in opposite direction with respect to each other. The outer of the flanges **26** may be secured in position in the tubular core by appropriate means as for example by spot welding at such points as are indicated at **27**. The intervals between points of welding may be spaced in accordance with the strength of the bond required to resist shear between the bushing and the wall to which it is attached.

As many bushings may be included in the construction as are desired, though of course it is preferable that a bushing be located at, or contiguous to, each end of the core. As illustrated in Fig. 4 of the drawings, the bushings are provided with keyways **28**, adapted to receive keys (not shown) by means of which they are locked against rotation on the mandrel. In some instances, it may be preferable to key the bushings upon the mandrel by forming the bushings with other appropriate noncircular shapes of center openings. For example, the openings may be hexagonal or octagonal in which event the keyway **28** is not required. The ends of the cores are formed with cutout portions **29** providing castellation **30**, shown in Fig. 3. In forming the castellations, sufficient metals should be cut out at **29** to assure that the castellations of contiguous units will intermesh with each other to provide a clutch-like coupling in event that two or more of the units are strung together upon a common mandrel.

The radial width of the fins **21** on the cylindrical core preferably approximately corresponds to the thickness of the layer of the bristles in lamination A at their mid portions. The bristles are of the double ended type and are looped about wire retaining rings **31** which in the embodiment of the invention shown, comprise cylindrical wires of appropriate gauge having end portions welded together or otherwise joined to provide a continuous, solid ring one of which is provided for each of the laminations. The rings in the embodiment of the invention shown in Fig. 1 are of a diameter corresponding approximately to the circle of the diameters of the tip portions of the fins **21**. Indeed the rings may seat directly upon the fins but may be of slightly greater diameter if so desired. The laminae of desired thickness, are assembled in as many layers as are required to fill the tubular core and may be tightly compacted one upon the other as hereinafter described. It will be observed that the waist portions of all or many of the bristles, which are looped about the retaining rings **31**, lie within the spaces between fins **21** so that they are retained from rotation or creeping about the circumference of the brush. Also, if a small tuft of bristles should be lost in any given locality and a resultant tendency for contiguous bristle to loosen and become lost in progression around the circumference of the brush is set up, the fins act as limiting barriers which check the progress of the loosening action and thus greatly prolong the length of life of the brush in actual service. However, the amount of metal in the fins is but small and very few bristles are replaced thereby.

While the fins **21** are, for the foregoing reasons, deemed to be quite desirable to the attainment of the full advantages of the present invention, it will be evident that some of the advantages can be attained without the use thereof, in as much as the bristles could be retained from peripheral creeping about the circumference of the brush by use of a cement, binding the waists of the bristles to the core, or by other means.

The laminae are held in position from axial displacement by means of suitable end retaining elements, such as annular rings **32** and **32***a*. These rings fit over the castellations **30** of the tubular core **20** and seat upon the ends of the flanges **21**. The castellations are bent over as at **33** to maintain them in the desired position.

It will be apparent that each fin is radially disposed with respect to the core or tube **20**. If desired, each core may be made up of two or more sections, the ends of which are joined by welding or by folding to provide longitudinally extending seams. The joints may be overlapped and welded or they may merely be butted together and welded to provide a smooth continuous surface as indicated for example at joint J_1. Other points in the circumference of the tube, such as J_2, J_3 or J_4, may also be selected as the lines of union. Fig. 11 illustrates a modified joint in which one edge of a core blank is folded approximately to an inverted U (as indicated at U) and the contiguous edge of the same or a neighboring blank is bent radially outwardly as at U_2 and is clamped between the legs of the U. The fins thus function both as fins and as a union between contiguous edges. If desired, the tubular cores **20** may be formed of a single sheet in which instance but a single line of union is required in order to join the two ends of the blank.

Bushings **22** for insertion in the tubular core, in the manner illustrated in Figs. 3 and 4 of the drawings, are formed as separate units by conventional means which it is not deemed necessary to describe in this application. These units are inserted in the tubular core and held in place by spot welding as indicated at **27**.

In the assembly of a brush, it is desirable that annular end ring **32** be positioned upon the tubular core and the castellations **30** be bent over to retain it in position against the ends of the fins **21**, whereby to facilitate subsequent assembling of the brush structure. A brush embodying the principles of the invention may be assembled manually or by application of various embodiments of apparatus.

A more detailed description of the specific apparatus will be found in my copending application entitled "Method of and Apparatus For Forming Rotary Brush," Serial Number 461,303.

In Fig. 5 of the drawing is illustrated a modified form of brush construction in which retaining rings of a plurality of different diameters are employed in the laminations. The several laminae are stacked in alternation, first a lamination A having a ring of smaller, internal diameter, and then one A_1 of larger internal diameter. In this construction, the retaining ring **31** of smaller internal diameter is disposed upon or near the outer edges of the fins **21**. Owing to the doubling of the bristles at their mid portions and also owing to the presence of the metallic ring about which the mid portions are looped, a substantially thickened roll indicated at R in Fig. 5 is formed and this roll would inherently tend somewhat to reduce the average density per unit area of the brush bristles. Where a second ring **31***a* of larger diameter is employed, the thickened roll is disposed at or slightly beyond the outer diameter of bulge of the lamination containing the ring of smaller diameter. The spacing between the laminations along the longitudinal axis of the brush can thus be appreciably reduced whereby to increase the bristle density per unit area of the brush construction.

The intermeshing of the bristles of the laminations A, with those of A_1 prevent them from creeping. If desired, as shown in Fig. 12, the bristles about cores or

rings 31*a* may be omitted. The latter then tend to compress and more firmly to hold the bristles in the contiguous laminae. Since they are outside of the perimeter of the rings 31 they do not reduce the number of bristles which may be assembled in the brush. If preferred, rings 31*a* may comprise annular stampings having axially projecting teeth designed to pierce the laminae.

As a further feature as illustrated in Figs. 12 and 13, cement may be injected at the looped portions of the bristles, as at 145, more securely cementing them to the core walls 20 and also acting as a medium preventing accumulation of scrubbing fluids, such as aqueous acids between said walls and the looped portions of the bristles. The directions of the forces acting on the looped portions of the bristles to clamp them against the core walls and between the several rings are illustrated in Fig. 13.

In the construction as shown in Figs. 7 and 8 the use of bushings 22 in the ends of the core wall 20 is obviated. In this construction, end rings 32 and 32*a* are replaced by rings 150, are formed to an internal diameter corresponding to the internal diameter of the bushings. A series of properly spaced slots 151 disposed in a circle corresponding to the diameter of the tube 19 receive the castellations 30 and in the finished brush are clinched outwardly to retain the rings. The end rings slip over a mandrel and thus permit the latter to be eliminated. The steps of forming a brush by use of such construction are essentially the same as those previously described.

While emphasis has been placed upon the use of end rings 32 and 32*a* for clamping the bristle laminations on the core, it is also contemplated, if desired, to spin or otherwise to flare the ends of the core outwardly without the end rings, in order to retain the laminations in place. With such construction, the notching of the tube 19 to form castellations 30 is not necessary, since the solid metal better retains the bristles.

Brushes constructed in accordance with the provisions of this invention are relatively simple. The tubular core is quite inexpensive, but at the same time, it is of high mechanical strength. This strength is greatly enhanced by the radially projecting fins 21 and also by the bushings 22 which are spot welded into the tubular core. A minimum of metal is required in securing the roots or butt portions of the bristles in place upon the core, which fact as already elaborated upon, is conducive to attainment of very high brush density per unit of area of surface. The reduction in the amount of metal inherently reduces the costs of the construction and the high density of bristle population increases the stiffness of the brush so that it becomes a substantially better means for brushing or scrubbing surfaces and notably of sheet iron or steel preparatory to the galvanizing operation. The stiffness of the brush bristles attained by tightly compacting the bristles of course reduces flexing in brushing operations and thus assists in attainment of a longer brush life. As previously pointed out, small failures of bristles when they occur, are localized by the fins 21 and progressive failure from the initial points until the entire brush has broken down is prevented, or delayed. It will be apparent that in this construction, the use of tabs or teeth struck out from metal such as that of an annular disc and having sharp angles and corners likely to cut or chafe the bristles or to provide points of stress concentration when the bristles are flexed, is obviated.

It is to be noted that the lugs at the ends of the brush cores produced by bending over the castellations 30 to secure the annular end rings 32 and 32*a* are designed to intermesh in clutch-like engagement. A plurality of brushes can thus be ganged together upon a single or common mandrel and a driving connection from one brush to the next can be so attained without the provision of keyways or other holding means extending the entire length of the mandrel.

While the embodiment of the invention described in which the bristles of the brush are looped about continuous retaining rings 31 to form individual laminations has important advantages and is usually preferred, it will be apparent that sometimes the rings can be replaced by a continuous filament spirally wound on a core to retain the bristles. Such construction is shown in Fig. 6.

In the latter, tube 19 has castellations 30 bent over to hold end rings 32. A retaining wire 31*b* which is spirally wound about the core and rests on fins 21, has an end appropriately secured to the core as for instance by eyelet portion 31*c* which is secured to tube 20 by a rivet 31*d*. The other end of the wire may be similarly secured. Bristles are looped about the wire as in the previously described construction to provide a rotary brush in which the bristles are locked from creeping by fins 21. The fins also function to localize degeneration due to loosening of the row, in event a few bristles should be lost from a given spot.

In Figs. 8 and 9 is illustrated a brush involving a series of units assembled as previously described and being ganged upon a common mandrel 155 and driven through clamping plate 156 and/or 157. An many units as may be desired may be strung together but for purposes of illustration a pair are shown. The castellations 30 at contiguous ends of these, are intermeshed to provide a positive drive. It is a feature of this construction that the intermeshed castellations have a thickness of the walls of the tube 20. The ends of the brush units are thus quite closely juxtaposed and a minimum gap in the bristle surface is provided.

Clamping plate 156 is removably mounted to permit the insertion of the mandrel in the brush core. To this end a portion of the mandrel is threaded as indicated at 158 to receive a clamping nut 159 which can be turned to tighten it against plate 156 and force it against the contiguous brush unit. The second clamping plate 157 may be similarly mounted, or it may be fixed on the mandrel as by welding. One or both plates may be provided with face slots 161 adapted to mesh with clinched over castellations 30. If but one of the plates 156—157 is provided with slots, it will be apparent that a drive between the driven brush unit and its neighbor is provided by the intermeshing castellations between the two. If three or more units are ganged, the intermediate unit or units are driven from one or both of the end units.

If the end plate 156 is employed as a driving device for the units on shaft 155, means such as a key 162 in the shaft and the plate should be provided.

It will be observed that shaft 155 is provided with bearing portions 163, which preferably are somewhat smaller in diameter than the threaded portion 158 and the mid-portion of the shaft in order to facilitate attachment of end plate 156 and nut 159.

In the construction shown in Figs. 9 and 10, the mandrel may be of circular section, as may the bushings in the brush units since power is transmitted to the brush units through the end castellations.

The forms of the invention as herein illustrated while they constitute as of the present preferred embodiments, are but illustrative of the invention. It will be apparent to those skilled in the art that various modifications may be made therein without departure from the spirit of the invention or the scope of the appended claims.

I claim:

1. A rotary brush comprising a substantially cylindrical core having a series of peripherally spaced, longitudinal fins, a series of brush sections disposed upon the core, each section comprising a retaining ring disposed upon the fins, double ended brush bristles having their tip portions projecting radially outwardly and having their mid portions looped about the retaining ring to form an annular bristle lamination in which the outer bristles of the lamination contact with the corresponding

bristles of contiguous laminations substantially from their looped portions to their tips, the looped portions of the bristles of each annular lamination being disposed between the fins and being grouped by the fins into segments extending peripherally of the corresponding ring, the looped portions of the bristles in the ends of the segments being in direct contact with a side of each of the two contiguous fins, whereby to prevent peripheral creeping of the bristles about the core.

2. A rotary brush comprising a substantially cylindrical core having a series of peripherally spaced, longitudinal fins, a series of brush sections disposed upon the core, each section comprising a retaining ring disposed upon the fins, double ended brush bristles having their tip portions projecting radially outwardly and having their mid portions looped about the retaining ring to form an annular bristle lamination in which the outer bristles of the lamination contact with the corresponding bristles of contiguous laminations substantially from their looped portions to their tips, the looped portions of the bristles of each annular lamination being disposed between the fins and being grouped by the fins into segments extending peripherally of the corresponding ring, the looped portions of the bristles in the ends of the segments being in direct contact with a side of each of the two contiguous fins, whereby to prevent peripheral creeping of the bristles about the core and annular end plates secured upon the core to prevent longitudinal displacement of the laminations.

3. A rotary brush comprising a substantially cylindrical tubular core having a series of peripherally spaced longitudinal fins, a series of brush sections disposed upon the core, each section comprising a retaining ring, disposed upon the fins, double ended brush bristles having their tip portions projecting radially outwardly and their mid portions looped about the retaining ring to form an annular bristle lamination in which the outer bristles of the lamination contact with corresponding bristles of contiguous laminations substantially from their looped portions to their tips, the looped portions of the bristles of each annular lamination being disposed between the fins and being grouped by the fins into segments extending peripherally of the corresponding ring, the looped portions of the bristles in the ends of the segments being in direct contact with a side of each of the two contiguous fins, whereby to prevent peripheral creeping of the bristles about the core and annular end plates disposed upon the ends of the core to prevent longitudinal displacement of the laminations, the ends of said core being outwardly flared to retain the annular end plates.

4. A rotary brush comprising a substantially cylindrical tubular core having a series of peripherally spaced longitudinal fins, a series of brush sections disposed upon the core, each section comprising a retaining ring, disposed upon the fins, double ended brush bristles having their tip portions projecting radially outwardly and their mid portions looped about the retaining ring to form an annular bristle lamination in which the outer bristles of the lamination contact with the corresponding bristle of contiguous laminations substantially from their looped portions to their tips, the looped portions of the bristles of each annular lamination being disposed between the fins and being grouped by the fins into segments extending peripherally of the ring, the looped portions of the bristles in the ends of the segments being in direct contact with a side of each of the two contiguous fins, whereby to prevent peripheral creeping of the bristles about the core and annular end plates secured upon the core to prevent longitudinal displacement of the laminations, said core being castellated and the castellations being outwardly flared to retain the annular end plates.

5. A rotary brush having a core comprising a tube having a series of peripherally spaced longitudinally extending fins extending radially therefrom and being replicately folded, longitudinally extending segments of the tube, a series of brush sections disposed upon the core, each section comprising a retaining ring disposed upon the fins, double ended brush bristles having their tip portions projecting radially outwardly and their mid portions being looped about the retaining ring to form a bristle lamination in which the outer bristles of the lamination contact with corresponding bristles of contiguous laminations substantially from their looped portions to their tips, the looped portions of the bristles of the annular lamination being disposed between the fins and being grouped by the fins into segments extending peripherally of the corresponding ring, the looped portions of the bristles in the ends of the segments being in direct contact with a side of each of the two contiguous fins whereby to prevent peripheral creeping of the bristles about the core.

6. A rotary brush having a core adapted to be disposed upon a mandrel and comprising a tube having a series of peripherally spaced longitudinally extending fins extending radially therefrom and being replicately folded, longitudinally extending segments of the tube, a series of brush sections disposed upon the core, each comprising a retaining ring disposed upon the fins, double ended brush bristles having their tip portions projecting radially outwardly and their mid portions being looped about the retaining ring to form a bristle lamination in which the outer bristles of the lamination contact with corresponding bristles of the contiguous laminations substantially from their looped portions to their tips, the looped portions of the bristles of the annular lamination being disposed between the fins and being grouped by the fins into segments extending peripherally of the corresponding ring, the looped portions of the bristles in the ends of the segments being in direct contact with a side of each of the two contiguous fins whereby to prevent peripheral creeping of the bristles about the core, said tube having castellations at the ends thereof and annular end plates upon the ends of the tube, the castellations being doubled over to retain the end plates and further being adapted to intermesh with castellations upon a contiguous member upon said mandrel to provide a positive drive.

7. A rotary brush comprising at least two brush units disposed upon a common mandrel, each unit comprising a tubular core having a series of peripherally spaced, longitudinally extending, radial fins thereupon, a series of brush sections disposed upon the core, each section comprising a retaining ring disposed upon the fins, double ended brush bristles having their tip portions projecting radially outwardly and their mid portions being looped about the retaining ring to form a bristle lamination in which the outer bristles of the lamination contact with corresponding bristles of the contiguous lamination substantially from their looped portions to their tips, the looped portions of the bristles of the annular lamination being disposed between the fins and being grouped by the fins into segments extending peripherally of the corresponding ring, the looped portions of the bristles in the ends of the segments being in direct contact with a side of each of the two contiguous fins, whereby to prevent peripheral creeping of the bristles about the core, said tube having castellations at the ends thereof and annular end plates upon the ends of the tube, the castellations being doubled over to retain the end plates, the castellations upon an end of one tube being meshed with the castellations upon the contiguous end of the second tube whereby to provide a positive drive between the tubes.

References Cited in the file of this patent

UNITED STATES PATENTS

553,402	Goulding	Jan. 21, 1896
1,054,160	Abbott	Feb. 25, 1913
1,240,604	Rasmesen	Sept. 18, 1917
1,714,137	Radinse	May 21, 1929
2,324,272	Anderson	July 13, 1943
2,409,309	Peterson	Oct. 15, 1949

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,824,327 February 25, 1958

William C. Van Clief, Jr.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 49, before "Serial" insert -- filed this day --; column 6, line 23, for "An" read -- As --.

Signed and sealed this 26th day of August 1958.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents