

Feb. 4, 1958

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2,821,729

MEANS FOR LOCKING BRUSH BRISTLES IN RETAINING STRUCTURES

Filed Feb. 16, 1955

4 Sheets-Sheet 1

FIG. 1

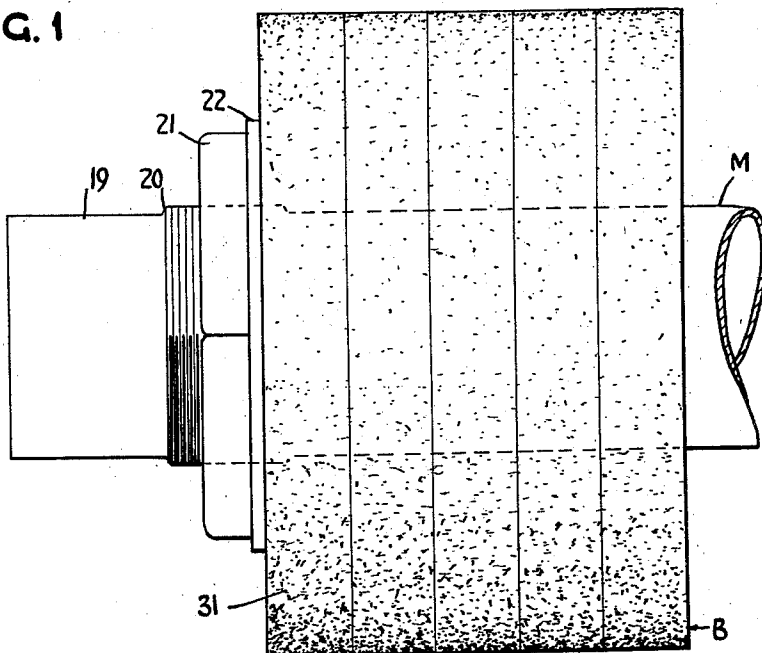


FIG. 2

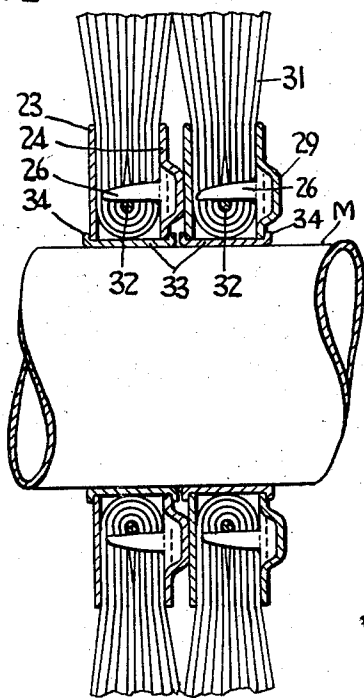


FIG. 3

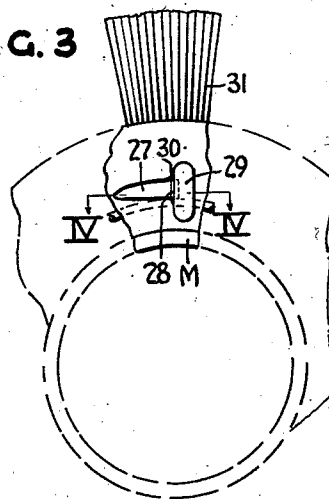
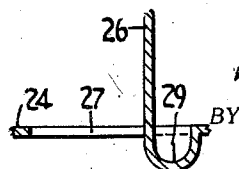


FIG. 4

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FIG. 5

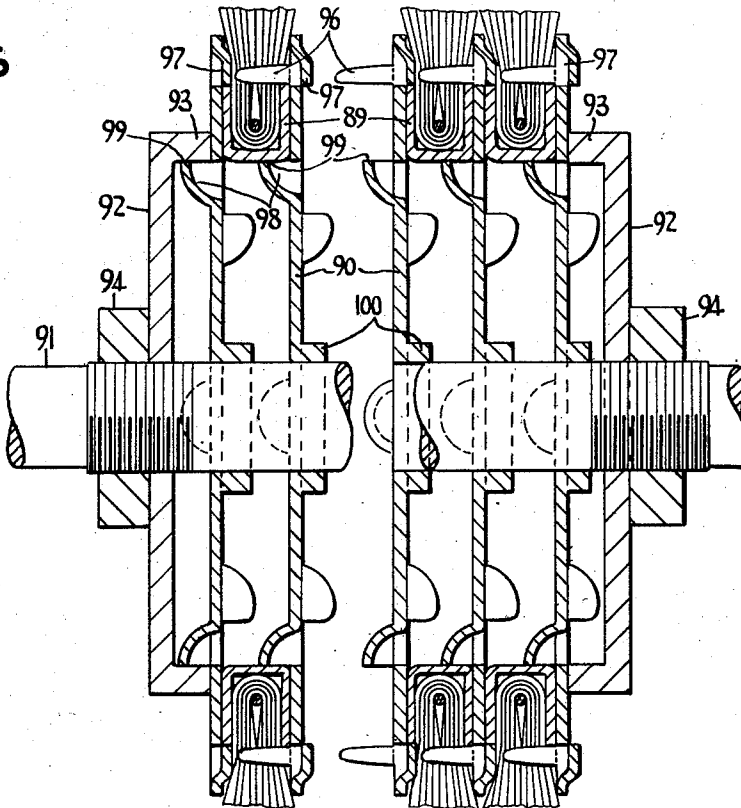
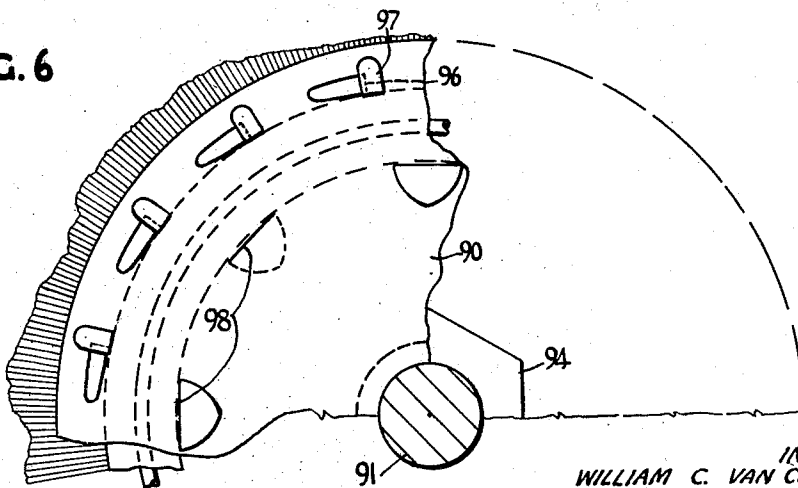


FIG. 6



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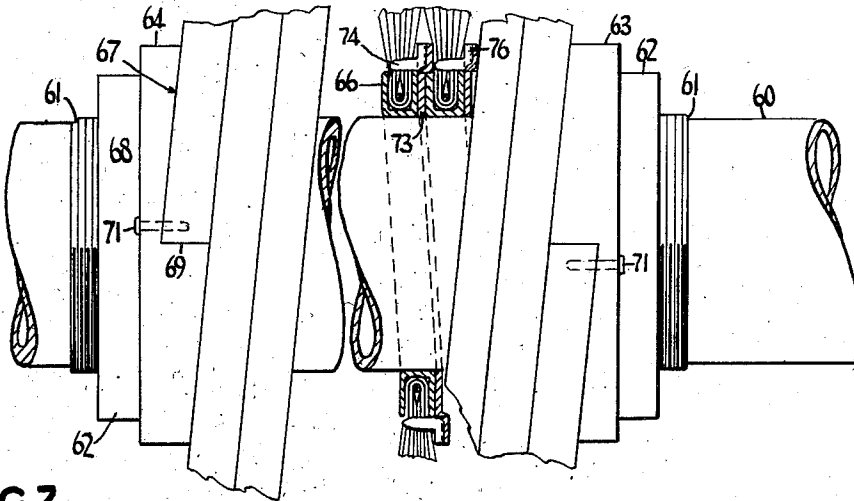


FIG. 7

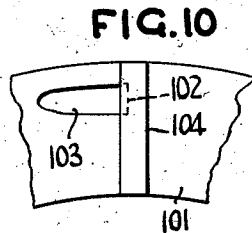


FIG. 10

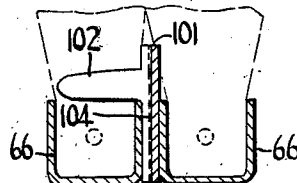


FIG. 9

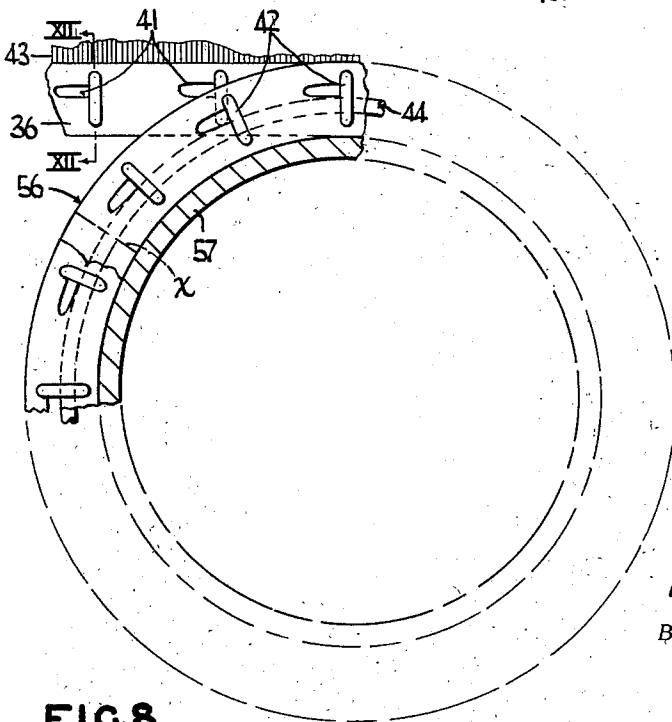


FIG. 8

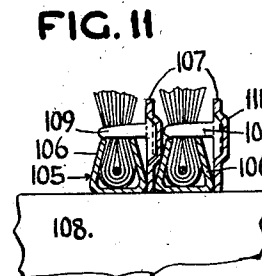


FIG. 11

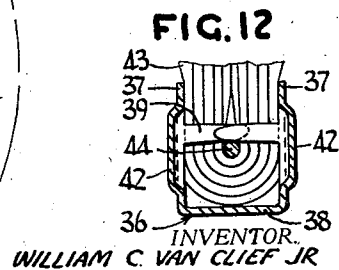


FIG. 12

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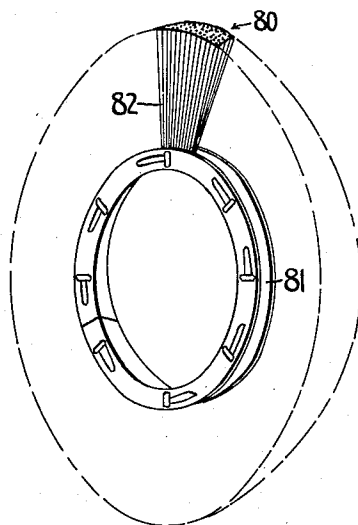


FIG. 13

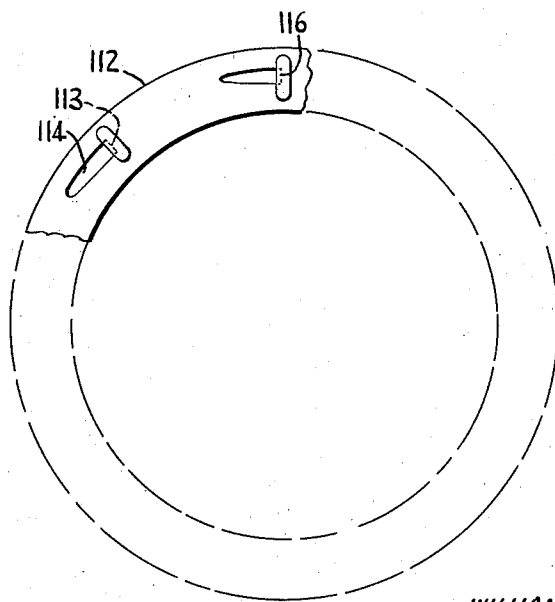


FIG. 14

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MEANS FOR LOCKING BRUSH BRISTLES IN RETAINING STRUCTURES

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Application February 16, 1955, Serial No. 488,499

9 Claims. (Cl. 15—181)

This invention relates to rotary brushes comprising one, or a series of annular basic sections which are strung upon a mandrel, or which comprise a continuous channel strip wound spirally upon a mandrel, and it has particular relation to a locking element for the bristle holding means of such brushes.

Brushes have heretofore been constructed from so-called "basic sections" one type of which, termed a locking ring construction, comprises double ended bristles folded about a ring-like core disposed between a pair of annular side plates of sheet metal which are appropriately pressed together to provide annular brush section. One or a plurality of such basic sections may be threaded upon a power driven mandrel to provide a rotary brush of relatively inexpensive construction. A brush of this type is illustrated in the patent to Mertes 1,829,665.

Brushes comprising a continuous channel strip of metal spirally wound to fit over a power driven mandrel and comprising a core or filament disposed in the loops of double ended bristles within the channel, are illustrated in Peterson Patent 2,303,386 or Nelson Patent 2,609,242.

When either type of the foregoing constructions is embodied in a brush which is driven at considerable speed, much centrifugal force is exerted upon the bristles or upon the bristle holding element. In an effort to obviate these centrifugal forces, it has been suggested in the Peterson and Nelson patents to provide a strip within the channel having teeth which project transversely of the channel strip (longitudinally with respect to the brush) and engage the outer portion of the filamentary core so that the latter is, in effect, locked in position. In these constructions, the filamentary core can be regarded as holding means for the bristles. The scale walls of the channel, with the teeth constitute locking means for the core.

In the Peterson Patent 2,609,559, annular rings having teeth struck out longitudinally are employed to lock annular basic sections constituting bristle holding means on a mandrel.

In these constructions in which teeth are struck normally with respect to the plane of a sheet metal member such as an annular disc or a side wall of a spirally wound channel, it is to be observed that the teeth, at their roots, are bent with respect to the plane of sheet metal in which they have their roots. The sharp bending at these points in a plane tends greatly to weaken the teeth so that the strength thereof may not be sufficient adequately to resist centrifugal forces upon the brushes composed of the basic sections or the channel strips when the brushes are driven at high speeds.

In accordance with the provisions of this invention, it has been found that the rigidity or the strength of the teeth of a locking structure for holding a bristle holding element upon a mandrel, can be greatly increased by pressing depressions of approximately semicircular section in the metal of the toothed annular discs or in the side walls of continuous channels constituting the locking structure or means. These depressions should be

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opposed to the teeth and the planes thereof should blend into or become tangential at the teeth roots, to the curve of the walls of the depression.

The strengthening action occasioned by the depressions, such as above described, would appear to be due, at least in part, to the fact that the depressions provide relatively gradual curvature, blending the roots of the teeth gradually into the plane of the metal of the annular side discs or of the side walls, as the occasion may be. Also the curve may add increased rigidity against longitudinal creasing or bending at the roots of the teeth, where the greatest stress is exerted.

For a better understanding of the invention, reference may now be had to the accompanying drawings in which:

Fig. 1 is an elevational view of a brush composed of basic sections constructed in accordance with the provisions of this invention;

Fig. 2 is a fragmentary sectional view disclosing one form of basic section and the mounting therefor, as employed in the rotary brush structure of Fig. 1;

Fig. 3 is a fragmentary side elevational view of a basic section constructed as disclosed in Fig. 2;

Fig. 4 is a sectional view taken substantially upon the line IV—IV of Fig. 3;

Fig. 5 is a sectional view of a modified form of brush embodying locking discs having teeth constructed in accordance with the provisions of the present invention; said discs being disposed between annular basic sections;

Fig. 6 is a fragmentary end view of the construction shown in Fig. 5;

Fig. 7 is a broken view partially in elevation and partially in section illustrating one application of a further embodiment of the invention to a brush comprising a spirally wound channel strip;

Fig. 8 is a view partially in section and partially in elevation illustrating a still further modification of the invention as applied to a spirally wound channel strip;

Fig. 9 is a fragmentary sectional view illustrating a modification of the tooth structure as employed in the practice of the invention;

Fig. 10 is a fragmentary elevational view of locking means employed in the embodiment of the invention disclosed in Fig. 9;

Fig. 11 is a fragmentary sectional view of a further modification of the construction as shown in Fig. 7;

Fig. 12 is a sectional view taken substantially upon the line XII—XII of Fig. 8;

Fig. 13 is a perspective view partially in phantom outline of one form of basic section; and

Fig. 14 is a view in fragment and partially in phantom of a locking ring which may be employed in the practice of the invention.

In the embodiment of the invention as disclosed in Fig. 1 of the drawings, a brush B is assembled from so-called "basic sections" which may be of various designs. One embodiment of such section is illustrated in Fig. 2 of the drawings and will be more fully described in a subsequent portion of this specification.

In the embodiment of the invention as disclosed, the sections are strung in well known manner upon an appropriate shaft or mandrel structure, such as the mandrel M illustrated in the drawings. The mandrel has bearing portions 19, and is provided with shoulder portions 20 which are appropriately screw threaded and upon which are disposed the clamping nuts 21 that engage clamping plates 22.

A basic brush section suitable for mounting upon the mandrel as shown in Fig. 1 of the drawings is illustrated in Figs. 2 and 3. This involves a so-called lock ring structure resembling those illustrated in the patents to Mertes (preceding) or Frost 1,683,456. The construction embodies annular side plates or discs constituting locking

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rings 23 and 24, one or both of which are formed with angularly spaced teeth 26 struck out normally with respect to the plane of the face of the disc and being disposed in radial planes. These teeth may be formed by shearing the metal of the disc as indicated in Fig. 3 to form openings 27 in the form of the tooth, except that the roots of the teeth at 28 are transversely uncut. Subsequently, the tabs of metal are bent outwardly to position to form teeth as indicated in Fig. 2 of the drawings.

In this embodiment of the invention, it will be observed that the sheet metal contiguous or integral with the roots of the teeth is indented or depressed as indicated at 29 in a direction with respect to the plane of the disc opposite to the teeth. In the construction as shown in Fig. 4, the roots of the teeth are blended or merged tangentially into the semicylindrical walls of the depressions 29, thus reducing the concentration of the stress at the point of union between the metal of the teeth and the metal of the plate from which they are struck and otherwise stiffening the teeth at their roots. If desired further to strengthen the teeth, the roots of the latter may be filleted as indicated at 30 in Fig. 3 of the drawings.

Bristles 31 of wire, tampico, plastic or the like between the plates 23 and 24 preferably are of the double ended type in which each filament is of approximately twice the length desired in the brush bristles and is replicately doubled about a central core structure or ring 32 of metal or other material of relatively high strength constituting holding means for the bristles.

Preferably, the core is of such outside diameter that the perimeter thereof will engage or substantially engage with the inner edges of the teeth 26, whereby the forces tending to spread or break the core are in part transferred to the teeth.

The inner diameter of the side discs is less than that of the core 32, and the outer diameter is less than that of the circle defined by the tips of the bristles.

Means to maintain the locking rings 23 and 24 in desired position with respect to each other, may comprise an appropriate central grommet 33 of a diameter (internal) corresponding to the outer diameter of the mandrel M upon which the sections are to be strung or ganged. The grommet is locked in position in the locking rings by flanges 34, radially outwardly upset about its edges.

As many basic sections as may be desired may be strung upon a mandrel M and when in appropriate position, are pressed or clamped together and are held against rotational movement upon the mandrel by suitably tightening the nuts 21 against the plates 22 or by other convenient means. The strengthening of the teeth at the roots thereof by the formation of the depressions 29 in the side plates or discs adds substantially to the overall strength of the construction; therefore, brushes so constructed may be driven at relatively high speed without danger of the bristles or the bristle holding core 32 being released, displaced or broken by reason of centrifugal force. As will be apparent from Fig. 2 of the drawings, the depressions in the metal accompanying the teeth 26 further form bosses on the opposite side that act as spacing means between contiguous basic sections, thus allowing air to flow between the sections to effect more rapid cooling of the latter, thus preventing overheating, or at least reducing the tendency of the sections to overheat when they are subjected to heavy loads. If desired, in those instances where both plates 23 and 24 of contiguous units are formed with depressions, the depressions of one section may be so disposed that they do not register with those of the contiguous section. However, if greater spacing between the basic sections is desired, the depressions of contiguous sections may be disposed in register with respect to each other, thus doubling the spacing between contiguous units and so increasing the cooling effects.

The principles as applied to the reinforcement of locking teeth for maintaining bristle holding elements in a

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rotary brush against centrifugal force is not necessarily limited to the construction of annular brush sections such as are illustrated in Fig. 2 of the drawings; but may be extended for example, to the construction of brushes comprising channel strips such as are illustrated in Peterson Patent 2,303,386. It will be observed that in the latter, a metallic tape having vertically disposed teeth near each edge thereof is employed as securing means for double ended brush bristles of fiber, wire or the like. The bristles are distributed along the tape with the mid portions thereof contiguous to the center line of the tape, a core member of wire or other material is laid down upon the top of the bristles at their mid portions and the sides of the tape are then bent upwardly in parallelism with respect to each other so that the teeth extending vertically to the planes of the side walls lock over the core, thus securing the bristles in place. The sides of the channel so formed are in parallelism with respect to each other and are interconnected by an intermediate web. This type of construction comprises a continuous channel strip which may be wound spirally about an appropriate mandrel in order to form a rotary brush.

In Figs. 8 and 12 of the drawings is illustrated a channel element 36 similar to that shown in the Peterson patent and comprising side walls 37 and an interconnecting bottom web 38. Teeth 39 formed on the side walls by bending out the tabs from slots 41 in the side walls have root portions remaining unsevered. For purposes of increasing the rigidity or strength of these teeth to resist distortion or tearing at their roots, depressions 42 of semicircular section are formed in intermediate portions of the side walls and the walls of the depressions merge into or become tangential to the planes of the teeth as already described so that there is no abrupt angle between the roots of the teeth and the planes of the side walls of the channel.

Double ended bristles 43 of wire, tampico, nylon or other plastic are disposed within the channel and are held from outward displacement by bristle holding means comprising a core 44 of wire or other filamentary material lying approximately in the median plane of the channel and being locked from outward displacement by means of the teeth 39 on side walls 37. A channel strip so formed may be wound as a spiral indicated at 56 in Fig. 8 upon a driven mandrel 57. Such channel strip may for example be mounted between end plates as shown in Fig. 7. The added locking strip (to be described) as shown in Fig. 7 is optional. Owing to the reinforcing action of the depressions 42, the constructions are particularly strong and are excellently adapted to resist the centrifugal and other forces exerted upon the bristles and securing filamentary core of brushes driven at considerable speed.

In Fig. 7 of the drawings is illustrated a second mode of reinforcing a spirally wound channel strip upon a driven mandrel structure. In this construction, the mandrel is indicated at 60 as comprising shoulders 61 which are screw threaded and have nuts 62 disposed thereupon for purposes of clamping end plates 63 and 64. The spirally wound strip 66 forming the brush 67 is disposed between these plates. As illustrated in the drawings, the opposed faces of the end plates are shaped to a spiral or helical surface 68 and the ends of the strip 66 may be abutted against shoulders 69 of the plates. Means securing the ends of the strip upon the mandrel may be conventional and are illustrated as comprising devices 71, such as screws, or rivets piercing the plates 63 and 64 and extending into the channel elements 66.

The channel strip 66 in Fig. 7, is indicated as being free of locking teeth. However, it is obvious that such teeth are optional and it may be provided with teeth having reinforcement depressions as shown in the latter Figures 8 and 12, or it may be provided with conventional teeth such as are shown in the aforementioned patent to Peterson. Naturally, the latter construction does not

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have the full strength to resist centrifugal forces or other operational forces characterizing in the construction shown in Figs. 8 and 12 of the present application. However, for many purposes the reinforcing action of the locking strip to be described is sufficient.

As means for locking the spirally wound channel strip, shown in Fig. 7 firmly upon the mandrel 60, even during high speed operation, a spiral strip 73 designed to be inserted between the turns of the strip 66 may be provided. This strip 73 may be similar to that described in my application Serial Number 482,560 filed January 18, 1955 and is mentioned herein as constituting one embodiment under the generic principles of the present application. The spiral strip, as shown in Fig. 7, is provided with teeth 74 struck out normally and being designed to engage the upper edge of one side wall of the strip 66.

Depressions 76 are also formed in the strip 73 so that the walls thereof blend into and are tangential to the roots of the teeth 74, as in the manner shown in Fig. 4. In the construction as shown, the depressions 76 extend down only to the outer perimeter of the edges of the side walls and the metal is bent in a line parallel to the edges of the strip 73. A lower edge is therefore provided upon each depression which, as shown in Fig. 7, hooks over the side wall of the channel 66 which is not engaged by the teeth 74. In this construction, both side walls of the channel are very positively locked upon the mandrel against outward displacement.

In the construction as illustrated in Figs. 7, 8 and 12 of the drawings, the channel strips are indicated as being spirally wound to provide elongated rotary brush structures which may be cylindrical or tapered. It will be apparent that the continuously wound spirals may also be appropriately cut, as for example, at the point or line indicated at X in Fig. 8, into single ring-like turns. The single turns of the spiral can be pressed by the exertion of but very slight force into planar rings or annular sections which though broken at the point of cutting, can be secured by a suitable locking annulus, as hereinafter described, and thus have sufficient strength for many purposes. Obviously, the ends of the annulus could also be secured together by soldering, brazing, welding or by means of an appropriate clamp.

In Fig. 13 of the drawings, is indicated a single basic section 80 formed by cutting off a single turn of the spiral shown in Fig. 8 of the drawings. This annulus comprising the channel member 81 and bristles 82 is similar to those shown in Figs. 8 and 12 and embodies angularly spaced teeth with the roots thereof merged into, or tangential with the walls of suitable depressions struck out from the walls on the sides opposite from the teeth.

In the embodiment of the invention illustrated in Fig. 5, a series of annular brush sections 89 which may be of the channel construction shown in Fig. 13 or other appropriate forms are clamped between a series of annular plates or discs constituting locking rings 90 on a mandrel 91. Clamping means for the assembly upon the mandrel comprises end plates or discs 92, having longitudinally projecting edge flanges 93 adapted to engage the end members of the series of plates 90. Means axially to actuate the discs 92 to effect a clamping action comprises nuts 94 threaded upon the mandrel and engaging the faces of the plates 92 so that turning of the nuts move the plates along the shaft.

It will be observed that each of the annular plates or discs 90 is provided near the outer perimeter with a series of teeth 96, the roots of which are blended into the side walls of depressions 97 in order to strengthen them. Teeth 96 are adapted to hook over one side wall of the section 89 to lock the same against outward movement due to centrifugal forces. The lower portion of each depression may terminate in a slit and the edge thus provided may be hooked over the walls of an adjacent section, thus positively locking both side walls of each section against centrifugal action.

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Means constituting seats maintaining the sections 89 in concentric relationship with respect to the shaft or mandrel 91, comprises depressions or indentations 98 pressed in the discs 90 and having their upper edges cut free by slitting to provide seats as at 99 for the inner perimeters of the channels of the sections. The depressions may be formed upon a single side of a disc near the outer perimeter thereof, or as illustrated in the drawings, they may be formed upon opposite sides in perimetrically spaced relationship so that each annulus 89 is supported upon both sides.

For purposes of increasing the security of seating of the discs 90 upon the mandrel 91, the discs may be provided about their inner perimeters with flanges 100 seating upon the mandrel.

Further applications of the principles of the invention are disclosed in Figs. 9, 10, and 11 of the drawings. In the construction, as disclosed in Figs. 9 and 10, the locking device comprises sheet metal member 101 which may be an annulus or a spiral strip, as may be desired (the fragment as disclosed in Figs. 9 and 10 being of either form); this element has teeth 102 struck out from the metal leaving openings 103. A depression 104 is pressed into the metal across the entire width of the element and the walls thereof are blended into or become tangential with respect to the plane of the teeth 102 when the latter are in erect position.

The construction of Figs. 9 and 10, if of spiral form, may be employed as is the strip 73 as shown in Fig. 7, the axially inner portions of the depressions 104 being disposed as spacers between contiguous turns of the strip 66. The positioning of such strip between the turns of the strip 66 is illustrated in Fig. 9. Naturally, the member 101 may also be formed as an annulus designed to be placed between annular sections such as are illustrated in Figs. 2 and 13.

In the construction as disclosed in Fig. 11 of the drawings, bristle holding means 105, such as basic sections or spiral turns, are formed and comprise as the holding means for the double ended bristles a channel 106 which may be wound as a spiral or may be an annulus, as may be desired. The side walls of the strip are inwardly inclined with respect to each other to provide a dove-tail section. The locking device or means for this construction comprises a sheet metal element 107 which may be an annular ring or spiral tape dependent upon whether the device is to be used to secure annular base sections or a spirally wound strip upon a mandrel, such as the mandrel 108. The locking means 107 includes teeth 109 struck out from the metal and having depressions 111 at the roots thereof and the planes of which blend into, or become tangent with respect to the walls of the depressions. It is to be observed that in these constructions, the depressions 111 are not slit at their lower edges, but are wedged between contiguous side walls of adjacent basic sections or in event that the brush is of a spirally wound strip, between the side walls of contiguous turns. It is evident that in this construction, the teeth 109 locking over the upper edges of the side wall of the brush element (strip or annular section) securely hold one side wall while the lower portion of the depression projecting in the opposite direction secures the other side wall by wedging action.

An appropriate locking ring which may be used with a basic section comprising a trapezoidal section is fragmentarily illustrated in Fig. 14. It comprises an annular ring of sheet metal indicated at 112 and having teeth 113 struck out leaving openings 114. Depressions 116 of approximately semicircular section and ovoid outline, are pressed into the metal at the roots of the teeth, but project from the sides of the metal opposite the teeth. The depressions may be wedged between two basic sections having inverted trapezoidal section while the inner edges of the teeth bear upon the edges of the side walls. The depres-

sions, as shown in Fig. 14, terminate a substantial distance from the outer perimeter of the annulus. This assists in preventing stretching of the annulus under tension.

The teeth, shown in the several embodiments, penetrate between the bristles and assist in preventing peripheral creeping of the bristles. They also tend to stiffen the bristles by shortening the length of unsupported material.

In those constructions, as shown in Figs. 2, 8, and 12, where teeth are provided upon side walls of sheet metal channel or upon annular side plates and in either instance where the teeth engage or lock a filamentary core which hold the bristles in place, the core may be regarded as being the holding means for the bristles; the toothed side walls of the channel or the side plates of a basic section may be regarded as locking means for the holding means. In those instances where a separate spiral strip having teeth engaging the edge of a spiral channel, having teeth as in Fig. 7 or a separate annular ring as in Fig. 5, having angularly spaced teeth engaging the edges of the annular side plate of a section is provided, the channel or side plates may be termed holding means for the bristles; the separate strip or separate ring may be termed locking means for said holding means.

It will be apparent to those skilled in the art that the embodiments of the invention as herein disclosed are by way of illustration rather than limitation. Numerous 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 structure comprising an axially extending core of circular section having bristle material projecting radially therefrom, holding means extending around the core and holding the bristles in place upon the core, locking means for said holding means also extending around the support, said locking means comprising a radially projecting sheet metal element contiguous to and paralleling the holding means and projecting substantially radially from the core and having a series of peripherally spaced teeth projecting longitudinally of the core, said teeth engaging the outer circumference of said holding means, said sheet metal element further having depressions corresponding to the teeth formed therein with an edge of each depression forming the roots of the corresponding tooth and projecting upon the side of the sheet metal opposite the teeth, the roots of the teeth being integral with and blended into the walls of the depressions.

2. A locking ring for securing annular basic sections of a rotary brush upon a mandrel, comprising an annular plate having a series of peripherally spaced teeth normal to the plane of said plate and being adapted to engage the outer perimeter of a side wall of one of said basic sections, the plate further having depressions formed therein and projecting upon the side of the plate opposite the teeth, the roots of the teeth being integral with and blended into the walls of said depressions, there being a depression for each tooth.

3. A rotary brush structure comprising a channel strip spirally wound upon a mandrel, said channel strip comprising a channel backing element having a bottom with side walls projecting radially therefrom, double ended brush bristles secured between the side walls and being held in position by a filamentary core disposed in the looped portions of the double ended bristles, the side walls of the channel further having integrally formed, peripherally spaced teeth struck inwardly parallel to the axis of the brush and being disposed in radial planes and engaging the filamentary core, and further having depressions struck outwardly at the roots of the teeth, the roots of the teeth being integral with, blended into, and being an inward continuation of the walls of the depressions, there being a depression for each tooth.

4. A locking ring for securing annular brush sections upon a mandrel comprising an annular plate adapted to

fit upon the mandrel between a pair of brush sections and having a series of integrally formed peripherally spaced teeth struck out normal to the annular plate and being disposed in radial planes and being adapted to engage a side wall of a brush section upon the mandrel and further having a series of depressions formed therein at the roots of the teeth and projecting upon the side opposite the teeth, there being a depression for each tooth and the roots of the teeth being blended into and being an integral continuation of the walls of the depressions, the depressions being terminated a substantial distance within the outer perimeter of said annular plate.

5. Means for locking brush sections upon a rotary brush mandrel comprising an annular plate having a series of peripherally spaced teeth struck out normally with respect to the plane of the plate, said teeth being disposed in radial planes and being adapted to engage the outer perimeter of a side wall of a brush section mounted upon the mandrel contiguous to the plate, said plate further having depressions struck radially there across from the inner to the outer perimeter and projecting upon the side opposite the teeth, the roots of said teeth being integral with, blended into and constituting a continuation of the side walls of the depressions.

6. Means for locking brush sections upon a rotary brush mandrel comprising an annular plate having a series of peripherally spaced teeth struck out normally with respect to the plane of the plate, said teeth being disposed in radial planes and being adapted to engage the outer perimeter of a side wall of a brush section mounted upon the mandrel contiguous to the plate, said plate further having a series of depressions corresponding in number to the teeth struck radially there across from the inner to the outer perimeter and projecting upon the side opposite to the teeth at the roots thereof, the roots of said teeth being integral with, blended into and constituting a continuation of the side walls of the depressions, the depressions being adapted to constitute spacer elements between contiguous sections permitting movement of air between said sections.

7. A rotary brush comprising a pair of annular basic sections mounted upon a central mandrel, a flat annular locking ring disposed upon the mandrel between the section, said ring having teeth struck out normally to the plane of the ring from a surface thereof and being disposed in radial planes and being adapted to engage the outer edge of a side wall of one of said basic sections and further having depressions struck from the side opposite the teeth, the roots of the teeth being integral with, blended into and constituting a continuation of the walls of the depression, the convex sides of the depressions having portions engaging the outer perimeter of a side wall of a basic section contiguous thereto.

8. Means for supporting and locking an annular brush section upon a rotary mandrel comprising an annular plate-like element adapted to seat upon a mandrel and having a series of peripherally spaced teeth struck therefrom and projecting normally with respect to the face of the plate and being disposed in radial planes, a series of depressions formed in the plate-like element at the roots of the teeth, and opposite in direction to the teeth, the teeth being integral with, and blended into, and being a continuation of the walls of the depressions, there being a depression for each tooth, the teeth being adapted to engage the outer perimeter of a brush section upon the mandrel, said plate further having a second series of peripherally spaced depressions formed therein and projecting to engage the inner perimeter of the section whereby to maintain said section in centered relationship with respect to the mandrel.

9. A rotary brush section comprising double-ended bristles doubled about a ring-like core and projecting outwardly from the core and annular plates engaging the sides of the bristle mass thus formed, ring means joining

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the plates together to form a channel containing the ring-like core, the plates being of an outer diameter less than that of the section and greater than that of the core and of an inner diameter less than that of the core, one of said plates having a series of angularly spaced teeth struck normally therefrom in radial planes and engaging the core and a series of indentations being formed in the latter plate at the bases of the teeth, one of the depressions being for each tooth and the walls of the depressions being blended with, a continuation of, and integral with

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the roots of the teeth and projecting from the plate on the side opposite the teeth.

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