May 31, 1966 B. E. NELSON 3,253,291

ROTARY BRUSH

Filed April 28, 1964 3 Sheets-Sheet 1

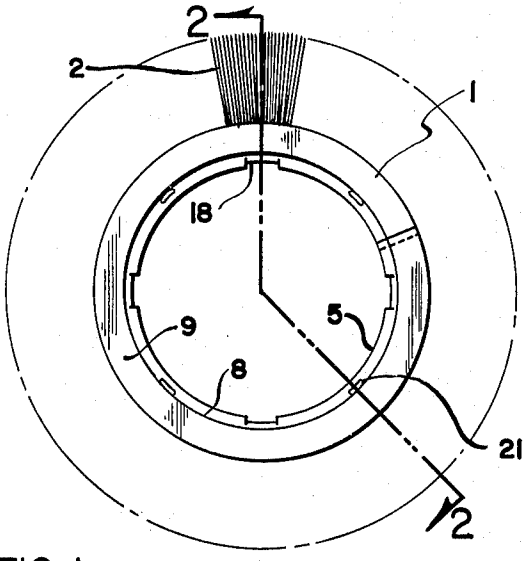

FIG_1

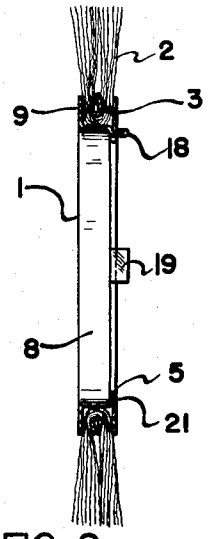

FIG_2

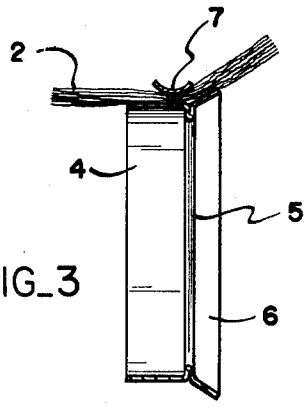

FIG_3

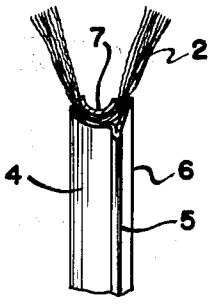

FIG_4

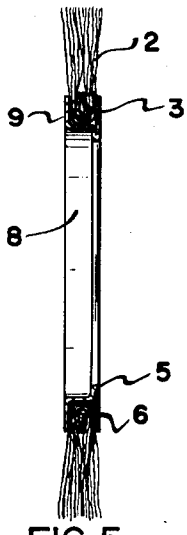

FIG_5

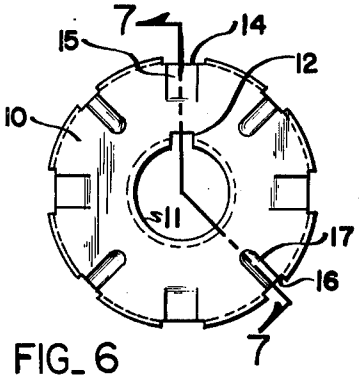

FIG_6

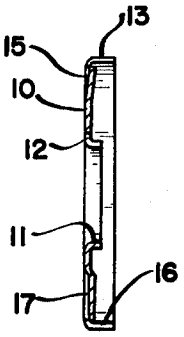

FIG_7

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May 31, 1966 B. E. NELSON 3,253,291

ROTARY BRUSH

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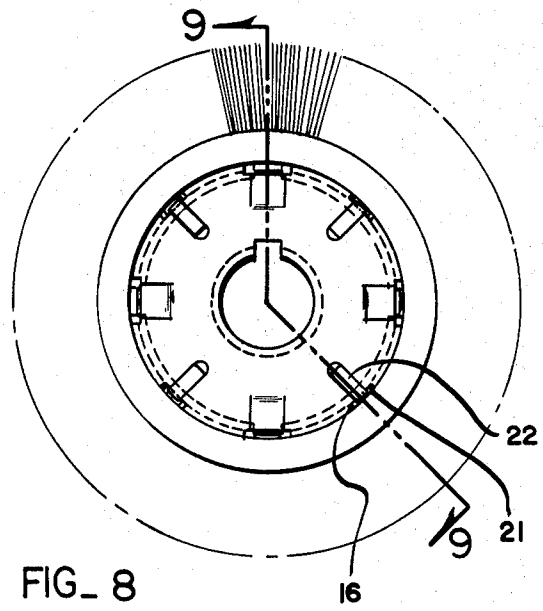

FIG_8

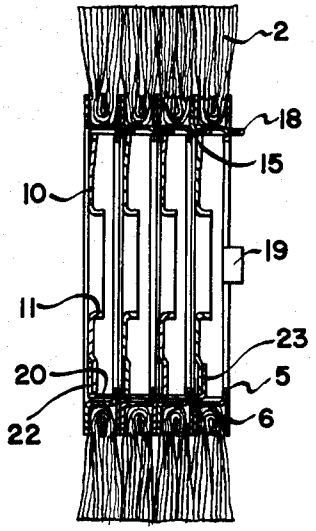

FIG_9

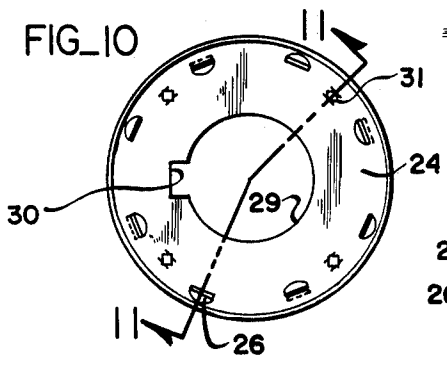

FIG_10

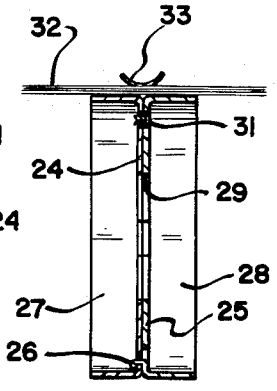

FIG_11

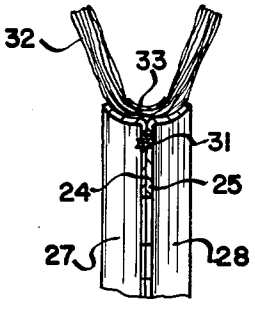

FIG_12

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ROTARY BRUSH

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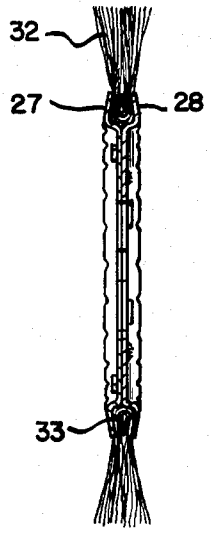

FIG_13

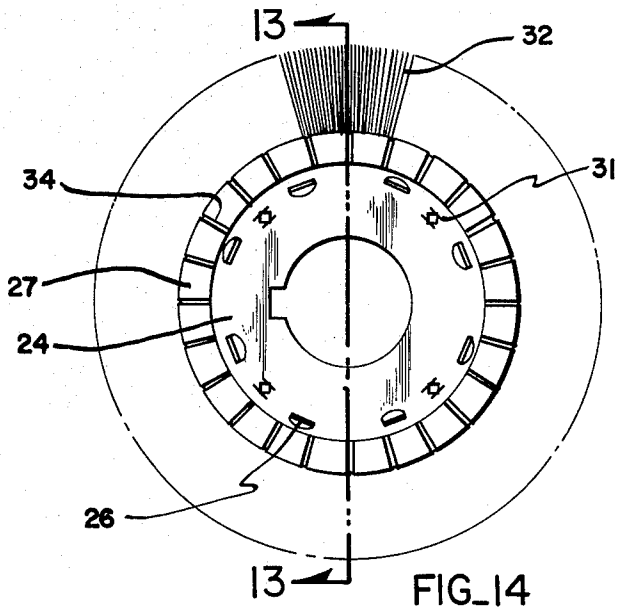

FIG_14

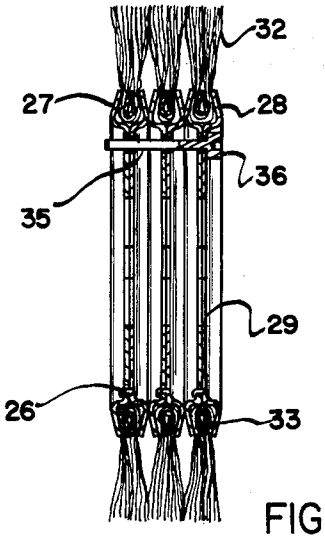

FIG_15

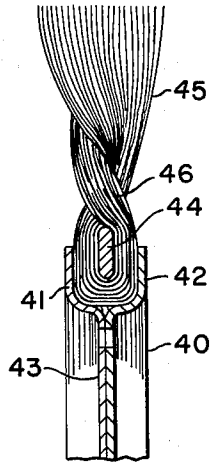

FIG_16

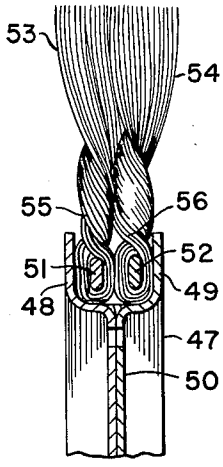

FIG_17

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United States Patent Office 3,253,291 Patented May 31, 1966

3,253,291

ROTARY BRUSH

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Filed Apr. 28, 1964, Ser. No. 363,156
8 Claims. (Cl. 15—181)

This application is a continuation in part of my co-pending application, Serial No. 289,305, filed 20 June 1963, entitled "Brush Construction" now abandoned.

This invention relates generally, as indicated, to a novel rotary brush construction and more particularly to a power driven rotary brush wherein the brush material is securely held in place and permanently maintained in a concentric relationship with the brush support means and which is adapted to be mounted upon an appropriate mandrel, arbor or the like.

Rotary brushes have long been known by the prior art, as for example, Whittle Patent 2,288,337, in which brush material is retained in an annular brush-back of generally channel shape cross-section by means of a retaining ring. Such brushes have been manufactured and sold commercially for a long period of time with considerable success. As mentioned in the Whittle patent, however, problems have been encountered under conditions of severe use, for it has been found frequently that the brush material is insecurely retained in the brush-back which results in an undesirably rapid deterioration of the brush due to shedding. Such condition also causes the brush to become unbalanced due to the fact that the brush material will shift either locally or as a body circumferentially of the brush and also that the retaining ring will shift eccentrically of the brush axis. Because of the increasing tendency to utilize power driven brushes at high speeds of operation as precision tools for the performance of many delicate brushing operations, brush unbalance is extremely undesirable.

It is equally important that such power driven brushes be easy to mount on various sizes and types of arbors and designed for axial assembly into multiple section brushes. It is also very desirable that such brushes be suitable for employment without the necessity of face plates to adapt the brush sections to the arbor.

It is accordingly an important object of the present invention to provide a power driven brush construction of the general type disclosed in the aforesaid Whittle patent having improved ability to hold concentricity in use.

It is an additional object of this invention to provide a rotary brush in which the brush material is held securely in position thereby preventing the loss of such material under conditions of severe use.

Another object of the invention is to provide a brush section which is dimensionally stable on its inside diameter.

Yet another object is the provision of a rotary brush in which brush unbalance is avoided by means of a brush material retaining ring which is tightly packed within the brush material thereby preventing the shifting of the retaining ring and brush material during operation.

Other objects, features and advantages of this invention will become apparent to those skilled in the art after a reading of the following more detailed description of the invention.

These and other objects are achieved by means of this invention in which an annular rotary brush construction is provided which is comprised of an annular brush-back having a radially outwardly opening sheet metal channel, a brush material retaining ring within the channel, a radially inwardly extending reinforcing flange which supports

the inner periphery of the channel, and brush material tightly interposed between the channel and retaining ring and extending radially outwardly therefrom to form the working surface of the brush. As will be explained more fully hereinafter, in such a brush the brush-back is supported against pressure of the brush material and retaining ring by the reinforcing flange and thus insures the maintenance of concentricity of the retaining ring, brush material, and channel of the brush-back.

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

FIG. 1 is an end view of an annular brush section constructed in accordance with the present invention;

FIG. 2 is a transverse section taken on the line 2—2 of FIG. 1;

FIGS. 3, 4 and 5 are sequential views illustrating a series of steps in the manufacture of a brush section in accordance with the invention, FIGS. 3 and 4 being fragmentary sections and FIG. 5 being a diametral transverse section;

FIG. 6 is an end view of an adapter designed to be employed with a brush section of the type previously illustrated;

FIG. 7 is a transverse section through such an adapter taken on the line 7—7 on FIG. 6;

FIG. 8 is an end view of a brush assembly comprising a plurality of annular brush sections utilizing such adapters;

FIG. 9 is a transverse section through such assembly taken on the line 9—9 on FIG. 8;

FIGS. 10, 11 and 12 are sequential views illustrating the mode of manufacture of another form of brush section embodying the principles of the invention, FIG. 11 being a transverse section taken on the line 11—11 on FIG. 10 and diagrammatically indicating the manner in which a layer of brush material and retaining ring are preliminarily mounted thereon, with FIG. 12 being a fragmentary sectional view illustrating a stage in the deformation of the elements;

FIG. 13 is a diametric cross-section through the completed brush taken on the line 13—13 on FIG. 14;

FIG. 14 is an end view of such completed brush;

FIG. 15 shows a plurality of these brush sections axially assembled and interconnected to form a multiple section cylindrical brush unit; and

FIGS. 16 and 17 are fragmentary sectional views showing additional embodiments of the present invention.

Now referring more particularly to said drawing and especially FIGS. 1–5 inclusive thereof, the brush section shown in FIGS. 1 and 2 comprises a sheet metal channel form back 1 having a layer of brush material 2 secured therein by means of an annular retaining element 3, likewise formed of sheet metal and being of collapsed U-shape cross-section.

As shown in FIGS. 3, 4 and 5 of the drawing, the mode of manufacture of such annular brush section is generally similar to that disclosed in Whittle Patent 2,288,337, but the brush-back or brush material receiving channel is of a different conformation. Thus, as indicated in FIG. 3, a sheet metal (ordinarily steel) annulus is formed having a generally cylindrical portion 4, a radially inwardly extending flange or rib 5 formed by folding and rebending the sheet metal, and an outwardly flaring side portion 6 extending to the other side of such radial

flange from cylindrical portion 4. A layer of brush material 2 is disposed about the outer surface of such annulus with the bristles (if bristles be employed) extending parallel to the axis of the annulus, and an outer sheet metal ring 7 of shallow U-shape cross-section is slipped over such brush material fairly tightly to clamp the latter in place upon the inner annulus. Then, as indicated in FIG. 4, portions 4 and 6 of the annulus are deformed outwardly to fold the layer of brush material about the retaining ring 7 while progressively compressing the latter to collapsed U-shape cross-section and thereby producing the retaining ring 3 (FIGS. 2 and 5). The original cylindrical portion 4 provides both the inner cylindrical surface 8 and the other side 9 of the channel shaped brush-back 1. As disclosed in Whittle Patent 2,288,337, this mode of forming the retaining ring 3 in situ results in radially inward shrinking of such retaining ring with consequent firm clamping of the folded brush material between the same and the bottom portion 8 of the brush-back channel. Flange 5, in this embodiment, constitutes a radially inward extension of one side of the channel back.

The radially inwardly directed rebent flange portion 5 of the annular brush-back is, of course, integral with the latter and greatly reinforces and rigidifies the same, both during the forming steps illustrated in FIGS. 3–5 inclusive of the drawing and also during subsequent operation of the brush in use. The brush section accordingly is dimensionally stable on its inside diameter and capable of holding the desired concentricity which is so important if uniform brushing action, avoidance of vibration and firm retention of the brush material are to be achieved. The provision of such radially inwardly directed integral flange 5 is also of assistance for another purpose as explained below.

The individual brush section may desirably be mounted on an adapter 10 comprising an annular dished sheet metal stamping of general flat disc shape provided with a central opening 11 having an inturned lip adapted to fit a corresponding arbor and notched at 12 to receive the usual drive key. The outer edge portion or rim 13 of adapter 10 is similarly upset to provide a cylindrical seat for the inner cylindrical surface 8 of the channelform brush-back 1, such seat being notched or cut away at four equally circumferentially spaced points as at 14 and indented as at 15 in the regions extending radially inwardly from such notches. The four other equally circumferentially spaced notches such as 16 are provided in such cylindrical seat 13 with depressed lands extending radially inwardly therefrom.

A plurality of brush sections may be individually mounted on the above-described adapters and then assembled together to form a cylindrical brush unit in the manner shown in FIGS. 8 and 9 to which reference may now more particularly be had. Laterally projecting tabs such as 18 and 19 may be struck up from the radially inwardly extending rebent flange 5 of each brush section (FIGS. 2 and 9) and a plurality of brush sections (four are shown) axially assembled by tightly inserting such tabs in the recesses provided by the notches 14 of the adjacent adapters, thereby interlocking all of the brush sections for rotation together as a unit. Tabs 18 and 19, of course, extend parallel to the inner cylindrical surfaces 8 of the channelform brush-backs and directly underlie the latter. The indentations 15 in the adapters 10 serve more centrally, and therefore more firmly, to underlie and engage the tabs such as 18 and 19.

In order further positively to secure the assembly together, flat metal strips such as 20 may be inserted through the aligned notches 16 of the several adapters and the apertures or holes 21 in flanges 5 of the brush sections, and their respective ends such as 22 and 23 bent radially inwardly to be received within the depressions 17 of the exposed adapter face at one end of the assembly and adequately recessed within the brush assembly at the other end. It will thus be seen that a novel brush section has been provided which is capable of manufacture in an advantageous manner with modifications which greatly rigidify the construction and maintain the desired concentricity. Such sections may be assembled together in a novel manner to provide a cylindrical brushing unit in which all elements are firmly interlocked for driving as a single brush when mounted on an arbor.

Now referring to FIGS. 10 through 15 inclusive of the drawing, another embodiment of the invention is there illustrated having certain novel and desirable attributes. A pair of flat sheet metal discs 24 and 25 are joined together by means of tabs such as 26 lanced from one disc and inserted through corresponding openings in the juxtaposed disc, being then upset to clinch the two discs together. Other alternative means may, of course, be employed to join the two discs such as spot welding, for example. These discs are dished to provide outer cylindrical portions 27 and 28 respectively and have aligned central openings providing an arbor hole 29 provided with the usual key slot 30. The opposed discs are also lanced as at 31 to provide pairs of opposed prongs or cam locks for a purpose explained below.

As diagrammatically indicated in FIG. 11, a layer of brush bristle material 32 may be disposed about the outer cylindrical surface of the disc assembly extending parallel to the axis of the latter and an outer sheet metal ring 33 of shallow U-shape cross-section may then be slipped over such brush material fairly tightly to clamp the latter in place. The cylindrical portions 27 and 28 are then flared outwardly as shown in FIG. 12 with progressive deformation of retaining ring 33 until a brush material receiving channel is produced as shown in FIG. 13 and the ring 33 is deformed to collapsed U-shape cross-section firmly to secure the brush material within the channel. Radial grooves such as 34 may be formed in the channel sides to facilitate outward flow of cooling air when a plurality of the brush sections are assembled together as shown in FIG. 15.

Referring now particularly to FIG. 13 of the drawings, the brush-back has a radially outwardly opening channel 37, which is formed by the pair of metal stampings. The inner periphery of the brush channel is supported generally midway of its width by a radially inwardly extending reinforcing flange 38. The annular retaining ring is positioned within the channel to retain firmly the brush material therein, with such material being doubled about the retaining ring and extending radially outwardly therefrom to form the working surface of the brush.

A plurality (in this case three) of the FIG. 14 brush sections may be conveniently assembled together to form a single cylindrical unit as shown in FIG. 15 by means of four drive pins such as 35 which lock to each section by means of the prongs or cam locks 31 lanced into each of the latter. The pins 35 are provided with socket heads 36 adapted to receive and engage the leading ends of corresponding pins or an adjoining multiple unit so that a plurality of these may be mounted on an arbor in directly engaged relationship. Flanges of collars (not shown) with mating holes and projections may be applied at each end of the complete assembly to confine and drive the brush. If desired, the brush sections may be deformed in the manner illustrated and described in U.S. Patent No. 3,090,062 in order to achieve an especially uniform finish on the work. It will thus be seen that the form of brush construction last described and illustrated in FIGS. 10 through 15 inclusive incorporates its own adapter, the arbor hole 29 being dimensioned as desired to fit the particular arbor on which it is contemplated the finished brush will be mounted.

In FIGS. 16 and 17, additional embodiments of the invention are illustrated. As shown, channel 40 is composed of a pair of metal stampings 41 and 42 which are welded together. The channel is supported by a flat sheet

metal reinforcing flange **43** which is positioned generally midway of the width of the channel to support same against the pressure of the brush material and brush material retaining ring. A solid brush material retaining ring **44** is positioned within the channel to secure the brush material **45** within the channel between the retaining ring and lower portion of the channel. The brush material is doubled about the retaining ring and twisted about itself at **46** so as to be comprised of a plurality of tufts of such material.

The FIG. 17 embodiment is similar to that of FIG. 16, except that a plurality of annular retaining rings are employed. As shown, channel **47** is composed of metal stampings **48** and **49** and is supported by a reinforcing flange **50**. A pair of solid retaining rings **51** and **52** are positioned within the channel. Tufts of brush material **53** and **54** are doubled about the retaining ring and themselves as shown at **55** and **56**, and extend radially outwardly therefrom to form the working surface of the brush.

When a solid retaining ring is employed, of the type illustrated in FIGS. 16 and 17, the brushes can advantageously be produced by the following method. Such method generally comprises the sequential steps of forming a sheet metal cylinder with a radially inwardly extending reinforcing flange of the type illustrated in FIGS. 10–12. A brush material retaining ring with a body of brush material doubled thereabout, or alternatively doubled about the retaining ring and twisted about itself, is axially applied closely about the cylinder thereby uniformly interposing the brush material between the retaining ring and the cylinder in a press-fitted relationship. In this position, the retaining ring is axially located in the same radial plane as the radial flange. The cylinder is thereafter formed into channel shape, thereby tightly packing the brush material between the retaining ring and channel.

It is to be noted that brush constructions of the type described can be produced by this method because of the provision of a radially inwardly extending reinforcing flange on the sheet metal cylinder, which flange supports the cylinder while the retaining ring and brush material are being axially applied. Without such a reinforcing flange, the cylinder would tend to yield to a greater extent than desirable and thus create a weakened condition within the brush-back. Because of the provision of a reinforcing flange on the cylinder, however, the above result will not occur.

One of the principal advantages of the last-described method is that, since the brush material can be doubled about the retaining ring prior to positioning on the cylinder, it can be very tightly wrapped therearound and thus will remain tightly packed when finally positioned within the brush-back. In addition, the brush material and retaining ring can be very exactly positioned within the brush-back so that a concentric relationship will be maintained.

When a rotary brush of the type described herein is used in a normal brushing operation, pressure is, of course, applied on the face of the brush which in turn exerts pressure on the brush material, retaining ring, and brush-back. Since the reinforcing flange provided by this invention is positioned beneath the brush-back channel, the flange will support the channel against the pressure which is being applied against the brush material and the brush material retaining ring. Since the channel is reinforced, it will thus yield under pressure to a considerably lesser extent than the prior art constructions. This is particularly true of the embodiments of this invention in which the reinforcing flange is positioned generally midway of the width of the brush back channel. Consequently, the brush material will remain tightly packed within the channel and will be precluded from shifting either locally or as a body circumferentially of the brush. In the same manner, the retaining ring will be securely held in place and prevented from shifting appreciably during use. Thus, the annular retaining ring and brush material will be maintained in a concentric relationship with the brush axis.

By press-fitting the tuft-carrying retaining ring very tightly on the cylindrical surface which subsequently comprises the channel bottom and then actively squeezing the basal portions of the twisted tufts between the outturned channel sides (e.g. FIGS. 16 and 17), the tufts may be forced to untwist slightly and thereby space the wire bristles apart where they emerge from the channel mouth, with consequent reduction in wear due to rubbing of one wire against another in use. The tufts are thereby also firmly held against highly undesirable wobbling as well as circumferential shifting. Solid ring **44** supports such press-fitting operation.

Any of the well-known brush materials may be utilized in this invention such as, for example, horsehair, tampico fibers, crimped wire, nylon, plastic coated wire and plastic coated glass fiber strands. The channel back and reinforcing flange will usually be of sheet metal such as steel but other appropriate materials can be employed depending upon the use intended.

In view of the foregoing, it is seen that a novel brush construction has been provided which is of unusual rigidity and is accordingly capable of maintaining concise concentricity in use. The radially inwardly extending reinforcing flanges herein provided not only assist in affording such desired rigidity, but also provide means for assembling and mounting the brush sections in multiple units as may be desired.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

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

1. A power driven rotary brush section comprising an annular channelform sheet metal brush back of general U-shape cross-section opening radially outwardly, a retaining ring within said back, a layer of brush material folded about said ring and tightly secured in said back by said ring with such brush material extending radially outwardly therefrom, an integral flange on said back formed of folded sheet metal extending radially inwardly thereof to rigidify said back, and a plurality of openings in said flange adapted to receive means therein to secure a plurality of brush sections into a brush assembly.

2. The brush section of claim **1**, wherein said flange constitutes a radially inward extension of one side of said channel back.

3. The brush section of claim **1**, wherein at least one tab is upset from said flange extending laterally outwardly of the brush-back.

4. A method of making an annular rotary brush comprising forming a sheet metal cylinder having a radially inwardly extending flange normal to the axis of rotation of the brush, axially applying a brush material retaining ring about said cylinder with brush material uniformly interposed between said ring and cylinder in a press-fitted relationship with said ring being axially located about said cylinder in the same radial plane as said flange, and subsequently forming said cylinder into channel shape thereby tightly packing said brush material between said ring and said channel.

5. A method of making an annular rotary brush which comprises the sequential steps of forming a sheet metal cylinder having a radially inwardly extending flat sheet metal reinforcing flange, axially applying a brush material retaining ring closely about said cylinder with brush ma-

terial uniformly interposed between said ring and cylinder in a press-fitted relationship, with said ring being axially located about said cylinder in the same radial plane as said radial flange, and forming said cylinder into channel shape thereby tightly packing said brush material between said ring and channel.

6. The method of claim 5 in which said brush material is doubled around said retaining ring and thereafter said retaining ring and brush material are axially fitted into said channel.

7. The method of claim 6 in which said brush material is twisted about said retaining ring and itself.

8. The method of making an annular rotary brush which comprises twisting a number of wire bristle tufts about a retaining ring with such tufts extending radially outwardly therefrom, press-fitting the resultant ring and tuft assembly onto the outer surface of a cylindrical sheet metal support, turning the side edge portions of such cylindrical support radially outwardly to thereby form a channel embracing the basal portions of such twisted tufts and compressing the channel sides toward each other actively laterally to squeeze such basal portions of such tufts to effect slight untwisting of the latter and thus slightly space such wire bristles apart in their portions extending beyond the channel mouth.

References Cited by the Examiner

UNITED STATES PATENTS

691,929	1/1902	Bicalky	74—230.14
1,561,280	10/1925	Radinse	15—181
1,597,997	8/1926	Nielsen	15—179
1,714,137	5/1929	Radinse	15—181
1,990,025	2/1935	Frost	15—181
2,039,677	5/1936	Brooks	15—181 X
2,288,337	6/1942	Whittle	15—179 X
2,599,785	6/1952	Sax	51—193.1
2,613,383	9/1952	Rousseau	15—181
2,668,311	2/1954	Parry	300—21 X
2,787,017	4/1957	Abbrecht	15—179 X
2,789,302	4/1957	Schofield	15—179
2,929,086	3/1960	Peterson	15—181
3,013,289	12/1961	Sasena	15—181
3,068,504	12/1962	Peterson	15—198
3,114,925	12/1963	Charvat	15—179
3,139,642	7/1964	Nielson et al.	15—181 X

FOREIGN PATENTS

555,950	9/1943	Great Britain.
834,598	5/1960	Great Britain.

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PETER FELDMAN, *Assistant Examiner.*