United States Patent

Schofield

[15] **3,643,281**

[45] **Feb. 22, 1972**

[54] ROTARY BRUSH

[72] Inventor: **Arthur T. Schofield,** Brecksville, Ohio

[73] Assignee: **The Manufacturers Brush Company,** Cuyahoga County, Ohio

[22] Filed: **Jan. 6, 1969**

[21] Appl. No.: **789,302**

[52] **U.S. Cl.** **15/181**

[51] **Int. Cl.** **A46b 13/00**

[58] **Field of Search** 15/179–183, 198, 15/200; 300/21

[56] **References Cited**

UNITED STATES PATENTS

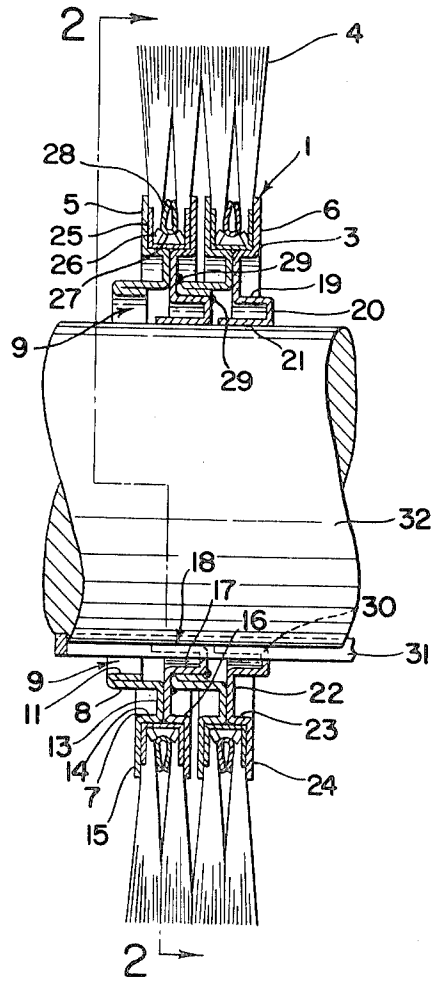
3,253,291	5/1966	Nelson	15/181
1,817,176	8/1931	Curtis	15/181
2,576,408	11/1951	Mertes	15/181
2,825,081	3/1958	Grogan	15/182
3,080,637	3/1963	Dutt	15/181 X
3,084,367	4/1963	Radinse	15/181
3,134,123	5/1964	Nelson	15/182
3,200,430	8/1965	Haracz	15/183
3,233,272	2/1966	Pambello	15/182

Primary Examiner—Peter Feldman
Attorney—McCoy, Greene & Howell

[57] **ABSTRACT**

A rotary brushing tool adapted for mounting on a drive shaft in brushing machinery and suitable for sweeping or scrubbing large areas; such brushing tool comprising a plurality of similar interlocking annular brush elements joined end to end, one to the other, in coaxial alignment. The brush elements are each formed of unitary first and second members and brush bristle material held in such members by anchoring means. The unitary first member has an axial hub portion and a radial flange, as does the unitary second member, and they are mounted with their flanges adjacent one another to form a channel holding the brush bristle material therebetween. The end of the hub portion of the first member is shaped to interlock with the end of the hub portion of the second member of another brush element so that brush elements so formed are joined in this manner end to end in interlocking coaxial alignment. The brushing tool so formed is suited for construction from a variety of materials including sheet metal, but is particularly suited for plastic construction. The tool is also suited for a variety of bristle configurations including a configuration characterized by the brush bristles intersecting the brush axis at oblique angles to afford a side-to-side motion during brush rotation.

25 Claims, 16 Drawing Figures



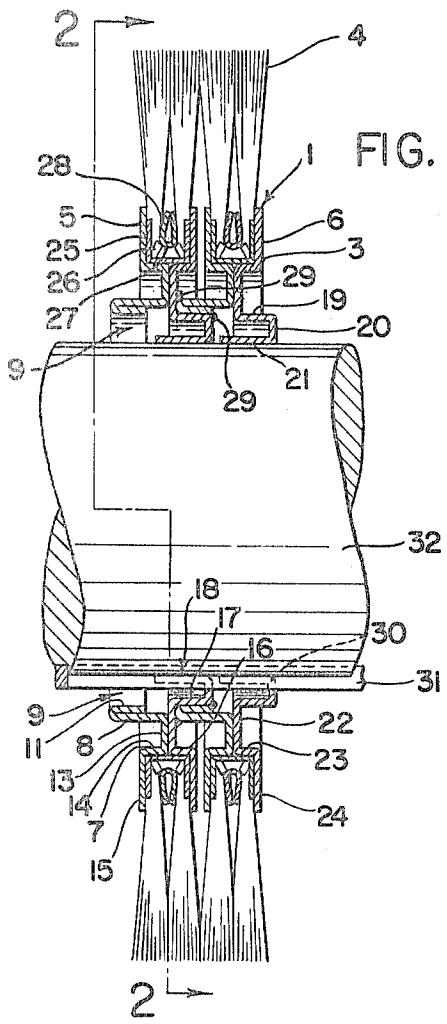


FIG. 1

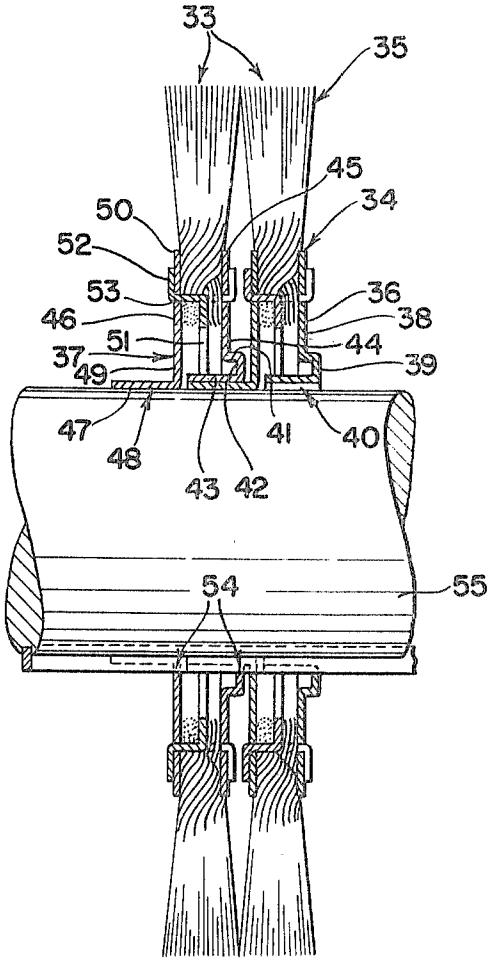


FIG. 3

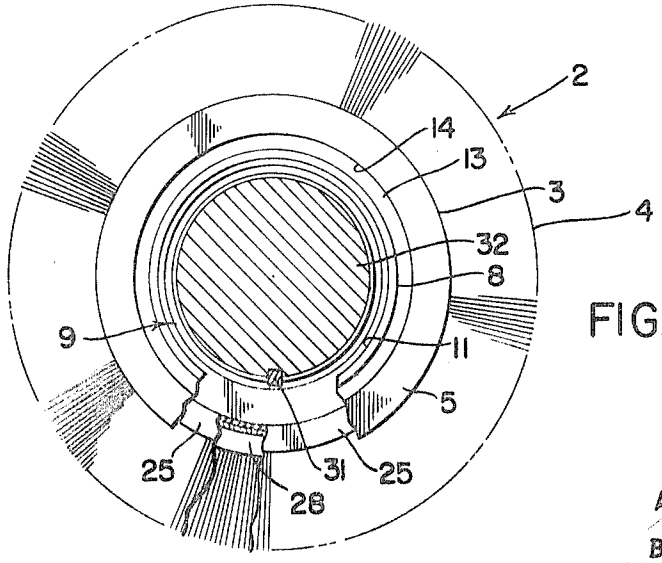


FIG. 2

INVENTOR.
ARTHUR T. SCHOFIELD

BY
McCoy, Greene & Howell

ATTORNEYS

FIG. 4

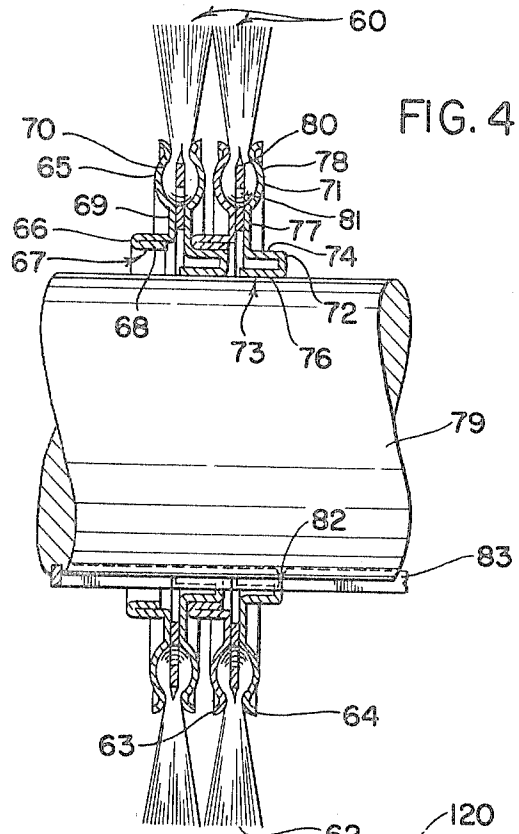


FIG. 5

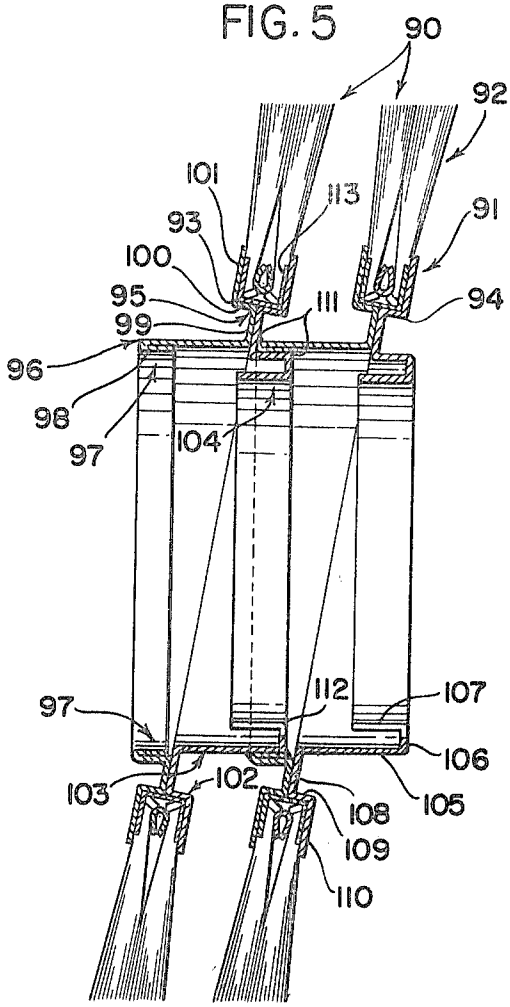
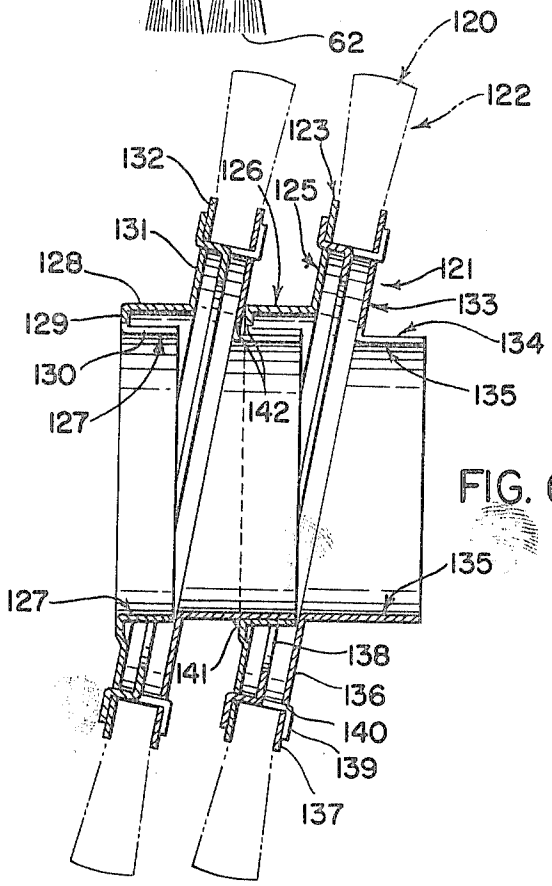


FIG. 6

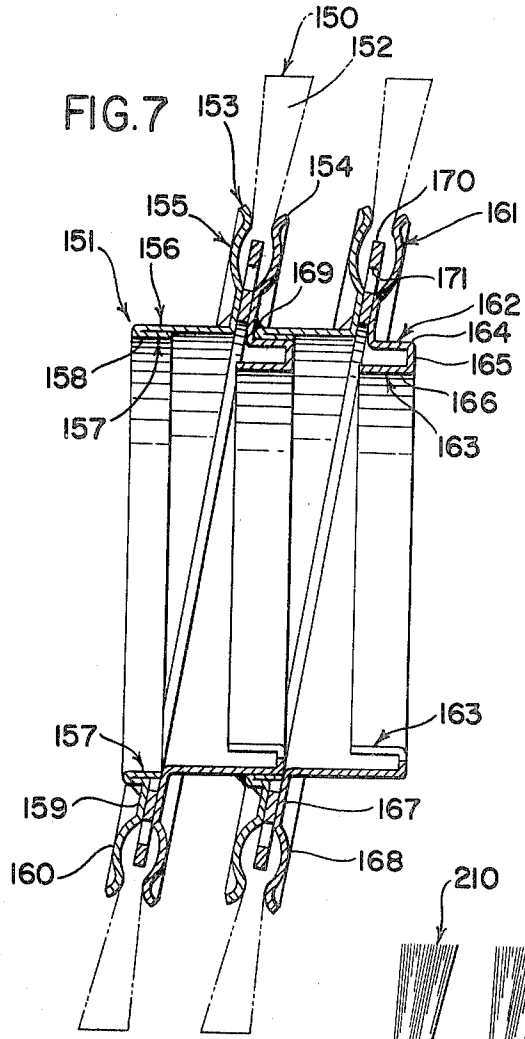


INVENTOR.
ARTHUR T. SCHOFIELD

BY
McCoy, Greene & Howell

ATTORNEYS

FIG. 7



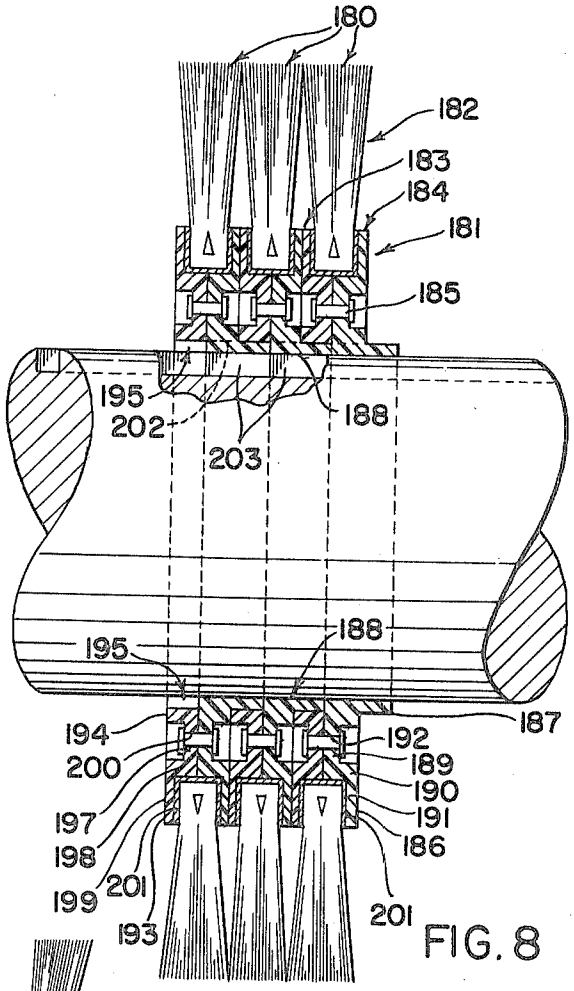


FIG. 8

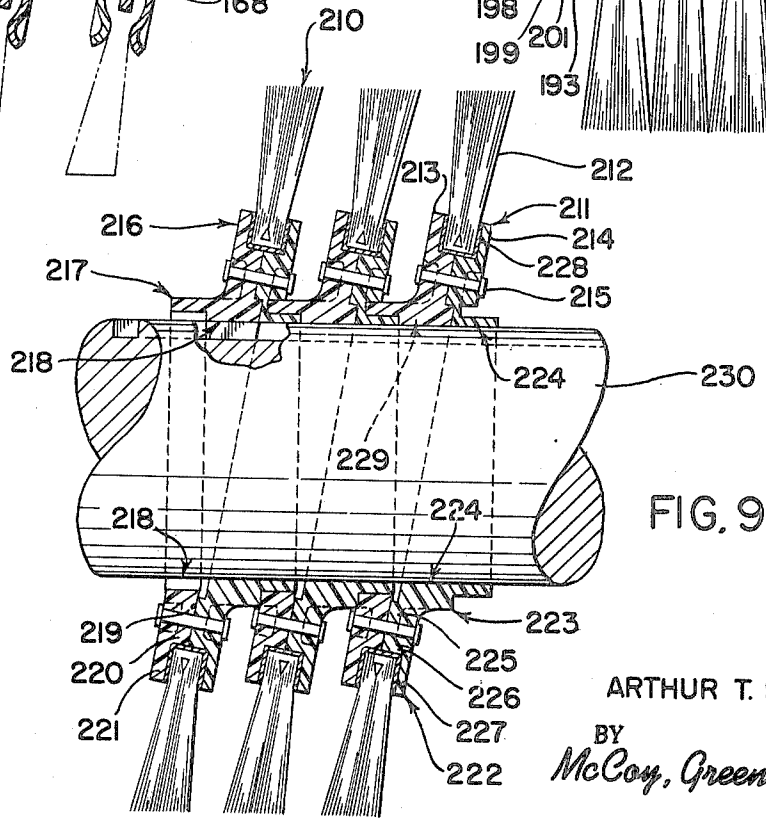


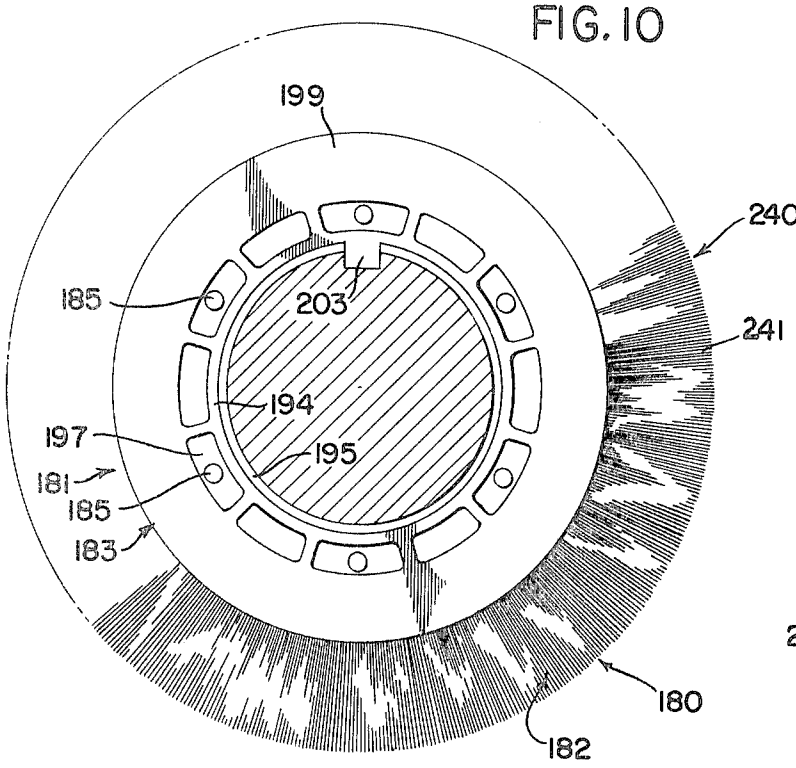
FIG. 9

INVENTOR.
ARTHUR T. SCHOFIELD

BY
McCoy, Green & Howell

ATTORNEYS

FIG. 10



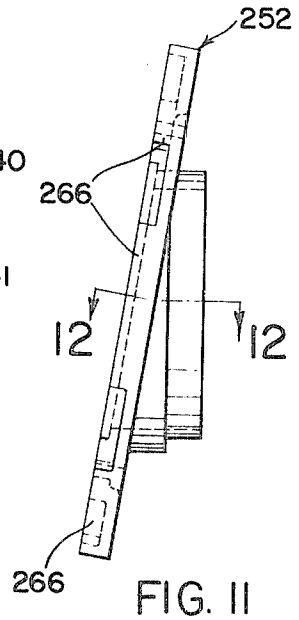


FIG. 11

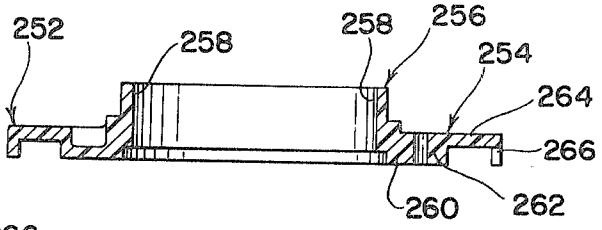


FIG. 12

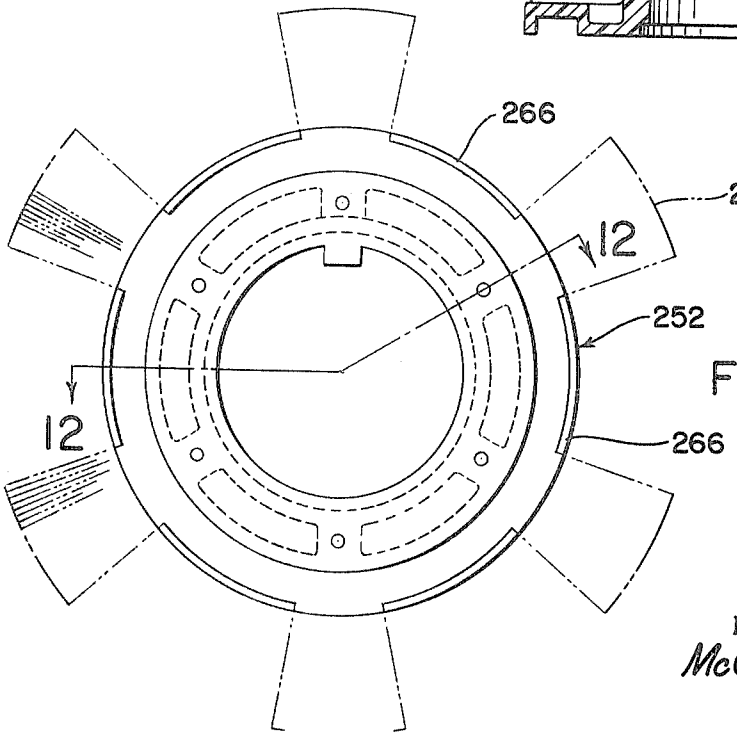


FIG. 13

INVENTOR.
ARTHUR T. SCHOFIELD

BY
McCoy, Greene & Howell

ATTORNEYS

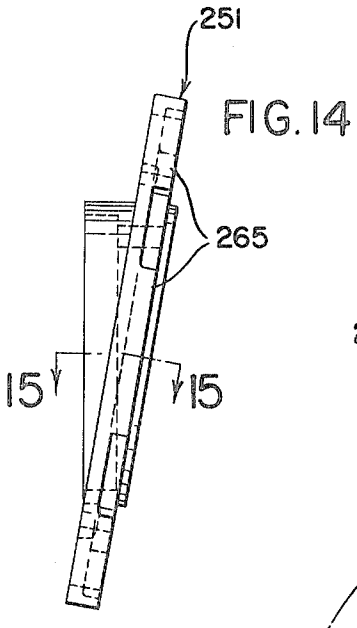


FIG. 14

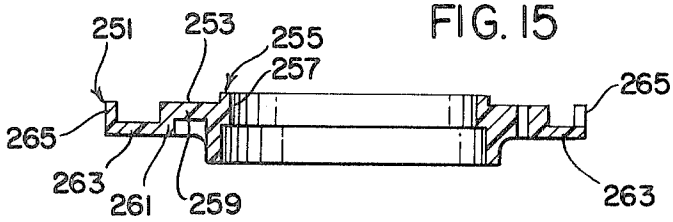


FIG. 15

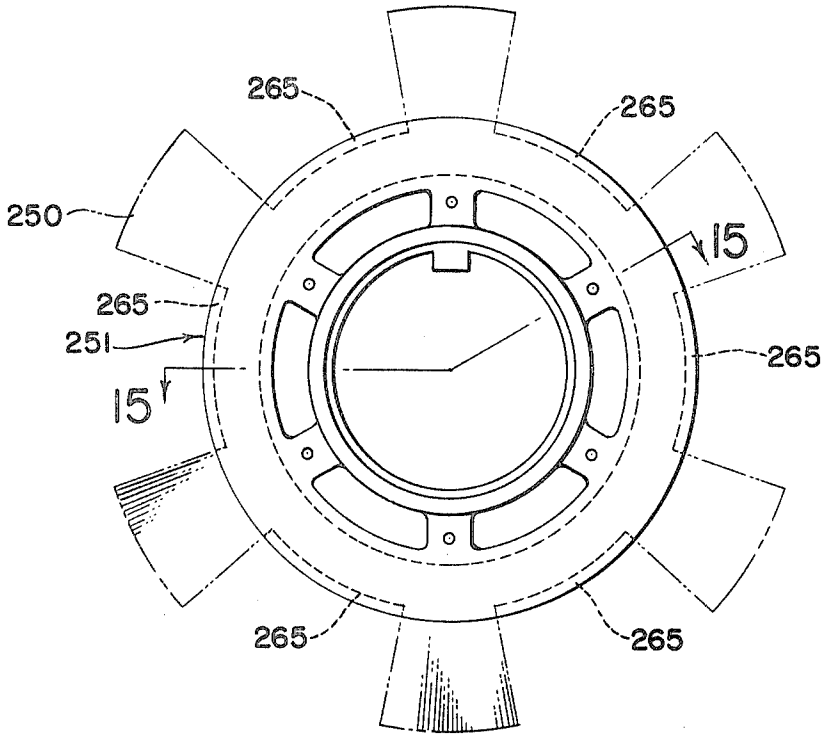


FIG. 16

INVENTOR.
ARTHUR T. SCHOFIELD

BY
McCoy, Greene & Howell

ATTORNEYS

ROTARY BRUSH

THE INVENTION

This invention relates to rotary brushing tools of the type where such tools are formed from a plurality of similar or identical brush elements assembled end to end in coaxial relation. More particularly, this invention relates to rotary brushing tools of relatively great axial extent where such tool is formed from a plurality of similar or identical relatively narrow brush elements assembled end to end in coaxial relation, such tool adapted for mounting on a drive shaft and for use in the sweeping, scrubbing, polishing, cleaning or other similar treatment of large flat surfaces such as floors or roadways.

It has been found desirable to construct large cylindrical brushing tools, such as are typically employed in industrial sweepers and scrubbers, from a plurality of similar or identical disclike brush elements joined end to end. One major advantage in this type of construction is that a number of standard width brush elements may be used to form a variety of brushing tools of varying axial length.

Brushing tools formed in this manner have typically been somewhat difficult to assemble, particularly in the case of "oblique angle" brushing tools. It has been common to mount the brush elements side-by-side on an arbor or mandrel under axial compression, and then to lock them in such position by welding locking rings to the arbor at either end of the brushing tool as shown in Radinse U.S. Pat. No. 3,084,367. When brushing tools of this type become worn out, it was possible to remove the worn brush elements from the arbor and to replace them with new ones. Unfortunately, the difficulty with which these tools were assembled made it nearly impossible for the user to replace the brush elements himself and it was usually necessary for the user to return the brushing tool (as well as the arbor) to the manufacturer for refill. Often, the expense of handling and shipping the heavy arbor (and incident downtime for the brushing machinery) made it preferable to discard the old tool and replace it with a wholly new one.

Attempts to solve the aforementioned problems related to replacement cost and assembly difficulties have included the use of auxiliary "adapters" (i.e., auxiliary units disposed between the brush elements, each having axially projecting arms which extend through apertures in adjacent brush elements and link them together) as shown in Peterson U.S. Pat. No. 2,316,185; and auxiliary cores (hollow lightweight cylindrical sleeves upon which a plurality of brush elements are mounted and slipped over the arbor) as shown in my U.S. Pat. No. 3,106,737.

The brushing tool of the present invention has overcome the aforementioned difficulties attendant to assembly and replacement without the necessity for auxiliary adapters or auxiliary cores. The brush elements of the present invention are formed to be fixedly joined end to end in interlocking coaxial relationship with other like brush elements without the need for auxiliary cores, adapters or the like, so that a plurality of such brush elements may be joined, one to the other, to form a brushing tool. The brush elements are simple to join together and replacement brushing tools may actually be constructed on the premises by the user himself from standard brush elements out of stock, without the need for special tools or costly delays.

The brush elements themselves are inexpensive to manufacture according to the present invention and, accordingly, substantial savings, both in manufacture and in replacement, are effected.

Such brush elements are well suited for construction of oblique angle brushing tools (i.e., brushes wherein the bristle layers are directed generally at angles oblique to the axis of rotation of the brushing tool to effect a side-to-side sweeping action during operation). In the past, assembly of these brushing tools was a particular problem.

Furthermore, the brush elements of the present invention are well suited for construction of their holder portions from plastic material so that even greater savings in cost can be realized over brushes of prior design.

It is important that the brush elements of the present invention are suited to be joined one to the other since this permits a brushing tool formed therefrom to be self-supporting so that it may be mounted between a pair of short cantilevered shafts to eliminate the need for heavier and more expensive full length driveshafts in the brushing machine.

It is thus an object of the present invention to provide a rotary brushing tool comprised of individual brush sections or brush elements which may be fixedly joined one to the other independently of the arbor or drive shaft.

A further object of the present invention is to provide a rotary brushing tool comprised of individual brush sections or elements which may be fixedly joined one to the other independently of the arbor or drive shaft and mounted directly on the drive shaft without the need for a mounting core.

It is a further object of the present invention to provide a rotary brushing tool comprised of individual brush sections or elements which direct the brush bristle material in layers generally at angles oblique to the axis of rotation of the tool, where such brush elements may be fixedly joined one to the other independently of the drive shaft.

It is a further object of the present invention to provide a rotary brushing tool comprised of individual brush sections or elements which direct the brush bristle material in layers generally at oblique angles to the axis of rotation of the tool where such brush elements may be fixedly joined one to the other independently of the arbor or drive shaft and rigidly mounted directly on the drive shaft without the need for auxiliary supporting means.

It is a still further object of the present invention to provide a rotary brushing tool for industrial scrubbing and sweeping machines, which is easy and convenient to replace with a like brushing tool, and which is constructed solely of a plurality of substantially identical, interchangeable brush elements.

These and other objects will become apparent from the following description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional elevational view of a pair of brush elements joined end-to-end and mounted on a drive shaft, such brush elements constructed in accordance with the principles of the present invention.

FIG. 2 is a view taken along lines 2—2 of FIG. 1 with parts broken away and shown in section.

FIG. 3 is a sectional elevational view of a pair of brush elements joined end-to-end and mounted on a drive shaft, such brush elements illustrating a second embodiment of the principles of the present invention.

FIG. 4 is a sectional elevational view of a pair of brush elements joined end-to-end and mounted on a drive shaft, such brush elements illustrating a third embodiment of the principles of the present invention.

FIG. 5 is a sectional elevational view of a pair of oblique brush elements joined end-to-end illustrating a fourth embodiment of the principles of the present invention.

FIG. 6 is a sectional elevational view of a pair of oblique brush elements joined end-to-end illustrating a fifth embodiment of the principles of the present invention.

FIG. 7 is a sectional elevational view of a pair of oblique brush elements joined end-to-end illustrating a sixth embodiment of the present invention.

FIG. 8 is a sectional elevational view of three plastic mounted brush elements joined end-to-end and mounted on a drive shaft, such elements illustrating a seventh embodiment of the present invention.

FIG. 9 is a sectional elevational view of three plastic mounted brush elements joined end-to-end and mounted on a drive shaft, such elements illustrating an eighth embodiment of the present invention.

FIG. 10 is a transverse view of the brush shown in FIG. 8.

FIG. 11 is an elevational view of the first half of the plastic channelform hub member of an oblique tufted brush element according to the present invention.

FIG. 12 is a sectional view along lines 12—12 of FIGS. 11 and 13.

FIG. 13 is a transverse view of the hub member shown in FIG. 11 with the tufted bristle arrangement indicated by broken lines.

FIG. 14 is an elevational view of the second half of the plastic channelform hub member of the oblique tufted brush element shown in FIG. 11.

FIG. 15 is a sectional view along lines 15–15 of FIGS. 14 and 16.

FIG. 16 is a transverse view of the hub member shown in FIG. 14 with the tufted bristle arrangement indicated by broken lines.

I. GENERAL PURPOSE BRUSHES

Referring in greater detail to the drawings, FIGS. 1 and 2 show a portion of a brushing tool 2 of the present invention suited for general purpose scrubbing operations and comprising two brush elements joined end to end in interlocking coaxial alignment. Each of the brush elements 1 comprises a channelform hub member 3 with brush bristle material 4 anchored in the channel of such member 3. The channelform hub member 3 is comprised of a unitary first member 5 and a unitary second member 6.

The unitary first member 5 comprises a first channel forming flange portion 7 and a first hub portion 8. The first hub portion 8 extends axially and has the general form of a right circular cylinder with a central generally circular drive shaft receiving aperture 9. The outer end of the hub portion 8 is bent inwardly to form an axial collar 11. The opposite or inner end of the first hub portion is integrally formed with the channel forming flange portion 7 which extends abaxially therefrom and comprises a radially outwardly extending neck portion 13, a channel base portion 14 extending axially from the distal or radially outer end of the neck portion 13, and a channel side portion 15 extending radially outwardly from the opposite end of the channel base portion 14.

The unitary second member 6 comprises a second channel forming flange portion 16 and a second hub portion 17. The second hub portion 17 has a central drive shaft receiving opening 18 and comprises an axially extending body portion 19, a radial shoulder 20 extending form the outer end of the body portion 19 towards the hub axis, and a sleeve portion 21 extending axially from the opposite end of the radial shoulder portion 20. The opposite or inner end of the body portion 19 of the second hub portion 17 is integrally formed with the channel forming flange portion 16 which extends abaxially therefrom and comprises a radially outwardly extending second neck portion 22, a channel base portion 23 extending axially from the radially outer end of the second neck portion 22, and a channel side portion 24 extending radially outwardly from the opposite end of the channel base portion 23.

The unitary first member 5 and unitary second member 6 are fixedly joined to one another at the neck portions 13 and 22 of their channel forming flange portions 7 and 16, with their hub portions 8 and 17 disposed coaxially. So joined, the first and second members 5 and 6 form an annular channel and comprise the channelform hub member 3.

Brush bristle material 4 is anchored in the annular channel of the channelform hub member 3 in a fashion similar to that shown in my U.S. Pat. No. 3,307,213 by means of a channelform anchor member 25 of substantially U-shaped cross section which defines an anchor channel for receiving brush bristle material. Pairs of axially spaced and transversely aligned prongs 26 project into the anchor channel at circumferentially spaced points. A sheet metal endless annular locking ring 27 is located concentrically within the anchor channel. Brush bristle material 4 is looped over the locking ring 27 and clamped in the anchor channel between the anchor member 25 and the locking ring 27. The locking ring 27 has wall portions 28 arranged with respect to the walls 24 of the channel to securely clamp the brush bristle material 4 therebetween.

The hub portion 8 of the first unitary member 5 has an inner diameter corresponding to the outer diameter of the hub portion 17 of the unitary second member 6. The individual brush elements 1 are joined end to end in interlocking coaxial relationship with the hub portion 8 of the unitary first member 5 of one brush element 1 encircling and interlocking with the hub portion 17 of the unitary second member 6 of the adjacent brush element 1, in telescope-fitted relationship, as shown in FIG. 1. Any number of such brush elements 1 may be joined in this fashion to form brushing tools 2 of varying lengths.

The adjacent interlocked brush elements 1 are fixedly joined one to the other by some suitable means. The channelform hub member of the instant embodiment is preferably stamped from sheet metal and the brush elements are fixedly joined preferably by standard metallic arc spot welding techniques as indicated in the drawings at numeral 29.

The central shaft receiving opening 18 of the second member 6 is preferably provided with a key receiving slot 30 to accommodate a key 31 on the drive shaft 32 which serves to lock the brushing tool 2 against rotary movement relative to the drive shaft 32.

It is important to note the function of the radial shoulder portion 20 of the second hub portion 17 in the construction of brushing tools of the present invention in this and other embodiments. Brush bristle length is largely determined on the basis of the bristle material employed and the job to be done. A single piece of brushing machinery may be employed for a variety of purposes. For example, a self-propelled floor machine manufactured by the G. H. Tennant Company may be used for ordinary dirt sweeping, ordinary scrubbing, and heavy duty floor cleaning (such as shearing paint off a factory floor). Different brushing tools are used for each purpose and they are interchangeable in the machine. While the outer diameter of each brushing tool will generally be the same, it may be desirable to vary bristle length to obtain brushing tools of variable aggressiveness or for other reasons. Generally, shorter bristles will be desired for heavier duty work. If shorter bristles are required in a brush tool having a fixed outer diameter, the outer diameter of the channelform flange portion of the channelform hub member may be enlarged by lengthening the radial shoulder in preference to lengthening the neck portion. The neck is relatively unsupported and may be a weak point in the tool if unduly lengthened. On the other hand, the radial shoulder may be lengthened without appreciably weakening the assembly. These shoulders form a plurality of radial ribs in the brushing tool and, as such, are quite strong when bearing the brushing load together as a unit.

FIG. 3 shows a second embodiment of a portion of a brushing tool of the present invention comprising two brush elements 33 joined end to end in interlocking coaxial alignment. Each of the brush elements 33 is comprised of a channelform hub member 34 with brush bristle material 35 anchored in the channel of such member 34. The channelform hub member 34 is comprised of a unitary first member 36 and a unitary second member 37.

The unitary first member 36 comprises a first channel forming flange portion 38 and a first hub portion 39. The first hub portion 39 has a central drive shaft receiving opening 40 and comprises an axially extending body portion 41, a radial shoulder 42 extending form the outer end of the body portion 41 towards the hub axis, and a sleeve portion 43 extending axially from the opposite end of the radial shoulder portion 42. The opposite or inner end of the body portion 41 of the first hub portion 39 is integrally formed with the channel forming flange portion 38 which extends abaxially therefrom and comprises a proximal neck portion 44 and a distal channel side portion 45.

The unitary second member 37 comprises a second channel forming flange portion 46 and a second hub portion 47. The second hub portion 47 extends axially and has the general form of a right circular cylinder with a central circular drive shaft receiving aperture 48.

The second channel forming flange portion 46 extends radially from the inner end of the second hub portion 47 and comprises a proximal neck portion 49 and a distal channel side portion 50.

The unitary first member 36 and unitary second member 37 are arranged in spaced relation with their channel forming flange portions 38 and 46 adjacent one another and with their hub portions 39 and 47 coaxially aligned. Thus, an annular channel is formed between the channel side portions 45 and 50 of the channel forming portions 38 and 46. An anchor ring 51 is mounted coaxially between the channel forming flanges 38 and 46. The ring 51 has a plurality of prongs 52 extending axially from its peripheral edge, alternate prongs 52 extending in opposite directions and received and secured in slots 53 formed at the base of the channel side portions 45 and 50. A bundle of brush bristle material 35 is looped over each of the prongs 52 of the anchor ring 51 and the ends of the bundle extend out of the channel in the radial direction.

The hub portion 39 of the first unitary member 36 has an inner diameter corresponding to the outer diameter of the hub portion 47 of the unitary second member 37. Thus, the individual brush elements 33 are joined end to end in interlocking coaxial relationship with the hub portion 39 of the first member 36 of one brush element 33 encircling the hub portion 47 of the unitary second member 37 of the adjacent brush element 33, as shown in FIG. 3. Any number of such brush elements 33 may be joined in this fashion to form brushing tools of varying lengths. The individual brush elements 33 are fixedly joined one to the other by suitably placed welds.

The central shaft receiving openings 40 and 48 of the hub portions 39 and 47 of the channelform member 34 are provided with key receiving slots 54 so that the brushing tool is adapted for mounting on a keyed drive shaft 55.

FIG. 4 shows a third embodiment of a portion of a brushing tool of the present invention comprising two brush elements 60 joined end to end in interlocking coaxial alignment. Each of the brush elements 60 comprises a channelform hub member 61 with brush bristle material 62 anchored in the channel of such member 61. The channelform hub member 61 is comprised of a unitary first member 63 and a unitary second member 64.

The unitary first member 63 comprises a first channel forming flange portion 65 and a first hub portion 66. The first hub portion 66 extends axially and has the general form of a right circular cylinder with a central circular drive shaft receiving aperture 67. The outer end of the first hub portion 66 is bent inwardly and reversely to form an axial collar 68. The first channel forming flange portion 65 extends radially outwardly from the inner end of the first hub portion 66 and comprises a proximal neck portion 69 and a distal channel side portion 70.

The unitary second member 64 comprises a second channel forming flange portion 71 and a second hub portion 72. The second hub portion 72 has a central drive shaft receiving opening 73 and comprises an axially extending body portion 74, a radial shoulder portion 75 extending from the outer end of the body portion 74 towards the hub axis, and a sleeve portion 76 extending axially from the opposite end of the radial shoulder portion 75. The opposite or inner end of the body portion 74 of the second hub portion 72 is integrally formed with the second channel forming flange portion 71 which extends radially outwardly therefrom and comprises a proximal neck portion 77 and a distal channel side portion 78.

The unitary first member 63 and second member 64 are fixedly joined at the neck portions 69 and 77 of their channel forming flange portions 65 and 71, with their hub portions 66 and 72 disposed coaxially. So joined, the first and second members 63 and 64 comprise the channelform hub member 61, being suited for mounting on a common drive shaft 79 and forming an annular bristle channel.

In the instant embodiment, brush bristle material 62 is anchored in the channel of the channelform hub member 61 by means of their connection to an anchor ring 80 having bristle receiving apertures 81 spaced around its periphery. The anchor ring 80 is mounted coaxially between the neck portions 69 and 77 of the channel forming flanges 65 and 71 of the first and second unitary members 63 and 64. The first and second unitary members 63 and 64 are actually spot welded to the anchor ring 80 at points on the neck portions 69 and 77 of those members 63 and 64. A bundle of brush bristle material 62 is looped through each peripheral aperture 81 of the anchor ring 80 and the free ends of the bristles extend and are directed out of the channel opening.

The hub portion 66 of the first unitary member has an inner diameter corresponding to the outer diameter of the hub portion 72 of the unitary second member 64. The individual brush elements 60 are joined end to end in interlocking coaxial relationship with the hub portion 66 of the unitary first member 63 of one brush element 60 encircling and interlocking with the hub portion 72 of the unitary second member 64 of the adjacent brush element 60 as shown in FIG. 4. Any number of brush elements 60 may be joined in this fashion to form brushing tools of varying lengths, the individual brush elements 60 fixedly joined one to the other by suitably placed welds.

The central shaft receiving opening 73 of the hub portion 72 of the unitary second member 64 is provided with a key receiving slot 82 so that the brushing tool is adapted for mounting on a drive shaft 79 having a key portion 83 on its surface.

In all embodiments of the present invention illustrated in FIGS. 1–4, the channel forming flange portions 7, 16, 38, 46, 65 and 71 of the brush elements 1, 33 and 60 extend radially outwardly from the hub portions 8, 17, 39, 47, 66 and 72 to lie generally parallel to a plane intersecting the axes of the hub portions 8, 17, 39, 47, 66 and 72 at right angles. Accordingly, the bristles 4, 35 and 62 of these brush elements 1, 33 and 60 extend radially outwardly in a generally flat layer which is generally parallel to a plane intersecting the axes of the hub portions 8, 17, 39, 47, 66 and 72 at right angles.

II. OBLIQUE ANGLE BRUSHES

FIGS. 5, 6 and 7, however, deal with an embodiment of the present invention wherein the channel forming flange portions 95, 102, 125, 133, 155 and 161 of the brush elements 90, 120 and 150 extend abaxially from their supporting hub portions 96, 103, 126, 134, 156 and 162 to be generally parallel to a plane intersecting the axes of said hub portions at oblique angles to those axes.

Brushes constructed in this manner mitigate against streaking which sometimes occurs when the right angle brushes shown in FIGS. 1–4 are employed since the bristles of the oblique angle brushes have a side-to-side component in their brushing action.

The first embodiment of this so-called oblique angle brushing tool is shown in FIG. 5 wherein there is shown a portion of a brushing tool comprising two brush elements 90 joined end to end in interlocking coaxial alignment. Each of the brush elements 90 comprises a channelform hub member 91 with brush bristle material 92 anchored in the channel of such member 90. The channelform hub member 91 is comprised of a unitary first 93 member and a unitary second member 94.

The unitary first member 93 comprises a first channel forming flange portion 95 and a first hub portion 96. The first hub portion 96 extends axially therefrom and has the general form of a truncated right circular cylinder with a central circular drive shaft receiving aperture 97. The outer end of the hub portion is bent inwardly and reversely to form an axial collar 98. The truncated opposite or inner end of the first hub portion 96 is integrally formed with the channel forming flange portion 95which extends abaxially therefrom and comprises an abaxially extending neck portion 99, a channel base portion 100 extending axially from the other end of the neck portion 99, and a channel side portion 101 extending abaxially from the opposite end of the channel base portion 100.

The unitary second member 94 comprises a second channel forming flange portion 102 and a second hub portion 103. The

second hub portion **103** has a central drive shaft receiving opening **104** and comprises an axially extending body portion **105**, having the general form of a truncated right circular cylinder. A radial shoulder **106** extends from the right outer end of the body portion **105** towards the hub axis, and a sleeve portion **107** extending axially from the opposite end of the radial shoulder portion **106**. The truncated opposite or inner end of the body portion **105** of the second hub portion **103** is integrally formed with the channel forming flange portion which extends abaxially therefrom and comprises an abaxially extending second neck portion **108**, a channel base portion **109** extending axially from the radially outer end of the second neck portion **108** and a channel side portion **11** extending abaxially from the opposite end of the channel base portion **109**.

The unitary first and second members **93** and **94** are fixedly joined to each other at the neck portions **99** and **108** of their channel forming flange portions **95** and **102** with their hub portions **96** and **103** disposed coaxially. As indicated, the channelforming flange portions **95** and **102** of each member **93** and **94** extend abaxially from their supporting hub portions **96** to **103** to lie generally parallel to a plane intersecting the axes of the hub portions **96** and **103** at oblique angles to those axes i.e., generally parallel to the planes of truncation of the hub portions **96** and **103**. The oblique angle or angle of truncation of the first member **93** is supplementary to the oblique angle or angle of truncation of the second member **94** so that when the first and second members **93** and **94** are radially aligned in coaxial disposition, their channel forming flange portions **95** and **102** (and planes of truncation) extend generally parallel to one another. Thus, their channel base portions **100** and **109** lie in the same plane to form the base of the channel of the channelform hub member **91**; their channel side portions **101** and **110** are parallel to form the sides of the channel of the channelform hub member **91**; and the channel so formed opens abaxially in a direction such that bristles directed therefrom form a layer which is generally parallel to the aforesaid plane of truncation.

Brush bristle material **92** is bound in an anchor member **113** of U-shaped cross section and mounted in the channel of the channelform hub member **91** in a fashion similar to that shown in my U.S. Pat. No. 3,307,213 as has been described above in relation to the embodiment of the present invention illustrated in FIG. **1** of the accompanying drawings.

The hub portion **96** of the first unitary member **93** has an inner diameter corresponding to the outer diameter of the hub portion **103** of the unitary second member **94**. The individual brush elements **90** are joined end to end in interlocking coaxial relationship with the hub portion **96** of the unitary first member **93** of one brush element **90** encircling and interlocking with the hub portion **103** of the unitary second member **94** of the adjacent brush element **90** as shown in FIG. **5**. Any number of such brush elements **90** are joined in this fashion to form brushing tools of varying lengths. The elements are welded one to the other at suitable points indicated by the numeral **111**. The central shaft receiving opening **104** of the second member **94** is provided with a key receiving slot **112** to accommodate a keyed drive shaft (not shown).

In the past, oblique angle brushes constructed from a plurality of similar brush elements have been particularly troublesome to assemble because their drive shaft openings are generally larger than the drive shaft by the amount necessary to account for the desired angle of "lean" or obliqueness. By extending the hub portions of the brush elements of the present invention so that the planes of their ends intersect the axis of the brushing tool at right angles, I have eliminated this difficulty and each brush element can stand freely on the drive shaft or against another like brush element with the bristles directed at the proper or desired angle regardless of the width of the brush element or drive shaft. This is very helpful during assembly.

An added advantage of the square-ended construction of my oblique angle brush elements is that they do not require special adapters for the sole purpose of squaring the ends of the brushing tool. A square end is required on most brushing tools to avoid interference with stationary portions of the machinery during operation.

A second embodiment of an oblique angle brushing tool of the present invention is shown in FIG. **6** wherein there is shown a portion of a brushing tool comprising two brush elements **120** joined end to end in interlocking coaxial alignment. Each of the brush elements **120** comprises a channelform hub member **121** with brush bristle material **122** anchored in the channel thereof. The channelform hub member **121** is comprised of a unitary first member **123** and a unitary second member **124**.

The unitary first member **123** comprises a first channel-forming flange portion **125** and a first hub portion **126**. The first hub portion **126** has a central drive shaft receiving opening **127** and comprises an axially extending body portion **128**, a radial shoulder portion **129** extending from the outer end of the body portion **128** towards the hub axis, and a sleeve portion **130** extending axially from the opposite end of the radial shoulder portion **129**. The body portion **128** of the hub **126** has the general form of a truncated right circular cylinder, with its inner ends lying in the plane of truncation and integrally formed with the channel forming flange portion **125** which extends abaxially therefrom and comprises an inner neck portion **131** and an outer channel side portion **132**. Both the neck portion **131** and channel side portion **132** lie in the same plane and are parallel to the plane of truncation of the hub body portion **128**.

The unitary second member **124** comprises a second channel forming flange portion **133** and a second hub portion **134**. The second hub portion **134** extends axially and has the general form of a truncated right circular cylinder with a central circular drive shaft receiving opening **135**. The hub portion **134** has the general form of a truncated right circular cylinder, with its inner end lying in the plane of truncation and integrally formed with the channel forming flange portion **133** which extends abaxially therefrom and comprises an inner neck portion **136** and an outer channel side portion **137**. Both the neck portion **136** and channel side portion **137** lie in the same plane and are parallel to the plane of truncation of the second hub portion **134**.

The angle of truncation of the first member **125** is supplementary to the angle of truncation of the second member **126**.

The unitary first and second members **125** and **126** are arranged in spaced relation with their channel forming flange portions **125** and **133** adjacent one another and with their hub portions **126** and **134** coaxially aligned. Thus, an annular channel is formed between the channel side portions **132** and **137**. An anchor ring **138** is mounted coaxially between the channel forming flanges. The ring has a plurality of prongs **139** extending axially from its peripheral edge, alternate prongs **139** extending in opposite directions and received and secured in slots **140** formed at the base of the channel side portions **132** and **137**. Bundles of brush bristle material **122** are looped over the prongs **139** of the anchor ring **138** and the ends of the bristles extend out of the channel to form a layer of bristle material **122** which is generally parallel to the aforesaid plane of truncation.

The hub portion **126** of the first unitary member **123** has an inner diameter, corresponding to the outer diameter of the hub portion **134** of the unitary second member **124**. Thus, the individual brush elements **120** are joined end to end in interlocking coaxial relationship with the hub portion **126** of the first member **123** of one brush element **120** encircling the hub portion **134** of the unitary second member **124** of the adjacent brush element **120**, as shown in FIG. **6**. Any number of brush elements **120** may be so joined to form brushing tools of varying lengths, individual brush elements **120** are joined one to the other by suitably placed welds **141**. The central shaft receiving openings **127** and **135** of the hub portions **126** and **134** of the channelform member **121** are provided with key receiving slots **142** for reception of a keyed drive shaft (not shown).

A third embodiment of an oblique angle brushing tool of the present invention is shown in FIG. 7 wherein there is shown a portion of a brushing tool comprising two brush elements **150** joined end to end in interlocking coaxial alignment. Each of the brush elements **150** comprises a channelform hub member **151** with brush bristle material **152** anchored in the channel thereof. The channelform hub member **151** is comprised of a unitary first member **153** and a unitary second member **154**.

The unitary first member **153** comprises a first channel forming flange portion **155** and a first hub portion **156**. The first hub portion **156** extends axially and has the general form of a truncated right circular cylinder with a central drive shaft receiving aperture **157**. The outer end of the first hub portion **156** is bent inwardly and reversely to form an axial collar **158**. The inner end of the first hub portion **156** lies in the plane of truncation and is integrally formed with the first channel forming flange **155**, extending abaxially and generally parallel to the plane of truncation, and comprises an inner neck portion **159** and an outer channel side portion **160**.

The unitary second member **154** comprises a second channel forming flange portion **161** and a second hub portion **162**. The second hub portion **162** extends axially and has a central drive shaft receiving opening **163** and comprises an axially extending body portion **164** having the general form of a truncated right circular cylinder with its inner end lying in the plane of truncation, and with a radial shoulder portion **165** extending from the outer end of the body portion **164** towards the hub axis. A sleeve portion **166** extends axially from the opposite end of the radial shoulder portion **165**. The inner end of the hub body portion **164** is integrally formed with the second channel forming flange portion **161** which extends abaxially therefrom generally parallel to the plane of truncation. The second channel forming flange portion **161** comprises an inner neck portion **167** and an outer channel side portion **168**.

The angle of truncation of the first member **153** is supplementary to the angle of truncation of the second member **154**.

The unitary first and second members **153** and **154** are fixedly joined at the neck portions **159** and **167** of their channel forming flange portions **155** and **161** by suitably placed welds, with their hub portions **156** and **162** disposed coaxially and radially aligned so that their channel forming flange portions **155** and **161** (and their planes of truncation) extend generally parallel to one another. Thus, their channel side portions **160** and **168** form the sides of the channel of the channelform hub member **151** and the channel so formed opens abaxially to direct bristles contained therein to form a layer which is generally parallel to the planes of truncation.

Brush bristle material **152** is anchored in the channel of the channelform hub member **151** by means of an anchor ring **170** having bristle receiving apertures **171** spaced around its periphery. The anchor ring **170** is mounted coaxially between the neck portions **159** and **167** of the channel forming flanges **155** and **161** of the first and second unitary members **153** and **154** which are welded to it at suitable points. Bundles of brush bristle material **152** are looped through each peripheral aperture **171** of the anchor ring **170** and the free ends of the bristles extend from the channel form a layer which is generally parallel to the plane of truncation.

The hub portion **156** of the first unitary member **153** has an inner diameter corresponding to the outer diameter of the hub portion **162** of the unitary second member **154**. The individual brush elements **150** are thus joined end to end in interlocking coaxial relationship with the hub portion **156** of the unitary first member **153** of one element **150** encircling and interlocking with the hub portion **162** of the unitary second member **154** of the adjacent brush element **150** as shown in FIG. 7. Any number of brush elements **150** are joined in this fashion to form brushing tools of varying lengths individual brush elements **150** being fixedly joined one to the other by suitably placed welds **169**.

The central shaft receiving opening **163** of the hub portion **162** of the second member **154** is provided with a key receiving slot **172** so that the brushing tool is adapted for mounting on a keyed drive shaft (not shown).

III. CONSTRUCTION FROM PLASTIC MATERIALS

The channelform hub members **3**, **34**, **61**, **91**, **121** and **151** of the embodiments of the present invention illustrated in FIGS. **1–7** and discussed above in connection therewith have been constructed of metal, and preferably of stamped sheet metal which is a relatively inexpensive way to form the brush elements. It is, in fact, one advantage of the present invention that it can be formed in this manner to reduce costs. Nevertheless, the present invention is also well suited for construction of the channelform hub members out of a sturdy plastic material such as nylon or polypropylene and FIGS. **8** to **16** illustrate how the brushing elements of the present invention may be formed when constructed from such plastic material.

Referring in greater detail to FIGS. **8** and **10** of the drawings, there is shown a portion of a brushing tool of the present invention which comprises three brush elements **180** joined end to end in interlocking coaxial alignment. The individual brush elements **180** are each comprised of a plastic channelform hub member **181** with brush bristle material **182** anchored in the channel of such member **181**. The channelform hub member **181** is comprised of a unitary first member **183** and a unitary second member **184** joined by a rivet **185** or the like.

The unitary first member **183** comprises a first channelforming flange portion **186** and a first hub portion **187**. The first hub portion **187** is formed integrally with the channelforming flange portion **186** and extends axially therefrom in the general form of a right circular cylinder with a central, generally circular, drive shaft receiving aperture **188**. The channelforming flange portion **186** extends abaxially (generally in the radial direction) from one end of the hub portion **187** and is comprised of a radial neck portion **189**, a channel base portion **190** extending from the distal or radially outer end of the radial neck portion **189**, and a channel side portion **191** extending radially outwardly from the opposite end of the channel base portion **190**. The radial neck portion **189** is provided with an aperture **192** extending parallel to the brush axis for receiving the aforesaid rivet **192** or other means for holding the unitary first and second members **183** and **184** together.

The unitary second member **184** comprises a second channelforming flange portion **193** and a second hub portion **194**. The second hub portion **194** is formed integrally with the channelforming flange portion **193** and extends axially therefrom in the general form of a right circular cylinder with a central, generally circular, drive shaft receiving opening **195**. The channelforming flange portion **193** extends abaxially (generally in a radial direction) from one end of the hub portion **194** and is comprised of a radial neck portion **197**, a channel base portion **198** extending from the distal or radially outer end of the radial neck portion **197**, and a channel side portion **199** extending radially outwardly from the opposite end of the channel base portion **198**. The radial neck portion **197** is provided with an aperture **200** extending parallel to the brush axis for receiving the aforesaid rivet **192** and other means for holding the unitary first and second members **183** and **184** together.

The unitary first and second members **183** and **184** are thus joined together at their neck portions **189** and **197** with their hub portions **187** and **194** disposed coaxially to form the channelform hub member **181**.

Brush bristle material **182** is bound in an anchor member **201** of U-shaped cross section and mounted in the channel of the channelform hub member **181**. The anchor member **201** and the disposition of the brush material **182** therein is substantially similar to that shown in my U.S. Pat. No. 3,307,213 as has been described above in relation to the embodiments shown and described in FIGS. **1** and **5**. Other means for anchoring the brush material may be employed, for example, of the sort shown and described in relation to the embodiments shown in FIGS. **3**, **4**, **6** and **7** or otherwise as will be apparent to persons of ordinary skill.

The hub portion **187** of the first unitary member **183** has an inner diameter corresponding to the outer diameter of the hub portion **194** of the unitary second member **184**. Thus, the individual brush elements **180** are joined end to end in interlocking coaxial relationship with the hub portion **187** of the unitary first member **183** encircling and interlocking with the hub portion **194** or the unitary second member **184**. Any number of brush elements **180** are joined together in this fashion to form brushing tools of varying lengths. The brush elements **180** may be fixedly joined to one another with epoxy or other means at suitable locations. The central shaft receiving opening **195** of the second member **184** is provided with a key receiving slot **202** to accommodate a keyed drive shaft **203**.

Referring now to FIGS. **9** of the drawings, there is shown a portion of an oblique angle brushing tool of the present invention which comprises three brush elements **210** joined end to end in interlocking coaxial alignment. The individual brush elements **210** are each comprised of a plastic channelform hub member **211** with brush bristle material **212** anchored in the channel thereof. The channelform hub member **211** is comprised of a unitary first member **213** and a unitary second member **214** each formed of a plastic material and joined by a rivet **215** or other suitable means.

The unitary first member **213** comprises a first channelforming flange portion **216** and a first hub portion **217** extends axially therefrom and has the general form of a truncated right circular cylinder with a central generally circular drive shaft receiving aperture **218**. The inner end of the hub portion **217** is integrally formed with the channelforming flange portion **216** which extends abaxially (on an oblique angle) therefrom and comprises an abaxially extending neck portion **219**, and a channel side portion **221** extending abaxially from the opposed end of the channel base portion **220**.

The unitary second member **214** comprises a second channel forming flange portion **222** and a second hub portion **223** extends axially therefrom and has the general form of a truncated right circular cylinder with a central generally circular drive shaft receiving aperture **224**. The inner end of the hub portion **223** is integrally formed with the channel forming flange portion **222** which extends abaxially (on an oblique angle) therefrom and comprises an abaxially extending neck portion **225**, a channel base portion **226** extending axially from the other end of the neck portion **225**, and a channel side portion **227** extending abaxially from the opposed end of the channel base portion **226**.

The unitary first and second members **213** and **214** are fixedly joined to each other at their neck portions **219** and **225** with the hub portions **217** and **223** disposed coaxially. As indicated, the channel forming flange portions **216** and **222** extend abaxially from their supporting hub portions **217** and **223** to lie generally parallel to a plane intersecting the axis at an oblique angle i.e., to lie generally parallel to the planes of truncation of the hub portions **217** and **223**. Those angles of truncation are supplementary to one another so that the flanges **216** and **222** are generally parallel to one another when the first and second members **213** and **214** are radially aligned in coaxial disposition. Thus, the channel of the channelform member **211** opens abaxially and bristles mounted therein form a bristle layer which is generally parallel to the aforesaid plane of truncation.

As in the brush shown in FIG. **8** of the drawings, the brush bristle material **212** is bound in an anchor member **228** of U-shaped cross section and mounted in the channel of the channelform hub member **211**. While this is as shown in my U.S. Pat. No. 3,307,213, other means for anchoring the bristle material **212** will be apparent to persons of ordinary skill.

The hub portion **217** of the first unitary member **213** has an inner diameter corresponding to the outer diameter of the hub portion **223** of the unitary second member **214**. Thus, the individual brush elements **210** are joined end to end in interlocking coaxial relationship with the hub portion **217** of the first member **213** encircling and and interlocking with the hub portion **223** of the second member **224**. The central shaft receiving opening **224** of the second member **214** is provided with a key receiving slot **229** to accommodate a keyed drive shaft **230**.

While the embodiment illustrated in FIG. **9** does not so indicate, when the outer diameter of the channelform hub member **211** must be enlarged (or the inner diameter narrowed) without corresponding alteration in the outer diameter of the brushing tool, it is generally preferable to form radial shoulders to extend radially inwardly from one or both of the hub portions **217** and **223**. This construction is preferable to merely thickening the hub (with its attendant molding problems) or to elongating the neck portions **219** and **225** (which generally weakens the tool).

The brushing tools of the present invention are suitable for both sweeping and scrubbing machines. Scrubbing operations are usually performed with full face brushes, one of which **240** is shown in FIG. **10**. Such brushes are characterized by their continuous layers of brush bristle material **241**. By comparison, tufted brushes are often preferred for sweeping operations and an oblique angle tufted brush according to the present invention is illustrated in FIGS. **11–16**. Such tufted brush is similar to brushes previously discussed herein in that it is comprised of a plurality of brush elements joined end to end in interlocking coaxial alignment, each individual brush element being comprised of a plastic channelform hub member with brush bristle material (shown in phantom at **250** in FIGS. **13** and **16**) anchored in the channel thereof. The channelform hub member is comprised of a plastic unitary first member **251** and a plastic unitary second member **252** joined by rivets or other suitable means.

The unitary first and second members **251** and **252** are very similar to those shown in FIG. **9** in that they are each respectively comprised of channelforming flange portions **253** and **254** and hub portions **255** and **256** having drive shaft receiving apertures **257** and **258**. The channelforming flange portions **253** and **254** are each comprised of neck portions **259** and **260**, channel base portions **261** and **262** and channel side portions **263** and **264** respectively.

However, the feature distinguishing a channelform hub member for tufted brushes from the channelform hub member of a full face brush is the presence of axial ribs **264** and **266** extending inwardly from the radially outer end of the channel side portions **263** and **264** respectively. These ribs **265** and **266** are peripherally spaced and serve to space the bristle tufts **250**.

In other material aspects, however, the first and second members **251** and **252** and the channelform hub member formed thereby are essentially similar. Various bristles anchoring means may be employed, either of the type shown in connection with other embodiments discussed herein or otherwise as will be readily apparent to persons of ordinary skill.

It is to be understood that in accordance with the provisions of the patent statutes, variations and modifications which depart from the illustrated embodiments may be adopted without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim:

1. A rotary brushing tool adapted for mounting on a drive shaft, said tool comprising a plurality of substantially similar annular rotary brush elements, each of said elements comprising a relatively rigid, nonyieldable channelform member and brush bristle material anchored in the channel of said channelform member, said channelform member comprising a channelform portion forming said channel to open abaxially and a hub portion formed adaxially of said channelform portion in said member, said hub portion having a central shaft receiving opening, a first end, and a second end axially opposed to said first end, said second end shaped to telescope-fit over the first end of the hub portion of another of said brush elements, said brush elements fixedly joined end-to-end one to the other in coaxial alignment.

2. A rotary brushing tool adapted for mounting on a drive shaft, said tool comprising a plurality of substantially similar telescope fitted individual annular rotary brush elements fixedly joined end to end, one to the other, in coaxial alignment, each of said elements comprising

a unitary relatively rigid nonyieldable metal first member comprising a first channel forming flange portion and a first hub portion, said first hub portion having an inner end, an outer end, and a central shaft receiving opening, said flange portion extending abaxially from the inner end of said hub portion in a direction generally parallel to a first plane intersecting the axis of said hub portion;

a unitary relatively rigid, nonyieldable metal second member comprising a second channel forming flange portion and a second hub portion, said second hub portion having an inner end, an outer end, and a central shaft receiving opening, said second flange portion extending abaxially from the inner end of said second hub portion in a direction generally parallel to a second plane intersecting the axis of said second hub portion, said first and second members fixedly joined in coaxial and radial alignment with said first and second planes parallel and said first and second channel forming flange portions adjacent to form an annular channel which opens abaxially to receive brush bristle material and direct such material abaxially and parallel to said planes, said outer end of said first hub portion shaped for telescope-fit with said outer end of said second hub portion so that a plurality of said similar brush elements may be joined end to end in coaxial alignment as stated;

brush bristle material disposed in said channel; and

means anchoring said material in said channel.

3. A rotary brushing tool as recited in claim 2 wherein the inner diameter of the outer end of said first hub portion corresponds to the outer diameter of the outer end of said second hub portion so that said brush elements may be joined end to end with the outer end of the second hub portion of one brush element received in the outer end of the first hub portion of another brush element.

4. A rotary brushing tool adapted for mounting directly on a drive shaft, said tool comprising a plurality of similar interlocking individual annular rotary brush elements fixedly joined end to end, one to the other, in coaxial alignment, each of said elements comprising

a unitary first member comprising a first channel forming flange portion and a first hub portion, said first hub portion comprising a first axially extending portion and a radial shoulder portion extending from said first axially extending portion towards the hub axis, said hub portion having a central shaft receiving opening formed therein, said hub portion having an inner end and an outer end, said flange portion extending abaxially from the inner end of said hub portion in a direction generally parallel to a first plane intersecting the axis of said hub portion;

a unitary second member comprising a second channel forming flange portion and a second hub portion having a central shaft receiving opening, said hub portion having an inner end and an outer end, said second flange portion extending abaxially from the inner end of said second hub portion in a direction generally parallel to a second plane intersecting the axis of said second hub portion, said first and second members fixedly joined in coaxial and radial alignment with said first and second planes parallel and said first and second channel forming flange portions adjacent to form an annular channel which opens abaxially to receive brush bristle material and direct such material abaxially, said outer end of said first hub portion shaped to interlock with the second hub portion of another of said substantially similar brush elements so that a plurality of said substantially similar brush elements may be joined end to end in interlocking coaxial alignment;

brush bristle material disposed in said channel; and

means anchoring said material in said channel.

5. A rotary brushing tool as recited in claim 4 wherein said anchoring means comprises an anchor ring mounted between said first and second channel forming flanges, said ring having a plurality of prongs extending axially from its peripheral edge, alternate prongs extending in opposite directions and received and secured in slots in said first and second channel forming flanges, and wherein said brush bristle material comprises a plurality of bundles of brush bristles, each bundle being looped around one of said prongs with the free ends of said bristles extending abaxially out of the channel opening.

6. A rotary brushing tool as recited in claim 4 wherein said anchoring means comprises an anchor ring mounted between said first and second channel forming flange portions, said ring having apertures at spaced intervals about its periphery, and wherein said brush bristle material comprises a plurality of bundles of brush bristles each of which is looped through one of said peripheral apertures with the free ends of said bristles extending abaxially out of the channel opening.

7. A rotary brushing tool as recited in claim 4 wherein said anchoring means comprises an annular channelform anchor member of substantially U-shaped cross section defining an anchor channel for receiving brush bristle material, pairs of axially spaced and transversely aligned prongs projecting into the anchor channel at circumferentially spaced points thereabout, and a sheet metal endless annular locking ring arranged concentrically with respect to said anchor channel, said brush bristle material clamped in said locking ring, said locking ring having wall portions arranged with respect to the walls of said channel to securely clamp the brush bristle material therebetween.

8. A rotary brushing tool adapted for mounting on a drive shaft said tool comprising a plurality of substantially similar telescope-fit interlocking individual annular rotary brush elements fixedly joined end to end one to the other in coaxial alignment, each of said elements comprising

a unitary first member comprising a first channel forming flange portion and a first hub portion, said hub portion having an inner end, an outer end, and a central shaft receiving opening, said flange portion extending abaxially from the inner end of said hub portion, in a direction generally parallel to a plane intersecting the axis of said hub portion at an oblique angle;

a unitary second member comprising a second channel forming flange portion and a second hub portion, said second hub portion having an inner end, an outer end, and a central generally circular shaft receiving opening, said second flange portion extending abaxially from the inner end of said second hub portion in a direction generally parallel to a plane disposed at an oblique angle to the axis of said second hub portion, said first and second members fixedly joined in coaxial and radial alignment with their first and second channel forming flange portions generally parallel and adjacent to form an annular channel which opens abaxially to receive brush bristle material and direct such material abaxially, said outer end of said first hub portion shaped to telescope-fit with the outer end of the second hub portion of another of said substantially similar brush elements so that a plurality of said brush elements may be joined end to end in telescopically fitting interlocking coaxial alignment;

brush bristle material disposed in said channel; and

means anchoring said material in said channel.

9. A rotary brushing tool as recited in claim 8 wherein said first and second hub portions extend axially, adjacent axially extending hub portions of adjacent brush elements having similar inner and outer diameters, adjacent axially extending portions of adjacent brush elements being coaxially received one within the other.

10. An annular brush element for making a rotary brushing tool adapted for mounting on a drive shaft in brushing machinery, said tool comprised of a plurality of such brush elements similarly constructed and fixedly joined end to end one to the other in telescope-fit interlocking coaxial alignment, said brush element comprising

a channelform hub member and brush bristle material anchored in the channel of said channelform hub member, said member comprising a channelform portion and a hub portion having a central shaft receiving opening, a first end and a second end, said second end of said hub portion shaped to telescope-fit with the first end of the hub portion of another like brush element, so that said brush element may be fixedly joined end to end to another such brush element in telescopically fitting interlocking coaxial alignment.

11. A brush element as recited in claim **10** wherein said hub portion includes a radial shoulder portion extending radially inwardly and having a central shaft receiving opening with an inner diameter generally corresponding to the outer diameter of the drive shaft so that said rotary brushing tool is adapted for mounting directly on the drive shaft.

12. A brush element as recited in claim **10** wherein said channelform portion of said element extends abaxially from between said first and second ends of said hub portion in a direction generally parallel to a plane intersecting the axis of said hub portion at oblique angles, said channelform portion having an annular channel opening abaxially to receive said brush bristle material and direct such material abaxially in a generally flat layer lying generally parallel to said plane of said channelform portion, so that said brush bristle layer extends at oblique angles to the axis of rotation of said element.

13. An annular brush element for making a rotary brushing tool adapted for mounting on a drive shaft in brushing machinery, said tool comprised of a plurality of such brush elements similarly constructed and fixedly joined end to end one to the other in telescope-fit interlocking coaxial alignment, said brush element comprising

a unitary first member comprising a first channel forming flange portion and a first hub portion, said first hub portion having an inner end, an outer end, and a central shaft receiving opening, said flange portion extending abaxially from the inner end of said hub portion in a direction generally parallel to a first plane intersecting the axis of said hub portion;

a unitary second member comprising a second channel forming flange portion and a second hub portion, said second hub portion having an inner end, an outer end, and a central shaft receiving opening, said second flange portion extending abaxially from the inner end of said second hub portion in a direction generally parallel to a second plane intersecting the axis of said second hub portion, said first and second members fixedly joined in coaxial and radial alignment with said first and second planes parallel and said first and second channel forming flange portions adjacent to form an annular channel which opens abaxially to receive brush bristle material and direct such material abaxially, said outer end of said first hub portion shaped to telescope-fit with the outer end of the second hub portion of another of said similarly constructed brush elements so that a plurality of such brush elements may be joined end to end in telescopically fitting interlocking coaxial alignment;

brush bristle material disposed in said channel; and means anchoring said material in said channel.

14. A brush element as recited in claim **13** wherein at least one of said first and second hub portions includes a radial shoulder portion extending towards the hub axis.

15. A brush element as recited in claim **13** wherein said anchoring means comprises an annular channelform anchor member of substantially U-shaped cross section defining an anchor channel for receiving brush bristle material, pairs of axially spaced and transversely aligned prongs projecting into the anchor channel at circumferentially spaced points thereabout, and a sheet metal endless annular locking ring arranged concentrically with respect to said anchor channel, said brush bristle material clamped in said locking ring, said locking ring having wall portions arranged with respect to the walls of said channel to securely clamp the brush bristle material therebetween.

16. An annular brush element for making a rotary brushing tool adapted for mounting on a drive shaft, said tool comprised of a plurality of such brush elements similarly constructed and fixedly joined end to end one to the other in telescopic-fit coaxial alignment, said brush element comprising

a unitary first member formed from a plastic material and comprising a first channel forming flange portion and a first hub portion, said first hub portion having an inner end, an outer end, and a central shaft receiving opening, said flange portion extending abaxially from the inner end of said hub portion in a direction generally parallel to a first plane intersecting the axis of said hub portion;

a unitary second member formed from a plastic material and comprising a second channel forming flange portion and a second hub portion, said second hub portion having an inner end, an outer end, and a central shaft receiving opening, said second flange portion extending abaxially from the inner end of said second hub portion in a direction generally parallel to a second plane intersecting the axis of said second hub portion, said first and second members fixedly joined in coaxial and radial alignment with said first and second planes parallel and said first and second channel forming flange portions adjacent to form an annular channel which opens abaxially to receive brush bristle material and to direct such material abaxially, said outer end of said first hub portion shaped to telescope-fit with the outer end of the second hub portion of another of said similarly constructed brush elements so that a plurality of said similar brush elements may be joined end to end in telescopically fitting interlocking coaxial alignment;

brush bristle material disposed in said channel; and

means anchoring said material in said channel.

17. A brush element as recited in claim **16** wherein said anchoring means comprises an anchor ring mounted between said first and second channel forming flanges, said ring having a plurality of prongs extending axially from its peripheral edge, alternate prongs extending in opposite directions and received and secured in slots in said channel forming flanges, and wherein said brush bristle material comprises a plurality of bundles of brush bristles, each bundle being looped around one of said prongs with the free ends of said bristles extending abaxially out of the channel opening.

18. A brush element as recited in claim **16** wherein said anchoring means comprises an anchor ring mounted between said channel forming flange portions, said ring having apertures at spaced intervals about its periphery, and wherein said brush bristle material comprises a plurality of bundles of brush bristles each of which is looped through one of said peripheral apertures with the free ends of said bristles extending abaxially out of the channel opening.

19. A brush element as recited in claim **16** wherein said anchoring means comprises an annular channelform anchor member of substantially U-shaped cross section defining an anchor channel for receiving brush bristle material, pairs of axially spaced and transversely aligned prongs projecting into the anchor channel at circumferentially spaced points thereabout, and a sheet metal endless annular locking ring arranged concentrically with respect to said anchor channel, said brush bristle material clamped in said locking ring, said locking ring having wall portions arranged with respect to the walls of said channel to securely clamp the brush bristle material therebetween.

20. An annular brush element for making a rotary brushing tool adapted for mounting on a drive shaft, said tool comprising a plurality of such elements similarly constructed and fixedly joined end to end one to the other in telescope-fit interlocking coaxial alignment, said brush element comprising

a unitary first member formed of a plastic material comprising a first channel forming flange portion and a first hub portion, said hub portion having an inner end, an outer end, and a central shaft receiving opening, said flange portion extending abaxially from the inner end of said

hub portion in a direction generally parallel to a first plane intersecting the axis of said hub portion at an oblique angle;

a unitary second member formed of a plastic material and comprising a second channel forming flange portion and a second hub portion, said second hub portion having an inner end, an outer end, and a central generally circular shaft receiving opening, said second flange portion extending abaxially from the inner end of said second hub portion in a direction generally parallel to a second plane intersecting the axis of said second hub portion at an oblique angle, said first and second members fixedly joined in coaxial and radial alignment with said first and second planes parallel and said first and second channel forming flange portions adjacent to form an annular channel which opens abaxially to receive brush bristle material and to direct such material abaxially, said outer end of said first hub portion shaped to telescopic-fit with the outer end of the second hub portion of another of said similarly constructed brush elements so that a plurality of said brush elements may be joined end to end in telescopically fitting interlocking coaxial alignment;

brush bristle material disposed in said channel; and

means anchoring said brush bristle material in said channel.

21. A brush element as recited in claim **20** wherein said first and second hub portions extend axially, the inner diameter of said second hub portion being similar to the outer diameter of said first hub portion, so that the first hub portion of a brush element may be received within the second hub portion of another of said similarly constructed brush elements.

22. A rotary brushing tool as recited in claim **4** wherein said first plane intersects the axis of said first hub portion at an oblique angle.

23. A rotary brushing tool as recited in claim **7** wherein said first plane intersects the axis of said first hub portion at an oblique angle.

24. A rotary brushing tool adapted for mounting on a drive shaft, said tool comprising a plurality of substantially similar interlocking individual annular rotary brush elements fixedly joined end to end, one to the other, in coaxial alignment, each of said elements comprising

a unitary first member comprising a first channel forming flange portion and a first hub portion, said first hub portion having an inner end, an outer end, and a central shaft receiving opening, said flange portion extending abaxially from the inner end of said hub portion in a direction generally parallel to a first plane intersecting the axis of said hub portion;

a unitary second member comprising a second channel forming flange portion and a second hub portion, said second hub portion having an inner end, an outer end, and a central shaft receiving opening, said second flange portion extending abaxially from the inner end of said second hub portion in a direction generally parallel to a second plane intersecting the axis of said second hub portion, said first and second members fixedly joined in coaxial and radial alignment with said first and second planes parallel and said first and second channel forming flange portions adjacent to form an annular channel which opens abaxially to receive brush bristle material and direct such material abaxially and parallel to said planes, said outer end of said first hub portion shaped to interlock with said outer end of said second hub portion so that a plurality of said similar brush elements may be joined end to end in interlocking coaxial alignment as stated;

brush bristle material disposed in said channel; and

means for anchoring said material in said channel comprising an annular channelform anchor member of substantially U-shaped cross section defining an anchor channel for receiving brush bristle material, pairs of axially spaced and transversely aligned prongs projecting into the anchor channel at circumferentially spaced points thereabout, and a sheet metal endless annular locking ring arranged concentrically with respect to said anchor channel, said brush bristle material clamped in said anchor channel between said locking ring and said anchor member, said locking ring having wall portions arranged with respect to the walls of said channel to securely clamp the brush bristle material therebetween.

25. A rotary brushing tool as recited in claim **24** wherein said first plane intersects the axis of said first hub portion at an oblique angle.

* * * * *