March 15, 1966 V. K. CHARVAT 3,239,867

BRUSH AND BRUSH MATERIAL

Filed Nov. 4, 1963 2 Sheets-Sheet 1

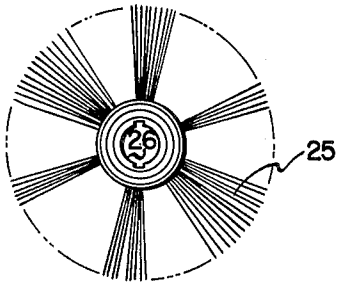



FIG_4




FIG_1




FIG_2




FIG_3

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BRUSH AND BRUSH MATERIAL

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FIG_5

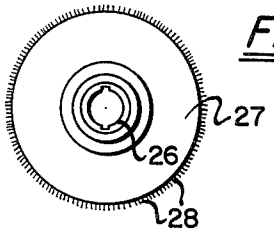



FIG_6

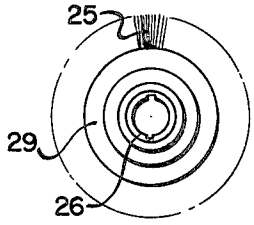



FIG_7

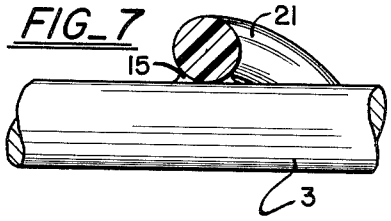
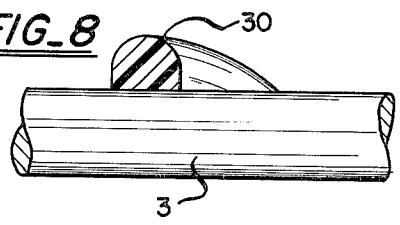



FIG_8



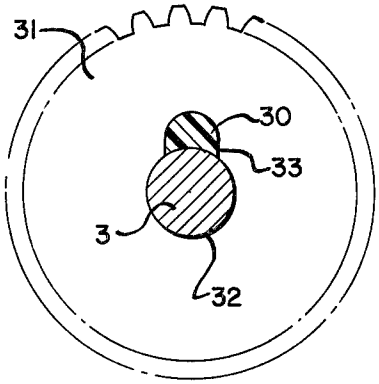




FIG_9

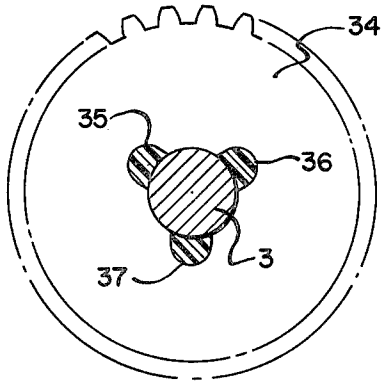



FIG_10

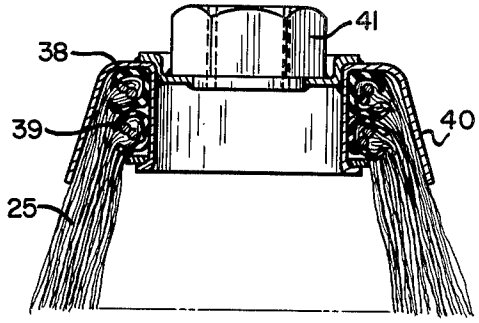



FIG_11

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3,239,867

# BRUSH AND BRUSH MATERIAL

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Filed Nov. 4, 1963, Ser. No. 321,239
25 Claims. (Cl. 15—179)

This invention relates as indicated to a novel brush and brush material, and more particularly to power driven rotary brushes having greatly enhanced brushing qualities.

Power driven rotary brushes may utilize a wide variety of brush fill material including wire bristles, Tampico fiber, plastic bristles such as nylon, horsehair, and plastic coated wire or glass fiber filaments as disclosed in Peterson Patent 2,682,734, for example. As the power brushing art has developed, there has arisen an increasing demand for rotary brushes which are true precision tools adapted to be driven at high speeds and having carefully trimmed and often ground brush faces adapted to produce specified predetermined effects upon the work. When using wire or plastic filaments as the brush bristle material, it has been conventional to crimp the filaments for a variety of reasons including the damping effect thereby achieved due to the interengagement of the filaments with one another at intervals along their length. This assists in the prevention of localized concentrations of stress which tend to produce long fracture of the bristles. Also, in wheel brushes and the like where the bristles extend generally radially from a central support, the density of brush fill material is necessarily less at the working face than where such material is secured to the support, and it is accordingly difficult to ensure uniform spacing of the brush bristle ends to produce a uniform brush face. Crimping of the brush material has likewise been of assistance in this regard.

Crimping of the brush material, on the other hand, also has certain disadvantages. When power driven rotary brushes having crimped brush bristle material, particularly wheel brushes, are rotated at high speed and brought into engagement with the work, some of the bristles tend to lengthen under the action of centrifugal force and as a result of their frictional engagement with the work, soon producing a relatively uneven brush face so that other of the bristles are prevented from engaging the work surface to the same degree or even at all. The carefully trimmed and often ground brush face loses its precision contour and the action of the brush on the work becomes correspondingly irregular. It may accordingly become necessary, for precision work, to regrind the brush face. Also, due to the crimp, certain of the brush bristle ends will extend in the direction of ratation of the brush whereas other bristle ends will extend in more or less the opposite direction, the first named bristle ends tending to dig into or gouge the work whereas the last named merely drag across the work surface. Very hard brush bristle material is also usually rather brittle and does not take a satisfactory crimp. It is accordingly an important object of the present invention to provide novel brush material and brushes utilizing the same which will have the advantages previously obtained by crimping but without the disadvantages of the same.

A further object is to provide straight brush bristle material and brushes utilizing the same which will not have the disadvantages encountered in the past, such as long fracture in use, but will instead have the characteristics previously obtained by crimping as well as a new constancy and precision of brushing face.

Another object is to provide a power driven rotary brush utilizing straight hard brush bristle material treated in a manner effective properly to space and control such bristles to prevent undue compacting or "knifing" of the brush face and to assure equal frequency of tip contacts per unit length of face despite surface projections which ordinarily tend to part the fill of conventional brushes so that it does not contact the portions of the work most needing such contact.



Still another object of this invention is to provide such brush in which the interaction of the brush bristle material is self-regulated to the control the degree and manner of flexing in use.

Yet another object is to provide such a brush in which the brush bristle material is resiliently but relatively firmly supported adjacent the base in a manner to assist in maintaining the desired spacing of the bristles and effectively to avoid stress concentration and so improve fatigue life, with such spacing being similarly controlled in the outer portions thereof by individual plastic coatings thereon.

Another object is to provide brush bristle material having the indicated desirable characteristics which is relatively simple and inexpensive of manufacture within closely controllable tolerances.

Other objects will appear as the description proceeds.

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 a vertical semi-diagrammatic elevation of equipment illustrating the manner in which the novel brush material of the present invention may be manufactured, such view being partly in vertical cross-section;

FIG. 2 is a much enlarged illustration of one form of brush bristle material in accordance with the invention;

FIG. 3 is a similarly much enlarged illustration of another form of brush bristle in accordance with the invention;

FIG. 4 is an end view of a typical rotary brush of the "wheel" type having radially extending brush bristle material in accordance with the invention;

FIG. 5 is an end view of a modified brushing tool in which such novel brush bristle material is embedded or encapulated in a body of elastomeric material extending substantially to the outer working ends of the bristles;

FIG. 6 is an end view of a rotary brush utilizing the novel brush material of this invention, the inner end portions of the same being embedded in an elastometric matrix in the region adjoining the central hub;

FIG. 7 is a much enlarged fragmentary view of a brush bristle to which a synthetic plastic strand has been adhered by means of adhesive;

FIG. 8 is a much enlarged fragmentary view of a brush bristle to which a synthetic plastic rib has been directly bonded;

FIG. 9 is a diagrammatic end view of a rotary die adapted to be employed in a plastic extruder to produce the brush bristle of FIG. 8;

FIG. 10 is an end view of a similar rotary die designed to apply a plurality of individual plastic ribs helically to a continuously advancing filament to produce one form of novel brush bristle material in accordance with the invention; and

FIG. 11 shows a cup brush utilizing the novel brush material of this invention.

Reference may be had to my issued U.S. Patent No. 3,090,061 for a disclosure of another form of brush bristle material designed to accomplish generally similar objectives to that of the present invention, such brush bristles ordinarily comprising elongated strands such as hard straight steel wire having plastic protuberances or

"beads" bonded thereto at spaced intervals therealong. Such beaded brush material has proved highly successful in operation, and it is an object of the present invention to attain generally similar benefits through the employment of another form of brush bristle material which is relatively simple of manufacture and which is also easy to handle and control during the brush manufacturing operation.

Referring now more particularly to FIGS. 1, 2 and 3 of the drawing, a pay-off reel **1** is shown mounted on a lower floor **2** from which a continuous filament such as a fine steel wire **3** is drawn and passed vertically upwardly and over pulleys **4** and **5** at an upper floor before being returned downwardly to a take-up reel **6**. On an intermediate floor **7**, a frame or turntable **8** is rotatably mounted on a base **9** by means of bearing **10** with the filament **3** passing vertically centrally upwardly therethrough, such turntable being rotated about filament **3** as a vertical axis by means of electric motor **11**, gear **12** and ring gear **13**. Within base **9** there is provided a small tank **14** having an aperture in its bottom through which passes the upwardly traveling wire **3** with a sufficiently close fit that the liquid adhesive **15** contained within the tank does not leak downwardly therethrough. A metering die **16** directly above the adhesive bath serves to remove excess adhesive from wire **3** so that only a thin film of adhesive remains thereon as the wire travels upwardly through rotating frame **8**. The supply of adhesive in tank **14** may be constantly replenished at the rate of use by means of a meter-mixer **17** drawing adhesive components from supply tanks **18** and **19** and delivering the material to tank **14**.

One or more spools such as **20** may be carried by rotating frame **8** bearing filamentous material **21** such as a fine nylon monofilament, for example, adapted to be wrapped helically about wire **3** as the latter travels continuously upwardly and frame **8** rotates about the axis of such wire. The pitch of such helix will, of course, be determined by the relative rate of travel of the wire and speed of rotation of frame **8**, and the mounting **22** for spool **20** may desirably be somewhat inclined toward such wire.

The helically wound filament **21** is, of course, bonded and adhered to the traveling wire **3** by means of the adhesive **15** which may thereupon be cured or set by passage through an oven **23** before passing over pulleys **4** and **5** to take-up reel **6**. Typical brush bristle material in accordance with the invention which may be produced as above described is illustrated in FIGS. 2 and 3, a single plastic monofilament **21** having been helically wound about the wire **3** and adhered thereto as shown in FIG. 3. As above indicated, any desired number of filaments may thus be wound on the continuously traveling filament or strand **3** by providing an appropriate number of supply spools on the rotating frame **8**. While the amount of adhesive employed to bond filaments **21** and **24** to wire **3** will ordinarily be metered to be just sufficient for such purpose, a somewhat thicker coating of adhesive may be provided if desired where such coating is desired to provide a thin protective film over the wire bristle **3**, suitable adhesive and coating materials for such purpose being certain of the epoxy resins, for example.

As shown in FIG. 4, the brush bristle material of the present invention may be assembled in known manner into a power driven rotary brush such as the wheel brush illustrated in FIG. 4 wherein the brush bristles **25** desirably comprising straight hard steel wires with plastic monofilaments helically wound thereon and adhered thereto, extend radially outwardly from a central annular hub **26**. It will, however, be understood that the novel brush material of this invention may be employed in all types of brushes including cup brushes, rotary end brushes, cylindrical brushes, etc.

Now referring more particularly to FIG. 5 of the drawing, when a relatively harsh brushing action is desired, elastomeric material may be intruded into the body of brush material between the bristles **25** as at **27** extending substantially to the brushing face of the tool with only the extreme end portions **28** of the bristles **25** protruding therefrom. Granulas abrasive may be incorporated in the body of elastomeric material **27** to be released at the working face of the tool as the latter wears back in use, such body of elastomeric material preferably being a type adapted to erode at a somewhat greater rate under working conditions than the ends of the bristles themselves. Intrustion of the elastomeric material between the individual bristles of the brush element is greatly facilitated by provision of the aforesaid filaments such as **21** and **24** wound thereon inasmuch as such filaments serve to prevent undue compacting of the layer of brush bristle material and hold the bristles uniformly spaced as the elastomeric matrix material is intruded therebetween, passages for intrusion of the matrix material being thus maintained by such filaments. When producing composite brushing materials of the type illustrated in FIG. 5, one may desirably employ the method disclosed and claimed in my prior co-pending application Serial No. 854,468, filed November 20, 1959, the brush with the novel brush material **25** being placed in an appropriate mold and the elastomeric material being introduced into the mold while the latter rotates at high speed so as to distribute such material uniformly within the outer peripheral portion of the mold; the elastomeric material is caused to foam and expand radially inwardly of the brush to intrude uniformly between the bristles **25** as above indicated. Polyurethane has been found to be a particularly suitable foamable resin for employment in the manner indicated. When employing a more usual type of molding operation to produce the composite tool of FIG. 5, neoprene (polychloroprene) having an appropriate foaming agent incorporated therein may also be utilized.

Now referring to FIG. 6 of the drawing, the brushing action of the brush may also be regulated and the inner ends of the brush bristle material seated in a manner still further reducing any localized concentrations of stress in the region of the brush support by intruding elastomeric material and preferably foamed elastomeric material **29** into the body of brush material **25** in the region adjacent the annular hub or support **26**. In both the FIG. 5 and FIG. 6 embodiments of the invention, the brush bristles are maintained in remarkably uniform spaced relationship to one another without locally compacting or otherwise disarranging the bristles.

As shown in FIG. 9 of the drawing, a plastic rib **30** may also be applied to the continuously axially advancing bristle filament such as wire **3** by passing the latter through a closely fitting rotary extrusion died **31**, the die opening **32** of which has a notch **33** of desired conformation to determine the shape of the rib **30** which is thus extruded on the wire. It is, of course, broadly well known in the plastic extrusion art thus to apply a continuous rib or the like to an elongated member passed through the extrusion die; in the present instance, the die may be caused to rotate at a desired speed relative to the rate of travel of the wire so that the rib **33** will be of helical form (see FIG. 8). When employing certain types of synthetic resins or plastics such as some of the epoxy resins, the latter will bond directly to the wire surface, but in other cases it may be desirable first to treat the surface of wire **3** to ensure the desired adherence of the plastic rib thereto. A similar rotary die **34** (FIG. 10) may be utilized having a plurality of notches **35**, **36**, **37** to form a corresponding number of helical ribs or ridges on the axially advancing wire **3** passing through the central portion of the die opening. The helical shape of such ribs or ridges assist in adequately retaining liquids (e.g., paint) which are to be applied to the work by a brush employing such bristle material

and also assist in retaining tacky brush treating fluids sometimes utilized when granular abrasive is supplied to a rotary brush for application to the work. While the most important advantages of the invention are achieved when employing hard straight wire brush bristles with the plastic filaments or ribs helically applied thereto, nevertheless a wide variety of brush bristle core materials may be utilized depending on the type of operation in which the brush is to be employed, and such core 3 may accordingly be of such materials as copper wire, nylon monofilaments of twisted strands, Fiberglas filaments, nylon coated steel wire and even materials such as tampico fiber which cannot, however, be as conveniently prepared in accordance with the invention as can filamentous materials which are available in continuous lengths. While not ordinarily preferred, a granular abrasive materials such as aluminum oxide, silicon carbide and the like may be incorporated in the pastic filaments 21 and 24 for application to the work surface when the brush employing such brush material is placed in use. Alternatively, lubricating materials such as certain oils, waxes and graphite may be incorporated in the plastic filaments 21, 24 and the plastic ribs such as 33 to modify the brushing action of the brush.

The brush bristle core material may, as above indicated, comprise any suitable brush bristles modified in accordance with the present invention but will ordinarily preferably comprise hard wire, especially steel wire having a Knoop hardness of at least 600. The Knoop hardness test is a U.S. Bureau of Standards test and is particularly suited to measure the hardness of fine filaments. In some cases the filaments may desirably have a Knoop hardness in excess of 700 and even in excess of 800. Stainless steel brush bristles are greatly improved and their life much extended in use by following the teachings of the present invention. Steel wire bristle material adapted to be modified in accordance with the invention will ordinarily have a diameter of from about .006" to about .035", and a preferred material for forming the helical plastic rib or ribs thereon comprises polyurethane and particularly a foamed polyurethane in which the rib is filled with a multitude of very small closed cells. The wire may desirably be treated with an adhesive composition 15 formed of a mixture of 35 parts Versamid 140 (a polyamide resin having an amine value of 350–400, viscosity 25° C. (cps.) 12,500 to 17,500, color Gardner NDT12, percent ash by weight maximum 0.05, specific gravity 0.97, available from General Mills) and 65 parts of Epon 820 (an epoxy resin having color Gardner 8 (maximum), epoxide equivalent 175 to 210, average molecular weight 350–400, viscosity 25° C. (cps.) 4,000 to 10,000, available from Shell Chemical Co.). After curing, this adhesive resin mixture has a Barcol hardness of 64–67 and very tenacious adhesion to a wide variety of substrates including wood, metal, glass, plastics and silicas, as well as excellent impact resistance, chemicals and solvent resistance, ability to inhibit corrosion of metal substrates, and flexibility. Not only is such adhesive excellent for bonding polyurethane filaments or ribs to a steel wire bristle core, but it is also excellent for bonding nylon monofilaments or twisted strands thereto. Polyvinyl chloride, polyurethane rubber, and neoprene (polychloroprene) are other examples of materials suitable for employment as the helical filaments or ribs to be applied to the bristle core. Various well-known bonding agents such as "Ty-Ply-S" may be utilized for bonding rubber and rubber-like materials to such cores.

Wire brush material and brushes utilizing the same in accordance with the present invention have numerous advantages; there are two aspects which are considered of principal importance. The first of these is the control which is gained over the reaction movements of the brush bristles when the tip ends of the latter impinge upon the work surface as they are forcibly brought into contact therewith. If adequate control is maintained over such bristles, the tips will stay in contact with the surface for the entire length of cut for each revolution of the brush, and such tip will generate a path within a narrow plane increment, making a straight line on the work. This is very different from the result ordinarily obtained with power driven rotary brushes where the bristle tips follow paths of least resistance and wander and bounce or dribble haphazardly across the work surface, creating a random effect. The effect ordinarily desired, however, both artistically and mechanically, is obtained if the bristles travel in straight lines with reasonably constant pressures. The helical ribs also serve to control and regulate the spacing and flexing of the bristles to minimize any tendency toward stress concentration at the retaining member or support as well as along the length of each bristle. The compound bristle has a configuration which provides a specific but variable bulk effect to the brush fill material as a whole, and this unifies the working face with a consequent averaging of the bristle tip action on the work rather than permitting highly erratic individual tip action characteristic of most brushes available up to the present time and largely attributable to the random angles of contact at which the bristle tips engaged the surface of the work.

The second principal objective which has been achieved by this invention is the provision of novel brush bristle material which is capable of continuous uniform production and adapted for employment in mass production methods of brush manufacture. Such brushes may be produced with steel retaining members locked together to secure the bristles and affording very high bursting strength without encountering any serious problem of maintaining uniform brush bristle distribution and consequently a uniform brush face.

The brush bristle of this invention comprises a central portion or core which is ordinarily that portion of the bristle which is expected to perform the brushing operation on the work, and an external portion or rib helically applied to such core and which has as its principal purpose the control and orientation of the bristle tips and the general protection of the entire length of such core portion from the destructive forces encountered in brushing operations. This bristle configuration permits the obtaining of the maximum number of operative tips (ordinarily the steel wire cores) per square inch of brushing face, with each brushing or cutting tip being presented to the work at the same angle and with the same force. This helical disposition of the applied rib allows an exceptionally high unit density of such wire cores to be obtained in the finished brush. Generally speaking, the more multiples of such ribs that are employed (with consequent higher pitch), the closer together the bristles may be packed within the brush without losing control, and this, of course, permits the employment of more cutting points per square inch of brushing face.

The precise contour of the filament or rib applied to the central bristle core may be varied depending on the particular characteristics desired. Thus, such rib may be of constant, circular, rectangular or triangular cross-section, for example. When the rib is of triangular cross-section, the bristles assembled into a brush have relatively limited axial flexibility but considerable mobility transversely since interbristle contact is initially slight, with further relative lateral displacement of the bristles being increasingly restrained as such bristles move together under imposition of brushing forces imposed in use. When the ribs are of rectangular cross-section, on the other hand, the bristles are allowed a higher degree of axial flexibility combined with significantly reduced mobility in the transverse direction.

In the past, it has generally been necessary to employ a heavier gauge or larger diameter of bristle filament in order that each working tip may be backed up with more force, the coarser filament affording more stiffness in the hope of increasing brush performance. This, however,

necessarily results in a reduction of the total number of brush bristle filaments in the brush so that there are fewer working points per square inch of brush face effective to act upon the work. This dilemma is substantially overcome by the present invention where the bristle central member or core may be of relatively fine gauge straight wire, for example, of unusual stiffness and hardness, reinforced and controlled by the longitudinally extending plastic ribs. The interaction of such bristles is such, in the case of a power driven rotary brush of proper fill density, that only the tips of the bristle cores contact the work in use rather than the sides of such bristles which merely drag across the work surface with a minimum of cutting action. A brush in accordance with the present invention may accordingly be very rapid in its cutting action upon the work while at the same time producing an exceptionally uniform and desirable finish on the latter.

While the reinforcing, regulating and cushioning rib or ribs may be applied by such means as direct extrusion, heat sealing or high frequency welding, it is contemplated that ordinarily some form of adhesive bonding medium may be desirable and employed. However the ribs are applied, the composite bristle must perform as required with the inner element doing the brushing work and the outer element or rib protecting and positioning the former. This means that a suitable adhesive should be flexible enough to withstand impact forces and capable of holding the core and rib together under operating conditions which involve flexing and reverse stresses. Such adhesive, because of its physical properties and/or its position and volume, serves to increase the modulus of stiffness of the bristle or is substantially non-contributing. While a wide variety of adhesives are suitable and may be employer, an epoxy system has been disclosed above which is particularly satisfactory. The epoxy system components, including a catalyst, are brought together and mixed just before application to either the core member or the rib filament or both, and fast gelation is achieved which assists in maintaining the adhesive located as required. Vinyl chlorides also serve as highly satisfactory adhesives in many cases and exhibit a desirable combination of physical properties.

The diameter of the central core member relative to the rib or warpped filament member may be in a ratio of less than 1 up to substantially higher than 1:1. This may be illustrated by employment of a gauge having a series of small holes one inch long drilled therethrough into which the completed bristle may be inserted to determine its over-all diameter. The table set forth below compares the core filament diameter to such over-all bristle diameter where the core has the helically wound cushioning rib applied thereto:

| Core Filament Diameter | Hole Size Ribbed Bristle Should Freely Enter | | | |
|---|---|---|---|---|
| | Maximum Cushion | Average Cushion | Least Cushion | Windings Per Inch |
| .006" and under | .030" | .020" | .010" | 12-20 |
| .008" to .014" | .060" | .045" | .035" | 8-13 |
| .014" to .040" | .090" | .080" | .065" | 6- 8 |

Liquid adhesives in the form of solutions or dispersions of polymeric materials such as polyurethane resins, styrene resins, acrylate resins, vinyl resins and the like are generally suitable and should ordinarily be those which will not be affected by the temperatures developed in dry brushing operations which for most work are around 175° F. minimum. Consequently, the preferred adhesive materials are usually those of the thermosetting plastic group although thermoplastic resins may also be utilized in some cases. The thermosetting adhesive materials will ordinarily be employed when the central core member is of wire, and elastomeric materials will ordinarily be employed with a non-metallic central member. Also, elastomeric adhesives are ordinarily preferred when the wound rib element is a thread-like filament of cord, hemp or other staple fiber. The adhesives may be a resin in the form of a plastisol, being a dispersion of fine particles of a thermosetting resin and a plasticizer. Such a plastisol may be solidified by heating, the resin going into solution in the plasticizer and forming a solid solution. A specific preferred example is a liquid adhesive coating material comprising a plastisol of polyvinyl chloride dispersed in a mixture of dioctyl phthalate and dioctyl adipate. Such vinyl plastisol comprises about 40–50% by weight of vinyl resin dispersed in about 60–50% by weight of the plasticizer. The temperature needed in oven **23** for gelling this particular plastisol is approximately 300–400° F., depending on the speed of travel of core wire **3** and the height of the oven employed. In many cases, it is only necessary partially to gel or set the adhesive at this stage in order to ensure safe passage over pulleys **4** and **5** with final setting taking place subsequently.

While the adhesive may be applied to either the internal or external element, or to both, it is ordinarily more simple to apply it to the internal or central member. On occasion, however, when a minimum amount of adhesive coating on the central member is desired, the adhesive may be applied only to the filament which is to be wrapped about such central member.

It will be understood that a variety of different bristels may be employed in a brush in admixture; such as a mixture of longitudinally helically ribbed bristles and non-ribbed bristles, a mixture of two or more types of helically ribbed bristles, a mixture of ribbed bristles and beaded wire bristles, and a mixture of helically ribbed hard wire bristles and tampico fiber bristles. The central bristle core may be a plurality of twisted strands or filaments, or a bundle of straight wire or glass fiber monofilaments bonded together, with the plastic rib helically encircling such core or bundle. Plastic coated hard straight wire monofilaments are very satisfactory for many purposes, e.g., nylon coated steel wire having a Knoop hardness of at least 800.

The bristles will ordinarily be packed as densely as possible in the support or brush back from which they extend in generally parallel side-by-side relationship although, of course, somewhat flaring in the case of the FIG. 1 wheel brush. The brush material of this invention is also very advantageously employed in rotary cup brushes such as that illustrated in FIG. 11 where the bristles are retained in annular sheet metal channel backs **38** and **39** generally similar to back **26** of FIG. 4 but deflected into cup shape by sheet metal holder **40**. The threaded nut portion **41** is adapted to secure such brush on the end of a rotary spindle or the like.

The brush material of this invention, whether employed in the FIG. 1 or FIG. 11 type of brush, or in other power driven rotary brushes of known types, is also particularly useful in such brushes which are intended to be operated at relatively slow speeds such at 250 r.p.m., for example. Such brushes utilizing hard straight bristles with helical plastic ribs thereon may be of short trim length and coolants and auxiliary bristle tip sharpening means may be employed in conjunction therewith to reduce the tendency of the bristle ends merely to peen or upset an edge or burr on a workpiece instead of actually removing metal therefrom. By operating the brush at slow speeds and utilizing the brush material of this invention where the straight bristle core has a Knoop hardness of at least 700 and preferably at least 800, it is possible and feasible to cause the sharp hard bristle ends to cut chips from the work, a result not previously obtained in a brushing operation, at least to any consequential degree. This is obviously very different from previously known random brushing operations.

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 brush comprising a support and stiff self-supporting brush bristles secured thereto and extending therefrom, said bristles each having an elongated central core with at least one helically disposed rib of vibration damping material adhered thereto.

2. The brush of claim 1, wherein said cores are of wire.

3. The brush of claim 1 wherein said ribs are of plastic.

4. The brush of claim 1, wherein said ribs are of foamed plastic.

5. The brush of claim 1, wherein said ribs are of helically wound staple fibers.

6. A brush comprising a support and brush bristles secured thereto and extending therefrom, said bristles each having an elongated central core with at least one helically disposed rib thereon, wherein said ribs are of helically wound filamentous material bonded to said cores.

7. The brush of claim 1, wherein there are two said helically disposed ribs on each said core.

8. The brush of claim 1, wherein there are three said helically disposed ribs on each said core.

9. The brush of claim 1, wherein said cores are of straight hard material.

10. The brush of claim 1, wherein said cores are of straight material having a Knoop hardness of at least 700.

11. A brush comprising a support and brush bristles secured thereto and extending therefrom, said bristles each having an elongated central core with at least one helically disposed rib thereon, wherein said cores are of straight material having a Knoop hardness of at least 700, and said ribs are of plastic material.

12. A rotary brush comprising a rotatable support and brush bristles secured thereto and extending therefrom in general side-by-side relation, said bristles being helically ribbed along their length, wherein said bristles are densely packed together in the region adjacent said support from which they extend in radial directions, and comprise straight core portions with helical ribs thereon.

13. A rotary brush comprising a rotatable support and brush bristles secured thereto and extending therefrom in general side-by-side relation, said bristles being helically ribbed along their length, wherein said bristles are densely packed together in the region adjacent said support from which they extend in radial directions, and comprise straight wires with helically disposed plastic ribs thereon.

14. A rotary brush comprising a rotatable support and brush bristles secured thereto and extending therefrom in general side-by-side relation, said bristles being helically ribbed along their length, wherein said bristles have hard elongated core elements adapted to perform the brushing function and helically disposed plastic ribs on said core elements to regulate the action thereof.

15. A composite brushing tool comprising bristles arranged in general side-by-side relation having hard elongated core elements with softer longitudinally extending ribs thereon disposed at angles to the longitudinal axes of said bristles, and a body of yielding material embedding said bristles and interengaged with said ribs.

16. A composite rotary brushing tool comprising a rotatable support with brush bristles held thereby and extending generally radially therefrom, said bristles having hard elongated core elements with softer longitudinally extending ribs disposed at angles to the longitudinal axes of said bristles, and a body of elastomeric material



embedding said bristles and interengaged with said ribs.

17. The tool of claim 16, wherein said elastomeric material is cellular.

18. The tool of claim 16, wherein said elastomeric material is cellular polyurethane.

19. The tool of claim 16, wherein said elastomeric material embeds the inner end portions only of said bristles.

20. The brushing tool of claim 16, wherein said elastomeric material is cellular and extends closely adjacent the outer working ends of said bristles with the latter protruding only slightly therefrom, said elastomeric material being more readily erodable in use than said bristle ends to maintain such relationship as the bristles wear back.

21. The brushing tool of claim 20, wherein said ribs helically encircle the respective individual bristles.

22. Brush bristle material for use in the manufacture of power driven rotary brushes and the like comprising an elongated core portion having a helical rib thereabout, wherein said core portion is straight and has a Knoop hardness of at least 700, whereas said rib is of synthetic plastic material.

23. Brush bristle material for use in the manufacture of power driven rotary brushes and the like comprising an elongated core portion having a helical rib thereabout, wherein said core portion is straight and of substantially harder material than said rib and, wherein said core portion is from .006 inch to .040 inch in diameter, and the over-all diameter of the ribbed bristle is from .010 inch to .090 inch.

24. Brush bristle material for use in the manufacture of power driven rotary brushes and the like comprising an elongated core portion having a helical rib thereabout, wherein said core is straight metal wire, and said rib is a plastic filament adhesively bonded thereto.

25. A rotary brush comprising a rotatable support and brush bristles secured thereto and extending therefrom in general side-by-side relation, said bristles having hard elongated core elements adapted to perform the principal brushing function with longitudinally extending ribs of softer vibration damping material thereon, said ribs being disposed at an angle to the longitudinal axes of said core elements.


**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 359,928 | 3/1887 | Kenyon | 15—197 |
| 1,773,969 | 8/1930 | Dreyfus et al. | 15—159.1 |
| 1,853,543 | 4/1932 | Bradford | 57—144 |
| 2,313,058 | 3/1943 | Francis. | |
| 2,433,722 | 12/1947 | Weiss | 57—144 X |
| 2,434,533 | 1/1948 | Wurzburger | 264—167 X |
| 2,637,893 | 5/1953 | Shaw | 15—159.1 |
| 2,666,976 | 1/1954 | Olmer et al. | 15—159.1 |
| 2,694,880 | 11/1954 | Artese et al. | 15—141 X |
| 2,746,839 | 5/1956 | Terry et al. | 161—177 X |
| 2,769,300 | 11/1956 | Luttge | 57—144 X |
| 2,950,495 | 8/1960 | Stingley | 15—179 |
| 3,090,061 | 5/1963 | Charvat | 15—179 X |
| 3,147,502 | 9/1964 | Charvat | 15—180 X |

FOREIGN PATENTS

| | | |
|---|---|---|
| 531,551 | 10/1956 | Canada. |
| 1,140,901 | 12/1962 | Germany. |


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