Oct. 8, 1963 R. O. PETERSON 3,105,988

BRUSH CONSTRUCTION

Original Filed July 13, 1953

FIG_1

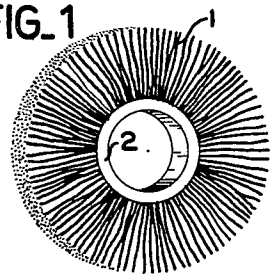


FIG_2

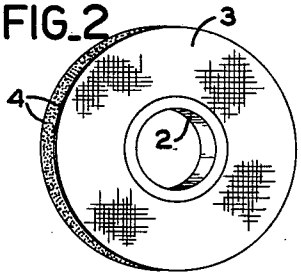


FIG_3

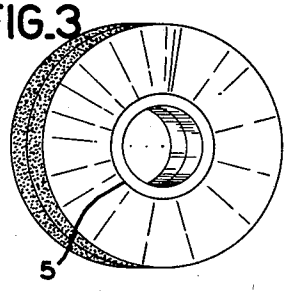
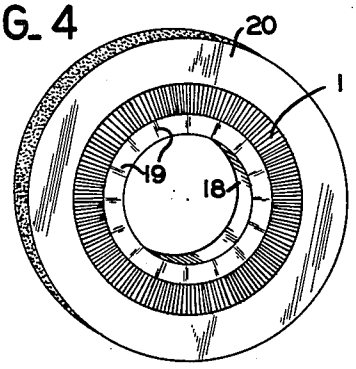


FIG_4



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3,105,988
BRUSH CONSTRUCTION

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2 Claims. (Cl. 15—179)

This invention relates to brush construction, and more particularly to a novel form of high speed rotary brushing tool having operating characteristics never before achieved.

In the manufacture of power driven rotary brushes and the like and particularly wire brushes, it has always been considered necessary to employ brushing material which is as tough as possible and which consequently has relatively high damping capacity and low hardness. Numerous disadvantages always previously considered unavoidable have flowed from such limitations. Wire and the like having a high damping capacity is also relatively soft and the ends of the material accordingly wear back and round over, thereby losing their cutting ability rather rapidly. Materials of this type do not have the requisite hardness to afford the degree of cutting action desired for the removal of flash, burrs, oxide coatings and the like. As a result, grinding wheels have generally been employed for this type of work. A grinding operation, however, unless performed with very accurately adjusted equipment, often mars the work surface to a degree requiring a further finishing operation, as by brushing, for example. It is accordingly a primary object of my invention to provide a brushing tool in which the brush material may be of a relatively high degree of hardness and the brush construction designed to provide adequately for the damping of destructive vibration.

Brush material of the type which I employ, e.g. hard tempered steel wire and glass fiber, is not only relatively brittle but its tendency to fracture in use is greatly increased by secondary factors. Very slight scratches on the surface of a glass fiber strand, such as result from interaction of such strands in a rapidly rotating brush are sufficient to cause fracture of the strands and rapid destruction of the brush. While this same effect is an important cause of self-destruction of wire brushes of the type in question, another effect, namely corrosion due to atmospheric, operating, and storage conditions is a still more serious cause of deterioration. In fact, when operating a power brush at a relatively high speed of rotation the impact of the brush wire against the air has the effect of raising the atmospheric pressure thereagainst, greatly increasing the ability of the air to oxidize steel wire, particularly at the somewhat elevated temperatures developed by operation of the brush. Changes in humidity during storage and contact with sweaty fingers are other corrosion accelerators. Once corrosion has commenced, the percentage fracture of the brush material is greatly increased.

Since brushes of this type are commonly employed to apply powdered abrasive and the like to a work-piece, it is obvious that a certain amount of such abrasive will find its way between the strands or bristles and initiate further premature fracture of the same.

When suitable hard brush materials are mounted in a brush back for use as a power brush, there is a tendency for vibrations resulting from operation of the brush to be communicated to concentrated points or areas along the length of the brush material strands. Such concentration of vibratory stresses induces fracture of the brush material at points well back from the working face of the brush and greatly reduces the life of the latter. Brush

material such as wire has in the past been crimped or twisted to minimize such concentrations of stress. When properly crimped for a given density of a given brush material, the strands support each other to a considerable extent and tend to confine the points of fracture near the working face of the brush. Similarly, when a tuft of brush wire, for example, is twisted to form a coiled knot of such wire, the individual wires thus closely associated tend to support each other and to diffuse the vibratory stresses in such manner as to reduce breakage at points far back from the working face of the brush. Extremely hard brush bristle material, however, usually cannot be crimped or twisted in a satisfactory manner and even when a degree of crimp may be imparted thereto (as when the material is heated) the tendency toward long fracture in use may nevertheless prove a serious disability.

Certain objects of this invention are therefore as follows:

To provide a brushing tool having improved cutting capacity and increased life;

To provide a tool of great cutting capacity yet capable of leaving a relatively smooth finish on the work as compared to the usual grinding wheel or similar fast cutting tool;

To provide a brushing tool modified for more effective application of abrasive;

To provide a brushing tool which will wear back evenly in use, providing a face of the same width and operating characteristics at all times;

To provide a brushing tool having hard brush material of low damping capacity associated with other material of a high damping capacity effective to prevent concentration of vibratory stresses at points far back from the working face with resultant long fracture of such brush material;

To provide a brushing tool in which the ends of the brush material will themselves progressively crumble or fracture in use and thereby remain sharp and effective rather than rounding over;

To provide a brushing tool in which the brush material is supported in a novel manner effective both to enhance its cutting capacity and to protect it from scratches, corrosion, and similar deteriorating influences.

Other objects of my invention 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 perspective view substantially in side elevation of a typical annular rotary brush section;

FIG. 2 is a similar view showing a brushing tool incorporating the brush of FIG. 1 embedded in plastic with cloth facing;

FIG. 3 is a similar view of another embodiment of my invention incorporating several turns of helically coiled brush strip; and

FIG. 4 is a side view of a rotary brushing tool generally similar to that of FIG. 2 but modified in that the inner end portions of the brush material are left exposed adjacent the annular brush back in accordance with the preferred form of my invention.

As above indicated, I employ brush material which may be of a very high degree of hardness, and I embed such material in a supporting body or matrix of suitable high damping capacity material.

Construction

Many well-known types of brushes are adapted to be modified in accordance with my invention to produce my new brushing tool. Reference may be had to my prior Patents Nos. 2,303,386; 2,316,185; and 2,421,647 as well as to Whittle Patent No. 2,288,337 and Bickel et al. Patent No. 2,062,047 for typical examples of well-known power driven rotary brushes which are thus suitable for use.

Referring now more particularly to the drawing, FIG. 1 thereof shows an annular rotary brush section in which stranded brush material **1** extends substantially radially from an inner circular channelform back **2**. I have modified brushes of this type by intruding a suitable plastic as described below between the strands of the brush material so that such material is completely embedded in the plastic matrix. Such brush material may be hard low damping capacity steel wire and the intruded plastic may, for example, be Neoprene having a certain amount of a filler such as bentonite incorporated therein together with the usual vulcanizing agents and the like. If desired, other abrasive powders may likewise be incorporated in the plastic material. The plastic is forced into the brush material within a suitable mold, the two sides of which may desirably be faced with cloth annuli **3** so that when, after curing, the finished article is removed from the mold, the cloth will adhere to the sides of the article as shown in FIG. 2. Instead of cloth, similar sheets of Nylon or a rubber-containing compound may be employed. These facings serve several purposes. The cloth will prevent the plastic from adhering to the mold, this sometimes being an annoying problem in the molding of rubber and like plastic materials, and especially so in the case of the materials preferred for use in accordance with this invention. The facing of cloth or like material reduces any tendency of the stranded brush material to break out laterally of the highly filled low tensile strength matrix in which it is preferably embedded. The nylon and high tensile rubber-like facings are, of course, also acid and alkali resistant and afford further protection to the tool under certain working conditions. One very satisfactory form of side facing consists of cloth impregnated with a rubber compound, thereby providing both strength and protection from acids and the like. A typical example of a higher tensile strength facing layer material is given below by way of illustration:

	Parts
Neoprene	100
Zn.O	5
Mg.O	5
Anti-oxidant	2
Softener	3
Stearic acid	1
Clay	50

The degree of resistance to abrasion of the plastic material which has been intrued into the brush material may be controlled by varying the amount of special filler therein, sufficient filler content causing such plastic to become somewhat crumbly under operating conditions at the working face of the tool.

By properly selecting the brushing material and the plastic matrix, a tool of this type may be provided in which the plastic wears or crumbles away at a slightly more rapid rate than the hard wire or similar brush material wears back. As a result, the ends **4** of the strands **1** will protrude very slightly from the matrix material and afford a very high cutting capacity while at the same time being resiliently supported in a manner to achieve a long useful life. As the tool wears down in use, the plastic continues to erode and the bristles are progressively exposed so that there is no consequential alteration in the brushing face presented. As compared to the type of grinding wheel generally employed for such work, this new brushing tool, while having a very high cutting capacity which renders it useful for the removal of burrs, flash, and oxide coating, for example, nevertheless provides a superior finish on the work-piece which usually obviates the necessity of any further finishing operation.

When my preferred hard brush material is employed in a resilient plastic composition as taught herein, any fracture due to impact or vibration will occur close to the working ends thereof which protrude slightly from the supporting matrix. This serves to keep such ends sharp without reducing the diameter of the tool with undue rapidity. Generally speaking, the less hard of the "hard" brush materials I may employ may protrude from such supporting matrix to a considerable extent without excessive long fracture in use. When, however, the Knoop hardness of the brush material exceeds 900 it becomes very important that such material protrude only very slightly from such matrix. Similarly, the more resistant to fracture brush material, the more resistant the resilient plastic composition should be to abrasion so that it will crumble away from the working face only sufficiently to expose very short lengths of such brush material. Various compromises may, of course, be effected to obtain a particularly desired set of operating characteristics.

Instead of employing a single annular brush section as above described, a cylindrical brushing tool having a wider face may be provided by similarly introducing plastic into several turns of helically wound brush strip **5** as shown in FIG. 3 and molding the same in an appropriate mold.

The FIG. 4 form, which is the preferred form of my invention, is generally similar to that of FIG. 2 described above. The annular sheet metal channelform back **18**, however, may desirably be radially indented as at **19** to facilitate radially outward flow of cooling air when the back is mounted on a ventilating adapter, for example. In this form, the resilient plastic matrix **20** is molded to embed the outer circumferential portions of the bristles **1** only, leaving the inner end portions of such bristles adjacent the back **18** exposed as illustrated. With certain bristle materials this arrangement affords adequate support and the other desired characteristics while reducing the amount of plastic material required, reducing the weight of the tool, and facilitating ventilation.

The Brush Material

The attitude of workers in the prior art toward the problem of brush material fracture has been to seek tougher materials. While toughness is a desirable quality, it is not as important as several other considerations. Tough steel wire is relatively soft so that the ends of the bristles round over in use and quickly lose their cutting ability. Nor do they have sufficient resistance to bending and "snap action," which is such a desirable characteristic in brushes. Wire of this type has much higher damping capacity with consequent rapid absorption of vibrations. This self-absorption of vibratory stresses and strains develops internal friction and heat which is a primary cause of fracture. When such absorption of vibratory stresses becomes concentrated at points relatively far removed from the working ends of the strands, long fracture thereof results and the brush consequently has a very short life. By the means herein taught such concentration of stresses at undesired points can be prevented.

A rotary brush revolves at such speeds that each strand is kept vibrating at all times from repeated contact with the work, whether such strands be of the high or low damping capacity type. Low damping capacity material is much less susceptible to self-destruction from this particular cause, however, since it does not do as much work fighting against vibration. Hard brushing materials are therefore desirable not only for their increased cutting capacity but also for the relatively low damping capacity which is generally associated therewith.

In accordance with my invention, I employ brush bristle material having a Knoop hardness in excess of 600, and preferably in excess of 700 or even 800. Strands of ma-

terials such as the following are available having the requisite degree of hardness:

Hard steel wire (severe quench and a minimum draw back)
Glass fiber
Beryllium copper wire
Stainless steel wire
"Z" nickel wire (hard drawn, heat treated, relatively pure nickel)

The last two materials listed have somewhat greater damping capacity than the others. It is interesting to note that an ordinary brush employing stainless steel wire was observed to have about one-third of life expectancy of a brushing tool employing the same wire but constructed in accordance with my invention. The resilient plastic takes over much of the damping function and literally saves the life of the brush material.

It should be appreciated that most wire, including steel wire, as well as most glass fiber commercially available has a degree of hardness substantially below Knoop 600. The techniques are, however, well known for the production of such wire and glass fiber having a hardness of the order specified.

The Knoop hardness of fine metal wire filaments, glass fibers and the like may be determined by means of apparatus known as the "Knoop indenter" which has been developed at the National Bureau of Standards and is now commercially available. The specification for Knoop indenters is set forth in detail in circular letter LC 819 of the National Bureau of Standards, United States Department of Commerce, dated April 1, 1946. The Knoop indenter is also described in U.S. Patent No. 2,091,995, and such indenter meeting the specifications of the National Bureau of Standards is manufactured and sold by Wilson Mechanical Instrument Company, Inc., an associate company of American Chain & Cable Company, Inc., 230 Park Avenue, New York 17, New York.

The relative hardness of different materials may be compared on a Knoop hardness scale in which the Knoop hardness number is expressed by the formula

$$I=\frac{L}{Ap}=\frac{L}{l^2Cp}$$

where:

I=Knoop hardness number
L=Load (in kilograms) applied to indenter
Ap=Unrecovered projected area of indentation (in square mm.)
l=Measured length of long diagonal of the indentation (in mm.)
Cp=Constant relating l to the projected area

In making the Knoop hardness test, it is standard practice to make a number of measurements and to take the average of the results obtained inasmuch as the hardness of some materials tested (e.g. steel) is not entirely uniform throughout. When materials such as steel wire used for brush bristle material are selected of increasing Knoop hardness, they become more and more brittle and susceptible to fracture whereas, as materials of lower Knoop hardness are selected, they become increasingly tough.

The degree of hardness obtainable will, of course, vary with the material employed. Thus glass fiber is available which is considerably harder than most harder grades of steel wire, and the latter may be had harder than stainless steel, for example. It is a general characteristic, however, that as hardness increases so does brittleness and notch sensitivity and the more important becomes the provision of my resilient, high damping capacity material in association therewith. With my modified construction I have employed stranded brush materials having a Knoop hardness in the 800 to 900 range with very great success.

In the case of steel wire, wire having a tensile strength of at least 300,000 p.s.i. attained by tempering (rather than by drawing) will ordinarily be in the upper range of Knoop hardness (and scratch hardness) which places it in the category of especially hard materials which I am now enabled to employ with superior results.

The Plastic

The plastics employed should ordinarily be able to withstand reasonably high operating temperatures without softening or smearing the work. Examples include:

Rubber (if operating temperatures not too high)
Neoprene (polychloroprene)
Hycar (modified copolymers of butadiene and acrylonitrile)
Nylon (polyamide resins)
Vinyl plastics (vinyl polymers and copolymers)
Melamine resins (melamine-formaldehyde reaction products)

It will be understood that in employing such plastics the same will ordinarily have included therewith suitable fillers as well as the usual vulcanizing agents or the like to produce the resilient plastic composition for my purpose.

The brush bristles will, of course, reinforce the plastic matrix to some extent and in all cases the plastic material must be strong enough to resist the outward pull of centrifugal force at operating speeds and should not break out in large pieces. It will be sufficiently resilient to prevent permanent deformation in use and should have a relatively high damping capacity. It is furthermore generally desirable that the plastic material be able to withstand a certain amount of contact with oil and grease.

When employing wire brush material, plastic compounds such as those having a neoprene base may have their bond to such brush material improved by first applying a cement to the material, such cement preferably comprising a synthetic rubber and resin composition such as is commercially available under the name of "Ty-Ply-S" (Vanderbilt). The cement may be applied by spraying, dipping, or painting the previously thoroughly cleaned brush material. The brush should then be properly dried before intruding the plastic matrix material.

Fillers

The plastic which is employed to embed the brush material substantially completely therein should not be so resistant to abrasion and wear that the ends of the brush bristles will not protrude therefrom. Thus, ordinary tire tread rubber containing certain selected carbon blacks is not suitable for my purpose as it is very resistant to abrasion and will not crumble or wear back at a rate appreciably greater than that of bristle material embedded therein. A buffing action is therefore obtained rather than the brushing or cutting action it is an object of my invention to provide. Moreover, it tends to smear the work.

To produce a tool of the type such as that illustrated in the several figures of the drawing and described above, for example, I may first incorporate a selected filler in the plastic material so that such material, while still quite resilient, will be less abrasion resistant and will wear or crumble away in use at a rate slightly faster than the ends of the bristles wear back. The working face of the tool will therefore always consist of very short (in some cases on the order of $\frac{1}{32}$ of an inch long) bristles projecting from the resilient plastic matrix. Such construction affords entirely novel characteristics in use, particularly fast cutting action coupled with a relatively smooth finish on the work-piece. It furthermore makes possible the use of brush material otherwise too brittle and makes such use advantageous. As extremely short bits fracture from the ends, such material constantly sharpens itself.

Typical examples of such suitable fillers include:

Finely crushed stone, such as limestone
Asbestine powder (asbestos gangue)
Kaolins
Clays, such as bentonite
Whiting
Various mixtures of the above

Rubber and the various synthetic plastics which may be employed are commonly combined with several other ingredients, including fillers, in a manner well known in the art. In fact, the final plastic material may comprise a composition of which only about one-fifth is constituted by the original pure plastic, such as neoprene, for example. The degree of abrasion resistance of such final plastic material relative to that of the brush material may be controlled and modified as necessary by employment of the proper proportion of fillers. When cured, such final plastic material should display at least some degree of resilience and should neither be hard (like hard rubber) nor overly tough and abrasion resistant (like tire tread rubber).

I prefer to employ fillers which are themselves mildly abrasive and therefore afford a cleansing action on the work. Such fillers should ordinarily be relatively free from iron oxide and the like and without tendency to smudge the work so that there will not be deposition of fine corrosion promoting particles thereon. They may also desirably display an ability to absorb certain lubricants which assist in preventing smudging of the work (see below).

Abrasives

It is often desired to apply abrasive to a work-piece in addition to the cutting or polishing action which may be produced by the brush material. In fact, brushes are often employed primarily as a means of applying powdered abrasive.

Wire brush material would be an excellent applicator of such powdered or granular abrasive except for the difficulty in inducing it to hold the same, even when the abrasive is supplied in the form of a paste to assist it in adhering to the wire strands. By incorporating the abrasive in the plastic employed in the "short trim" brushing tool above described, such abrasive is continuously supplied to the working face of the tool as the plastic crumbles away.

Typical examples of suitable abrasives for use in accordance with my invention include:

Aluminum oxide ("Alundum," "Aloxite")
Silicon carbide ("Carborundum," "Corundum")
Chrome oxide
Natural abrasive (e.g. pumice, emery)
Mixtures of the above

The employment of abrasive in the plastic may further increase the heat generated by the tool in use. Some plastics, when heated sufficiently, tend to smudge the work but I have found that inclusion of the above-mentioned fillers greatly reduces such tendency, the filler having a lubricating effect on the freshly cut surface of the work-piece, preventing adherence of the plastic. Small amounts of special lubricants such as paraffin wax, sulphonated oils, and cerotic acid (synthetic beeswax) may also be incorporated in the plastic to enhance such lubricating, smudge-preventing effect. A preferred method of incorporating such lubricant is to treat the filler therewith before adding the latter to the plastic compound. Certain of the clays, such as bentonite, are especially satisfactory for such purpose.

Three specific examples of plastic compositions employed in the production of this type of tool follow:

		Parts
(I)		
(1)	Hycar	100
	Filler (whiting)	400
(2)	Rubber sub	50
(3)	Softener	30
	Sulphur	3
	Altox	1
	Thionex	.1
	Zinc oxide	5
	Stearic	1
(II)		
(1)	Neoprene	100
	Filler (whiting)	400
(2)	Rubber sub	50
(3)	Softener	30
	Zinc oxide	5
	Stearic	1
	Magnesium oxide	5
(III)		
(1)	Neoprene	100
	Zn.O	5
	Mg.O	5
	Anti-oxidant	2
(3)	Softener	30
	Stearic acid	1
(2)	Rubber sub	50
	Limestone *	250
	Clay *	100

*Filler.

Notes.—(1) Both Hycar and neoprene are synthetic rubberlike materials.

(2) So-called "rubber substitutes" are commonly employed in compounding rubber and similar plastics, and may comprise blown oils.

(3) The softener was a petroleum distillation product. Waxes commonly used in the rubber industry may be employed for this purpose.

It will be noted that a great deal more filler is employed in these examples than in the example of facing composition given above. In fact, the amount of filler may comprise three or four times the amount of pure plastic, and even more.

Annular rotary brush sections having hard, low damping capacity steel wire brush material with a high tensile strength of over 350,000 p.s.i. were placed in molds and the above plastic compositions intruded into such material. After curing, the resultant rotary tools were tested and showed notable effectiveness in such fields as burr removal, flash removal, and removal of oxide coatings from metal surfaces. A finish was left far superior to that obtainable with conventional grinding wheels applied by similar offhand methods. It was found that such tools would remove steel burrs in approximately five seconds' time which required forty-five minutes to remove with the standard brush commercially available best suited for such purpose.

The more abrasion resistant plastic compositions such as tire tread rubber are unsuitable for my purpose. I have found (through observation of the rapidly rotating tool by means of a Strobotach) that with my hard, relatively brittle brush bristle materials it is essential to limit the amplitude of movement of each bristle under impact with the work in use to less than one-third of the normal unimpeded free movement of the bristle in the absence of the restraining plastic matrix. Such plastic matrix must, however, be capable of yielding resiliently under normal operating conditions to an extent affording an amplitude of deflection of each bristle end portion at the point where it emerges from the supporting matrix at least equal to the diameter of the bristle. The resistance of a body of resilient plastic material may be measured

by means of a Durometer in accordance with ASTM standard D–676–49T (promulgated in 1942). Such Durometers are available from Shore Instrument Manufacturing Company of Jamaica, New York, and also from other makers, and utilize a scale reading from 0 to 100 Durometer Hardness Type D. On such scale the Durometer gives a reading of 100 on plate glass and a reading of 0 upon penetration of 1/10 of 1 inch or more into the material being tested.

I have found that the resilient plastic materials suitable for my purpose should give a reading of between 5 and 40 Durometer Hardness Type D, and preferably between 10 and 30. A Durometer hardness reading of 20 will be preferred for a great many embodiments of the invention.

Not only must the resilient supporting plastic matrix have a Durometer reading within the range indicated above properly resiliently to support my hard brittle brush bristles, but also such plastic material must be selected or prepared (ordinarily by compounding with suitable fillers as indicated above) to be appreciably less abrasion resistant than the bristle material. This is, of course, a relative matter in the sense that as the degree of abrasion resistance of the bristle material is changed, the degree of abrasion resistance of the supporting plastic matrix may likewise be changed, it only being important that the abrasion resistance of the plastic always be appreciably less than that of the brush bristle. The relative abrasion resistance of the plastic and brush bristle material may be determined by any standard or convenient abrasion test, modelled for example on ASTM test D394–47, where the material being tested is pressed against a rapidly rotating abrasive disc and subjected to the action of an air blast. The rate of wear on a common abrasive surface under equal load and at the same speed should be at least twice as great for the plastic matrix as for the hard bristle material to be employed therewith, considering the rate of wear of the bristle to include progressive fracture of the extreme end of the exposed terminal portion.

By thus always employing resilient plastic material within the Durometer range indicated, the flexing or deflection of the hard brush bristles will be adequately controlled by the resilient deformation of the plastic, the permitted deflection being sufficiently great to reduce the shock of impact with the work and thereby prolong the life of the bristle and at the same time sufficiently small to ensure that such rapidly repeated deflections of the bristle in the region where it is secured to the support are insufficient to stress and fatigue the same to the point of fracture in such region.

By ensuring that the resilient plastic matrix is selected of an abrasion resistance substantially less than that of the bristles thereby to be more subject to erosion at the working face of the tool in use than the ends of the bristles there exposed, extremely short end portions of the bristles will continually project from the plastic matrix. Since such short, hard, outer bristle ends are brittle (although highly resistant to abrasion), they are thereby adapted to maintain sharp cutting edges by repeated fracture at the extreme ends thereof upon impact with the work in use.

This application is a division of my co-pending application Serial No. 367,421, filed July 13, 1953, which in turn is a continuation-in-part of application Serial No. 50,850, filed September 23, 1948, now abandoned.

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 rotary brushing tool comprising a substantially rigid central member adapted to be mounted for high speed rotation about an axis, resiliently flexible brush bristles having a Knoop hardness of at least 600, said bristles having inner end portions secured to said member in close mutually supporting side-by-side relationship and diverging to space apart their outer working end portions; and a matrix of resilient high damping capacity plastic material embedding and joining said bristles yieldingly to hold the outer end portions of the same in such spaced apart relationship; said plastic material having a Durometer reading of from 5 to 40 and being capable under normal operating conditions of yielding resiliently to an extent affording an amplitude of deflection of each bristle end at the point where it emerges from such supporting matrix at least equal to the diameter of the bristle when it engages the work at high speed rotation of the tool but effective to limit such amplitude of deflection of each bristle end to less than one-third of the normal unimpeded free movement of such bristle end in the absence of said matrix, to ensure that throughout the useful life of the brush the rapidly repeated deflections of the hard bristles are insufficient to stress and fatigue such bristles to an extent to cause long fracture thereof while at the same time cushioning impact with the work to prevent fracture of the protruding bristle end where it emerges from such supporting matrix; said plastic material being selected of an abrasion resistance substantially less than that of said bristles thereby to be more subject to erosion at the working face of the tool in use than the ends of said bristles there exposed so that extremely short bristle ends will continually project therefrom, said short, hard, outer bristle ends being brittle and thereby adapted to maintain sharp cutting edges by repeated fracture at the extreme ends thereof upon impact with the work in use; said plastic matrix being spaced radially outwardly from said rigid central member to expose radially inner portions of the brush bristle material.

2. A rotary brushing tool including resiliently flexible hard wire brush bristles, the outer ends of said bristles being spaced apart; and a matrix of resilient high damping capacity plastic material embedding and joining said bristles yieldingly to hold the outer end portions of the same in such spaced apart relationship; said plastic material being capable under normal operating conditions of yielding resiliently to a limited extent only to ensure that throughout the useful life of the brush the rapidly repeated deflections of the hard bristles are insufficient to stress and fatigue such bristles to an extent to cause long fracture thereof while at the same time cushioning impact with the work to prevent fracture of the protruding bristle end portion where it emerges from such supporting matrix; said plastic material being selected of an abrasion resistance substantially less than that of said bristles, thereby to be more subject to erosion at the working face of the tool in use than the ends of said bristles there exposed so that extremely short bristle end portions will continually project therefrom, said short hard bristle outer end portions being adapted to maintain sharp cutting edges by repeated fracture at the extreme ends thereof upon impact with the work in use; said plastic matrix being spaced radially outwardly from a central hub portion to expose radially inner portions of the brush bristle material.

References Cited in the file of this patent

UNITED STATES PATENTS

634,617	Hansen	Oct. 10, 1899
2,129,279	Kingman	Sept. 6, 1938
2,232,289	Jurkat	Feb. 18, 1941
2,345,422	Peterson	Mar. 28, 1944
2,648,084	Swart	Aug. 11, 1953
2,739,332	Flohr	Mar. 27, 1956
2,740,148	Nelson et al.	Apr. 3, 1956