July 6, 1954 R. O. PETERSON 2,682,734

BRUSH

Filed Nov. 6, 1948

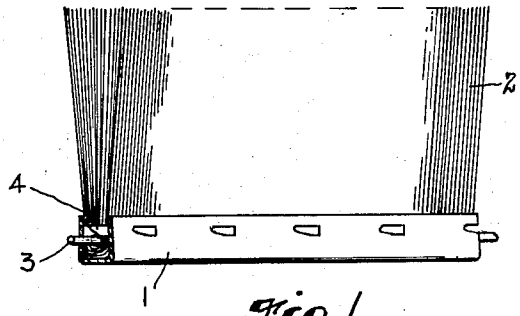


Fig. 1



Fig. 7



Fig. 6

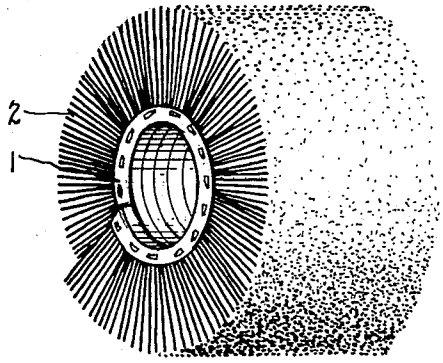


Fig. 2

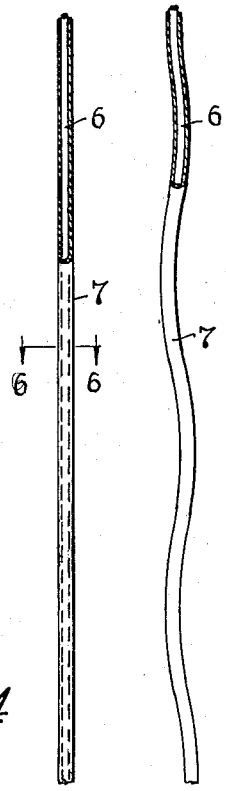


Fig. 5

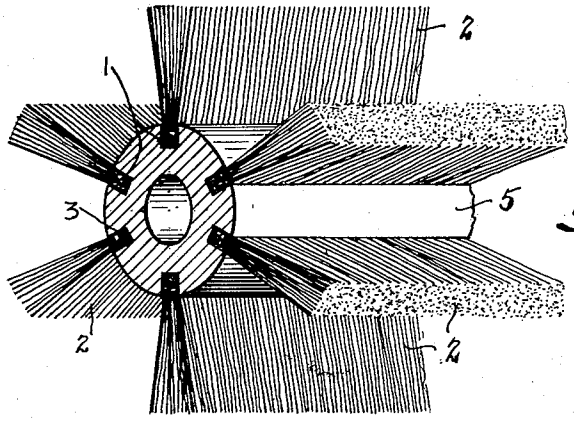


Fig. 3

Fig. 4

INVENTOR.
RUBEN O. PETERSON
BY
Oberlin & Limbach
ATTORNEYS.

Patented July 6, 1954 2,682,734

UNITED STATES PATENT OFFICE

2,682,734

BRUSH

Ruben O. Peterson, University Heights, Ohio, assignor to The Osborn Manufacturing Company, Cleveland, Ohio, a corporation of Ohio

Application November 6, 1948, Serial No. 58,670

22 Claims. (Cl. 51—190)

1

This invention relates as indicated to brushes and more particularly to power driven rotary brushes and the like.

In the manufacture of rotary brushes and particularly brushes designed for removal of burrs, encrusted material, and for surface finishing and blending and similar operations, several distinct problems have been encountered which have not previously been satisfactorily solved. Wire brush material, tampico fiber, and similar fibrous materials have commonly been employed in such brushes, but such material as previously known has been far from satisfactory. When employing wire it has always been considered necessary to employ a brushing material which is as tough as possible and which consequently has relatively high damping capacity and low hardness. 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. Brush material of the type which I prefer, for example 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 resulting 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 the 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 comonly 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 surface of the brush and greatly reduces the life of the latter.

2

It is sometimes necessary to operate power brushes under wet and even corrosive conditions. Where, in the past, only wire brush material has had the requisite characteristics for certain of the operations to be performed, the life of such brushes has been extremely limited under such conditions.

Although plating with protective metal coatings has been tried as a means for extending the usual life of the brush, it has proved not to be a satisfactory solution to the problem. When such plating is applied electrolytically or by hot dipping, it is an essential and common practice to clean by etching with acid the surface of the metal to be plated. Such treatment exaggerates the already brittle characteristics of the material and also reduces its fatigue strength.

It is therefore a primary object of my invention to provide a novel brush combining increased effectiveness with longer life, even under difficult operating conditions.

It is another object of my invention to provide a brush employing stranded brush material, which strands will effectively resist corrosive conditions, prevent cutting interaction between the strands in use, and which will tend to prevent concentrations of vibratory stresses which heretofore have been a common cause of fracture of the brush material far back from the working face, commonly referred to as "long fracture."

Still another object is to provide stranded material adapted to endure flexing, vibration, impact, and tensile stress as when employed in power-operated rotary brushes without fracture or elongation in use.

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 view of a length of brush strip of the type which may be produced in accordance with my prior Patent No. 2,303,386 and which may incorporate the brush material of this invention;

Fig. 2 is a fragmentary perspective view of a cylindrical or roller brush which may be produced by helically winding brush strip of the type shown in Fig. 1;

Fig. 3 is a fragmentary perspective view of another type of rotary brush in which straight or relatively straight lengths of brush strip may be employed.

Fig. 4 is a somewhat diagrammatic view of one form of my novel coated brush material;

Fig. 5 is a similar view of such material in crimped form;

Fig. 6 is a transverse sectional view taken along the line 6—6 on Fig. 4; and

Fig. 7 is a cross sectional view similar to Fig. 6 wherein the central core is composed of a plurality of filaments united into a single strand.

This invention is primarily concerned with improved brushes and especially power driven rotary brushes incorporating a novel brush material therein and is not limited to any particular form of brush back or mounting means. Thus, 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 such well-known forms of brush construction.

Referring now to Fig. 1 of the drawing, there is there illustrated a length of brush strip having a channel-form back 1 with stranded brush material 2 doubled about a wire retaining member 3 held in such back by means of teeth 4 punched in from the sides of the latter. Such brush strip is particularly adapted to be circularized into annular sections or helically wound as shown in Fig. 2 to form a cylindrical brush which may then be mounted upon a power driven arbor, for example.

In the form of rotary brush illustrated in Fig. 3, a number of lengths of brush strip are secured in a rotary base member 5 parallel with the axis of the latter. If desired, such brush strip may be given a slightly helical twist when mounted in such rotor 5. A great many other forms of power driven rotary brushes are well known in the art, including end brushes, cup brushes, twisted tuft brushes, and the like.

The brush material of this invention comprises stranded material such as wire 6 or glass fibers to which has been applied a coating of plastic such as nylon (a polyamide resin). This coating has a stiffening and form giving effect, and protects the inner component strand or strands from contaminating and corrosive agents and from destructive vibration. Such brush material may be crimped (Fig. 5) by passing the same between intermeshing gear shaped rollers, for example. When the stranded brush material such as glass fiber does not take a permanent set to form a crimp, it may be desirable to heat such rollers to cause the plastic coating to take the desired set. The crimp will preferably be in a plurality of angularly related planes.

The brush material

The stranded brush material which is to be coated in accordance with my invention may comprise any of such materials commonly employed in the industry. Such materials include: wire, fiber glass, and vegetable fibers such as cotton, jute, hemp, sisal, paper, etc.

For certain uses, however, I much prefer to employ relatively hard, low damping capacity stranded material such as the following which have not previously been considered suitable for heavy duty power operated brush purposes:

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. This and other inherent qualities of such brush materials have imparted to brushes made of these materials too short a life expectancy to justify their cost of use on many power brush jobs. However, my invention increases the effectiveness of these materials and greatly lengthens the life expectancy of brushes made therefrom.

Considerable improvement is obtained when conventional stranded brush material such as wire of relatively high damping capacity and fiber cord, for example, is coated with plastic and employed in a rotary brush in accordance with my invention, but the most striking results are achieved when a hard, low damping capacity brush material is thus coated and employed.

The attitude of workers in the prior art toward the problem of brush material fracture has been to seek tougher materials. While toughness is ordinarily a desirable quality, it is not as important as several other considerations. Tough steel wire, for example, is relatively soft so that the ends of the strands or bristles round over in use and quickly lose their cutting ability, nor do they have sufficient resistance to bending and the requisite "snap action" which is such a desirable characteristic in most brushes. Such tough, relatively soft wire has a much higher damping capacity than the harder, more brittle wire and consequently absorbs vibration more rapidly. 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 will have 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 (has greater fatigue strength) 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.

The plastic material with which the individual strands or bristles are coated reduces interaction of such bristles and prevents one from scratching or cutting another. Since such plastic coating also has a high damping capacity, it takes over the job of damping out and reducing excessive vibration of the bristle material, thereby prolonging the latter's life by deferring the time when it will reach the limit of its fatigue strength. I have consequently been enabled to employ relatively hard and brittle brush materials to obtain optimum brushing action coupled with long life.

In addition to the other advantages enumerated, the plastic coating prevents any strand which may fracture back from the cutting face of the brush from being thrown off at a dangerously high speed by rotation of the latter. Such fractured portions will generally be retained in

the brush until they again strike the working area where they will be dropped.

The coating, being of strong, tough, wear and chemical resistant plastic, has the ability and function, when so used, of enclosing and thereby uniting multiple strands into a unitary bristle material. This is a very important feature of this invention. A plurality of fine strands have a very desirable brushing action. But when very fine strands are used individually, their action is much too soft for many practical purposes; and when such strands are not coated as herein taught, they are especially subject to the destructure forces of contaminants and corrosive materials. Otherwise good lubricants, such as oils, will hold grit on the surface of brush filaments in such a manner as to make the combination a destructive abrasive which is especially destructive to hard wire and glass fiber. But, when a plurality of fine strands of such material are united by means of my plastic coating, any lubricant on such strands will be kept clean and serve its purpose as a lubricant therebetween. In this way the component strands can lie side by side in very close cooperative action without danger of one damaging the other. Furthermore, this feature permits the use of a straight nontwisted lie for component strands used in considerable numbers without sacrificing the ability of the unitary strand to bend readily.

When a considerable number of substantially parallel filaments, such as glass fiber, for example, are adhesively joined together as known in the prior art to produce a compound strand, there is a pronounced tendency, when such strands are bent, for the filaments lying on the outer side of the bend to be subjected to excessive stress which will either fracture those outer fibers or will fracture the adhesive bond to destroy the unitary nature of the strand at that point. Both are very undesirable results. However, in my coated strand, the component fibers, filaments, or wires can slide one on the other with such action facilitated by a clean efficient film of lubricant. This is especially true when the strands have been cut to the length normally used in the brush.

Such strand construction is rather diagrammatically illustrated in Fig. 7 where the core comprises a number of individual filaments 8 surrounded by a plastic sheath or coating 7. Fig. 7 is, of course, a cross-sectional view similar to Fig. 6, the general appearance of the bristle material being similar to that shown in Fig. 4. One example of brush material of this type which I have employed with great success comprised a core of 400 glass fibers to which only a slight twist had been given, and an outer coating of nylon.

Plastic coated wire brushes of the type above described have been found to be very satisfactory for such uses as the removal of plaster from cast iron polishing tables employed in the manufacture of plate glass. In this operation it is necessary to remove the plaster, which ordinarily has a corrosive effect upon the brush material, from the cast iron table without harming the surface of the latter. My new brushing tool not only performs such operation much more rapidly and satisfactorily, but also has a much longer useful life than was the case when ordinary wire brushes had been employed.

I prefer that the brushing materials have a Knoop hardness in excess of 600 and very desirably in excess of 800. (The Knoop hardness test is a United States Bureau of Standards test and is particularly suited to measure the hardness of fine filaments.) Such materials constitute a category not previously successfully employed.

The degree of hardness obtainable will, of course, vary with the material employed. Thus, glass fiber is available which is considerably harder than most hard 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 plastic coating. With my modified brush construction I have employed stranded brush materials having a Knoop hardness in the 800–900 range with very great success.

Even when employing brushing materials of relatively lower hardness in the range now in general use, coating of the strands serves to protect the same in the manner above explained and also renders the latter more effective in the application of abrasive as described below.

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 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 coating

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

Nylon (polyamide resins)
Vinyl plastics (vinyl polymers and copolymers)
Trifluorochloroethylene polymer

Other plastics such as neoprene (polychloroprene) and Hycar (modified copolymers of butadiene and acrylonitrile) as well as rubber and melamine resins (melamine-formaldehyde reaction products) may be employed in some cases, particularly when compounded to exhibit properties similar to nylon.

It will be understood that in employing such plastics the same will commonly 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 thin plastic coating may be applied to the stranded material by extrusion or any other suitable method. When employing wire brush material, plastic compounds such as those having a neoprene base may, if desired, 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 material should then be properly dried befor applying the plastic coating material.

It should be pointed out, however, that the plastic coating or sheath will ordinarily not be adhesively adhered or bonded to more than an outer layer of the inner strand or core when such core is made up of many filaments unless the adhesive material used is quite resilient and facilitates movement of one filament with respect to another. Such plastic coating, sheath, or sleeve will fit tightly on the inner strand, whether the latter be a single wire or other monofilament or

a plurality of filaments such as glass fibers, and such sheath will protect such inner strand as above explained while nevertheless permitting a certain amount of relative movement between such inner strand and sheath when the composite brush material is flexed in use. When inner strand and sheath are rigidly bonded or adhered together throughout their length, there is a decided tendency for the sheath to rupture at points of flexure, thereby losing many of the advantages of my invention. In contrast, when a plurality of lubricated filaments, for example, are enclosed within the outer plastic sheath in accordance with my invention a degree of relative movement is permitted between the filaments themselves. The sheath should, however, surround the inner strand quite tightly so as not to be readily stripped therefrom or tend to elongate in use beyond the end of such strand.

Artificial materials, with very low proportional limits of elongation, fracture rather than stretch when tensile stresses slightly exceeding their yield points are applied. When monofilaments of such materials are flexed, the portion of the filament on the outside of the bend must stretch and/or that on the inside of the bend must be compressed. The larger the diameter of the monofilament of a given material, the greater the degree of stretch required on the outside of the bend and the greater the compression on the inside of the bend, for any particular radius of bend. From these considerations it is apparent that low elongation materials such as glass strands and hard tempered steel wire may be flexed as required for my purpose only when the individual monofilaments are of relatively small diameters. In many cases such diameter limitation is too small to permit practical use of the individual monofilament. I therefore combine a number of the same in side-by-side relationship to form the core of my new composite strand within the plastic sheath or coating. By permitting a degree of individual movement to such monofilaments thus assembled the composite strand may be flexed in use without fracture thereof. For the purposes of this invention "low elongation" artificial materials may be defined as those which, when formed into monofilaments of diameters of .010 inch or more cannot be bent around a cylinder of their own diameter without fracture; and natural "low elongation" materials may be defined as those composed of individual natural fibers which exhibit no greater ability to stretch without fracture than do individual cotton fibers.

In one sense, my new brush material may be considered a reinforced plastic strand so constituted that it avoids the usual difficulties involved when employing plastic stranded materials in high-speed power-operated rotary brushes and the like. One great advantage is that the usual tendency of such plastic strands to elongate inordinately in use is substantially overcome.

It is often desired that the plastic coating should be less abrasion resistant than the core material so that it will wear back slightly in use from the ends of the strands or bristles to expose the latter for full cutting efficiency while still continuing to protect substantially the entire length of such strand. To modify a plastic to obtain such desired characteristic, 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. I have found that it is often desirable to have about 1/64 to 1/8 of an inch of the core material thus exposed. This construction provides a tool which is capable of fast cutting action coupled with the provision of a relatively smooth finish on the workpiece. It furthermore both makes possible the use of brush material otherwise too brittle and renders such use advantageous. As extremely short bits fracture from the ends of the core material such material constantly sharpens itself. Typical examples of suitable fillers include:

Finely crushed stone such as limestone
Asbestine powder (asbestor 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 sometimes 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 adequate tensile strength, and should not be brittle.

Abrasive

It is often desired to apply abrasive to a workpiece 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 coating material such abrasive is continuously supplied to the working face of the tool as the plastic crumbles away but does not come into active contact with the longitudinal surfaces of the brush material strands back from the working face. For this reason 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 be no 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).

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

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

The aluminum oxides are particularly suitable where good abrasive action combined with the production of a relatively good finish is desired.

The silicon carbides make hard and sharp abrasives for maximum cutting action.

Chrome oxide is employed to give a finish on stainless steel and similar materials.

Pumice produces a fine finish on certain types of work and the various examples of filler materials set forth above generally have a sufficient although mild abrasive action to have a cleaning effect on the work, thus serving a dual purpose.

The employment of abrasive in the plastic may further increase the heat generated by the tool in use. Some plastics such as nylon, 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.

To make one type of brush material which has qualities suitable for many brushes and an action which is very desirable, I prefer to employ strands of multiple fiber-glass monofilaments only slightly twisted together and coated with a plastic, such as nylon. A ratio of nylon plastic to glass fiber which is very satisfactory has been found to be one between 40% and 60%, by weight, although somewhat more and somewhat less plastic can be used in special cases. Strands of multiple fiber glass monofilaments which are only slightly twisted together readily lend themselves to manufacturing methods involving plying together various numbers of strands to produce various diameters of brush material. When the more tightly twisted textile glass fiber yarns are used, and these are very desirable materials for the larger diameters of brush materials, it is best to use them in the sizes in which they are commercially manufactured without attempting to ply them together. When used in the larger diameter of brush materials, the greater number of turns of twist per unit length improves the bending characteristics of the brush material strands required in the brush manufacturing operation. However, this same quality is not so desirable in the finer diameter brush material strands for the reason that a greater stiffening effect is required in these cases, and can be accomplished by the use of strands of multiple fiber glass monofilaments with only a slight amount or no twist. As used in the claims, the term "filamentous" is intended to include one or more filaments and is not restricted to the extremely small fibers.

When a multiplicity of filaments of wire or glass fiber are enclosed in substantially straight parallel arrangement within my plastic sheath or coating there is also a tendency for such coating to rupture on the outside of the bend when the compound strand or bristle is sharply flexed. In the case of parallel glass fibers enclosed in a nylon sheath, I have found that the plastic should desirably comprise 40% to 60% of the weight of the finished strand. In the case of steel wire, best results are obtained when the plastic amounts to from 15% to 25% of the finished strand by weight. As a general rule, when employing such relatively stiff materials as glass fiber and wire (as opposed to cotton or jute cord, and the like) the plastic should amount to at least 50%, by volume, of the finished strand. A useful product of this type may, however, have such plastic sheath constituting between 30% and 70% by volume thereof. When coating materials such as hemp or jute cord, where there is no necessity for additional damping action, a much thinner plastic coating is generally entirely adequate and even preferable, from about 15% to about 25% by weight being ample. This is, of course, a much smaller volume than in the case of the steel wire discussed above.

Two rotary wire brushes, identical in all respects except that in one case the strands were nylon coated, were operated intermittently in a salt spray under identical load conditions and at the same speed to determine the relative values under corrosive conditions with the following results:

Brush fill	Wire Size, Inches	Final Brush Diameter, Inches	Total Breakage (Grams)	Units of Metal Cut	Cutting Ability [1]	Relative Life [2]
1. Bright tempered wire	.010	5 1/16	247.3	303	100	100
2. Bright tempered wire, nylon coated	.010	8 5/32	148.95	434	143	517

[1] Brush No. 1 taken as 100.
[2] Brush No. 1 taken as 100, period required for a brush to lose 125 grams brush material. Since the weight of material lost by brush No. 2 includes nylon coating material, the contrast between the amount of wire lost by each brush is actually even greater.

A comparison of similar brushes under dry operating conditions shows the superiority of the plastic coated brush material:

Brush fill	Wire Size, Inches	Final Brush Diameter, Inches	Total Breakage (Grams)	Units of Metal Cut	Cutting Ability [2]	Relative Life [3]
3. Bright tempered wire	.010	7 13/16	125.8	501	100	100
4. Bright tempered wire, nylon coated	.010	8 1/16	[1] 125.7	499	99	220

[1] This figure includes weight of nylon coating lost (about 42 grams) so that actually only about 84 grams of wire were lost compared to 125.8 grams of uncoated wire.
[2] Brush No. 3 taken as 100.
[3] Brush No. 3 taken as 100; period required for a brush to lose 125 grams.

In the above examples the nylon coating performed a damping service which, in effect, materially increased the fatigue strength of the wire. No special etching or cleaning process was first necessary to cause the plastic coating to adhere to the wire. Any such etching will, of course, increase the breakage rate of the wire in use, which has been the experience when protective metal plating has been used.

When subjected to corrosive conditions, only very short active end portions of the coated wire brush material were exposed thereto, and such end portions were sharpened and rendered more effective thereby.

The superior cutting ability indicated for the nylon coated wire in the salt spray test is in part due to the fact that the diameter of the brush has not been reduced nearly to the degree of the uncoated brush and hence there is a greater surface speed. This is a real advantage in commercial use, however.

The relationship between hardness of the brush material and life of the brush in use is shown in the following table. Ten inch diameter rotary wire brushes were employed:

Sample	Wire Gauge	Knoop Hardness	Rockwell [1] "C" Scale	Relative life rating of wire
1	33	826.5	64	130
2	33	762.6	62	100
3	33	628.2	56	[2] 75

[1] These figures are derived from the Knoop hardness numbers to show results in a somewhat more familiar scale.

[2] The performance of this brush material, while inferior to the other two, is considerably better than that of the softer materials commonly employed.

It will be seen from the foregoing that I have produced a new type of brushing tool having all of the advantages of prior art brushes but overcoming the deficiencies thereof. Not only are my new brushes more effective in use, but their useful life has at the same time been considerably increased.

This application discloses but does not claim certain subject matter disclosed and claimed in my co-pending application Serial No. 50,850, filed September 23, 1948.

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 base and flexible bristle material extending therefrom, such bristles comprising an inner core of filamentous low damping capacity material having a Knoop hardness of at least 600, and an outer coating of resilient high damping capacity plastic.

2. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising an inner core of filamentous low damping capacity material having a Knoop hardness of at least 800, and an outer coating of resilient high damping capacity plastic.

3. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising an inner strand composed of a bundle of filaments having a Knoop hardness of at least 600 and an outer coating of resilient high damping capacity plastic enclosing such composite inner strand.

4. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising an elongated strand composed of a bundle of filaments of low damping capacity material having a Knoop hardness of at least 600, a lubricant applied to said filaments, and an outer coating of resilient high damping capacity plastic enclosing such inner composite strand, said lubricant and said plastic coating cooperating also to inhibit deleterious chemical attack on said filaments.

5. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising an elongated strand composed of a bundle of filaments of low damping capacity material having a Knoop hardness of at least 800, a lubricant applied to said filaments, and an outer coating of resilient high damping capacity plastic enclosing such inner composite strand.

6. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising an inner strand composed of a bundle of wire filaments having a Knoop hardness of at least 600 and an outer coating of resilient high damping capacity plastic enclosing such composite inner strand.

7. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising an elongated strand composed of a bundle of filaments of low damping capacity wire having a Knoop hardness of at least 600, a lubricant applied to said filaments, and an outer coating of resilient high damping capacity plastic enclosing such inner composite strand, said lubricant and said plastic coating cooperating also to inhibit deleterious chemical attack on said filaments.

8. A brush comprising a rigid base and flexible bristle material extending therefrom, such bristles comprising individual strands each composed of a bundle of glass filaments having a Knoop hardness of at least 600 and an outer coating of resilient high damping capacity plastic individually enclosing each such inner composite strand.

9. A brush comprising a rigid base and flexible bristle material extending therefrom, such bristles comprising an inner strand composed of a bundle of filaments having a Knoop hardness of at least 600 and an outer coating of resilient high damping capacity plastic enclosing such composite inner strand, said plastic outer coating constituting at least 50% by volume of the entire bristle material.

10. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising elongated strands composed of a bundle of low damping capacity wire filaments having a Knoop hardness of at least 600 and an outer nylon sheath enclosing such composite strand and constituting from 15% to 25% by weight of the entire bristle.

11. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising individual elongated strands of crimped, low damping capacity wire having a Knoop hardness of at least 600 and an outer nylon coating thereon.

12. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising elongated strands of low damping capacity filamentous material having a Knoop hardness of at least 600, an outer coating of resilient high damping capacity plastic, and powdered filler material incorporated in said plastic effective to reduce smearing of the work in use

and to cause said coating to crumble back in use at a more rapid rate than said inner strand.

13. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising an elongated filamentous strand of low damping capacity wire having a Knoop hardness of at least 600, an outer coating of nylon on said wire and powdered filler material incorporated in said nylon.

14. A brush comprising a base and flexible bristle material extending therefrom, such bristles comprising an elongated filamentous strand of low damping capacity wire having a Knoop hardness of at least 600, an outer coating of nylon on said wire, and fine abrasive and powdered filler material incorporated in said nylon.

15. A brush comprising a base and flexible bristle material extending therefrom, said bristles comprising an inner filamentous core of a bundle of lubricated filaments and an outer plastic sheath tightly encasing said core, said filaments being capable of sliding movement relative to each other and to said plastic sheath when said bristle is flexed in use to a degree sufficient to avoid fracture of said filaments and rupture of said sheath in the region of such flexing.

16. A brush comprising a base and flexible bristle material extending therefrom, said bristles comprising an inner core of a bundle of substantially straight parallel glass filaments and an outer plastic sheath tightly encasing said core, said filaments being capable of sliding movement relative to each other and to said plastic sheath when said bristle is flexed in use to a degree sufficient to avoid fracture of said filaments and rupture of said sheath in the region of such flexing.

17. A rotary brush comprising a base and flexible bristle material extending therefrom, said bristles comprising an inner stranded core of a plurality of low damping capacity, low elongation material filaments having a Knoop hardness of at least 600, and an outer sheath of resilient high damping capacity plastic tightly encasing the same, said filaments being slightly relatively movable when said brush material is flexed, permitting such flexing without fracture thereof.

18. A strand adapted for use as bristle material in power-driven rotary brushes and the like comprising a core formed of a bundle of filaments of low elongation material each coated with a movement facilitating lubricating film, and a sheath of tough, high softening temperature, plastic material tightly encasing said core and constituting between 30% and 70% by volume of the entire strand.

19. A strand adapted for use as bristle material in power-driven rotary brushes and the like comprising a core formed of a bundle of filaments having a Knoop hardness of at least 600, and an outer sheath of resilient high damping capacity plastic tightly encasing the same, said filaments being relatively movable when said strand is flexed, thereby permitting such flexing without fracture of individual filaments.

20. A strand adapted for use in power-driven rotary brushes and the like comprising a filamentous inner core of low damping capacity material having a Knoop hardness of at least 600, and an outer sheath of resilient high damping capacity plastic.

21. As a new article of manufacture, a strand comprising an inner core formed of a bundle of glass filaments, and an outer sheath of flexible plastic closely encasing the same.

22. A composite strand adapted for use as bristle material in power-driven rotary brushes and the like comprising an inner filamentous core of a bundle of lubricated filaments and an outer plastic sheath tightly encasing said core, said filaments being capable of sliding movement relative to each other and to said plastic sheath when said composite strand is flexed in use, whereby fracture of said filaments and rupture of said sheath may be avoided in the region of flexing.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
376,800	Frisbie	Jan. 24, 1888
634,617	Hansen	Oct. 10, 1899
1,508,059	Komorous	Sept. 9, 1924
1,915,817	Dahlberg	June 27, 1933
2,100,138	Heldt	Nov. 23, 1937
2,129,279	Kingman	Sept. 6, 1938
2,232,389	Jurkat	Feb. 18, 1941
2,268,663	Kuzmick	Jan. 6, 1942
2,328,998	Radford	Sept. 7, 1943
2,388,867	Peterson	Nov. 13, 1945