

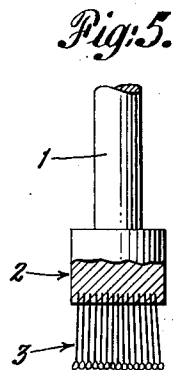
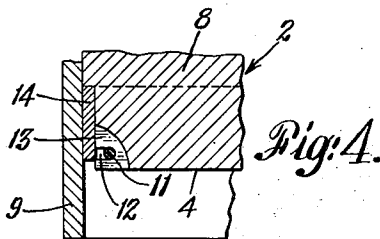
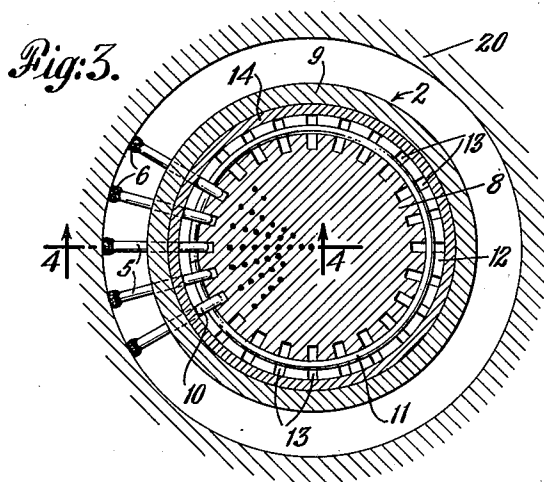
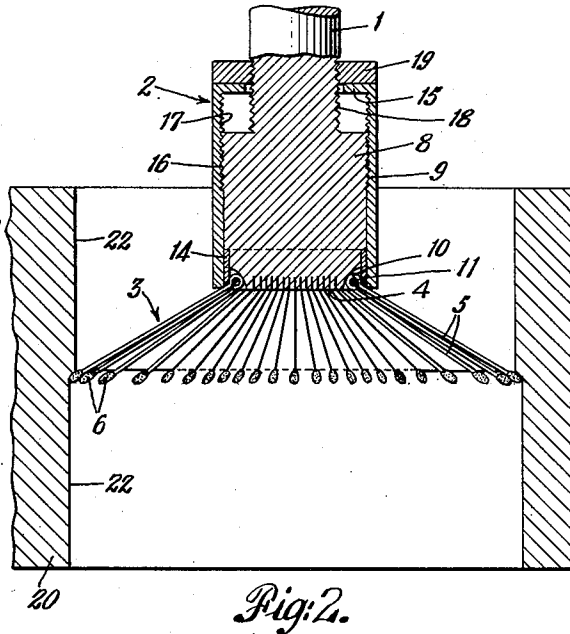
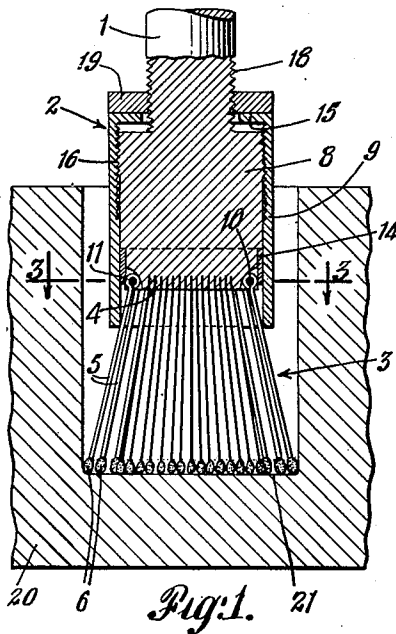
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ABRASIVE WIRE BRUSH FOR INTERNAL GRINDING AND CUTTING

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ABRASIVE WIRE BRUSH FOR INTERNAL GRINDING AND CUTTING

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10 Claims. (Cl. 51—184.1)

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This invention relates to an abrasive wire brush for internal grinding and cutting.

It is the object of this invention to provide a wire brush which is adapted for cutting, grinding or polishing internal metal surfaces and more particularly for the cutting, grinding or polishing of undercut surfaces of cavities in metals which are difficult or impossible to reach with the usual cutting, grinding or polishing tools.

It is a further object of this invention to provide a wire brush which is adapted for grinding holes and perforations in metal and for forming under-cuts and various shaped enlargements within a hole or perforation which cannot be produced with the ordinary metal drill.

Other objects and various advantageous features of the wire brush in accordance with this invention will appear in the detailed description thereof which follows.

The wire brush in accordance with this invention comprises essentially a shaft one end of which is adapted for connection to a source of rotary power and the other end of which carries a circular brush head comprising a backing member from which extends a plurality of abrasive tipped wire bristles, the position of which can be altered with respect to the backing member and the shaft by changes in the speed with which the shaft is rotated.

The circular backing member is centered on the end of the shaft and has its outer surface positioned in a plane at right angles to the axis of the shaft. A plurality of bristles are affixed in its outer surface which, when the brush is at rest, extend outwardly from the surface in a direction nearly parallel to the axis of the shaft. Each of the bristles consists of a slender, cylindrical spring-metal shaft, the outer end of which carries an abrasive head consisting of an abrasive in the form of discrete particles affixed around and across the end of the shaft by a softer matrix of a binding material. Each of the metal shafts extends outwardly the same distance from the surface of the backing member, placing the abrasive heads in a zone substantially paralleling the surface of the backing member, when the brush is at rest.

The shafts of the bristles positioned near the outer edge of the circular backing, which I will refer to hereinafter as "peripheral bristles" are adapted to allow their abrasive heads to move outwardly at right angles to the axis of the main shaft of the brush under the centrifugal force created by the rotation of the shaft and backing member. In one embodiment of my invention,

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the shafts of the peripheral bristles are relatively stiff and are affixed to the backing member by a pivotal attachment which may be locked in a position such that the axis of the bristles are parallel or nearly parallel to the axis of the main shaft and which may be unlocked to allow the bristles to swing outwardly under the centrifugal force created by the rotation of the main shaft. In an alternative embodiment of my invention, the shafts of at least the peripheral bristles are of a predetermined stiffness, or conversely a predetermined springiness, such that they bend outwardly under the centrifugal force created by the rotation of the main shaft at a relatively high rate of speed but are substantially unaffected by the smaller centrifugal force created by the rotation of the main shaft at lower rates of speed.

The main shaft of my brush may be made of steel or other structural metals, such as brass or aluminum. The circular backing member may be made of such a structural metal, of plastic, or other suitable material. It may be composite of two or more different materials, with, for example, a structural metal such as steel used to provide strength and to carry a lower melting metal or metal alloy which forms the surfaces in which the shafts of the bristles are affixed.

The shafts of the individual bristles may be made of any spring metal, such as, for example, steel, an alloy steel or brass. I have found that spring steel is usually suitable for the purpose. The abrasive which I utilize in the abrasive head of the bristles may be, for example, silica, fused aluminum oxide, silicon carbide, tungsten carbide, boron carbide, titanium carbide, or diamond. The binding material which I use to hold the abrasive particles in position may be, for example, a metal, such as aluminum, copper or one of the alloys used as a solder, a synthetic resin or a plastic.

The hardness of the discrete abrasive particles and their range of particle sizes and the strength of the bond provided by the bonding material of the abrasive tips of the bristles, are determined by the intended use of the particular brush. Thus, for example, a brush which is intended for the fast grinding or cutting of a hard metal is provided with abrasive tips made of particles of a hard abrasive, having a relatively large average particles size and a strong bonding matrix. On the other hand, a brush which is intended for light grinding or for polishing is provided with abrasive tips made of particles of a softer abrasive having a relatively fine particle size and a softer bonding matrix.

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The wire brush in accordance with this invention can be used for the drilling of a hole or perforation in metal. In using the embodiment in which the bristles can be locked into position, the drilling may be done by pressing the abrasive tips of the brush against the metal, while using any desired speed of rotation of the main shaft of the brush with the peripheral bristles locked in position. In using the alternative embodiment of this invention which does not include a lock for the peripheral bristles, the drilling is done by pressing the abrasive tips of the bristles against the metal while keeping both the speed of rotation of the main shaft of the brush and the pressure of the bristles against the metal low enough to avoid an outward flexing of its peripheral bristles.

When it is desired to make an interior enlargement of a hole or perforation or to produce under-cuts in metal by the use of the embodiment of this invention which includes a peripheral bristle lock, the peripheral bristles are unlocked by an adjustment of the bristle lock and the main shaft of the brush is rotated at a sufficiently high speed to cause the abrasive heads of the peripheral bristles to swing outwardly and bear against the wall of the hole or perforation under the centrifugal force created by the rotary motion. The alternative embodiment of this invention which does not include a peripheral bristle lock, may be used for these purposes merely by increasing the speed of rotation of its main shaft to a point such that the centrifugal force created thereby causes the shafts of the peripheral bristles to flex outwardly and bear against the wall of the hole or perforation.

Having now described the general nature of this invention and its mode of operation, I will now proceed with a detailed description of two specific embodiments thereof with reference to the accompanying drawing in which like reference characters are utilized to refer to like parts wherever they occur. In the drawings:

Figure 1 is a cross-sectional view of a brush in accordance with this invention which is provided with a bristle lock, shown with its peripheral bristles locked in position for boring a hole in metal.

Figure 2 is a cross-sectional view of the same embodiment of my brush illustrated by Figure 1 shown with its peripheral bristles unlocked and in position for enlarging a hole or cavity in metal.

Figure 3 is an enlarged cross-sectional view taken along the section line 3—3 of Figure 1.

Figure 4 is a further enlarged, fragmentary, cross-sectional view taken along the section line 4—4 of Figure 3, and

Figure 5 is a side, partly cross-sectional view of an alternative embodiment of the brush in accordance with this invention.

Referring to Figures 1, 2, and 5, it will be seen that the abrasive brush in accordance with this invention comprises essentially a rotatable shaft 1 which is adapted for connection to a source of rotary power (not shown by the drawing), a cylindrical backing member 2, and a plurality of bristles 3, 3, 3 . . . extending outwardly from the surface 4 of the backing member and spaced at intervals over the entire surface. Each of the bristles 3, 3, 3 . . . consists of a shaft 5 and an abrasive head 6. The abrasive head consists of a finely divided natural or synthetic abrasive material held on and around the end of the shaft 5 by a matrix of a softer bonding material.

In the embodiment of this invention illustrated

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by Figures 1 to 4, inclusive, the backing member 2 comprises a cylindrical central section 8 which may be an enlarged continuation of the shaft 1 and a cylindrical outer sleeve 9 which functions as a locking mechanism for the bristles 3, 3, 3 . . . positioned around the periphery of the surface 4. The surface 4 is entirely on the central section 8. The bristles 3, 3, 3 . . . , positioned around the periphery of the surface 4 are attached by means of pivots which allow the bristles to swing outwardly.

Each of the bristles 3, 3, 3 . . . which are pivotally attached around the periphery of the surface 4 has a loop 10 at the end of its shaft at which the attachment is made. A circular member 11 passes through the loop 10 of each of the peripheral bristles and is positioned in a slot or groove 12 extending circumferentially around the central cylindrical member 8 near its surface 4. The slot or groove 12 is cut into a series of segments by a series of slots 13, 13, 13 . . . cut into the edge of the member 8 adjacent to and at right angles to its surface 8, and each of the loops 10, 10, 10 . . . are positioned in one of those slots. Each of the slots 13, 13, 13 . . . are of dimensions such that the loops 10, 10, 10 . . . have freedom to rotate around the member 11, in a radial direction, but cannot move circumferentially along that member. The circular member 11 and the loops 10, 10, 10 . . . carried thereon are held in the circumferential slot or groove 12 and the slots 13, 13, 13 . . . , respectively, by a cylindrical band 14 positioned around the lower part of the member 8. The lower edge of the cylindrical surface of member 8 is countersunk to receive the band 14 in a position such that its outer surface forms a continuation of the remainder of the cylindrical surface of the member 8.

The sleeve 9 is longer than the cylindrical element 8 and has a circular shoulder 15 on one end, shown as the upper end in Figures 1 and 2, which is positioned around the shaft 1. A portion of the cylindrical element 8 carries threads 16, which are engaged by companion threads 17 on the inner surface of the sleeve 9. Upon rotating the sleeve 9 with respect to the element 8 and the remainder of the brush, the sleeve moves parallel to the axis of rotation. When moved to a position in which its lower portion extends beyond the surface 4, it locks the peripheral bristles so that they cannot pivot outwardly as illustrated by Figure 1. A reverse rotation of the sleeve with respect to the element 8 moves it upwardly and frees the peripheral bristles to pivot outwardly as shown by Figure 2.

The shaft 1 has a threaded section 18 adjacent its point of attachment to the element 8 which carries a threaded element 19, which functions as a lock-nut to prevent any undesired rotation of the sleeve 9 with respect to the element 8 during the use of the brush, when its lower surface is turned to a tight contact with shoulder 15. This locking element 19 may be circular, square, hexagonal, or octagonal, as may be desired.

The bristles 3, 3, 3 . . . other than the peripheral bristles are permanently affixed in and spaced over the entire area of the surface 4. The shafts 5, 5, 5 . . . of these bristles and of the peripheral bristles are of a length such that their abrasive heads 6, 6, 6 . . . are positioned in a uniformly contoured surface when the peripheral bristles are in their locked position. This surface may be in a plane normal to the axis of the shaft 1 or it may be slightly convex or concave.

This embodiment of my brush may be rotated

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at any desired speed for boring a hole or perforation in metal. For enlarging a cavity, making under-cuts or the like, it may be rotated at any speed above the minimum which creates sufficient centrifugal force to cause its peripheral bristles to pivot outwardly when they are not locked against such movement.

Figure 1 shows this embodiment of my brush adjusted for boring a hole in the metal section 20. It will be noted in that figure that the sleeve 9 has been moved into position to lock the peripheral bristles against pivotal movement by extending it beyond the surface 4, and that it is, in turn, locked against rotation with respect to element 8 by the element 19 bearing tightly against its shoulder 15. During such boring the abrasive heads 6, 6, 6 . . . of the brush are kept in close contact with the bottom surface 21 of the hole being bored in the metal by a light downward force applied along the axis of the shaft 1, and all of the abrasive heads, including those of the peripheral bristles and those of the bristles affixed at spaced intervals in the surface 4, contact and grind the surface 21.

Figure 2 shows this brush adjusted for enlarging a hole or making under-cuts. It will be noted that the sleeve 9 has been moved to its retracted position and locked there by element 19 bearing tightly against its shoulder 15. This figure shows the position the peripheral bristles assume under centrifugal force created by the rapid rotation of the brush. In this position it will be noted that they swing outwardly with their abrasive heads 6, 6, 6 . . . bearing against the walls 22, 22 of the metal 20 and that those walls may be ground by slowly moving the brush either upwardly or downwardly. During such grinding the abrasive heads of the non-peripheral bristles do not bear against the metal which is being ground.

Figure 5 illustrates an alternative embodiment of this invention which is simpler than that described hereinbefore, in that it includes neither a mechanism which allows the peripheral bristles to pivot nor a locking mechanism to prevent the pivoting of the peripheral bristles. The backing member 2 is a single unit, although if desired it may consist of two or more different materials, such as, for example, a steel shell filled with a lower melting alloy forming the surface 4 in which the bristles 3, 3, 3 . . . are affixed.

All of the bristles 3, 3, 3 . . . , including both those around the periphery of the surface 4 as well as those spaced over its more central areas, have one end of their shafts firmly affixed in the surface 4 and their abrasive heads 6, 6, 6 . . . positioned in a regularly contoured surface which is, preferably, a plane normal to the axis of the shaft 1 of the brush.

The shafts 5, 5, 5 . . . of at least the bristles positioned around the periphery of the surface 4 are flexible, but are stiff enough to be effected only very slightly by the centrifugal forces created by rotating the shaft 1 and backing member 2 at relatively slow speeds, and such speeds are used when the brush is used for boring holes in metal. On the other hand, these shafts have a flexibility such that they flex outwardly, moving their abrasive heads away from the axis of rotation of the shaft 1 and the backing member 2 under the greater centrifugal forces created by rotating the axis and the backing member at higher speeds, and such higher speeds are utilized when it is desired to utilize the brush for enlarging a hole, creating under-cuts, etc., by

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grinding the side walls of a hole or cavity in a metal.

It is desirable to use a source of rotary power, such as, for example, a variable speed electric motor, with this brush which has a controllable range of speed which is coordinated with the flexing or non-flexing of the bristle shafts. This speed range will be determined both by the flexibility, or conversely, the stiffness of the shafts 5, 5, 5 . . . of peripheral bristles and by the diameter of the backing member 2 of the brush.

It will be appreciated that this invention is not limited to the specific embodiments described in the foregoing. Thus, for example, a number of variations of both the specific pivot for the peripheral bristles and the specific bristle locking mechanism utilized in the first embodiment described above may be used within the scope of my invention. Further, it will be appreciated that the brushes may be made in a wide range of sizes, adapted for operation over different speed ranges, as well as designed for cutting and grinding a variety of different types of materials. Although I have repeatedly referred to the cutting and grinding of metals in the foregoing description, the brushes are not limited to use with metals, but may be used on many other materials.

What I claim and desire to protect by Letters Patent is:

1. An abrasive wire brush comprising a rotatable shaft adapted for connection to a source of rotary power, a circular backing member and a plurality of abrasive tipped spring metal bristles, which has the circular backing member centered on and attached to the end of the said shaft and the said bristles affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the brush is at rest to place their abrasive tips in a plane normal to the said axis of rotation, the part of the said bristles which are positioned at the periphery of the said backing member being adapted to move their abrasive tips away from the said axis of rotation when the brush is rotated at a high speed.

2. An abrasive wire brush comprising a rotatable shaft adapted for connection to a source of rotary power, a circular backing member and a plurality of bristles consisting of spring metal shafts having abrasive tips of a finely divided abrasive attached across and around their ends by a matrix of a bonding material softer than the said abrasive, the said brush having the circular backing member centered on and attached to the end of the said shaft and the said bristles affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the brush is at rest to place their abrasive tips in a plane normal to the said axis of rotation, the part of the said bristles which are positioned at the periphery of the said backing member being adapted to move their abrasive tips away from the said axis of rotation when the brush is rotated at a high speed.

3. An abrasive wire brush comprising a rotatable shaft adapted for connection to a source of rotary power, a circular backing member fixed coaxially thereon, a circular bristle-locking member positioned around the periphery of the said circular backing member and a plurality of abrasive tipped spring metal bristles, affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the shaft is at rest to place their abrasive

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tips in a plane normal to the said axis of rotation, a part of the said bristles being pivotally attached at the periphery of the said backing member by pivots which can be locked by the said bristle locking member with the bristles parallel to the axis of rotation of the said shaft, and which are capable when not locked by the bristle locking member of pivoting the said bristles and moving their abrasive heads away from the said axis of rotation when the brush is rotated.

4. An abrasive wire brush comprising a rotatable shaft adapted for connection to a source of rotary power, a circular backing member, a circular bristle-locking member positioned around the periphery of the said circular backing member and a plurality of bristles consisting of spring metal shafts having abrasive tips of a finely divided abrasive attached across and around one of their ends by a matrix of a bonding material softer than the said abrasive, the said brush having the circular backing member centered on and attached to the end of the said shaft and the said bristles affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the shaft is at rest to place their abrasive tips in a plane normal to the said axis of rotation, a part of the said bristles being pivotally attached at the periphery of the said backing member by pivots which can be locked by the said bristle locking member with the bristles parallel to the axis of rotation of the said shaft, and which are capable when not locked by the bristle locking member of pivoting the said bristles and moving their abrasive heads away from the said axis of rotation when the brush is rotated.

5. An abrasive wire brush comprising a rotatable steel shaft adapted for connection to a source of rotary power, a metal circular backing member, a metal circular bristle-locking member positioned around the periphery of the said circular backing member and a plurality of bristles consisting of spring steel shafts having abrasive tips of a finely divided abrasive attached across and around one of their ends by a matrix of a bonding material softer than the said abrasive, the said brush having the circular backing member centered on and attached to the end of the said shaft and the said bristles affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the shaft is at rest to place their abrasive tips in a plane normal to the said axis of rotation, a part of the said bristles being pivotally attached at the periphery of the said backing member by pivots which can be locked by the said bristle locking member with the bristles parallel to the axis of rotation of the said shaft, and which are capable when not locked by the bristle locking member of pivoting the said bristles and moving their abrasive heads away from the said axis of rotation when the brush is rotated.

6. An abrasive wire brush comprising a rotatable steel shaft adapted for connection to a source of rotary power, a metal circular backing member, a metal circular bristle-locking member positioned around the periphery of the said circular backing member and a plurality of bristles consisting of spring steel shafts having abrasive tips of finely divided silicon carbide attached across and around one of their ends by a matrix of a bonding material softer than the said silicon carbide, the said brush having the circular back-

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ing member centered on and attached to the end of the said shaft and the said bristles affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the shaft is at rest to place their abrasive tips in a plane normal to the said axis of rotation, a part of the said bristles being pivotally attached at the periphery of the said backing member by pivots which can be locked by the said bristle locking member with the bristles parallel to the axis of rotation of the said shaft, and which are adapted when not locked by the bristle locking member of pivoting and moving their abrasive heads away from the said axis of rotation when the brush is rotated.

7. An abrasive wire brush comprising a rotatable shaft adapted for connection to a source of rotary power, a circular backing member, and a plurality of abrasive tipped spring metal bristles, the circular backing member being centered on and attached to the end of the said shaft and the said bristles affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the shaft is at rest to place their abrasive tips in a plane normal to the axis of rotation, the spring metal shafts of at least the part of the said bristles which are positioned at the periphery of the said backing member having a strength such that they undergo very little flexing under the centrifugal force created by rotating the brush at slow speed but undergo substantial flexing under the greater centrifugal force created by rotating the brush at a relatively high rate of speed.

8. An abrasive wire brush comprising a rotatable shaft adapted for connection to a source of rotary power, a circular backing member, and a plurality of bristles consisting of spring metal shafts having abrasive tips of a finely divided abrasive attached across and around their ends by a matrix of a bonding material softer than the said abrasive, the said brush having the circular backing member centered on and attached to the end of the said shaft and the said bristles affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the shaft is at rest to place their abrasive tips in a plane normal to the axis of rotation, the spring metal shafts of at least the part of the said bristles which are positioned at the periphery of the said backing member having a strength such that they undergo very little flexing under the centrifugal force created by rotating the brush at slow speed but undergo substantial flexing under the greater centrifugal force created by rotating the brush at a relatively high rate of speed.

9. An abrasive wire brush comprising a rotatable steel shaft adapted for connection to a source of rotary power, a metal circular backing member and a plurality of bristles consisting of spring steel shafts having abrasive tips of a finely divided abrasive attached across and around their ends by a matrix of a bonding material which is softer than the said abrasive, the said brush having the circular backing member centered on and attached to the end of the said shaft and the said bristles affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the shaft is at rest to place their abrasive tips in a plane normal to the axis of rotation, the spring steel shafts of at least the part of the said bristles which are positioned at the periphery of the said backing

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member having a strength such that they undergo very little flexing under the centrifugal force created by rotating the brush at slow speed but undergo substantial flexing under the greater centrifugal force created by rotating the brush at a relatively high rate of speed.

10. An abrasive wire brush comprising a rotatable steel shaft adapted for connection to a source of rotary power, a metal circular backing member and a plurality of bristles consisting of spring steel shafts having abrasive tips of finely divided silicon carbide attached across and around their ends by a matrix of a bonding material which is softer than the said silicon carbide, the said brush having the circular backing member centered on and attached to the end of the said shaft

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and the said bristles affixed to the said backing member and extending nearly parallel to the axis of rotation of the said shaft when the shaft is at rest to place their abrasive tips in a plane normal to the axis of rotation, the spring steel shafts of at least the part of the said bristles which are positioned at the periphery of the said backing member having a strength such that they undergo very little flexing under the centrifugal force created by rotating the brush at slow speed but undergo substantial flexing under the greater centrifugal force created by rotating the brush at a relatively high rate of speed.

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No references cited.