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(54) **CAVITIED ABRADING DEVICE WITH LAYERED GRIT.**

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Description

Background of the Invention

This invention relates generally to an abrasive wheel for use in abrading various types of materials. More particularly, the invention utilizes crushed, sintered refractory metal grits such as sintered tungsten carbides and like hard particle substances which can be braze metal joined (or joined by other means) to a supporting base member.

It is well known in the prior art to magnetically orient individual metal grits on a spherical metal surface. In such applications, metal grits have been used in which substantially all of the grit had a typical length exceeding their smallest cross section. Then, by subjecting the metal surface to a magnetic field, the grit could be magnetically oriented into an abrading surface whereby substantially all of the grits' longest axes extended generally radially out from the curved metal surface. Such prior art devices utilized protrusions or protuberances of a predetermined size and configuration. These protuberances were applied to, or formed from, the metal base member, and the protuberances were then armed with metal grit. The grit was then brazed to the periphery of the protuberances. (See, for example, the process described in U.S. Patent No. 3,918,217.)

These prior art devices have several disadvantages. For example, the utilization of grit whose length exceeds its smallest cross section causes the grit to extend radially outward from the point the magnet is applied. This limitation requires that longer grit be used (to aid in selection), and also results in the abraded material becoming trapped and loading up on the protrusions. Additionally, the magnetic field causes the metal grit to bunch up on the outermost periphery of each protuberance, with no grit occupying the smooth areas located between the protuberances of the base member. This particular grit formation exposes the grit to fracturing and reduces the useful life of the tool.

Summary of the Invention

The present invention is directed to an abrasive wheel for use in the abrading of various materials. This tool maintains all the advantages of the prior art devices, while providing enhanced performance and a longer useful life.

One object, therefore, of the present invention is to provide a generally uniform and layered distribution of small metal grit over the smooth lands area of the abrasive wheel which will allow the cutting surface of the abrasive wheel to achieve a longer useful life.

A second object of the present invention is to allow for a more aggressive cutting action of the wheel by providing for improved removal of abraded material from the cutting surface of the wheel.

A third object of the present invention is to impart an enhanced cutting ability to a wheel while employing a smaller abrasive particle size, resulting in a finer texture left on the work piece.

A fourth object of the present invention is to provide a cutting tool which runs cooler and more efficiently than prior art devices through improved heat distribution from contact to non-contact surfaces, as well as a lowered torque due to a shortened extension of the grit particles from the metal surface.

A fifth object of the present invention is to provide a cutting tool which is more economical to manufacture.

These objects are achieved, at least in part, by the addition of cavities or recesses -- instead of protuberances -- which are distributed along a metal surface. When a magnetic field is applied to this novel configuration of the metal surface, the metal grit is caused to generally uniformly distribute itself along the smooth lands area of the metal surface, leaving the cavities free of grit.

Brief Description of the Drawings

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its aims and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures, and in which:

Figure 1 is a side view of one type of abrasive wheel, commonly referred to as a "contour wheel", showing the metal base member, and the supporting base member with the sintered metal grit distributed generally uniformly along the surface.

Figure 2 is a close-up view of the surface of the supporting base member, showing the sintered metal grit on the lands area, as well as the concavities void of metal grit.

Figure 3 is a cross sectional view of the supporting base member and grit protrusions.

Detailed Description of the Invention

Referring to the drawings in greater detail, the finished tool, with metal base member 1, handle 2, and supporting base member 3, is shown in Figure 1. It should be noted that the abrasive wheel illustrated in Figure 1, known in the trade as a "contour

wheel", is only one embodiment of the present invention. Those skilled in the art will understand that a variety of wheel shapes, e.g., conical or cylindrical, can be employed.

Referring now to Figure 2, the generally uniform distribution of metal grit 4 over the smooth portion of "lands" area 5 of supporting base member 3 is illustrated. Note that no grit occupies the cavities 6 on base member 3. Figure 3 illustrates the disposition of the magnetized, metal grit 4. The grit is not confined to extending radially outward from a center point, but rather forms interconnected layers of vertically and horizontally positioned grit. When a small grit particle breaks away, this layered effect enables another grit particle to be exposed.

Referring back to Figure 1, the present invention teaches the use of cavities or recesses distributed either uniformly or non-uniformly along the supporting base member 3; the periphery of these cavities faces the metal base member 1. These cavities may be of any convenient shape, e.g., round, square, etc. The spacing of the cavities can be varied to conform with the desired action of the wheel and the size of the abrasive material to be applied. The cavities may be spaced in straight rows or staggered in any number of design combinations. It can be appreciated by those skilled in the art that the size and spacing of the cavities can be changed to achieve an abrasive wheel with a wide operating range. Such a range allows, for example, for variances in the size of the abrasive material or the given cutting area an operator has to work with. In addition, the cavities provide an important structural advantage which further enhances the cutting ability of the wheel. The material removed by the wheel has the free area in the cavities to retreat to. At the point of contact with the wheel, portions of the abraded material are displaced within the individual cavities. As the high speed abrasive wheel rotates, the abraded material is expelled from the cavities by centrifugal force. In contrast, removed material in prior art devices tended to become trapped and load up on the abrasive protrusions, reducing the wheel's cutting ability. Further, some conventional wheels had holes on their outer working surface. Such configurations not only physically reduce the strength of the wheel, but also allow the abraded material to pass through the holes and build up on the inner surface of the wheel, causing the holes to close. Further, it has been found that a magnetic field applied to a wheel with holes causes the grit to lie flat and ineffectual upon the metal surface. The cavities of the present invention allow for a more aggressive cutting action of the wheel by ameliorating the effect of abraded material buildup.

With the supporting base member 3 constructed as shown in Figure 1, a magnetic field and then sintered metal grit are applied, with the result that the metal grit positions itself as shown in Figure 3: metal grit is generally uniformly distributed over the lands area of the supporting base member, but not on the inner surface of the cavities. The prior art taught the formation of bunched grit on the outermost periphery of the protuberances, and not on the lands area between the protuberances. This is due to the fact that the metal grit, as a result of magnetic flux lines which naturally concentrate in areas of discontinuity, is forced to points on the external metal surface that exhibit rapid contour changes. Additionally, smaller metal grit can be utilized than that of the prior art, as the grit of the present invention need not be selected such that its length exceeds its smallest cross section. These smaller size particles impart an enhanced cutting ability to the wheel, as the resulting decreased cutting clearance makes the wheel easier to control, and leaves a finer texture on the work piece. Also, the longer particles of the prior art are more subject to fracturing and breakage.

The layered, interconnected grit of the present invention imparts a longer useful life to the abrasive wheel for three reasons. First, the layered configuration insures that when one piece of grit breaks away, another grit particle below it will be exposed for cutting. Second, the dimpled effect on the supporting base member allows the tool to run cooler and more efficiently. This is due to the fact that the inner surface of a wheel with recesses encompasses a greater surface area than a smooth surface. This increased surface area provides enhanced heat transfer capabilities to the metal surface, and thus improves heat dissipation as the wheel is used. Third, the smaller grit extends a shorter distance from the supporting base member than prior art tools. This shortened distance lowers the torque and thus the force applied to individual grit particles, which decreases the energy required to do work. More total work is accomplished, however, due to the increased number of smaller grit particles.

The heat transfer capabilities of the present invention, referred to above, are novel for another reason as well. As can be seen from Figure 3, the distal portions of the grit particles overhang individual cavities. This novel structuring allows the individual cavities to act as natural heat sinks: the heat from the grit particles is transferred from the distal ends of the grit to the cavities, and the rotation of the wheel then cools both the inner and outer surfaces of the recesses.

The present invention also allows for more economical manufacture of these abrading tools. This economy is achieved through the previously

described more efficient utilization of smaller abrasive particles than conventional wheels.

In a preferred embodiment of this invention, the metal grit consists of sintered tungsten carbides which can be braze metal joined (or joined by other means) to the supporting base member. The supporting base member is usually constructed out of a mild steel or other iron base alloy which has a high enough melting temperature beyond that of the brazing metal used to bond the various constituents of the finally processed device. (See U.S. Patent No. 3,918,217).

Claims

1. An abrasive tool, comprising: a ferrous or ferrous alloy base member (1) including a plurality of cavities (6) separated by a generally continuous and substantially smooth external lands area (5); and particles of metal grit (4) distributed over the surface of the base member (1) and bonded by braze metal to said base member (1), **characterised in that** said grit (4) is located generally uniformly on said lands area (5) and not in said cavities (6), said particular distribution being obtainable by application of a magnetic field.
2. The abrasive tool of claim 1, **characterised in that** said metal grit (4) is made of tungsten carbide.
3. The abrasive tool of claim 1 or claim 2, **characterised in that** heat generated from operation of the tool is dissipated by transfer from said metal grit to said cavities.
4. The abrasive tool of any one preceding claim, **characterised in that** said cavities (6) are distributed in uniform spacing across said base member (1).
5. The abrasive tool of claim 4, **characterised in that** said cavities (6) are of a non-uniform size and shape.
6. The abrasive tool of claim 4, **characterised in that** said cavities (6) are of a uniform size and shape.
7. The abrasive tool of claim 4 or claim 5, **characterised in that** said cavities (6) are generally concave.
8. The abrasive tool of any one preceding claim, **characterised in that** distal portions of said metal grit (4) overhang said cavities (6).

9. The abrasive tool of any one preceding claim, **characterised in that** said metal grit particles (4) are bonded by braze metal to themselves and to said base member (1) in interconnected layers whereby as individual grit particles (4) are broken off or worn in use, other particles are made available for use.

Patentansprüche

1. Schleifwerkzeug mit: einem Eisen- oder Eisenlegierungsgrundkörper (1), der mehrere durch eine allgemein durchgehende und im wesentlichen glatte äußere Stegfläche (5) getrennte Hohlräume (6) enthält; und Teilchen von Metallkörnern (4), die über die Fläche des Grundkörpers (1) verteilt und über ein Hartlot mit dem Grundkörper (1) verbunden sind, dadurch gekennzeichnet, daß die Körner (4) allgemein gleichmäßig auf der Stegfläche (5) und nicht in den Hohlräumen (6) angeordnet sind, wobei die bestimmte Verteilung durch Anlegen eines Magnetfeldes erreicht werden kann.
2. Schleifwerkzeug nach Anspruch 1, dadurch gekennzeichnet, daß die Metallkörner (1) aus Wolframkarbid bestehen.
3. Schleifwerkzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß durch den Betrieb des Werkzeuge erzeugte Wärme durch Übertragung von den Metallkörnern auf die Hohlräume abgeleitet wird.
4. Schleifwerkzeug nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Hohlräume (6) in gleichmäßigem Anstand über den Grundkörper (1) verteilt sind.
5. Schleifwerkzeug nach Anspruch 4, dadurch gekennzeichnet, daß die Hohlräume (6) nicht gleichmäßiger Größe und Form sind.
6. Schleifwerkzeug nach Anspruch 4, dadurch gekennzeichnet, daß die Hohlräume (6) gleichmäßiger Größe und Form sind.
7. Schleifwerkzeug nach Anspruch 4 oder 5, dadurch gekennzeichnet, daß die Hohlräume (6) allgemein konkav sind.
8. Schleifwerkzeug nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die distalen Teile der Metallkörner (4) über den Hohlräumen (6) hängen.
9. Schleifwerkzeug nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß

die Metallkornteilchen (4) über ein Hartlot miteinander und mit dem Grundkörper (1) in miteinander verbundenen Schichten verbunden sind, wodurch beim Abbrechen oder im Gebrauch verschlissenen einzelnen Kornteilchen (4) andere Teilchen zur Verwendung zur Verfügung gestellt werden.

Revendications

1. Outil abrasif, comprenant : un organe de base (1) ferreux ou en alliage ferreux comportant une pluralité de cavités (6) séparées par une zone de parties plates (5) externe généralement continue et substantiellement lisse; et des particules abrasives métalliques (4) réparties sur la surface de l'organe de base (1) et liées par un métal de brasage audit organe de base (1), **caractérisé en ce que** lesdites particules abrasives (4) sont situées généralement uniformément sur ladite zone de parties plates (5) et non dans lesdites cavités (6), ladite répartition des particules pouvant être obtenue par l'application d'un champ magnétique. 10 15 20 25
2. Outil abrasif selon la revendication 1, **caractérisé en ce que** lesdites particules abrasives métalliques (4) sont en carbure de tungstène. 25
3. Outil abrasif selon la revendication 1 ou la revendication 2, **caractérisé en ce que** la chaleur engendrée par le fonctionnement de l'outil est dissipée par transfert desdites particules abrasives métalliques dans lesdites cavités. 30 35
4. Outil abrasif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** lesdites cavités (6) sont réparties suivant un espacement uniforme en travers dudit organe de base (1). 40
5. Outil abrasif selon la revendication 4, **caractérisé en ce que** lesdites cavités (6) ont une dimension et une forme non uniformes. 45
6. Outil abrasif selon la revendication 4, **caractérisé en ce que** lesdites cavités (6) ont une dimension et une forme uniformes. 50
7. Outil abrasif selon la revendication 4 ou la revendication 5, **caractérisé en ce que** lesdites cavités (6) sont généralement concaves. 55
8. Outil abrasif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les portions distales desdites particules abrasives métalliques (4) surplombent lesdites cavi-

tés (6).

9. Outil abrasif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** lesdites particules abrasives métalliques (4) sont liées par un métal de brasage les unes aux autres et audit organe de base (1) en couches interconnectées, grâce à quoi lorsque des particules abrasives individuelles (4) se détachent ou sont usées lors de l'utilisation, d'autres particules deviennent disponibles pour l'utilisation.

