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2,370,970

ABRASIVE ARTICLES

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Fig. 1,

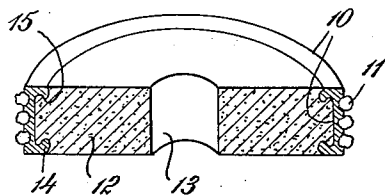


Fig. 2,

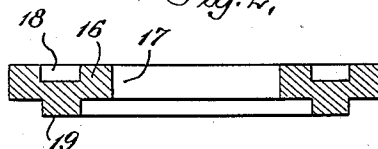


Fig. 3,

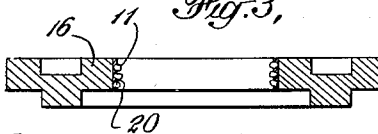


Fig. 4,

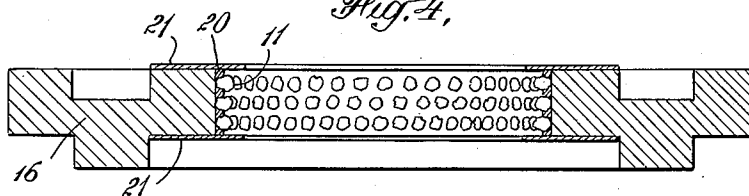


Fig. 5,

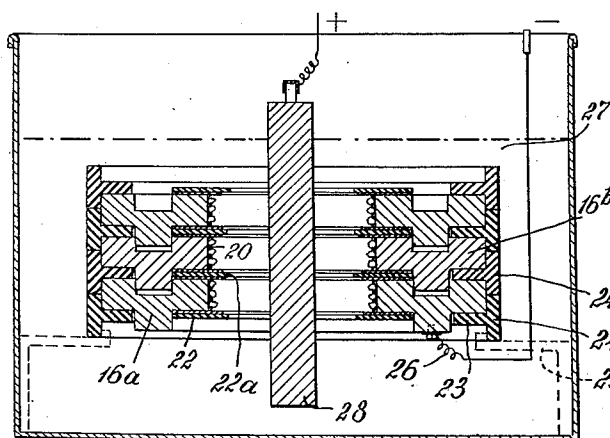


Fig. 7,

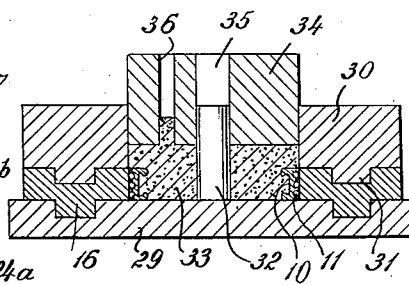
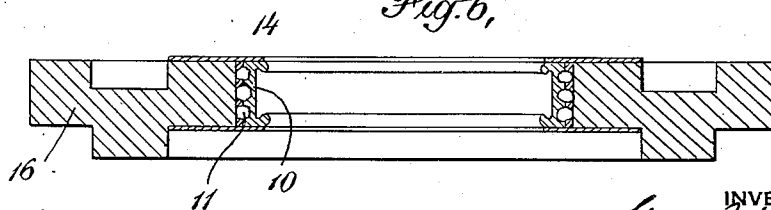


Fig. 6,



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ABRASIVE ARTICLE

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Application May 11, 1944, Serial No. 535,149

5 Claims. (Cl. 51—309)

This invention relates to tools for grinding and similar purposes which include abrasive particles bonded together and affixed to a tool body, which is preferably formed of plastic material. More particularly, the invention is concerned with a novel abrasive tool in which the abrasive particles are carried by a layer of bonding metal and the layer and tool body are securely interlocked. The invention further comprehends a new method by which the tools of the invention may advantageously be made.

Abrasive tools are now frequently made in the form of wheels of large diameter. To reduce the weight of the wheel, it is preferable to make the body of a light material, such as a suitable plastic, although a body made of a light metal or alloy by sintering or by die casting may also be used. Such a body may be secured to the rim by molding with heat and pressure to form the body in direct contact with the rim. As the rim is formed of a bonding metal of a coefficient of expansion different from that of the material of which the body is made, the body is likely to shrink somewhat from the rim when it cools after molding.

The present invention is, accordingly, directed to the provision of an abrasive tool in which provision is made for interlocking the layer or rim carrying the abrasive particles to the tool body to prevent separation of the parts. In the tool of the invention, the objective is attained by forming the layer with one or more integral extensions, which enter the molded or cast body and include offset portions which provide the locking effect.

In making such a tool by the new method, the layer of bonding metal is formed by electrodeposition and, in this operation, the deposit is controlled to produce the extensions referred to. The layer is thus built up to the desired thickness and the extensions formed in a single operation and the extensions are integral with the layer.

In the new tools, the abrasive particles may take the form of a single superficial layer on the surface of the bonding metal or they may be distributed throughout the bonding metal. When diamond particles are used as the abrasive, a thin superficial layer of such particles on the working surface of the tool is satisfactory, and, for purposes of explanation, a tool which includes a single layer of diamonds will be illustrated and described in detail. It will be apparent, however, that the utility of the invention is not limited to the use of that specific abrasive or to the employment of a single layer of abrasive particles.

For a better understanding of the invention, 45

reference may be had to the accompanying drawing, in which

Figure 1 is a sectional perspective view of a grinding wheel embodying the invention;

Figures 2, 3 and 4 are sectional views of a blank used in making the wheel of Figure 1, the views showing different steps in the use of the blank;

Figure 5 is a sectional view through an electrolytic cell showing a stack of the blanks ready 10 for the plating operation;

Figure 6 is a sectional view of one of the blanks, shown in Figure 5, after the completion of the plating operation; and

Figure 7 is a sectional view showing the manner of forming the body of the tool of Figure 1.

The tool shown in Figure 1 is a grinding wheel of the peripheral type, that is, one in which the abrasive material is on the peripheral surfaces, and the tool includes a layer or rim 10 of a bonding metal, such as iron in which a superficial layer of abrasive particles 11 is mounted. In the drawing, the particles have been shown much exaggerated in size for purposes of illustration, but it is to be understood that they will vary greatly in size, depending upon the use to which the tool is to be put. When the abrasive is formed of diamond particles, these particles may vary through a wide range of size, as, for example, from 80 to 600 mesh.

The rim 10 of the tool is mounted on a tool body 12, which is formed with a central opening 13 by means of which it may be mounted on a rotary spindle. The body 12 is made of a molded plastic material or a sintered or die cast light metal or alloy and the rim and body are secured together by integral extensions 14 from the inner surface of the rim. These extensions have inwardly offset end portions or ribs 15 so that the distance between the offset portions is less than the thickness of the tool body. In the formation of the tool body, the extensions lie within the body and thus form and fill cavities in the body. Because of their offset portions, the extensions provide a dovetail connection between the rim and the body and interlock the two securely. This interlock is important because, when the body is made by molding, sintering, or die casting, the material of the body tends on cooling to contract more than the metal forming the rim, so that the body and rim might become loose, except for the interlock provided by the extensions.

In the formation of the tool, the first step is that of forming the rim and, for this purpose, a blank 16 is employed. The blank is preferably made of hardened steel and it is annular in form

and has an inner surface 17 of the shape and size of the rim to be produced. The blank is provided with a circumferential channel 18 in its upper face and a rib 19 of corresponding shape in its lower face so that the blank may be stacked with others without danger of side slip.

In the use of the blank, its surface 17 is provided with a coating of a suitable soft material which may, for example, be a thin film 20 of lead applied by electrodeposition. Instead, a thin coating of an adhesive may be applied to the surface 17 of the blank, if desired, but the lead is preferable because it is electroconductive. After the application of the film to the inner surface of the blank, the abrasive particles 11 are distributed over the film and forced into it in any suitable manner. Preferably, the particles are rolled into the film and sufficient pressure is applied to force them through the film and into contact with the surface of the blank. After the desired quantity of particles has been so embedded in the blank, a number of similar blanks are prepared.

When the blanks are ready, a ring 21 of thin metallic material, such as tinfoil, is applied to each face of each blank, the ring having an inner diameter such that the ring projects into the opening through the blank to terminate inward from the film 20 in which the particles are embedded. The amount by which the rings 21 project inward from the inner wall of the blank depends on the length that the projections from the rim are to have. The length of the projections is determined by the thickness of the bonding layer and the strength of the interlock that is desired. In a typical case, the inner diameter of the rings 21 will be about 4 mm. less than that of the blank.

After the rings 21 have been placed in position, the blanks are to be assembled one above another in the form of a stack within an electrolytic cell. Preliminarily, however, a ring 22 of insulating material is placed against the under surface of the blank which is to form a bottom element of the stack, the ring 22 having an inner diameter slightly less than that of the ring 21 of foil with which it lies in contact. The blank 16a with the ring 22 in place is then mounted on the internal flange 23 of a ring of insulating material 24, which may be supported in the cell in any suitable manner, as, for example, on brackets 25. With the blank in this position, a ring 22a of insulating material, similar to ring 22, is placed upon the ring 21 of foil on the upper surface of the blank. A ring 24a, similar to ring 24, is then placed upon the upper edge of ring 24, with the internal flange of ring 24a overlying blank 16a. The next blank 16b is placed in position on the internal flange of ring 24a and the various parts are assembled as described to build up a stack of blanks of any suitable number. Each blank carries a thin film of metal in which the abrasive particles are embedded on its inner surface and each blank also has rings of thin metallic material applied to its upper and lower faces with the rings overhanging the inner surface of the blank. The rings 21 are held in place by rings of insulating material 22 and the insulating rings separate the conductive rings 21 on adjacent blanks.

When the stack has been assembled within the cell, as described, a connection 26 is made to one of the blanks of the group and the electrolyte 27 is then introduced into the cell to a level which will cover the stack. The anode 28 is then in-

serted through the aligned openings in the blanks and the current turned on. As the metal is deposited, it builds up a layer 10 which engulfs those portions of the particles lying exposed at the surface of the film 20 on each blank. At the same time, the rings of foil result in additional deposition of metal along the upper and lower edges of the film and this deposited metal builds outwardly to form the integral extensions 14 previously described. As each blank is provided with a ring 21 at both top and bottom, the layer of deposited metal is formed with two integral extensions 14 and, as these extensions are built up, the metal is so deposited as to form the offset portions 15 extending inwardly from the extensions and toward one another.

When the electrodeposition has been carried on to produce a layer 10 of the desired thickness on each blank, the stack is removed from the cell and the rings 22 and 24 are separated therefrom. The rings 21 may also be removed, if desired, but since these rings are of light foil, it is immaterial whether they are removed or not. The rim carrying the abrasive particles, which has been formed on the inner surface of each blank may then be affixed to a tool body, and the body is preferably formed while the rim remains in place on the blank. When this is done, the blank supports the rim during the formation of the body and distortion of the rim is prevented.

The formation of the body within the rim carried by the blank may be performed in various ways and the molding of a body of plastic material is illustrated in Figure 7. For this operation, the blank 16 is mounted on a plate 29 having a channel to receive the rib 19 on the under surface of the blank. The mold cavity is then completed by an annular block 30, which is placed on top of the blank 16 and is formed with a rib 31, which enters the channel 18 in the upper surface of the blank. The plate 29 may be provided with a pin 32 of the diameter of the opening 13 to be formed through the tool body and extending upwardly from plate 29 a substantial distance.

When the mold cavity has been assembled as described a quantity of plastic material 33 is introduced into it and a plug 34 is then inserted in the opening through the annular block 30 to rest upon the plastic material. The plug has an opening 35 to receive the pin 32 and it is also provided with a passage 36 extending through it and into which excess plastic material may be forced.

When the mold has been filled and the plug 34 placed in position, the assembly is placed in a press between heated platens and heat and pressure are thereby applied to the plastic material 33 to compact and form it into the solid tool body 12. In the molding operation, the plastic material is forced into the space between the integral extensions 14 and the extensions form and fill cavities within the tool body. When the molding operation is completed, the tool body is molded with a dovetail connection to the rim carrying the abrasive particles. After the molding operation, the mold parts may be disassembled and the tool body removed from the blank in any suitable manner. After suitable finishing operations, the tool is in condition for use.

Instead of forming the body of plastic material by molding, the body may be made of light metals or alloys by die casting or by powder metallurgy. Such operations are well known and require no further description.

I claim:

1. A method of making an abrasive tool, which comprises mounting abrasive particles on a support, electrodepositing metal over the particles and controlling the electro-deposition to build up a deposited layer which overlies the particles and is provided with an integral extension of deposited metal, said extension projecting from the face of the deposited layer opposite to that in which the particles lie, and affixing a tool body to the layer with the extension entering a cavity in the body.

2. A method of making an abrasive tool which comprises mounting abrasive particles on a support, mounting a conductive member on the support with a portion thereof projecting beyond the particles in the direction in which the particles extend from the support, electro-depositing metal over the particles and onto the projecting portion of the member to form a layer having an integral extension along the side of the said portion adjacent the particles of such length as to extend beyond the particles, and affixing a tool body to the layer with the extension engaging with the body.

3. A method of making an abrasive tool which comprises mounting abrasive particles on a support, mounting conductive members on the support at opposite sides of the area on which the particles are mounted with portions of said members projecting beyond the particles in the direction in which the particles extend from the support, electrodepositing metal over the particles and onto the inner sides of the projecting portions of the members to form a layer having integral extensions with thickened free end portions extending beyond the metal deposited onto the particles, and affixing a tool body to the layer

with the extensions interlocking the body to the layer.

4. A method of making an abrasive tool which comprises mounting abrasive particles on a support, stacking a plurality of supports one upon another with conductive members between them, portions of said members projecting beyond the particles in the direction in which the particles extend from the supports, electrodepositing metal over the particles and onto the projecting portions of the members to form a layer on each support having integral extensions with thickened free end portions along the sides of the respective projecting portions adjacent the particles of such length as to extend beyond the particles, and affixing a tool body to each layer with the extensions therefrom engaging the body and interlocking it to the layer.

5. A method of making an abrasive tool which comprises mounting abrasive particles on a support, mounting conductive members on the support at opposite sides of the area on which the particles are mounted with portions of the members projecting beyond the particles in the direction in which the particles extend from the support, electrodepositing metal over the particles and onto the projecting portions of the members to form a layer having integral extensions along the inner sides of said projecting portions of such length as to extend beyond the particles, the extensions having thickened free end portions, and, while the layer remains in contact with the support, applying heat and pressure to a quantity of moldable material to form a tool base interlocked with the extensions.

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