Dec. 10, 1968 R. T. HALLEWELL ET AL 3,415,635

METHOD OF MAKING A GRINDING MEMBER

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Fig. 1.

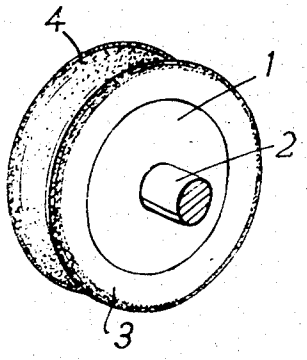
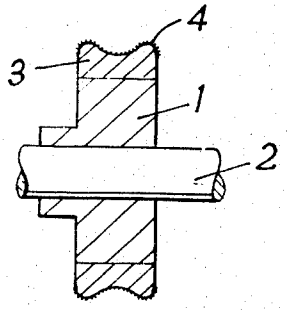


Fig. 2.



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METHOD OF MAKING A GRINDING MEMBER

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ABSTRACT OF THE DISCLOSURE

A method of making a grinding member having a base and on said base a kneadable composition comprising a synthetic resin and abrasive particles, the improvement comprising the steps of:

rolling said composition on said base to a predetermined form with a master roller, and thereafter causing said composition to harden slowly without substantially changing the volume.

This invention relates to grinding members, and more especially to grinding wheels.

Grinding surfaces, especially plane and profiled surfaces for use in precision grinding, have been made in the past by impregnating a metal surface with an abrasive such as diamond dust. Grinding wheels for example may be made by embedding abrasive in the rim of a metal disc. The disc, which may be of copper, brass or aluminum, may be cast with the required rim profile, or a blank can be formed first and its rim shaped with a turning tool. The profiled disc is then mounted on a spindle and abrasive rolled into its rim by means of a master roller, to produce a grinding surface. This impregnation step requires the application of very high pressure between the roller and the disc, so that power consumption is high, and much of the abrasive is crushed and wasted. This wastage is particularly serious in the case of a costly abrasive such as diamond dust. Furthermore the disc and its mounting tend to lift away from the roller under the high pressure applied, so that the accuracy of profile that can be achieved by this method is limited, and the finished wheel rarely runs true on its spindle. This effect is so pronounced that thick wheels cannot be treated satisfactorily in this way.

According to the present invention a method of making a grinding member includes the steps of forming a body of a kneadable composition comprising a major proportion of comminuted metal suspended in a hardenable synthetic resin and a hardening agent for the said resin and having abrasive embedded in at least one exposed surface thereof, and causing the said body to harden slowly with substantially no volume change to produce a grinding member having at least one grinding surface.

The resin-metal composition may initially be intimately mixed with the abrasive, but it is preferred to form the body first and then to apply the abrasive over its surface, so that a highly abrasive surface may be produced using the minimum amount of abrasive.

The invention also provides a grinding member comprising a body of a composition comprising a major proportion of comminuted metal suspended in a hardened synthetic resin, at least one exposed surface of the body having embedded therein an abrasive to provide a grinding surface.

For the production of a flat or profiled grinding surface, the body of composition may be worked, as by rolling, to the required form, and abrasive, for example diamond dust from about 80 to 200 grit size, then dusted over the shaped surface and embedded in it with a master roller. Alternatively, the abrasive may be applied to the surface of the body before profiling. The layer is preferably allowed to harden partially before being profiled to ensure that the composition does not stick to the roller. The resin and the hardening agent used in the composition are therefore preferably so selected that the prepared composition retains its workable consistency for an extended period, e.g. for an hour or more.

For the production of a grinding wheel, a layer of the composition may be applied around the rim of a supporting disc and then treated as described above. The rim of the disc may be preformed to the required profile before the application of the composition, but is preferably flat and roughened, as by scoring or pitting, to provide a key for the kneadable composition.

Due to the workable nature of the plastic metal composition, the method of the invention does not require the application of high pressure for either the profiling or the impregnation step, so that power consumption is relatively low, there is little or no wastage of abrasive, and there is no limitation as to the width of the discs that can be treated. For the same reason the empregnation step need not interfere with the accuracy of the profiling. The invention thus provides a method whereby cheaper and more accurately profiled grinding members with a wider range of possible profiles can be produced than has been possible heretofore. In the production of grinding wheels the method of the invention has the additional advantage that it can be operated without affecting the true running of the finished wheel; the wheel can be mounted, trued up, and then profiled and impregnated in position and ready for use.

A wide variety of metals may be employed as the metallic constituent of the composition. The softer metals such as copper and aluminium have the advantage of wearing in use to expose abrasive and so promote efficient grinding over extended periods of use, whilst a composition comprising steel retains its profile for longer periods. To obtain the optimum workable consistency it may be necessary to include a thickening agent, such as silica, in the composition. Polymerisable epoxy or polyester resins, in admixture with a hardening agent, e.g. one comprising a polyamide and a mild base such as an amine, are suitable for use as the resinous component of the composition.

An eletcrically conductive grinding wheel, suitable for use in electrolytic grinding, can be produced by the method described above, the composition employed being one which hardens with substantially no shrinkage to yield an electrically conductive body. A number of compositions suitable for this purpose are available, comprising for example a major portion of comminuted copper or other conductive metal suspended in an acrylic, epoxy or polyester resin and a hardening agent for the resin.

The invention will now be further described by reference to the following specific example of the production of a diamond grinding wheel:

EXAMPLE

A metal disc of about 6" diameter, about 1" thick and having a roughened rim is mounted on the spindle of a grinding machine. A layer of Devcon A (Devcon Limited), a resinuous composition including 80% comminuted steel and 20% curable epoxy resin, is applied around the rim of the disc and allowed to partially harden. The required form is then rolled into the peripheral layer of Devcon A by means of a master roller, which is then used to roll diamond dust into the profiled surface. The profiled and impregnated layer of Devcon A is then allowed to set to its final hardness. The Devcon A sets to a hard mass with substantially no shrinkage,

so that a hard-wearing abrasive surface of accurate profile is obtained.

Similar results were obtained using Devcon F, a hardening resinous composition including 80% comminuted aluminium.

It has been found that grinding wheels according to the invention are particularly suitable for forming or dressing wheels and rollers, e.g. the rollers employed for grinding vehicle crankshafts and like workpieces.

A grinding wheel constructed in accordance with the invention is shown schematically, by way of illustration only, in the accompanying drawings wherein

FIG. 1 is a schematic perspective view of the wheel,

FIG. 2 is a sectional end view of the wheel.

In the drawings **1** represents a copper disc rotatably mounted on a spindle **2**. Around the periphery of disc **1** is bonded a profiled peripheral layer **3** of hardened Devcon A consisting of 80% comminuted steel suspended in 20% cured epoxy resin, the profiled surface of layer **3** having diamond dust **4** of from 80 to 200 grit size embedded therein. It will be understood that in the drawings the thickness and profile of layer **3** have been exaggerated for clarity. In other embodiments, the layer **3** may for example comprise comminuted aluminium or copper suspended in a hardened acrylic, epoxy or polyester resin.

What is claimed is:

1. In a method of making a grinding member having abrasive particles embedded in a substrate comprising a synthetic resin, the improvement which comprises the steps of:

(1) placing a continuous layer of said resin on a base,

(2) while the resin is supported on the base and is in a partially hardened condition in which it is capable of being permanently deformed upon application of pressure thereto and is nonsticky, molding the resin layer to alter the shape of said resin layer by moving a rotating shaping roller over an exposed surface of the resin layer and applying a deforming pressure onto said surface of said resin layer by means of the roller and thereby altering the shape of said resin layer until it has been deformed to a final profile, and then

(3) causing the resin to harden slowly without changing the shape of the surface and with substantially no volume change to form a grinding member having a grinding surface of said final profile and to unite the resin to the base.

2. A method as defined in claim **1**, comprising the additional step of mixing the resin with abrasive particles so that same become dispersed therein prior to placing the layer on the base.

3. A method as defined in claim **1**, comprising the additional steps of applying abrasive particles to the exposed surface of the resin layer before the surface has been deformed by the roller, and embedding the abrasive particles into the resin layer before the resin hardens.

4. A method as defined in claim **1**, comprising the additional steps of applying abrasive particles to the exposed surface of the resin layer after the final profile has been formed thereon but before the resin layer has hardened, and embedding the abrasive particles in the resin layer before the resin hardens.

5. A method as defined in claim **1**, comprising the additional steps of embedding abrasive particles into the resin layer before the resin layer hardens.

6. A method as defined in claim **5**, comprising the additional step of forming a roughened surface on the base prior to the placing of the resin layer thereon.

7. A method as defined in claim **5**, wherein the resin contains comminuted metal in suspension therein.

8. A method as defined in claim **5**, wherein the base comprises a central supporting disk and the continuous resin layer is of an annular configuration disposed around the rim of the disk with the exposed surface of the layer constituting the peripheral surface of the annular layer.

9. A method as defined in claim **5**, wherein the base comprises a central supporting disk and the continuous resin layer is of an annular configuration disposed around the rim of the disk, and wherein the exposed surface of the layer is roller to said final profile while said disk is mounted in its operable grinding position, whereby the grinding member is produced already mounted and trued up in position ready for use.

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