The present invention relates to abrasive tools, such as are employed for grinding, cutting or polishing operations, and has for its object to provide a method of making a tool of this character that possesses electrical conducting properties, in addition to its abrasive properties.

In the co-pending application of William D. Schmidt and Harold L. Blood, Serial No. 65,281, filed March 11, 1936, there is shown and described a grinding machine, in the operation of which the grinding wheel is utilized as an electrical conductor, for the purpose of establishing an electrical circuit through the grinding wheel and the workpiece, when these members come together, in order to procure a change in the grinding operation. According to the present invention, there is provided an improved method of making an abrasive tool, which is particularly well adapted for use as a conducting grinding wheel in the machine described in the aforementioned co-pending application, as well as for analogous purposes.

While I am aware of the fact that metal has heretofore been employed as a bond for the abrasive particles of abrasive tools, so that such tools possess electrical conducting properties, such previous tools are not particularly well adapted for grinding purposes, owing to the non-abrasive qualities of the metallic bonding material. According to the method of the present invention, an abrasive tool is rendered conductive without appreciably impairing its abrasive properties, so that such tools may be utilized for grinding, cutting or polishing operations, in the same manner as existing tools composed entirely of non-conducting material. Briefly stated, my invention resides in subjecting an ordinary abrasive tool of a porous character to the effect of hydrostatic pressure developed within a fluid or semi-fluid medium composed partially of conducting material, whereby to obtain a thorough impregnation of the tool by this medium and the formation of a multiplicity of thin coatings of conducting material extending throughout the tool.

The above and other objects of the invention will more fully appear from the following description, considered in connection with the accompanying drawing, in which:

Fig. 1 illustrates, on an enlarged scale, the internal structure of a portion of a grinding wheel produced in accordance with the method of the present invention.

Fig. 2 illustrates, diagrammatically, one form of apparatus for carrying out the method.

Referring first to Fig. 1, a portion of a grinding wheel W is shown as consisting of particles 1 of abrasive material, held together, individually or in groups, by bonding material 2, so as to constitute a unitary structure which, nevertheless, is of a somewhat porous character, with interstices 3 of tortuous or irregular form extending therethrough. Most grinding wheels in commercial use are of this general character, although of course the percentage of abrasive material to bonding material, and the form and size of the interstices may vary for different wheels.

In carrying out the invention, one or more wheels W consisting entirely of non-conducting material, as described above, are placed in an annular cage 4, preferably composed of open-work material, such as wire mesh, so that the walls of the cage offer substantially no resistance to the passage of liquid therethrough. This cage is positioned within a solid-walled bowl 5 that is rotatably mounted, and is adapted to be driven at a high speed by any suitable mechanism, not shown. The bowl 5 also provides a suitable cover 6 having a central opening 7, of considerably less diameter than the inside diameter of the annular cage 4. Impregnating apparatus of this general character is more fully shown in Hyde patent, No. 1,961,433, issued November 20, 1934.

In order to impregnate the relatively porous wheels W with conducting material, the bowl 5 is partially filled with a fluid or semi-fluid medium containing conducting particles, and it has been found that colloidal graphite is particularly well adapted for the purposes of the present invention. The bowl 5 is then rotated, and as the speed builds up, centrifugal force, acting radially outward from the axis of rotation of the bowl, presses the fluid medium against the solid wall of the bowl. Therefore, by the time the bowl is up to speed, the medium will tend generally to assume the dotted line position of Fig. 2, thus leaving a clear space in the middle of the bowl 5, determined by the diameter of the opening 7 in the cover 6.

Considering now the wheels W, within the open-work cage 4, it is evident that they will be subjected to a squeezing action due to hydrostatic pressure developed within the medium which is at its maximum at the solid wall of the bowl 5, the pressure decreasing inwardly toward the axis of rotation. Therefore, as the bowl rotates, all the articles within the cage are positioned in the zone of the greatest hydrostatic pressure, near the solid wall of the bowl, so that
As rotation continues, the colloidal graphite is forced completely through the relatively porous wheels W at a rate depending upon the speed of rotation, the radius of the cage, the fluidity of the medium and the permeability of the wheels. As the impregnation of the wheels progresses, the squeezing action expels air from the interstices of the article and particles of graphite will be deposited within each wheel in the form of very thin conducting coatings extending along the interstices as shown in Fig. 1. By properly controlling the degree of fluidity of the colloidal graphite or other conducting medium, and the duration of the periods of impregnation within the bowl, it has been possible to deposit several conducting coatings, which extend through each wheel and provide continuous conducting paths for electrical current. If desired, the wheels W can be subjected to heat before and after successive impregnations, in order to dry and thoroughly amalgamate the conducting coatings.

After the impregnation of a wheel with conducting material has been carried out, in the manner described above, there results a grinding wheel which exists, with its abrasive properties substantially unimpaired, while at the same time, possessing the property of conducting electrical currents. Since the wheel is of a homogeneous character throughout, its electrical conducting properties are unimpaired by repeated dressings of the wheel when in use in a grinding machine, since the uniform coatings of conducting material extend entirely through the wheel and so render the wheel conductive down to its smallest usable diameter.

I claim:

1. A method of treating an abrasive element of a porous nature, which consists in subjecting the element to the action of pressure developed centrifugally within a mass of colloidal graphite completely surrounding the abrasive element.

2. A method of treating an abrasive tool, consisting of particles of abrasive material bonded together with interstices extending therethrough, which consists in subjecting the tool to the action of pressure developed centrifugally within a mass of colloidal graphite in which the abrasive tool is submerged.

3. A method of treating an abrasive tool consisting of particles of abrasive material bonded together with interstices extending therethrough, which consists in subjecting the tool to the action of pressure developed centrifugally within a mass of colloidal graphite in which the abrasive tool is submerged, to obtain the deposit of successive coatings of graphite extending along the interstices of the tool.

4. A method of imparting electrical conductive properties to an abrasive element of a porous nature, which consists in submerging the element in a fluid medium containing conducting material and developing pressure within said medium by centrifugal action to force the medium through the pores of the element and form a multiplicity of electrical conducting paths extending therethrough.

5. A method of imparting electrical conductive properties to a pre-formed tool consisting of particles of abrasive material bonded together with interstices extending therethrough, which consists in submerging the tool in a fluid medium containing colloidal graphite and developing pressure within said medium by centrifugal action to force the medium through the interstices of the tool and obtain the deposit of coatings of graphite extending along said interstices.

6. A method of imparting electrical conductive properties to a pre-formed tool consisting of particles of abrasive material bonded together with interstices extending therethrough, which consists in submerging the tool in a fluid medium containing colloidal graphite and developing pressure within said medium by centrifugal action to force the medium through the interstices of the tool by a squeezing action which expels the air from the interstices and results in the deposit of coatings of graphite extending along said interstices.

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