

UNITED STATES PATENT OFFICE

2,136,931

METHOD OF MAKING ABRASIVE ARTICLES

Raymond C. Benner and George J. Easter, Niagara Falls, N. Y., assignors to The Carborundum Company, Niagara Falls, N. Y., a corporation of Delaware

No Drawing. Application September 11, 1937,
Serial No. 163,436

3 Claims. (Cl. 51—280)

This invention relates to abrasive articles such as grinding wheels, disks, and the like, in which the bond is of a metallic nature. More particularly, it relates to articles in which the abrasive is bonded by metallic means and in which amalgams play an important intermediate role in the bonding process. The invention is particularly applicable to the bonding of diamonds although it can be used for bonding other abrasives such as boron carbide, silicon carbide and fused alumina.

It is well known by those acquainted with the fabrication and use of bonded diamond articles that it is extremely difficult to obtain a good bond for diamonds. This is largely due to the difficulty of obtaining a bond which will thoroughly wet or coat the surface of the diamond particles and consequently promote the close adherence or adhesiveness between the abrasive and the bond. In the use of metal in its powdered or cast form, the adhesion between bond and diamond has never been as satisfactory as might be desired. The diamond particles have not been thoroughly wetted and have to a large extent been merely gripped by the surrounding metal bond without complete wetting of the interfaces taking place. Articles so made therefore have not shown the high efficiencies and durability which are so much to be desired.

One of the main objects of this invention is the metallic bonding of diamond particles in such a way that the diamond particles are more completely wetted by the bond and a resulting article obtained of improved cutting ability and characteristics, as well as prolonged life. We accomplish this by the use of metal amalgams as the wetting and bonding materials for the diamonds according to the methods herein set forth, which methods play an important part in the successful formation of such articles.

Another important feature of the present invention is the provision as a wetting and bonding material for diamonds of an amalgam relatively inexpensive and therefore extremely economical for general industrial or commercial application. For this purpose we make use of amalgams containing substantial amounts of base metals, and at times even the amalgam is composed entirely of base metals.

The amalgams which we use can all be easily made by simple intimate admixing of the metal or metals with mercury, although due to the difficulty of obtaining some of the metals in powdered form we usually prefer to carry out the amalgamation indirectly by electrolytic decomposition of the metallic salts of the metal which we desire to amalgamate using mercury as a cathode or a similar decomposition of a mercury salt using the metal as a cathode, depending upon the availability of the respective raw materials. Numerous other methods of obtaining the amal-

gams may be used, but the above two general methods, especially the electrolytic method, are given as examples because of their simplicity and their applicability to practically all of the amalgams we may care to make. In forming the amalgams we use additional mercury over that required to form the solid amalgam of the metal and sufficient to obtain an amalgam in pasty or semi-liquid condition, often containing excess mercury. Although the amalgam is usually made up in small quantities just prior to use, we sometimes have found occasion to make it up some time before using it as the bond or wetting agent, in which event it is desirable to maintain the amalgam under electrolytic potential to prevent its deterioration in any way before use.

Some of the metals which we are able to amalgamate by one or more of these methods are potassium, sodium, barium, calcium, zinc, tin, lead, bismuth, copper, antimony, silver and gold. The amalgams which we use are usually combinations of more than one of the above metals in which case we generally proceed by successive electrolytic amalgamation of the various constituent metals of the desired final amalgam. In this process after amalgamation of one of the metals for a predetermined period of time the first constituent metal to be amalgamated and which has acted during its amalgamation as the cathode is removed, the second metal to be amalgamated is then placed in the same amalgamation chamber as the cathode and the operating conditions readjusted to those best suited for its amalgamation and the operations resumed until the desired amount of this metal is present in the amalgam. After all of the desired constituent metals have served as cathodes for the periods necessary to amalgamate the required amounts of each metal desired to be in the final alloy-amalgam, the operation is complete. During the later portion of the operation, as the amalgam becomes pasty rather than fluid, it is desirable to employ mechanical stirring of the amalgam more or less continuously in order to cause the depositing metal to be dispersed evenly throughout the amalgam rather than plated onto it as a separate surface layer. Heat may also be applied as required to keep the amalgam workable at concentrations which result in the formation of a powderable texture when cold. This electrolytic process of amalgamation is quantitatively very accurate and practically any desired composition of alloy-amalgam may be obtained in this way.

After the amalgam has been made and is ready to use in paste or liquid form, we then thoroughly mix into the mass a quantity of diamond particles, continuing the mixing until we are sure the diamonds are uniformly distributed throughout the amalgam. Instead of using diamonds as the

coating the diamond particles with a silver-copper amalgam, thereafter adding metal powder free from mercury to the coated diamonds and molding and sintering the mass to shape.

5 3. The process of manufacturing metal-bonded abrasive articles which comprises moistening non-metallic abrasive particles with a wetting-out agent which assists the wetting of said par-

ticles by amalgams, coating said abrasive particles with an amalgam, thereafter mixing the amalgam-coated particles with additional metallic bond free from mercury to form an abrasive mixture, pressing and sintering said mixture to the 5 desired shape.

RAYMOND C. BENNER.
GEORGE J. EASTER.