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GRINDING AND CUTTING BODY

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Our invention relates to the manufacture of grinding bodies and cutting bodies from metal alloys, particularly alloys containing beryllium, for example, copper-beryllium, iron-beryllium, nickle-beryllium.

Ceramic materials and hard substances are usually treated with grinding or cutting discs made from heavy metals or alloys of heavy metals, for instance, steel or any other iron alloy in which the abrasive, for example, diamond dust, is embedded. These discs have the disadvantage to be worn off rather quickly as the grip of the abrasive grains in the base material is not firm enough to stand the high stress.

Recently abrasive and cutting discs have been known whereby the abrasive (diamond dust) is pressed into an alloy of iron, cobalt and nickel. These discs are in fact extraordinarily hard but have the disadvantage that they cannot be used up sufficiently. If, in using these abrasives the diamond grains are ground to spherical bodies they are not rubbed off and do not give way to the deeper lying diamond grains but are incapable to move owing to the hardness of the base material. In consequence thereof a sufficient grinding or cutting effect ceases after a relatively short employment.

Now we have found that certain alloys of heavy metals such as copper, iron or the like with beryllium show mechanical properties which are excellently suited for the utilization as base material for abrasives, for example, diamond dust or the like.

Very good results have been obtained with copper-beryllium alloys with a beryllium content of 2 to 5% by weight. Such alloys have a considerable tenacity, warranting a firm grip of the abrasive. Besides, the necessary using up through abrasion of the worn abrasive grains from the effective surface is not limited. The tendency of spontaneous structural changement of these alloys is very low and fractures through repetition of stress are therefore—in comparison with the hitherto known discs—only rarely occurring. Good results were also obtained with alloys of iron and nickel with beryllium or an alloy of iron-nickel-beryllium. The content of beryllium depends to a certain extent upon the content of the heavy metal or heavy metals alloyed therewith. Thus, for instance, it has proved advantageous to keep the beryllium content in iron-beryllium alloys somewhat higher than in copper-beryllium alloys, especially if abrasives or cutting bodies of elevated hardness are to be produced. The content of beryllium may be about 10% by weight or even more. If different quantities of beryllium are added the qualities of the base material are influenced with respect to hardness, tenacity, structural stability or the like. In this manner abrasive bodies will be obtained with special suitability for certain purposes. In each case the best suited heavy metals and the content of the beryllium may be ascertained by simple preliminary tests.

The alloys of copper, iron, nickel with beryllium may also contain inferior quantities of other metals, for instance, of tungsten, molybdenum, chromium, vanadium either alone or in mixture. The additions may influence the qualities of the alloys to a certain degree.

The manufacture of the alloys of heavy metals according to our invention is carried out by a sintering process, expediently in such manner that a pulverulent mixture of the substances is heated to temperatures not far below the melting point. The sintering is preferably carried out at temperatures as high as possible whereby melting is avoided. The abrasive material, for instance, diamond dust, diamond splits, silicium carbide, boron carbide, beryllium carbide, or mixtures thereof, are embedded into the heavy metal-beryllium alloy during the working operation. According to our invention we may also proceed in such manner that the abrasive material is applied to the base material and then more or less sintered into the base material.

The heavy metal-beryllium alloys according to our invention possess the great advantage that after quenching they may be easily worked up, i. e., drilled, milled, cut or the like. They may also be tempered with the effect of improved qualities with respect to hardness, tenacity and the like. The tempering may, for instance, be carried out, in such manner that the article to be tempered is heated to a suitable temperature below the melting point, quenched and tempered by heating at suitable, preferably moderate temperatures. According to the conditions of the tempering process the mechanical properties of the final material may be influenced as desired.

The hardness of a copper-beryllium alloy with about 2 to 5% by weight of beryllium shows after quenching 100 to 150 Brinell and after one hour tempering at temperatures of 350° C. about 300 to 400 Brinell, even 500 Brinell. The hardness of a nickel-beryllium alloy with 2% of weight Bé. is after quenching, for instance, 120 Brinell and after tempering at a temperature of 400° C. dur-

ing a period of 36 hours, the hardness will be increased to about 450 Brinell. Iron-beryllium alloy with 4% by weight of Bé. quenched, possesses about 250 Brinell and after tempering at a temperature of 450° C. the hardness increases to about 520 Brinell. An alloy, consisting of 10% nickel, 1% beryllium, rest iron shows a hardness of about 350 Brinell in a quenched state and after tempering at a temperature of 450° C., the hardness will increase to about 611 Brinell.

The process for the production of abrasive and cutting bodies will be illustrated by the following examples:

(1) Copper powder is intimately mixed with a suitable amount of beryllium powder (preferably between 2 and 5% by weight) and a suitable quantity of diamond dust, the mixture coldpressed to a shaped body and sintered under pressure. The sintering temperature is expediently chosen in such manner that it lies not far below the melting point of the final alloy in order to facilitate the formation of the alloy by way of diffusion. The pressure is thus rated that the disc obtains an especially suitable strength for its special purposes. The sintered body is then quenched and subjected to an after treatment. Subsequently the sintered body will be tempered according to the usually known methods in order to obtain its final properties.

Instead of coldpressing the pulverized mixture may be applied to a suitable form and sintered under pressure whereby forming and diffusion are carried out at one single operation step.

(2) A mixture of heavy metal powder, for instance, copper powder and beryllium powder are pressed without addition of an abrasive material. To the surface or effective area, for instance, cutting area of this body, a layer of an abrasive of a suitable thickness is applied, whereupon the abrasive will be sintered with pressure into the base material.

What we claim is:

1. A grinding and cutting body consisting of a tempered, sintered carrier composed of an alloy of beryllium and a metal selected from the group consisting of copper, iron and nickel, and an abrasive embedded therein.

2. A grinding and cutting body consisting of a tempered sintered carrier composed of an alloy of copper and beryllium, the beryllium being present in a quantity of 2% to 5% of the alloy, and diamond dust embedded therein as an abrasive.

3. A process for producing a grinding and cutting body composed of a sintered carrier composed of an alloy of 2% to 5% of beryllium and copper and diamond dust embedded therein, which comprises mixing beryllium powder with copper powder and diamond dust, the quantity of beryllium being sufficient to form an alloy containing 2% to 5% of beryllium with said copper, sintering the mixture under pressure to effect alloying of the copper beryllium quenching the sintered body, and subsequently tempering such body.

4. A process for producing a grinding and cutting body composed of a sintered carrier composed of an alloy of beryllium and a metal selected from the group consisting of copper, iron and nickel, and an abrasive embedded therein, which comprises mixing beryllium powder with powder of a metal selected from the group consisting of copper, iron and nickel and an abrasive, sintering the mixture under pressure to effect alloying of the metals therein, quenching the sintered body, and subsequently tempering such body.

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