

C. DANTSIZEN.

WEAR RESISTING BODY AND METHOD OF MAKING THE SAME.

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1,096,688.

Patented May 12, 1914.

Fig. 1.



Fig. 2.



Fig. 3.

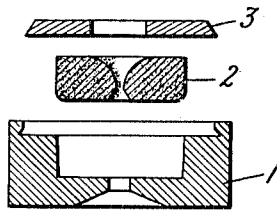
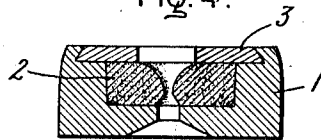


Fig. 4.



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WEAR-RESISTING BODY AND METHOD OF MAKING THE SAME.

1,096,688.

Specification of Letters Patent.

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Application filed February 6, 1912. Serial No. 675,829.

To all whom it may concern:

Be it known that I, CHRISTIAN DANTSIZEN, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Wear-Resisting Bodies and Methods of Making the Same, of which the following is a specification.

My present invention comprises a material consisting of refractory earthy oxids such as the oxids of aluminum, beryllium, and titanium, in a very hard dense condition free from crystalline structure and therefore especially valuable as a wear-resisting body such as a die, or metal working tool. I have discovered that these oxids, particularly alumina, Al_2O_3 , can be sintered to a very dense state without actual fusion and consequent crystallization. The material is mechanically strong and far more durable than steel for the purposes mentioned. It is as hard as sapphire and possesses some of the desirable wearing qualities of diamond.

In the accompanying drawings Figure 1 shows a preliminary form into which the material is shaped when it is intended to utilize it for a die; Fig. 2 shows the material after having been trimmed in a lathe subsequent to firing; Fig. 3 shows the finished die with its mount, and Fig. 4 shows the die and mount assembled in final form.

I will describe in its various stages the manufacture of a die from the loose oxid powder to the mounted die, referring in this description particularly to aluminum oxid. I wish it understood that this description is also illustrative of other forms of tools, rolls, bearings, drills and the like.

Very finely divided aluminum oxid is mixed with about 10% of suitable binder such as gum tragacanth. When it is desired to make a die for wire drawing the mixture is compressed into the form of a flat cylinder which may be for example, one-fourth inch high and three-fourth inch in diameter. Cylinders or die blanks such as these are baked in an ordinary kiln at a temperature of about 1300° to 1400° C. After baking the substance has the consistency of chalk and therefore may be easily machined. The depression in the top of the die blank shown in Fig. 1 is increased along its axis so as to extend through the cylinder as shown in Fig. 2. When thus bored the cylinders are fired to 1800° to 2000° C.

in an inert environment. A furnace suitable for carrying out the firing operations is for example, a tungsten or molybdenum-wound resistance furnace as described in vol. 20, pages 287-293, *Transactions of the American Electrochemical Society*. This temperature is not high enough to actually melt the alumina but it is a higher temperature than has been heretofore used to bake or fire alumina. I find it sinters the alumina into a very dense, amorphous or structureless condition in which it is very strong, fine grained and is hard as sapphire. This form of alumina is not to be confused with the commercial article known as "alundum". The latter substance is an impure form of alumina which has been electrically melted and has a crystalline structure. When alundum is heated and plunged into water it cracks into pieces. Highly sintered alumina produced according to the above process may be heated to 1000° C. or even higher, and then may be plunged into water without damage. In order to identify it from the slightly baked alumina heretofore produced I may say it has a specific gravity of 3.8 to 3.9. It is capable of taking a high polish with diamond dust. It is opaque.

After having been fired as above described the dies are given their proper shape with diamond dust and are then mounted in a casing illustrated in Fig. 3, the die 2 placed in a recess prepared for it in the steel or brass casing 1 and the plate 3 is inserted into a recess in the holder 1 which is somewhat under-cut as shown in the drawing. The plate 3 is then upset by pressure so as to flow into the undercut portion and the edge of the holder is then spun over the edge of the plate 3 to hold it in place as shown in Fig. 4.

For the drawing of copper, a die made as above described lasts sixty times as long as the ordinary steel die. Of course, metals other than copper, such as steel, nickel, or even tungsten may be drawn both cold and hot through my improved die.

When making articles of oxids other than aluminum oxid, the process is essentially the same, except that the final firing temperature should in all cases be below the melting point of the respective material.

I mean by the appended claims to cover not only an article consisting of the oxid of aluminum but also of the described equivalent

lents, namely, the oxids of beryllium and titanium.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

- 5 1. An article of manufacture consisting of aluminum oxid sintered in its approximate shape at a temperature just below its melting point to a dense, amorphous state in which it is capable of taking a high pol-
10 ish and withstanding sudden changes of temperature without cracking.
2. A shaped wear-resisting body consisting of an oxid of aluminum sintered in its approximate shape to a strong, hard, struc-
15 tureless form capable of taking a high polish.
3. A shaped wear-resisting body consisting of dense, opaque, oxid of aluminum sintered in its approximate shape devoid of
20 crystalline structure and having a specific gravity of 3.8 to 3.9, and a hardness equal to that of sapphire.
4. The process which consists in compact-
25 ing a refractory oxid with a binder, baking to a temperature at which slight sintering takes place, shaping the material mechanically and finally firing at a higher temperature below the melting point at which complete sintering takes place.
5. The process which consists in compact- 30
ing the oxid of aluminum with a binder, baking to a temperature of about 1300° to 1400° C., shaping the material mechanically and finally firing at a temperature of about 1800° C. 35
6. The process which consists in compact-
ing a highly refractory, earthy oxid with a carbonizable binder, firing to a tempera-
ture of about 1300° C., machining the ma-
terial to its approximate final shape and 40
then firing to a higher temperature just below the melting point of the oxid whereby sintering to a dense, strong, structureless state is secured.
7. The process which consists in compact- 45
ing aluminum oxid and gum tragacanth, baking to slightly sinter the material, shaping the same into desired form, and firing
at a temperature of about 1800° to 2000° C.
to sinter the same into a dense, amorphous 50
state.

In witness whereof, I have hereunto set my hand this 5th day of February, 1912.

CHRISTIAN DANTSIZEN.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.