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RICHARD R. WALTER, OF NUREMBERG, GERMANY

METAL COMPOSITION

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My invention pertains to a metal composition partially produced by a process for condensing or consolidating a powdered metallic aggregation or coherent mass of powdered particles, or sintered metal body.

The formation of metals or metal compounds or combinations with a high melting point, including tungsten, molybdenum, tantalum and others or their metallic combinations with other elements, usually occurs by compression of the powdered and sintered ingredients at high temperatures.

Such sintered bodies composed of powdered materials are known and to the naked eye disclose an apparently ultra dense texture, but in reality they are in most cases not a homogeneous metallic mass or true alloys, rather, the individual dust particles of the prepressed bodies produced by the sintering process are only stuck together and as microscopically viewed, highly magnified, these sintered metal bodies also reveal, throughout a cross-sectional plane, a structure with many cavities.

In order to improve the density of metal powders having a high melting temperature additions of other metals in powdered form have heretofore been made, notably, metals like nickel and cobalt which have a lower melting point than the main mass. However, the results of that method for lessening the cavities have proven insufficient because such additions merely effect a better agglutination or frit or what might be termed a partial fusion of the particles of the constituents of high melting temperature which cannot become liquefied at the usually employed sintering temperatures ranging between fifteen hundred and eighteen hundred degrees centigrade.

One object of the present invention is to avoid the drawbacks such as porosity and inadequate mechanical tenacity which till now have been associated with sintered metal bodies. I have discovered that a sintered metallic mass, for example of tungsten or either tungsten or molybdenum carbides or nitrides and produced according to the well-known manner as above described can exercise a considerable and important capillary action if brought into contact with fluid metals or fluid alloys, in consequence of the extraordinary minute porosity which is uniformly distributed throughout the sintered metal body though not detectable to the naked eye. Actually, such sintered metal bodies suck up the molten metal with so pronounced a capillary power that they become homogeneously permeated therewith. My invention may, for example, be conveniently practiced by laying nickel or chromium singly or together or other metals singly or together upon a sintered metal mass and then heating the whole until the superimposed metal melts. When that occurs the molten metal disappears in a few seconds and the sintered mass will have completely absorbed it. The absorption is not dependent upon a superimposed contact.

The occurrence may be compared with a lump of sugar upon which a drop of fluid is deposited to have its moisture become uniformly distributed throughout the entire lump. Naturally, the capillary power of absorption is comparatively far greater in the case of sintered metal bodies because of the correspondingly greater fineness of the ingredient particles or granules.

The density and homogeneity of a powdered metal mass or of metallic combinations treated according to this invention are markedly greater than if the same ingredients be chosen and merely sintered together in powdered condition. When the volume of the sintered or otherwise aggregated or agglutinated metallic mass remains the same and yet has had to encompass additional metal by the described liquation and capillary absorption, it is inevitably established that the density must have correspondingly increased. It has been learned that sintered metallic masses can absorb by capillary liquation twenty per cent or more of their own weight of other metal, as for instance chromium, cobalt or nickel and others, without altering their exterior shape. That per cent of absorption is not the maximum because it is possible to introduce greater quantities of molten metal by absorption. A point is, however, reached when the capillary suction power overcomes the coherence or

mechanical firmness of the sintered metal body to occasion a cracking or bursting of the latter. Accordingly, for every sintered metal body there is a best or preferable receptivity up to which it will maintain its shape without danger.

Besides increasing the density of metallic bodies, my process will considerably enhance their mechanical firmness and above all their resistance to wear and, according to the choice of the metal or metals to be absorbed, likewise their hardness.

I would have it understood that the scope of my invention is not required to be limited in consequence of my description pertaining to sintered bodies which was merely selected to exemplify one successful adaptation for producing an alloy with certain desired attributes; nor need the pre-formed aggregation be one metal, nor a mixture of several nor a compound or combination of several with other chemical elements. Variations in the number of metals to be melted and absorbed and of the chemical groups to which they may belong and of the required temperatures suited thereto are recognized to be feasible and comprehended by the range of novelty. For instance, if a molten alloy which itself possesses value for cutting purposes be absorbed, the fitness of the eventual product for cutting purposes is correspondingly improved.

I claim:—

1. In a metal composition capable of resisting wear during use for cutting, the combination of metal particles including tungsten and fritted to each other into a coherent mass having minute cavities between said particles and a filling of an alloy in said structure cavities, said alloy including a metal of the iron group and a metal of the chromium group and constituting about twenty per cent by weight of the tungsten mass.

2. A metal composition capable of resisting wear during use for cutting, comprising tungsten nitride particles fritted to each other in the form of a coherent porous structure and an alloy including cobalt and a metal of the chromium group filling the voids in said structure.

3. A hard yet tenacious metal composition of particles of a tungsten combination preformed as a sintered mass of predetermined porosity and an alloy of metals of the iron and chromium groups respectively, said alloy being of lower melting temperature than said tungsten combination and of sufficient quantity to fill the pores therein.

Signed by me, this 18th day of November, 1927.

RICHARD R. WALTER.