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DIAMOND TOOL

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No Drawing. Application June 2, 1951,
Serial No. 229,658

4 Claims. (Cl. 125—39)

This invention relates to cutting or dressing tools of the diamond-pointed type and more particularly to the composition of the matrix in which the diamond is held.

A general object of the invention is to provide a new and improved tool of that character in which the matrix is a sintered mixture of metal powder resulting in a composition of matter having qualities and characteristics especially suited for employment as the holding means for a diamond.

The perfection of a diamond tool for cutting or dressing materials such as non-ferrous and precious metals, vitreous material and the like, has long been a problem in the art that has not been satisfactorily solved. With the diamond but partially embedded in the matrix, the problem of tightly securing the diamond under all conditions of usage is a difficult one of completely satisfactory solution. Moreover, in the use of the tool considerable heat is generated which means that the tool must either be cooled by the employment of a coolant or the cutting speeds must be reduced to keep the generation of heat within the range of dissipation of heat for if the diamond becomes too hot it does cause more rapid than normal deterioration and wear.

It is a more particular object of this invention, therefore, to provide a tool in which the matrix is of such character that the diamond is at all times firmly held and in fact remains in firm contact with the diamond not only to hold the same but to provide for more effective and efficient dissipation of heat.

Another object is to provide a tool having a matrix the coefficient of expansion of which is not greater than that of diamond.

Still another object is to provide a tool the matrix of which of such character that when sintered under pressure it alloys with the diamond so that there is a direct bonding with the diamond.

Other objects and advantages will become apparent from the following description and the appended claims, it being understood that the disclosure hereinafter made is exemplary and that it is not intended to limit the invention thereto but to cover all products falling within the spirit and scope of the invention as defined in the appended claims.

Tools of the character here described are generally well known and comprise a shank or shaft which is usually of steel on or in one end of which is secured one or more diamonds through the medium of some bonding or holding material commonly referred to as the matrix. We are here concerned only with the composition of the matrix.

The matrix is herein compounded to have a coefficient of expansion no greater than that of diamond and preferably has a coefficient of expansion less than that of diamond. A matrix with those characteristics will not, when the tool is in use and as a result becomes heated, expand away from the diamond thereby loosening its grip on the diamond and thus permitting initial slight movement or shifting with resultant working loose of the

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diamond as the tool continues to be employed. Moreover, a matrix having such a coefficient of expansion permits of more effective heat dissipation from the diamond because tight contact with the diamond is maintained.

I have found that a composition composed of 64% iron powder and 36% of hydrogen reduced nickel powder sintered while under pressure results in a matrix having a coefficient of expansion not higher than that of diamond, in fact, even lower for the coefficient of expansion of such a product is $.8 \times 10^{-6}/^{\circ}\text{C}$. which is somewhat lower than $1.18 \times 10^{-6}/^{\circ}\text{C}$. which is the coefficient of expansion of diamond.

Not only does the above described matrix have a coefficient of expansion which is not greater than that of diamond, but it has been discovered that the matrix gives a most desirable, highly sought after but in this case entirely unexpected result. It has been found that the composition given above by way of example, when sintered at the necessary temperature which is approximately 1850° F., actually alloys with the diamond held therein. Much so-called "wetting" of diamonds is claimed by manufacturers and patentees, but tests reveal that diamonds when removed from the matrix of those products for which "wetting" of the diamonds is claimed are no different than they were before embedding in the matrix. When embedded in this matrix, however, in its powdered form and heat and pressure applied to the powdered matrix to sinter the same, a coating is formed on the diamond that cannot be removed by the use of acids or other methods short of burning and thus indicates that there is an actual alloying of the carbon of the diamond with the metals of the matrix. There is thus formed a direct and integral bond between the diamond and the matrix, whereby the matrix is able very firmly and rigidly to hold the diamond. Equally if not more important is the fact that this direct, integral bond causes much more efficient heat dissipation and thus materially reduces the deterioration and destruction of the diamond that is otherwise wrought when the diamond becomes heated due to use of the tool.

Cooperating with the direct and integral bonding of the matrix and the diamond and serving to preclude any breaking of the bond is the fact that the matrix has a coefficient of expansion which is less than that of the diamond so that there is no stress on the bond but, on the contrary, as the diamond is heated during use the matrix even holds the diamond more tightly than when cold.

I claim as my invention:

1. A diamond tool comprising a diamond, a matrix of sintered metal powder consisting of 64% iron and 34% nickel, and an alloy of the diamond and the matrix forming a direct and integral bond between the diamond and the matrix.

2. A diamond tool comprising a diamond, a matrix of sintered metal powder comprising approximately 64% iron and 34% nickel, and an alloy of the diamond and the matrix forming a direct and integral bond between the diamond and the matrix.

3. A diamond tool comprising a diamond, a matrix of sintered metal powder having a coefficient of expansion no greater than that of the diamond and including a mixture composed in the main of iron and nickel with iron constituting the major portion and nickel the minor portion, said mixture being capable of alloying with the diamond, and an alloy of said mixture and the diamond forming a direct and integral bond between the diamond and the matrix.

4. A diamond tool comprising a diamond, a matrix of sintered metal powder having a coefficient of expansion no greater than that of the diamond and including a mixture of nickel and iron in the approximate proportions

of 1:2, said mixture being capable of alloying with the diamond, and an alloy of said mixture and the diamond forming a direct and integral bond between the diamond and the matrix.

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