PATENT SPECIFICATION

799,498

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COMPLETE SPECIFICATION

Improvements in or relating to a method of Polishing a Cutting Edge of a Diamond for a Cutting Tool

I, HUMBERTO FERNÁNDEZ-MORÁN, of Instituto Venezolano de Neurologia e Investigaciones Cerebrales, Ministerio de Sanidad, Caracas, Venezuela, a National of Venezuela, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a method of polishing a cutting edge of a diamond for a cutting tool as may be used in the cutting machine described and claimed in Patent Specification No. 799497 (Application No. 25236/55) from which the present specification has been divided out.

It has been proposed to polish a diamond by holding it in contact with a rotating disc coated with diamond paste, the diamond being polished by the grinding action of diamond particles contained in the paste. Such a polishing method is dependent on the grinding action of the diamond particles, and does not easily lead to the obtaining of diamond cutting edges of 0.001 to 0.01 micron thickness, as prior to reaching such fine limits of thickness the cutting edge is continually broken by the action of the grinding particles.

It is an object of this invention to obtain particularly sharp and even cutting edges of 0.001 to 0.01 micron thickness.

The invention consists in a method of polishing a cutting edge of a diamond for a cutting tool, comprising the steps of applying a paste comprising a diamond powder of grain size between 0.002 and 0.005 microns and a liquid to a side surface of a disc, rotating the disc, and while the disc is being rotated holding the diamond at a fixed angle to the surface of the disc and in contact with it, the disc being rotated at such a speed that its linear speed at its region of contact with the diamond is such that by frictional effects on the diamond a high temperature having a burning-off effect on surface irregularities of the diamond is produced.

The advantageous effect of the grain size chosen has been found in practice and may perhaps be explained as follows:—

By using a paste comprising diamond powder of a grain size between 0.002 and 0.005 micron, the frictional effects on the diamond being polished are such as to produce a high temperature having a burning-off effect on surface irregularities, rather than a wearing-off effect. This burning-off effect does not cause the cutting edge to be broken during formation, or at least not to the same extent as with the previously proposed methods.

Preferably the diamond is polished in a direction according to its grain. The diamond may be of bort, in which case it may be polished in a direction parallel to its natural separating planes and to its cutting edge.

In performing the method hereinbefore defined, use is made of the fact that certain industrial diamonds, for example bort, are built up of submicroscopically thin layers (the thinnest having a thickness of only 0.001 to 0.005 microns), and the diamonds are easily split along the planes of these layers. The cutting edges obtained by splitting are irregular and are first ground by means of a fine diamond powder on an iron plate according to usual methods. It is, however, necessary to polish the edges subsequently with an ultra fine diamond powder of grain size between 0.002 and 0.005 microns. This polishing can be effected with good results by using a machine to be hereinafter described.

To make the invention clearly understood reference will now be made to the accompanying drawings, which illustrate, by way of example, a machine for performing the method of this invention and in which:—

Fig. 1 is a perspective view of a polishing machine for obtaining a particularly sharp cutting edge on a diamond; and

Fig. 2 is a side view of the machine of Fig. 1.

The machine illustrated in Figs. 1 and 2 [illegible] in such a manner that the diamond,

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the edge of which is to be polished, is fixed to an end of a rotatable lever and fed thereby to the surface of a disc rotating at a high speed, a paste containing ultra-fine diamond powder being applied to the disc. The machine illustrated comprises a base 45 to which a support 46 is screwed, which has two brackets 47. A grinding disc 48 is keyed to a shaft 49 which in use extends vertically; the grinding disc 48 is accurately balanced and centred on the shaft 49 and its upper, grinding, surface has been carefully polished. With its pointed lower end, the shaft 49 bears against a polished plate 50 of hard metal, carborundum, or possibly diamond, the plate 50 being capable of being raised and lowered; the shaft 49 is held in two V-shaped bearings 51 of bronze or diamond provided in the two brackets 47. A pulley 52 keyed to the shaft 49 is provided underneath the grinding disc 48 and is driven by means of a driving belt 53 by an electric driving motor (not shown) possibly through a suitable gear. The grinding disc 48 and the pulley 52 are keyed on the shaft 49 between the two bearings 51. For raising and lowering the plate 50, the same is connected to a screw 54, screwed into the base 45. A locking nut 55 locks the screw 54 in position.

The electric driving motor may have a rotational speed of 5,000 to 40,000 rotations per minute. By means of a suitable gear the grinding disc 48 may be rotated with a speed of between 10,000 to 400,000 rotations per minute. Usually, a speed of between 20,000 to 40,000 rotations per minute will be chosen. By the combination of V-shaped bearings and a pointed supporting end of the shaft 49 the balanced grinding disc can be rotated evenly and free of vibrations even at the highest speeds occurring.

A holder 56 for a diamond 57 to be sharpened is inserted in the sleeve-like free end of a lever 58 and can be fixed in a desired adjusted position relatively to the lever 58 by means of a screw 59; the lever 58 is rotatably mounted on a horizontal stud in a fork 60 fixed to the upper end of a vertical column 61, which in turn is rotatably mounted in a vertical cylinder 62 fixed to the base 45.

A spring 63 connected to the lever 58 and to a rod 64 mounted on the fork 60 tends to draw the lever 58 upwards from the grinding disc 48. One end of an operating lever 65 is pivoted to an arm 66 and a link 67 interconnects the levers 58 and 65 so that the holder 56 for the diamond 57 can be lifted, lowered and turned sideways by means of the operating lever 65.

The terms "upper," "lower" and the like refer to the position of the machine when in use, that is to say, as shown in Figs. 1 and 2.

The ultra-fine diamond powder used for grinding is obtained by repeated centrifuging and ultra-centrifuging (at about 60,000 rotations per minute) of an oil suspension of fine diamond powder. When a powder of the desired grain size (0.002 to 0.005 microns) has been obtained by centrifuging, it is mixed with a suitable liquid to a paste, which is applied in a thin layer to the grinding disc 48. The pre-ground diamond is mounted in the holder 56 and is carefully brought into contact with the grinding paste on the disc 48 along its entire cutting edge, the operation being continually watched through a microscope of a 30 times magnification. In this manner a skilled expert can obtain a particularly sharp cutting edge which even when magnified 700 times appears as a completely rectilinear line. The cutting edge may have a thickness of between 0.001 and 0.01 microns and an included angle of between 60° to 80°. The shape of the cutting edge is of importance for the quality of the sections made by means of the microtome described in Patent Specification No. 799497 (application No. 25236/55).

WHAT I CLAIM IS:—

1. A method of polishing a cutting edge of a diamond for a cutting tool, comprising the steps of applying a paste comprising a diamond powder of grain size between 0.002 and 0.005 microns and a liquid to a side surface of a disc, rotating the disc, and while the disc is being rotated holding the diamond at a fixed angle to the surface of the disc and in contact with it, the disc being rotated at such a speed that its linear speed at its region of contact with the diamond is such that by frictional effects on the diamond a high temperature having a burning-off effect on surface irregularities of the diamond is produced.

2. A method as claimed in claim 1, wherein the diamond is polished in a direction according to its grain.

3. A method as claimed in claim 2, wherein the diamond is of bort, and is polished in a direction parallel to its natural separating planes and to its cutting edge.

4. A method of polishing a cutting edge of a diamond for a cutting tool substantially as hereinbefore described with reference to the accompanying drawings.

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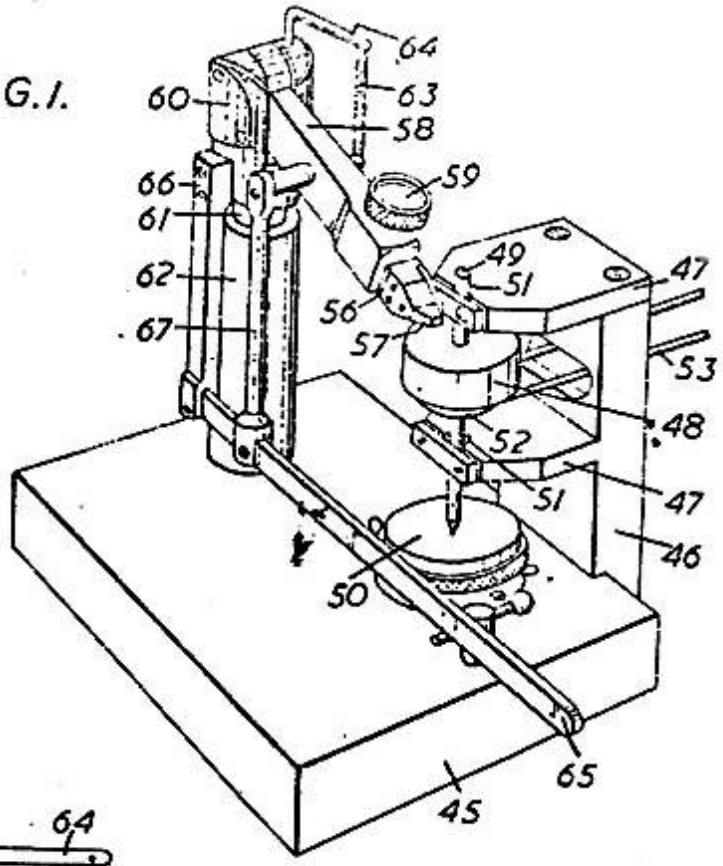
SPECIFICATION
This drawing is a reproduction of the Original on a reduced scale.

FIG. 1.



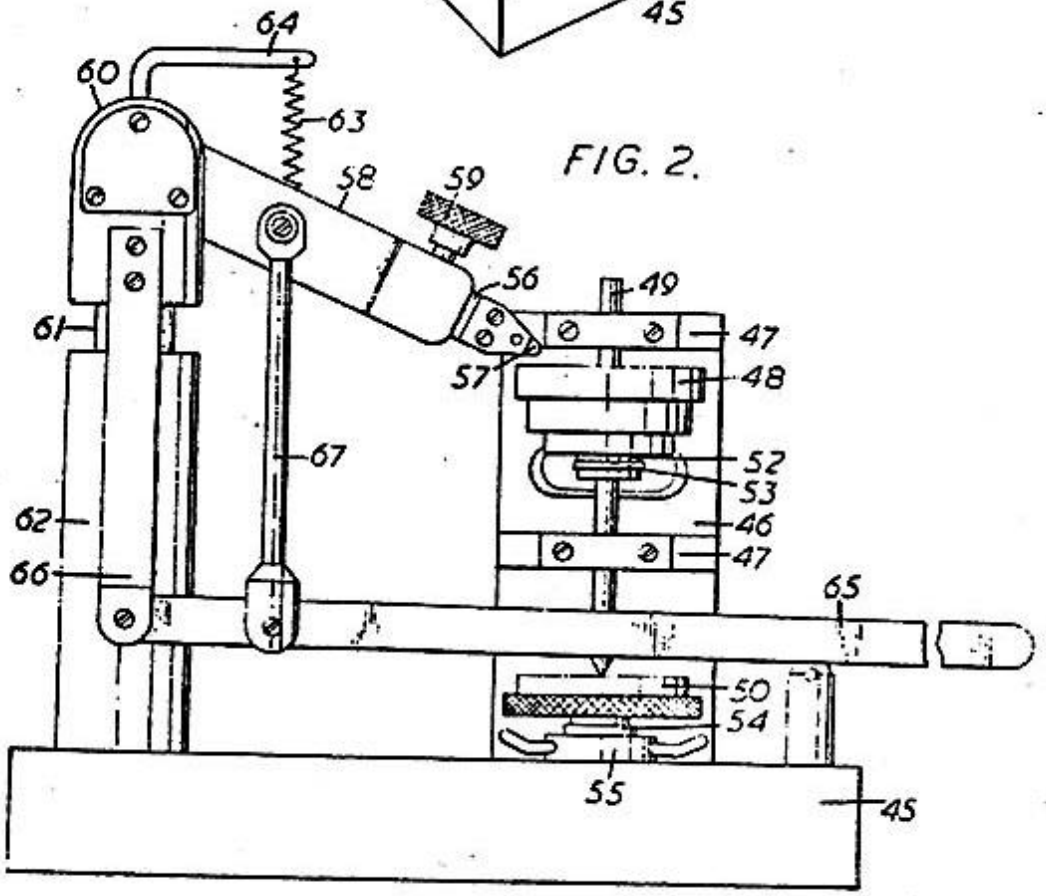


FIG. 2.