Paper No. 25

UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

_____

Ex parte JOHN E. GRAEBNER
SUNGHO JIN and
THOMAS H. TIEFEL

_____

Appeal No. 1996-0073
Application 08/278,688

_____

ON BRIEF

_____

Before CAROFF, METZ and HANLON, Administrative Patent Judges.

HANLON, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 from the final rejection of claims 1-10, all of the claims pending in the application. The claims on appeal involve removing a quantity of diamond material from a polycrystalline diamond film. Claims 1 and 8 are representative and read as follows:

1. Method of making an article that comprises a film of diamond, the method comprising

a) providing a film of polycrystalline diamond having at least one free major surface; and

b) removing a quantity of diamond material from said free major surface; wherein step b) comprises

c) contacting at least a portion of the free major surface with metal selected from the group consisting of Fe, Ni, Mn, and Ti by

i) depositing a layer of the metal on at least a portion of the free major surface; or

ii) urging a body of the metal against the free major surface; or

iii) contacting the free major surface with a powder of the metal; and

d) maintaining the metal-contacted diamond film at a temperature in the range 600-1100EC without relative motion in any direction parallel to the free major surface between the diamond film and the contacting metal, for an effective time for removal of said quantity of diamond material.

8. Method of making an article comprising heat generating means and a polycrystalline diamond film of thickness t in thermal contact with said means, the method comprising providing the diamond film and the heat generating means, and thermally conductively mounting said means on the diamond film;

CHARACTERIZED IN THAT

the method further comprises

a) providing a polycrystalline diamond film of thickness greater than t that comprises relatively fine-grained diamond material adjacent to a first major surface of the diamond film, and relatively coarse-grained diamond material adjacent to a second major surface of the diamond film; and, prior to mounting of the heat generating means on the diamond film,

b) removing a quantity of diamond material from the diamond film such that the diamond film of thickness t results, at least a first part of the removed material being relatively fine-grained diamond material adjacent to the first major surface.

The sole issue in this appeal is whether claims 1-10 were properly rejected under 35 U.S.C. § 103 as being unpatentable over UK patent application GB 2,061,904 A.[1]

Discussion

A. Claim 1

Claim 1 is directed to a method of making an article comprising a polycrystalline diamond film whereby a quantity of diamond is removed from a free major surface of the film. The removal step includes contacting at least a portion of the free major surface of the polycrystalline diamond film with metal selected from the group consisting of Fe, Ni, Mn and Ti by (1) depositing a layer of the metal on at least a portion the free major surface, (2) urging a body of the metal against the free major surface, OR (3) contacting the free major surface with a powder of the metal. Thereafter, the metal-contacted diamond film is

[1]UK patent application GB 2,061,904 A issued May 20, 1981 (hereinafter "GB '904A").

maintained at a temperature in the range of 600-1100EC for an effective time to remove the quantity of diamond material.

According to the examiner (Answer, p. 3):

> GB '904A discloses a method of processing diamonds by contacting diamond and a metal template at a temperature of 600-1800EC (p.1 lines 44-47[, 48-61 and 91-95]) which results in the removal of material (p.1 lines 55-56 and 73-78). In one embodiment, the template can be iron or nickel (p. 1 lines 63-64 [(sic, lines 62-63)]). However, GB '904A fails to teach a polycrystalline film.

See also p. 1, lines 104-108 (metal applied to diamond surface in the form of a paste or by sputtering to effect removal of diamond material).

The examiner maintains (Answer, p. 3):

> It is well known in the vapor deposition art that diamond is generic to polycrystalline diamond or monocrystalline diamond. One skilled in the art would know that monocrystalline diamond has similar properties to that of polycrystalline diamond. It is the examiner's position that one of ordinary skill in the art would reasonably expect that the removal of monocrystalline diamond in the GB patent [application] would work for a polycrystalline diamond. Hence, it is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized polycrystalline diamond because there would have been an expectation that the deposition process would have been fully successful.

Based on the record before us, we agree that the examiner has set forth a prima facie case of obviousness. However, in rebuttal, appellants argue that (Brief, p. 3):

> A significant aspect of the instant appeal is the difference in certain characteristics that exists between conventional single crystal (monocrystalline) diamond and polycrystalline diamond (PCD) film.
>
> It is appellants' position that it is well known in the art that PCD film differs radically in some important aspects from monocrystalline diamond. One very important difference is the difference in the workability of the two forms of diamond.

In support thereof, appellants rely on an article by Willem van Enckevort entitled "Diamonds Polished by Solid State Diffusion" appearing in Physics World, pp. 22-23 (August 1992) (copy attached to appellants' Brief) which recognizes that single-crystal diamond can be polished along the "softer" crystallographic planes and directions but notes that polycrystalline diamond (PCD) can be abraded only very slowly by conventional means due to a random orientation of crystallites.

Appellants also rely on an affidavit of Dr. Sungho Jin, a co-inventor of the application involved in this appeal, dated January 11, 1993. According to Dr. Jin (p. 2):

> It is well known among those skilled in materials science that polycrystalline materials frequently are subject to
>
> a) preferential chemical attack at their grain boundaries; and
>
> b) preferential impurity in-diffusion at their grain boundaries.
>
> . . . . Preferential impurity in-diffusion at grain boundaries would in general be expected to have a negative impact on the thermal conductivity of PCD film, one of the material properties of PCD film of prime technological interest.

> Indeed, there are published results which show that PCD film is indeed subject to preferential chemical attack at grain boundaries. See S. Jin et al., Diamond and Related Materials, Vol. 1, p. 949, FIG. 5, which shows the severe preferential etching of grain boundaries that resulted from maintaining PCD film for one hour in O_2 at 800EC. Such material would typically be unacceptable for technological purposes.

Appellants urge that "it is established that there exist significant differences in such properties as workability between monocrystalline diamond and polycrystalline diamond" (Brief, p. 4). Consequently, appellants challenge the factual basis upon which the examiner's position finds support. Appellants argue that the examiner has failed to provide facts or reasons in support of the position that one of ordinary skill in the art "would reasonably expect that the removal of monocrystalline diamond in the GB patent [application] would work for a polycrystalline diamond." Brief, p. 5; see also Answer, p. 3.

The examiner does not take issue with appellants' position that differences such as workability exist between single crystal diamond and polycrystalline diamond film. Rather, the examiner appears to be of the opinion that these differences do not translate to surface removal of diamond material as in the claimed process. See Answer, p. 6. Nevertheless, due to the examiner's failure to provide countervailing evidence which rebuts appellants' position, we are constrained to reverse the rejection before us. For this reason, the rejection of claims 1-7[2] under 35 U.S.C. § 103 as unpatentable over GB '904A is reversed.

[2] Claims 2-7 are dependent on claim 1.

B. Claim 8

Claim 8 is also directed to a method of making an article. The method comprises thermally conductively mounting a heat generating means on a polycrystalline diamond film of thickness t. Prior to mounting the heat generating means on the diamond film, the diamond film of thickness t is prepared by (1) providing a polycrystalline diamond film of thickness greater than t having relatively fine-grained diamond material adjacent to a first major surface of the diamond film, and relatively coarse-grained diamond material adjacent to a second major surface of the diamond film and (2) removing a quantity of diamond material from the diamond film such that the diamond film of thickness t results, at least a part of the removed material being relatively fine-grained diamond material adjacent to the first major surface.

Thus, claim 8 is of a different scope than claim 1. Nevertheless, the examiner appears to reject claim 8 using the same rationale as used in the rejection of claim 1 and adding the following (Answer, p. 5):

> It is the examiner's position that it would have been obvious to one of ordinary skill in the art to contact a metal to any diamond product with the expectation of obtaining the known benefits.

Appellants argue that "[n]othing in '904 suggests the subject matter of claim 8" (Brief, p. 9). Clearly, the examiner has failed to point to any teaching in GB '904A which would have suggested the invention of claim 8 to one having ordinary skill in the art. For

this reason, we reverse the rejection of claims 8-10[3] under 35 U.S.C. § 103 as being unpatentable over GB '904A. See In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992) (the examiner bears the initial burden of presenting a prima facie case of unpatentability).

The decision of the examiner is reversed.

Marc L. Caroff)
Administrative Patent Judge)
)
)
Andrew H. Metz) BOARD OF PATENT
Administrative Patent Judge) APPEALS AND
) INTERFERENCES
)
Adriene Lepiane Hanlon)
Administrative Patent Judge)

S.H. Dworetsky
AT&T Bell Laboratories
600 Mountain Avenue
P. O. Box 636
Murray Hill, NJ 07974-0636

[3]Claims 9 and 10 are dependent on claim 8.

ALH/cam