

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1953

600099

APPLICATION FOR A STANDARD PATENT

I\We,

SANDVIK AKTIEBOLAG

APPLICATION ACCEPTED AND AMENDMENTS

of

S-811 81 Sandviken,
Sweden

ALLOWED.....23-5-90.....

hereby apply for the grant of a standard patent for an invention entitled:

CEMENTED CARBIDE TOOL

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
025629	US	13 MAR 87

My/our address for service is care of CLEMENT HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 03rd day of March 1988

SANDVIK AKTIEBOLAG

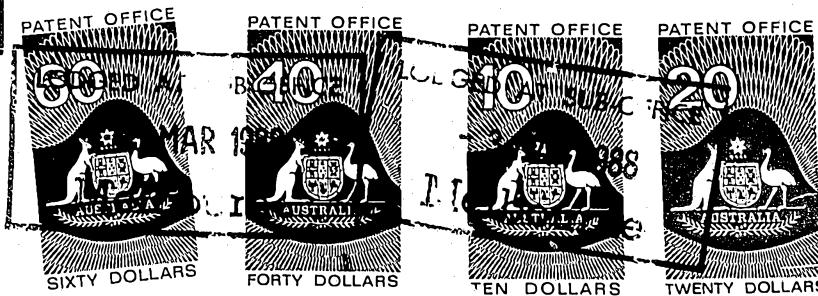
CLEMENT HACK & CO.

[Handwritten signature]

TO: The Commissioner of Patents.

LODGED AT SUB-OFFICE
- 3 MAR 1988
Melbourne

FEE STAMP TO VALUE OF \$...130... ATTACHED
MAIL OFFICER. *[Signature]*



AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

Name(s) of Applicant(s) In support of the application made by Sandvik AB

Title for a patent for an invention entitled Cemented carbide tool

Name(s) and address(es) of person(s) making declaration I/We, Lennart Tåquist
c/o Sandvik AB
Patent Department
S-811 81 Sandviken, Sweden

do solemnly and sincerely declare as follows:-

1. I am/we are the applicant(s) for the patent, or am/are authorised by the abovementioned applicant to make this declaration on its behalf.
2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:-

Country, filing date and name of Applicant(s) for the or each basic application

in USA on March 13 19 87
by Sandvik AB
in _____ on _____ 19 _____
by _____

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Name(s) and address(es) of the or each actual inventor

4. The actual inventor(s) of the said invention is/are Udo Fischer, Friherregatan 66, S-162 34 Vällingby, Sweden
Torbjörn Hartzell, Åkerögränd 10, S-125 40 Älvsjö, Sweden
Mats Waldenström, Thaliavägen 31, S-161 40 Bromma, Sweden

See reverse side of this form for guidance in completing this part

5. The facts upon which the applicant(s) is/are entitled to make this application are as follows:-

The applicant is the assignee of the actual inventors

DECLARED at Sandviken this 10th day of February 19 88

Lennart Tåquist

This form may be completed and filed after the filing of a patent application but the form must not be signed until after it has been completely filled in as indicated by the marginal notes. The place and date of signing must be filled in. Company stamps or seals should not be used.

No legalisation is necessary

(12) PATENT ABRIDGMENT (11) Document No. AU-B-12595/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 600099

(54) Title
CEMENTED CARBIDE TOOL

International Patent Classification(s)
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(74) Attorney or Agent
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(56) Prior Art Documents
AU 32901/84 E21C 35/18

(57) Claim

1. Cemented carbide tool or wear part comprising a cast iron or cast steel body carrying one or more cast-in inserts characterized in that each said insert comprises a cutting or wearing element of cemented carbide including an embedded portion extending into said body and a projecting portion extending beyond said body and an enclosure cast-in with respect to said body and completely surrounding said embedded portion, said enclosure comprising a material having a higher melting point than said body and connected by a metallurgical bond to said body and by a shrink fit to said element.

AUSTRALIA

PATENTS ACT 195

600099
FORM 10

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Short Title:

Int. Cl:

Application Number:
Lodged:

Complete Specification-Lodged:
Accepted:
Lapsed:
Published:

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

Name of Applicant: SANDVIK AKTIEBOLAG

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Actual Inventor:

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601 St. Kilda Road,
Melbourne, Victoria 3004,
Australia.

Complete Specification for the invention entitled:
CEMENTED CARBIDE TOOL

The following statement is a full description of this invention
including the best method of performing it known to me:-

CEMENTED CARBIDE TOOL

The present invention relates to cemented carbide tools and, in particular, to tools for drilling of rock and other minerals comprising a cast iron or steel body carrying one or more cast-in inserts but it is also applicable to other cemented carbide cutting tools and wear parts.

US 4,584,020 discloses a wear part having a carbide wear layer. This wear layer comprises a cast-in layer which is metallurgically bonded to the body and to a steel layer which is disposed along one or two sides of the carbide. The rear side is uncovered to permit the molten material of the body to flow among the carbide particles during the fabrication process. The carbide particles are directly cast-in relative to the body.

In US 2,743,495 a tool comprises a metal body, a plurality of cemented carbide elements embedded within and projecting from the body and jackets surrounding the embedded portions of the elements. The jackets are connected to the cemented carbide elements by a metallurgical (fused) connection.

When casting-in cemented carbide parts in iron alloys such as steel and cast iron the cemented carbide parts are exposed to complex residual stresses due to the essentially lower thermal expansion of the cemented carbide than that of the iron base material. This has no negative influence on the performance of the product as long as the cemented carbide part is completely embedded in the matrix such as disclosed in U.S. Pat. No. 4,119,459 assigned to the same assignee as the present application. However, when the cemented carbide body has a certain protrusion from the matrix the complex tensions in the transition matrix - free cemented carbide part lead to an unacceptable decrease of strength. Another great disadvantage from a strength point of view is that, in addition, a brittle transition zone is formed due to dissolution of iron in the surface zone of the cemented carbide.

Thus, the above-mentioned two factors result in great limitations on the casting technique, in particular, for products requiring a certain protrusion of the cemented carbide such as buttons or inserts in rock drill bits. For such products today, conventional methods of fastening have to be used (brazing, pressing etc.). These methods result in high costs due to the necessity of precision manufacturing (boring - grinding).

It is an object of the present invention to avoid or alleviate the problems of the prior art.

The disadvantages described above can be avoided by protecting the cemented carbide part during the casting operation according to the following:

The cemented carbide part is provided with an enclosure of steel or similar suitable alloy. The cemented carbide part with the enclosure is placed in the mould. At the subsequent casting a good metallurgical bond is obtained between the enclosure and the cast alloy and simultaneously a good shrink fit between the enclosure and the cemented carbide part is obtained. The cemented carbide part never comes in contact with the melt and, thus, the above-mentioned brittle transition zone is never formed.

In a preferred embodiment of the invention the cemented carbide part protrudes above the surface of the cast iron. Said protrusion shall be at least 10% and preferably at least 20 % of the height of the cemented carbide part.

Fig 1 shows a crosssectional view through a tool according to the present invention. In the figure 1 is the cemented carbide insert, 2 is the enclosure and 3 is cast iron or steel.

The material of the enclosure is chosen in such a way that its melting point is higher, at least 50 °C preferably

200 - 400 °C above the melting point of the cast alloy of the tool body. When an essentially graphitic cast iron is used for the tool body a low carbon steel has turned out to be a suitable enclosure material. Generally the carbon content of the steel enclosure is 0.2% at most.

The wall of the enclosure should be so thick that it protects the cemented carbide part during the casting. However, it must also be thin enough to allow a certain deformation during the cooling in order to further fasten the cemented carbide body in the cast iron body. A wall thickness of 0.5 - 10 mm preferably 1 - 5 mm is suitable in most cases.

In a preferred embodiment the enclosure protrudes somewhat above the surface of the cast iron in order to protect the 'corner' cemented carbide - cast iron where the notch effect is particularly severe. A protrusion of >1 mm is generally sufficient.

The steel enclosure is generally in the form of a cylindrical cup but other shapes are also possible. To further decrease the residual stresses the enclosure can be chamfered towards the inside.

The joint can be compared with conventional shrink joints as regards strength and residual stresses. It is strong enough to withstand the impacts occurring in heavy wear applications.

As mentioned, the invention is particularly applicable to rock drill applications. For oil well drill bit cutting, elements of diamond and/or cubic boron nitride are often used.

In tools or wear parts according to the invention, the cast iron part exposed to wear is advantageously provided with a surface layer in which cemented carbide particles are

dispersed e.g. according to U.S. Pat. No. 4,119,459. The thickness of said layer should be less than 10 mm preferably 5 - 7 mm.

5 The following examples illustrate the invention in rock drilling applications.

Example 1

10 In order to lower the cost when producing button bits, attempts were made with the casting technique. The buttons were cast in the drill according to the invention, i.e., with a low carbon steel enclosure (0.05% C) and without enclosure in the conventional way.

Drill bit: \emptyset 178 mm DTH (= Down-The-Hole-bit)
low alloyed steel with 0.6% C

Cemented carbide

button 6% Co, 94% WC
 \emptyset 16 mm, height 30 mm, protrusion 8 mm.

Machine Ingersoll Rand

25 Rock Granite

Variant 1 Standard bit with bored shrink fitted buttons

Variant 2 Bit according to the invention (cast-in carbide)

30 Variant 3 Bit with buttons without enclosure (cast-in carbide)

Result:

35	Variant	Life, drilled meters	
	1	560 m	worn out button
	2	568 m	worn out button
	3	5 m	button failure

Example 2

In order to improve the erosion resistance of oil well drill bits of PDC-type such bits were manufactured of nodular iron with cemented carbide particles in the surface layer (US 4,119,459) and studs according to the invention.

Drill bit: \emptyset 216 mm, Fish Tail bit

10 PDC-stud \emptyset 17.5 mm, height 33 mm, protrusion 15 mm

The test was performed in a laboratory rig in order to test the strength of the cemented carbide stud. The drilling was performed in granite in order to enhance the strain.

Variant 1 PDC drill bit of standard type with shrink fitted cemented carbide studs

20 Variant 2 PDC bit according to the invention

Variant 3 PDC bit with cast in cemented carbide studs without enclosure.

25 Data:

Load 10, 20, 30, 40 tons

Penetration rate 1 mm/ rev

30 Number of revolutions 70 rpm

Cemented carbide grade 15 % Co, 85 % WC

Result Variants 1 and 2 withstood the load of 10 - 40 tons

35 Variant 3 was damaged already at 10 tons.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Cemented carbide tool or wear part comprising a cast iron or cast steel body carrying one or more cast-in
5 inserts c h a r a c t e r i z e d in that each said insert comprises a cutting or wearing element of cemented carbide including an embedded portion extending into said body and a projecting portion extending beyond said body and an enclosure cast-in with respect to said body and completely
10 surrounding said embedded portion, said enclosure comprising a material having a higher melting point than said body and connected by a metallurgical bond to said body and by a shrink fit to said element.
- 15 2. Cemented carbide tool or wear part according to claim 1 c h a r a c t e r i z e d in that the wall thickness of the enclosure is 0.5 - 10 mm and the melting point of the enclosure is more than 50 °C above the melting point of the body.
- 20 3. Cemented carbide tool or wear part according to claim 1 c h a r a c t e r i z e d in that a surface of the body exposed to wear has thereon a layer with a thickness of less than 10 mm in which cemented carbide particles are
25 dispersed.
- 30 4. Cemented carbide tool or wear part according to claim 1 c h a r a c t e r i z e d in that said tool or wear part comprises a rotary drill bit, said cutting or wearing element comprising a cutting button with a diamond and/or cubic boron nitride layer.

DATED THIS 2ND DAY OF MARCH 1988

SANDVIK AB

By its Patent Attorneys:

CLEMENT HACK & CO.

Fellows Institute of Patent
Attorneys of Australia

12595/88

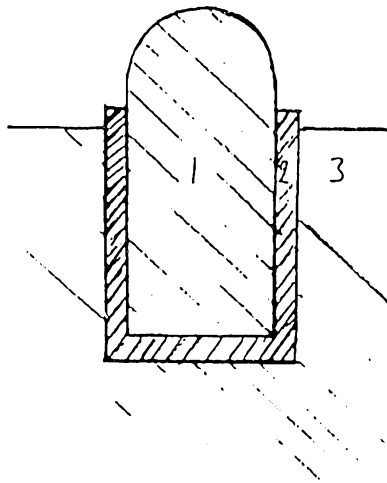


Fig 1