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**D E C I S I O N**  
**of 9 January 2004**

**Case Number:** T 0180/01 - 3.2.6  
**Application Number:** 90303589.7  
**Publication Number:** 0392729  
**IPC:** B23C 5/22  
**Language of the proceedings:** EN

**Title of invention:**  
A cutting insert for a milling cutting tool

**Patentee:**  
ISCAR LTD.

**Opponent:**  
Seco Tools AB  
Widia GmbH

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 52(1), 54(1), 56, 57, 123(2), (3)  
EPC R. 88

**Keyword:**  
"Admissibility of amendments - yes"  
"Novelty and inventive step - yes"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 0180/01 - 3.2.6

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.6  
of 9 January 2004

**Appellant:**  
(Opponent 02)

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**Respondent:**  
(Proprietor of the patent)

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**Further party:**  
(Opponent 01)

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**Decision under appeal:**

Decision of the Opposition Division of the  
European Patent Office posted 15 December 2000  
rejecting the opposition filed against European  
patent No. 0392729 pursuant to Article 102(2)  
EPC.

**Composition of the Board:**

**Chairman:** P. Alting van Geusau  
**Members:** G. C. Kadner  
M. B. Tardo-Dino

## Summary of Facts and Submissions

- I. The mention of grant of European patent No. 0 392 729 in respect of European patent application No. 90 303 589.7 claiming a GB priority from 12 April 1989 and filed on 4 April 1990 was published on 18 October 1995.
- II. Three notices of opposition were filed against this patent with requests for revocation based on the grounds of Article 100(a) EPC (all opponents), Article 100(b) EPC (Opponent 01) and Article 100(c) EPC (Opponent 03). Opponent 03 withdrew its opposition with letter dated 17 July 2000.

By decision announced on 6 November 2000 and posted on 15 December 2000 the Opposition Division rejected the oppositions.

The Opposition Division was of the opinion that an error in the formula of claim 2 did not hinder the skilled person to carry out the invention. Furthermore the relevant prior art neither disclosed, nor did it contain any suggestion of, the combination of features of the claimed peripheral rotary milling cutter, which therefore involved an inventive step.

- III. Notice of appeal was lodged against this decision by the Appellant (Opponent 02) on 7 February 2001 together with payment of the appeal fee.

The statements of grounds of appeal was filed on 12 April 2001.

IV. In a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal dated 14 October 2003 and sent together with the summons to oral proceedings, the Board expressed doubts as to whether the subject matter of claim 1 was novel when compared to the disclosure of D1 (US-A-3 551 978). If novelty could be established, discussions would focus on the issue of inventive step. With regard to the first to fourth auxiliary request filed by the Respondent with reply dated 8 December 2003, admissibility of these requests under Article 123(2) EPC was in doubt.

V. Oral proceedings were held on 9 January 2004. From the documents cited in opposition proceedings only

(D1) US-A 3 551 978 and

(D3) EP-A 0 239 045

were discussed again.

The Appellant requested that the decision under appeal be set aside and that the European patent No. 0 392 729 be revoked.

The Respondent (Patentee) requested that the appeal be dismissed and that the patent be maintained in an amended form on the basis of claims 1 to 5 of the main request filed during the oral proceedings.

Amended claims 1 and 2 read as follows:

"1. A peripheral rotary milling cutter (20) having a cylindrical holder (20a) and a plurality of

replaceable, peripherally disposed cutting inserts (21), a cutting insert (21) formed with at least one curved cutting edge (22) defined between a cutting rake surface (25) and a relief flank surface (24) of the insert (21), the cutting edge (22) being elliptically curved and forming part of an elliptically curved side (43) of a plane (42) which intersects a cylinder (41) constituting a surface of revolution of said cutting edge (22) and at an angle ( $\alpha_A$ ) corresponding to the axial rake angle of the insert (21) in the milling cutter (20), characterised in that the cutting rake surface (25) of the cutting insert is continuously curved in the direction of the cutting edge and that the relief flank surface and the rake surface are maintained at a substantially constant angle  $\delta$  along the cutting edge.

2. A peripheral rotary milling cutter (20) having a cylindrical holder (20a) and a plurality of replaceable, peripherally disposed cutting inserts (21), a cutting insert (21) formed with at least one curved cutting edge (22) defined between a cutting rake surface (25) and a relief flank surface (24) of the insert (21), the cutting edge being elliptically curved, characterised in that the cutting rake surface is continuously curved in the direction of the cutting edge and that the relief flank surface and the rake surface are maintained at a substantially constant angle  $\delta$  along the cutting edge and that its radius of curvature is given by the relationship

$$r = \frac{\left(\frac{l}{4}\right)^2 + \left(\frac{D}{2} - \sqrt{\frac{D^2}{4} - \frac{l^2}{4} \sin^2 \alpha_A}\right)^2}{\frac{D}{2} - \sqrt{\frac{D^2}{4} - \frac{l^2}{4} \sin^2 \alpha_A}}$$

where

- r = radius of curvature of the cutting edge;
- l = length of a chord joining the ends of the curved cutting edge;
- D = Diameter of cylindrical envelope of the cutting edge;
- $\alpha_A$  = Axial rake angle."

Opponent 01 had not made any submissions and had informed the Board that it would not be represented at the oral proceedings.

VI. In support of its requests the Appellant essentially put forward the following submissions:

Taking into account the small dimensions of the cutting inserts concerned, an elliptical curvature of the cutting edge of a cutting insert could not be distinguished from a helical curvature of such a cutting edge. Therefore the subject-matter of claim 1 lacked novelty.

If found to be novel, the subject-matter of claim 1 was obvious at least by virtue of a combination of the teachings of D1 with those of D3. A milling cutter having the precharacterising features was known from D1. That document disclosed a rotary end mill cutter

with replaceable cutting inserts which at least had a nearly elliptical cutting edge. Trying to optimise the rake and relief flank angles, D3 taught an appropriate solution to that problem. Keeping the angle between the cutting rake surface and the relief flank surface constant along the cutting edge was derivable from figures 6 and 7a to 7c of D3, at least when interpreted with the help of US-A-4 940 369, a patent family document of D3.

The teaching of claim 2 was contradictory in that the equation defined a circle line whereas the cutting edge of the cutting insert should have an elliptical shape. Moreover, it was general knowledge that an elliptical curve in the area of its major axis and conjugate axis could be approximated by a circle having a definite radius.

VII. The arguments of the Respondent are summarised as follows:

The cutting insert according to D1 had a planar rake surface, and no indication was derivable from that document with regard to maintaining the angle between the relief flank surface and the rake surface constant.

The interpretation of D3 based on the US patent family member was not admissible because the US document was not published before the priority date of the patent in suit. The cutting edge of the cutting inserts disclosed in D3 was a true helix. The skilled person, when starting from D1, would not combine its teachings with those of D3 in view of the different cutting geometry. The maintenance of constant angles between the cutting

rake surface and the relief flank surface was also not derivable from D3. Since none of the prior art documents suggested using a cutting edge of elliptical shape in combination with this constant angle, the subject-matter of claim 1 was novel and inventive.

There was no contradiction in claim 2 because according to the common mathematical knowledge an ellipse could indeed be approximated by a circle but nevertheless remained an elliptic curve.

### **Reasons for the Decision**

1. The appeal is admissible.

2. *Admissibility of introduction of new documents*

The newly filed US-A-4 940 369, a patent family document of D3, was published on 10 July 1990, whereas the priority date of the patent in suit is the 12 April 1989. Since this document is not prior art within the meaning of Article 54(2) EPC it cannot be admitted in appeal proceedings.

3. *Amendments*

3.1 The amendments to claims 1 and 2 are disclosed in the patent specification (page 6, lines 2 and 11 to 14), in line with the passages of the originally filed application (page 12, lines 20 and 21; page 13, lines 2 to 7). They restrict the extent of the protection conferred.



Claim 2 further includes a correction in the mathematical relationship shown on page 6 of the patent specification which rectifies an obvious error in the denominator of this formula.

The description was adapted to the subject-matter claimed.

3.2 In view of the above assessments the amendments are admissible under Article 123(2), (3) and Rules 57a and 88 EPC.

4. *Clarity of claim 2*

The Appellant itself acknowledged that an elliptical curve in the area of its major axis and conjugate axis could be approximated by a circle having a definite radius. In view of the usual dimensions of cutting inserts extending only along a small distance of the elliptical curve in the region of the conjugate axis, no contradiction can be seen in applying the formula for the radius of the approximation circle in that region.

5. *Novelty*

5.1 The subject-matter of claims 1 and 2 differs from the rotary end mill cutter disclosed in D1 in that the cutting rake surface of its cutting inserts is continuously curved in the direction of the cutting edge and that the relief flank surface and the rake surface are maintained at a substantially constant angle  $\delta$  along the cutting edge, whereas the respective front face of the cutting insert according to D1 is

plane. Thus keeping the angle  $\delta$  constant along the cutting edge between the relief flank surface and the rake surface is not possible.

5.2 D3 discloses a cutting insert for a rotary end mill, the cutting edge of which is formed in a helical curve. Unlike this helical curve, the curvature of the corresponding cutting edge according to claims 1 and 2 is of elliptical form. That there is a distinct angle between the relief flank surface and the rake surface along the cutting edge, can be derived from D3, but that document does not explicitly disclose keeping that angle substantially constant along the cutting edge.

5.3 All further documents cited in opposition and not raised again in the appeal proceedings deal with cutting inserts for milling cutters with helical cutting edges.

Since the lack of novelty of the amended claims was also no longer contested by the Appellant, the Board concludes that the subject matter of claims 1 and 2 meets the requirement of novelty (Article 54(1) EPC).

## 6. *Inventive step*

6.1 The closest prior art is represented by D1, which discloses a milling cutter with the precharacterising features of claims 1 and 2. A cutting insert for a rotary end mill cutter is shown having a cylindrical holder 10, 12 and two replaceable, peripherally disposed cutting inserts 20 disposed on the holder so as to present an axial rake angle (column 2, lines 15 to 23; Fig. 1). A cutting edge 24 is defined between a

rake surface 21 and a relief flank surface 26. Since the insert disclosed in D1 is rectangular its front face constituting the rake surface lies in a plane which, intersected with a cylinder, results in an ellipsoid (column 2, line 26; Fig. 4, 5). In accordance with column 2, lines 35 to 39 "the cutting edge 24 has a definite radius and does not need to be cut as a true spiral (i.e. helice). If the radius is properly adjusted to the diameter of the mill it will provide an extremely straight wall in a slot as shown by dotted lines in Fig. 6". Nothing else can be derived from these statements than that the intention is to arrive at a straight wall slot, which is only possible if the outer cutting surface of the mill is cylindrical. The further statements, according to which the cutting edge of the cutting insert according to D1 is ground with a helical motion (column 2, lines 47 to 50), do not lead to a different conclusion because mathematically the material left on the cutting edge 24, both lying on a cylindrical surface and in the upper plain of the insert, can only be an ellipsoid. In this respect the argument submitted by the Respondent, according to which the wording "extremely straight" pointed to a non-perfect straight wall, is not considered convincing. In the Board's opinion, D1 clearly suggests having a fully cylindrical end mill cutter cutting periphery, which together with the flat upper surface of the insert must lead to an ellipsoidal cutting edge.

6.2 Starting from this known milling cutter, the problem underlying the patent is to provide a new and improved peripheral rotary milling cutter having at least one cutting insert with a suitably curved cutting edge capable of producing a substantially smooth milled

surface and wherein the disadvantages of the prior art are substantially reduced or overcome. In particular, the aim is to achieve optimum cutting performance and tool life, to reduce the cutting forces and to achieve a smooth milled surface.

- 6.3 These problems are solved by a peripheral rotary milling cutter having a cylindrical holder and a plurality of replaceable, peripherally disposed cutting inserts with the features of claim 1 or claim 2. In particular, when the cutting angle is kept constant, the cutting forces remain balanced over the whole length of the cutting edge, leading to an optimal cutting performance.
- 6.4 The cutting edge of the cutting insert having a plane rake surface used in the prior art milling cutter according to D1 is ground with a helical motion. This kind of grinding of the relief flank helps to optimise the relief angle. However, since the upper side of the insert is flat, the tool rake angle is invariant along the length of the cutting edge and, owing to the axial rake angle, does not provide an optimum cutting geometry, also in respect of the chip flow. The skilled person recognising this disadvantage of the known insert would therefore try to optimise the cutting geometry in order to reduce the cutting forces and to yield a smooth milled surface.
- 6.5 It is in itself known from the milling cutter disclosed in D3 that the wedge angle can be kept constant over the length of the cutting edge, leading to a varying rake angle which helps to improve the chip flow. However, since the constant wedge angle is only

disclosed in combination with a helical cutting edge, there is no reason to deviate from this particular combination, particularly since D1 also emphasises the helical grinding motion. So the skilled person is led to adopt the solution in D3 with all its features, there being no reason for a different combination.

6.6 In addition, having regard to the period between the publication of D1 in 1971 and of D3 in 1987, in which newly developed cutting inserts went on using helical cutting edges, the skilled person would be prevented, for this reason too, from trying to combine the teachings of D3 with those of D1. Thus the solutions according to claim 1 and claim 2, in particular the elliptically curved cutting edge in combination with the continuously curved cutting rake surface in the direction of the cutting edge and the maintenance of a substantially constant angle  $\delta$  along the cutting edge between relief flank surface and rake surface, are non-obvious when compared with the prior art cutting inserts for rotary milling cutters.

Regarding the Appellant's argument whereby practically no difference existed between a helical and an elliptical cutting edge, it is the Board's view that without clear evidence this mere allegation cannot be considered convincing.

6.7 The cutting plates disclosed in the other cited documents not referred to during the appeal proceedings do not come closer to the claimed subject-matter than the prior art discussed above and therefore in no way suggest the claimed subject-matter either. Consequently

the cutting plate according to claim 1 involves an inventive step (Article 56 EPC).

6.8 In view of the above findings the Board comes to the conclusion that the proposed solution of the technical problem underlying the patent in suit as defined in independent claims 1 and 2 is novel and inventive, and that these claims as well as their dependent claims 3 to 6 relating to particular embodiments of the invention comply with the criteria for patentability (Article 52(1) EPC).

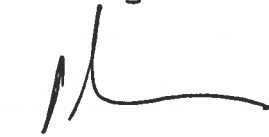
**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to maintain the patent on the basis of the following documents:

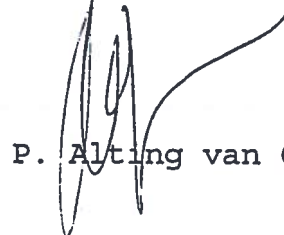
claims 1 to 6 of the main request filed during the oral proceedings  
 pages 2, 4, 5, 6 of the description as granted together with page 3 as filed during the oral proceedings  
 and figures 1 to 17 as granted.

The Registrar:

  
 P. Cremona  
 0744.D



The Chairman:

  
 P. Alting van Geusau

7BTD .