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D E C I S I O N
of 20 September 1995

Case Number: T 0088/93 - 3.2.2

Application Number: 85850319.6

Publication Number: 0181844

IPC: B23B 51/04

Language of the proceedings: EN

Title of invention:
Drill and cutting insert therefor

Patentee:
Santrade Ltd.

Opponent:
Widia GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0088/93 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 20 September 1995

Appellant: (Opponent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office dated 8 December 1992 rejecting the opposition filed against European patent No. 0 181 844 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: H. Seidenschwarz
Members: M. Bidet
M. Aúz Castro

Summary of Facts and Submissions

I. On 21 January 1993 the opponent filed an appeal against the decision of the Opposition Division, issued on 8 December 1992 rejecting the opposition to European patent No. 0 181 844 because the subject-matter of the patent in suit involves an inventive step with regard to the prior art disclosed by the documents cited during the opposition proceedings, more particularly by the documents EP-A-0-088-505 (D1) and DE-A-2 502 183 (D2). The appeal fee was also paid on 21 January 1993 and the statement setting out the grounds of appeal was received on 30 March 1993.

II. Claim 1 of the patent as granted reads as follows:

"Cutting insert for a drill comprising an upper and a lower face (22,23) which are mainly parallel, and four side surfaces (24,25) joining them, said lower face (23) is smaller than the upper face (22) such that the cutting insert (21) achieves a positive cutting geometry, cutting edges (26,27) formed at parts of the lines of intersection between two of the side surfaces and the upper face (22), said cutting insert is provided with a central securing hole (28'), said two side surfaces (24) are broken in the middle so that each cutting edge forms an internal obtuse angle (δ) at the break, characterised in that the insert seen in top view has a generally rectangular shape, where said two side surfaces form short side surfaces (24) and the two other side surfaces form long side surfaces, and includes two regular triangles (32,33) with convexly broken sides, where two of the corners of each said triangle (32,33) and one side of each said triangle (32,33) coincide with a cutting edge (26,27) of the cutting insert (21) and parts of the other sides of the triangles coincide with

the long side surfaces a certain distance to form minor cutting edges, so that both of the third corners (32',33') of the triangles (32,33) arranged within the cutting insert overlap each other by a distance (d) which is 0.5 to 0.7 times the length (L) of the cutting insert between the break points of the cutting edges (26;27) and in that in the plane of the upper face (22) the shortest distance (w2) between said long side surfaces (25) of the cutting insert is shorter than the distance (w1) between the ends (26',27') of respective cutting edge (26,27)."

III. Oral proceedings were held on 20 September 1995 in which the parties referred to the following documents in addition to the documents D1 and D2 mentioned above:

DIN 4987, pages 1 to 5, March 1981 (D6),
DE-A-2 539 855 (D11)
US-A-4 360 297 (D15)

IV. In its statement of grounds of appeal and in the oral proceedings the Appellant (Opponent) argued as follows:

Figure 6 of Document D1 disclosed a cutting insert for a drill which achieved a positive cutting geometry and comprising upper and lower faces, side surfaces, cutting edges having obtuse angle and a central securing hole as defined in the pre-characteristic portion of Claim 1.

If the known cutting insert lacked strength because the cross-section of the portion located between the central securing hole and the effective cutting edge portion was too small due to the trigonal shape of this cutting insert, there was only one way left to the skilled person for removing this drawback, namely to increase the distance between the central securing hole and the effective cutting edge. Since this, however,

resulted in reducing the strength of the portions located between said hole and the other cutting edges, the only possibility for raising the strength was to move the central securing hole further away from the cutting edges in an elongate portion opposite to one of the pairs of the cutting edges. Having regard to economic reasons, the skilled person arrived logically at two parallel long side surfaces and a minor image-like design of effective cutting edges including minor cutting edges to re-establish the indexing ability of the cutting insert, i.e. he had only to duplicate the "trigon-insert" known from Figure 6 of document D1 by means of a shaft being smaller than the overall width of this cutting insert.

This shape of cutting insert was also obvious in the light of the basic shapes of cutting inserts disclosed by document D6 in combination with the cutting inserts having an elongated shape with effective cutting edges on their ends according to the documents D2, D11 and D15.

For avoiding any waste of material and for stabilising such a cutting insert, the length of the parallel long side surfaces should not be too long or too short. The so-called "dog bone" shape of the cutting insert was the inevitable consequence if the skilled person had to improve the strength of cutting inserts used for drilling holes of small diameters.

The alternative solution - improving the quality of the material of the cutting insert, omitting completely the central securing hole and increasing the thickness of the cutting insert - would not have been considered by the skilled person, since it was clear that the optimal material was always used and the use of clamping members

and thicker cutting inserts was excluded due to lack of space in the holes of small diameter to be drilled by these cutting inserts.

The combination of the teaching of document D1 with that of document D2 or document D15, would have led the skilled person to the cutting insert according to Claim 1.

V. The Respondent (Patentee) argued as follows:

Document D1 with the embodiment according to Figure 6 disclosed the cutting insert according to the pre-characterising portion of Claim 1. This so-called "trigon-insert" was not used hitherto for drilling holes of small diameters. There was no document in the state of the art disclosing the geometrical relationship between the length of the cutting insert and the width of the rectangular form of the cutting insert. As to the logical changes to the insert according to Figure 6 of document D1 as submitted by the Appellant, other solutions could have been possible to the skilled person. More generally the dog-bone shape of the cutting insert with the parameters as specified in Claim 1 did not result in an obvious manner from the state of the art as disclosed by the cited documents.

VI. The Appellant (Opponent) requested that the decision under appeal be set aside and that the European patent No. 0 181 844 be revoked.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Prior art*

2.1 Document D1 discloses according to the embodiment of Figure 6 a cutting insert for a drill comprising upper and lower faces which are mainly parallel and side surfaces joining them. The lower face is smaller than the upper face so that the cutting insert - provided with a central securing hole - achieves a positive cutting geometry. Cutting edges are formed at parts of the lines of intersection between the side surfaces and the upper face. The side surfaces are broken in the middle so that each cutting edge forms an internal obtuse angle (δ) at the break. Seen in the top view, the insert includes a regular triangle with convexly broken sides.

It is an object of the known cutting insert to provide an insert with **greater strength at its corner** - when the corner extends beyond the diameter of the shank - with respect to the prior art drills fitted with hexagonal or trigonal inserts, because in a **trigonal insert** the insert located at the outside part of the shaft of the drill presents an acute angle at the outer cutting point which can be easily damaged during rotation (see page 1, lines 28 to 31, page 4, line 30 to page 5, line 4.)

The cutting insert according to Claim 1 of the patent in suit differs from the embodiment of Figure 6 in that:

(a) the insert seen in top view has four side surfaces and a generally rectangular shape, where two side surfaces form short side surfaces and the two other

side surfaces form long side surfaces, and includes two regular triangles with convexly broken sides, whereby also two of the corners of the second triangle and one side of said second triangle coincide with a second cutting edge of the cutting insert and whereby parts of the other sides of the second triangle coincide with the long side surfaces a certain distance to form minor cutting edges,

(b) both of the third corners of the triangles arranged within the cutting insert overlap each other by a distance (d) which is 0.5 to 0.7 times the length (L) of the cutting insert between the break points of the cutting edges, and

(c) in the plane of the upper face the shortest distance (w2) between said long side surfaces of the cutting insert is shorter than the distance (w1) between the ends of respective cutting edge.

2.2 Document D2 relates to a drill to be used in a deep hole drill receiving a cutting insert achieving a positive cutting geometry comprising upper and lower faces, four side surfaces, cutting edges formed at parts of the line of the intersection between two of the side surfaces and the upper face. The two side surfaces are broken in the middle so that each cutting edge forms an internal obtuse angle (δ) at the break. The insert seen in top view has a generally rectangular shape wherein the two said side surfaces form the short sides of the rectangular shape and the two other side surfaces - not having a cutting edge - defining the long sides of the rectangular shape. A clamp claw holds the cutting insert in its site on the drill shank.

It is an object of the teaching of document D2 to provide a drill for machining precise diameters in an economical manner in comparison to the cutting inserts which needed changes of the head of the drill or new sharpening of the cutting insert.

However, the known cutting insert is not provided with a central securing hole. Furthermore, it does not have two regular triangles with convexly broken sides including minor cutting edges formed by the third corners of the regular triangles in combination with the long sides of the rectangular shape. From this it also results that no parameters concerning the ratio between the distance of the third corners and the length of the cutting insert between the break points of the cutting edges, and the ratio between the distance of the long side surfaces and the ends of the cutting edges are disclosed in document D2.

2.3 Document D6 relates to the standard shapes of cutting inserts for all general machining operations with cutting tools. No details regarding to the geometry of the cutting edges and side surfaces and to the parameters as specified in Claim 1 of the patent in suit are shown.

2.4 Document D11 deals with a drill having an indexable cutting insert which extends along the whole diameter of a bore. It is attached to the drill shank by means of a central securing hole, a slot in the drill shank and a screw. The cutting insert has on each of its longitudinal side surfaces one pair of cutting edges which face in opposite directions in such a manner that an obtuse angle "b" is obtained between the cutting edge defined by the intersection of one face (e.g. lower face) with the side face and the other cutting edge

defined by the intersection of the other face (e.g. upper face) with this side face (see column 7, lines 18 to 23, column 8, lines 34 to 50, Figures 5 and 6).

2.5 Document D15 discloses an indexable cutting insert having end wall regions, parallel side surfaces and parallel lower and upper faces perpendicular to said side surfaces. A central notch is formed on the top face and bottom face to receive the nose of a clamp member. Each cutting edge forms an internal acute angle at the break. This type of cutting insert is used for threading operations.

3. *Novelty*

It results from the above that there is no documents disclosing in combination all the features specified in Claim 1 of the patent as granted, which has not been contested by the Appellant.

The subject matter of Claim 1 is therefore considered to be new within the meaning of Article 54(2) EPC.

4. *Nearest prior art*

From the above points 2.1 to 2.5, it follows that the embodiment according to Figure 6 represents the state of the art nearest to the invention.

5. *Inventive step*

5.1 According to the description of the patent in suit (see column 2, lines 15 to 19), it is an object of the invention to provide an insert so designed that improved strength of the insert can be achieved particularly at smaller drill diameters.

5.2 According to the characterising portion of Claim 1, this object is achieved by the features a, b and c, cited in point 2.1 above, defining a kind of "dog bone" shape with laterally cutting corners, minor cutting edges extending along the long side surfaces of said "dog bone" and a particular range for the length over width ratio defined by the overlap of inscribed triangles.

With the generally rectangular shape of the cutting insert, the distance between the central securing hole and the cutting edges is greater than between the central securing hole and any of the cutting edges of the so-called trigone insert according to Figure 6 of document D1. It is therefore possible to increase the cross-section of the portions located between the central securing hole and the cutting edges which results in a higher strength of the cutting insert.

The geometrical feature, namely the particular range for the length over the width of the cutting insert, defines the limits of the length for a given width to insure that the side surfaces are long enough to allow for securing the cutting insert on the drill shank, but not too long, which otherwise may create flexion of the protruding part of the cutting insert or may require longer sites for its insertion in the drill shaft.

5.3 In response to the problem of unbalanced forces applied on the cutting edges of cutting inserts having a trigonal or octagonal shape and being secured at different distances from the axis of rotation of the drill shank, document D1 teaches that these cutting inserts are provided with corners of equal obtuse angles and with cutting edges joining in an obtuse angle in combination with two different widths of chip removal

elements spaces rearwardly from each of said cutting edges (see page 1, lines 14 to 17 and 25 to 31, page 2, lines 1 to 19, Claims 1, 6 and 7; Figures 4 and 6)

Since this document does not contain further indications to other geometrical shapes of the cutting insert as mentioned above and to any parameters as defined in Claim 1 of the patent in suit, it cannot therefore give any hint for developing the known cutting insert in the way as specified in said Claim 1.

5.4 The allegation of the Appellant, that the "one-way street" starting from the embodiment according to Figure 6 of document D1 is common knowledge of the person skilled in the art, if he wants to improve the strength of such cutting insert, is based on an ex-post facto analysis of the invention. First, document D1 discloses in the embodiment of Figure 4 a solution to the same problem which does not specify a "dog-bone" shape of the cutting insert, but an octagonal shape of the cutting insert having cutting edges on all sides. Secondly, the formation of a cutting insert according to present Claim 1 by duplication of the known "trigon-insert" with the help of a shaft would imply several steps which are not suggested in document D1; namely the steps of:

- increasing the distance in each "trigon-insert" between a pair of cutting edges and the central securing hole;

- moving both "trigon-inserts" in such a manner that the resulting cutting insert includes two triangles so that one side of each said triangle coincides with a cutting edge and the corners of the triangles opposite to the cutting edges arranged within the cutting insert overlap each other by a

distance which is in relation to the length of the cutting insert between the break points of the cutting edges;

- determining the range of the overlap so that only one of the two central securing holes is left;

- removing a part of the other two pairs of cutting edges of each "trigon-insert" in such a manner that they form the long side surfaces of a rectangular shape cutting insert;

- forming minor cutting edges at the ends of the opposite cutting edges and the long side surfaces, and

- defining the width of the distance between the long side surfaces in relation to the distance between the ends of the cutting edges.

5.5 Also document D6 cannot give any hint to the skilled person how to proceed for developing the cutting insert according to Figure 6 of document D1 in the direction of the claimed cutting insert, since document D6 concerns only different standard shapes of cutting inserts which do not include the shape of a cutting insert as specified in Claim 1 of the patent in suit.

5.6 Document D2 teaches the adjustment of a rectangular cutting insert in the only site at the cutting end of the drill by means of a clamp claw which permits a simple replacement of a used cutting insert by a new one thus maintaining a precise diameter of the hole to be drilled during the whole drilling operation (see page 2, second full paragraph to page 3, first full paragraph). Since the application of a securing hole instead of a clamp claw would not contribute to the solution of the

aforementioned problem which is of a different nature than that of the patent in suit (see point 4.1), document D2 cannot give any hint to alter a cutting insert having a "trigonal" shape with a central securing hole according to Figure 6 of document D1 to a "dog-bone" shape as claimed in the patent in suit.

5.7 Since document D11 does not teach one cutting edge being broken to form an obtuse angle (see also point 2.4), it cannot stimulate the skilled person to consider this document for modifying a "trigon-insert" as disclosed by Figure 6 of document D1 and to modify this known insert in such a way that it fulfils the requirements of Claim 1 of the patent as granted.

5.8 From the description of document D15 (see column 2, lines 10 to 22) and of Claim 1 it follows that, first, the acute angle formed between the cutting edges and secondly, the clamping notch for clamping the disclosed insert in the site of the drill shank are requirements for this kind of insert to be used for threading operations. The skilled person therefore, would not consider document D15 to obtain any idea for solving the problem underlying the subject-matter of Claim 1 by the features as specified in this claim.

5.9 Furthermore, the teachings of the other documents cited during the proceedings could not, either alone or in combination with the teachings of the documents discussed in the foregoing paragraphs, lead the skilled person to a cutting insert according to Claim 1 of the patent in suit, which cutting insert has a kind of a "dog-bone" shape with laterally projecting cutting corners, minor cutting extending along the longitudinal edges of said "dog bone" and a particular range for the length over width ratio defined by the overlap of inscribed triangles.

5.10 Consequently, it was not obvious to arrive at the claimed insert in view of the prior art. Therefore the subject-matter of Claim 1 involves an inventive step as required by Article 52(1) and 56 EPC.

6. Claim 1 being allowable, the same applies to dependent Claims 2 to 6 which are directed to preferred embodiments falling within the scope of Claim 1 and whose inventiveness is supported thereby.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

S. Fabiani

The Chairman:

H. Seidenschwarz