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**Datasheet for the decision
of 3 December 2009**

Case Number: T 0306/08 - 3.2.07

Application Number: 02006785.6

Publication Number: 1245333

IPC: B24B 1/00

Language of the proceedings: EN

Title of invention:

Grinding method and numerically controlled grinding machine

Patentee:

TOYODA KOKI KABUSHIKI KAISHA

Opponent:

REFORM Maschinenfabrik Adolf Rabenseifner GmbH & Co.KG

Headword:

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Relevant legal provisions:

EPC Art. 56

Relevant legal provisions (EPC 1973):

-

Keyword:

"Inventive step (no - all requests)"

"Problem solved independently by different features"

"Method of claim 1 - based on deliberate choice enabled in an obvious manner (see point 4.7)"

Decisions cited:

-

Catchword:

-



Case Number: T 0306/08 - 3.2.07

DECISION
of the Technical Board of Appeal 3.2.07
of 3 December 2009

Appellant: REFORM Maschinenfabrik
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 29 November 2007
rejecting the opposition filed against European
patent No. 1245333 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: H. Meinders
Members: H.-P. Felgenhauer
E. Dufrasne

Summary of Facts and Submissions

I. This appeal is against the decision of the opposition division rejecting the opposition against European patent No. 1 245 333.

II. Oral proceedings before the Board were held on 3 December 2009.

The appellant (opponent) requested that the decision under appeal be set aside and the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed or, in the alternative, that the decision under appeal be set aside and that the patent be maintained on the basis of one of the auxiliary requests 1, 4 and 5, filed with letter dated 2 November 2009.

Auxiliary requests 2 and 3 filed with the same letter, were withdrawn during the oral proceedings.

III. Claim 1 according to the **main request** (claim 1 as granted) reads as follows (with reference letters for the individual features added by the Board, for convenience of use in the reasons for the decision):

(a) A method for grinding a circular or non-circular workpiece (W) being eccentric from its rotational axis in a plurality of grinding steps, the method comprising:

- (b) causing a grinding wheel (G) to effect profile generation movement in synchronism with rotation of the workpiece (W) and in accordance with profile data derived from the target shape of the workpiece (W);
- (c) advancing, in each grinding step, the grinding wheel (G) in such a manner that the grinding wheel (G) causes cut-in movement within a predetermined cut-in angle defined on the workpiece (W); and
- (d) retracting, after completion of a final finish grinding step, the grinding wheel (G) over a predetermined back-off angle defined on the workpiece (W),

characterised in that

- (e) the retraction being effected in accordance with composite data obtained through combining the profile data and back-off data,
- (f) the back-off angle being greater than the cut-in angle employed during the final finish grinding step
- (g) whereby spark-out grinding is eliminated.

Claim 1 according to **auxiliary request 1** differs from claim 1 according to the main request in that feature (f) has been replaced by the feature of claim 2 as granted

(h) the cut-in angle employed during the final finish grinding step being not greater than one third of the back-off angle.

Claim 1 according to **auxiliary request 4** differs from claim 1 according to the main request by the additional feature

(i) the cut-in feed and the final finish grinding step as well as the back-off step are performed within 450 degrees.

Claim 1 according to **auxiliary request 5** differs from claim 1 according to the main request by the addition of features (h) and (i) as cited above.

IV. The following prior art, referred to already in the opposition proceedings, is considered in the present decision

D1 JP-A-63-084863

D2 US-A-4 848 038.

V. According to the impugned decision the subject-matter of claim 1 as granted (corresponding to the present main request) is novel with respect to D1 and involves an inventive step considering D1 as closest prior art in combination with D2. According to the impugned decision this applies likewise in the event that, corresponding to an argument of the opponent, D2 is considered as closest prior art.

VI. The facts, evidence and arguments essentially relied upon by the appellant can, as far as they are relevant to the present decision, be summarised as follows:

The feature of claim 1 according to all requests defining that spark-out grinding is eliminated is in no relation with the remaining features of these claims. Since it is the result of a deliberate choice whether or not spark-out grinding is performed this feature cannot be considered in the evaluation of novelty and inventive step.

Since as compared to the method according to D1 the feature defining that spark-out grinding is eliminated would be the only distinguishing feature, the method of claim 1 according to the main request cannot be considered as being novel with respect to D1.

The feature according to which retraction is effected in accordance with composite data obtained through combining the profile data and back-off data as comprised in claims 1 of all requests needs, in the end, to be seen as being equal to the approach as disclosed in D2, according to which prior to retraction machining is performed based on profile data while thereafter retraction is performed based on back-off data. This feature thus cannot distinguish the subject-matter of claim 1 according to the main request from the method according to D2. Since furthermore for the method according to D2 no spark-out grinding step as such is necessary and therefore not disclosed, the method of claim 1 lacks novelty as compared to D2.

The method according to claim 1 of the main request moreover does not involve an inventive step with respect to D2.

Since it depends on deliberate choices based on a trade-off between on the one hand the quality of a machined workpiece, which depends on the weight of the profile data and back-off data within the composite data influencing the volume of an otherwise unground portion remaining on a machined workpiece, and on the other hand the machining time required for grinding, which is shorter the larger the remaining volume is, it is obvious that, in case quality requirements permit a lower quality, the machining time for the method of D2 can be shortened simply by appropriately combining the profile data and back-off data.

For the same reason it is obvious to eliminate spark-out grinding in case quality requirements permit it to save the time otherwise necessary for the spark-out grinding step.

Since it is furthermore obvious to incorporate these two measures, namely appropriate combination of profile data and back-off data and elimination of spark-out grinding, into the method of D2, without essential modifications of the known method being required, the method according to claim 1 of the main request does not involve an inventive step, starting from the one disclosed in D2.

Consequently, since the method of claim 1 already does not involve an inventive step, starting from D2 as closest prior art and attempting to shorten the

machining time, further effects which can, as alleged by the respondent, be obtained by the method according to claim 1 need not be considered in the evaluation of inventive step.

Since the claims 1 according to auxiliary requests 1, 4 and 5 differ from claim 1 of the main request only in that features relating to the size of the back-off angle i.a. as compared to the cut-in angle, are further limited without any particular effects associated with these further limitations, the methods defined therein are obvious in view of the method disclosed in D2 for the same reasons as apply with respect to claim 1 according to the main request.

VII. The facts, evidence and arguments essentially relied upon by the respondent can, as far as they are relevant to the present decision, be summarised as follows:

The method according to claim 1 of the main request is novel with respect to D1 or D2.

This claim 1 clearly defines a method in which, after completion of a final finish grinding step, the retraction of the grinding wheel is effected in a particular manner, namely in accordance with composite data obtained through combining the profile data and back-off data.

Consequently, depending on quality requirements, the volume of an unground portion remaining after completion of the final finish grinding step can be reduced to a volume which is tolerable. This has the result that, depending on the size of the tolerable

remaining unground volume, the machining time can be shortened.

Since the volume of the unground portion can be kept small, the method according to claim 1 allows further shortening of the machining time in that spark-out grinding can be dispensed with.

The above mentioned features distinguish the method of claim 1 from the ones according to D1 or D2.

The method of claim 1 also involves an inventive step considering D2 as closest prior art, since this document does not give any indication to the method step of effecting retraction in accordance with composite data obtained through combining profile data and back-off data.

In this connection, besides shortening of the machining time, further effects obtained by the method according to claim 1 need to be considered, namely that a depression being otherwise formed on a workpiece upon completion of finish grinding is avoided and that spark-out grinding is eliminated.

Furthermore D2 fails to give any indication concerning further shortening of the machining time by the elimination of spark-out grinding.

Claims 1 according to auxiliary requests 1, 4 and 5 are further limited with respect to the size of the back-off angle, i.a. as compared to the cut-in angle employed during the final finish grinding step, making

it even more unlikely that the methods of these claims can be considered as being obvious in view of D2.

VIII. In the annex to the summons to oral proceedings dated 28 August 2009 the Board gave its preliminary opinion.

Reasons for the decision

1. Subject-matter of claim 1 (main request)

Claim 1 comprises features (a) - (c) concerning the grinding of a workpiece (cf. section III. above). It further comprises features (d) - (f) defining retraction of the grinding wheel and finally it comprises feature (g) according to which spark-out grinding is eliminated.

1.1 It is common ground that due to the rotation of the workpiece during grinding as defined by feature (b) cut-in movement within a predetermined cut-in angle as defined on the workpiece according to feature (c) leads, after completion of the final finish grinding step as referred to in feature (d), i.e. after one revolution of the workpiece starting with or, in other words, including, the cut-in movement of the grinding wheel, to a **"volume of an unground portion left after completion of the final finish grinding"** (cf. patent in suit, page 3, lines 47 - 49; page 6, lines 13, 14; figure 6: small volume of an unground portion "a").

1.2 It is also common ground that in the method of claim 1 **the unground portion** referred to above is further ground after completion of the final finish grinding

step according to feature (d), while the grinding wheel is, simultaneously, being retracted as defined by **feature (e)**, due to the fact that the retraction according to this feature is effected in accordance with **composite data** obtained through combining the **profile data** and **back-off** data.

Consequently according to feature (e)

- the unground portion is ground to some extent, due to profile data comprised within the composite data and, simultaneously,
- the grinding wheel is retracted from the workpiece due to back-off data comprised within the composite data

still leaving some **volume of the unground portion** on the finished workpiece.

1.2.1 According to the respondent this combination of profile data and back-off data as defined in feature (e) leads, in combination with the definition of the back-off angle in relation to the cut-in angle as defined by feature (f), in the method according to claim 1 to a **first effect** of reducing the machining time, since the hitherto remaining unground portion is ground while, simultaneously, the grinding wheel is being retracted. According to the respondent the machining according to features (e) and (f) within the combination of features of claim 1 will be such that the remaining volume of the unground portion is, depending on quality requirements, tolerable.

1.2.2 According to the respondent the combination of profile data and back-off data as defined in feature (e) has, in combination with the definition of the back-off angle in relation to the cut-in angle as defined by feature (f), a second and a third further effects.

According to the **second effect** a depression being otherwise formed on a workpiece upon completion of grinding is avoided (cf. patent in suit, paragraphs [0011] and [0012]) and according to the **third effect** spark-out grinding is eliminated (cf. paragraphs [0012] and [0015]), as defined by feature (g).

1.2.3 According to the appellant the manner in which profile data and back-off data are combined, and consequently the relative weight of profile data and the back-off data within the composite data as defined by feature (e), is not further defined in claim 1.

Thus it is only certain that features (e) and (f) lead, within the method according to claim 1, to the first effect being achieved, namely that the machining time is reduced. This reduction of the machining time, however, is achieved at the expense of the quality of the finished workpiece.

The second and the third effect referred to by the respondent would at least depend on the nature of the composite data (i.e. the variation of the profile data and likewise of the back-off data along the back-off angle and, resulting therefrom, the weight of the profile data and the back-off data within the composite data), if not additionally on further parameters, like the shape of the workpiece and the grinding depth at

the final finish grinding step, which remain undefined. Thus the composite data defined only in general terms by feature (e) cannot be considered as causing the second and third effect, since this would at least require further definition of the composite data in the claim.

1.2.4 Concerning the effect(s) resulting from features (e) and (f) the Board shares, with both parties, the opinion that these features cause, in the method according to claim 1, the first effect of shortening the machining time at the expense of the quality of the workpiece ground. In the view of the Board the relationship between shortening the machining time and a decrease of quality of the workpiece can be derived, as argued by the appellant, from the content of the composite data, namely the relative weights of the profile data and of the back-off data constituting the composite data: the more weight the profile data and the less weight consequently the back-off data have, the better the quality of a finished workpiece and the longer the time for grinding and vice versa.

Since, as can be derived from the following, the method according to claim 1 (all requests) cannot be considered as involving an inventive step considering the technical problem based on the first effect as indicated above, it need not be further established whether, and in case it applies, to what extent, the second and third effects are likewise caused by the method as defined by claim 1.

1.3 Concerning **feature (g)** it is common ground that the term "spark-out grinding" referred to therein defines, irrespective of its duration or circumferential length, a final grinding step comprising, contrary e.g. to the prior grinding steps according to features (b) and (c), no advancement of the grinding wheel.

1.3.1 With respect to the question of whether the elimination of spark-out grinding as defined by feature (g) is caused by the remaining features (a) - (f) of claim 1, the Board is, contrary to the opinion of the respondent, not convinced that such a causal relationship is clearly defined by the combination of features of the method defined by claim 1 (all requests). The reason is that from the combination of features (d) - (f), as referred to in this connection by the respondent, it can only be derived that due to these features in the method as defined by claim 1 the volume of the unground portion remaining after grinding can be reduced such that it can be tolerable depending on circumstances, i.e. the quality requirements to be met by a workpiece.

Thus the composite data referred to in feature (e) can, as indicated above (cf. point 1.2.4), be considered as having an impact on the quality of a workpiece, this impact, however, being confined to that section of the circumference which is covered by these composite data. Beyond the section for which the retraction according to feature (e) takes place, the composite data cannot be considered as contributing to the quality of the workpiece.

1.3.2 Concerning the elimination of spark-out grinding as defined by feature (g) the Board consequently is of the opinion that it has not been convincingly shown that, as a further effect, the combination of features (a) - (f) also leads to spark-out grinding being made obsolete.

1.3.3 The Board thus considers the argument of the appellant convincing, according to which feature (g) has to be considered as an additional feature which, separate from the combination of features (a) - (f) and unrelated to these features, defines that the method of grinding according to claim 1 is chosen to be such that no spark-out grinding is performed. This choice is dependent on circumstances like, as in the case of a tolerable remaining unground portion (cf. point 1.2.2), the quality requirements to be met by a workpiece ground according to the method of claim 1.

For completeness' sake the Board wishes to point out that this understanding of feature (g), namely that it is to be seen as a feature which is in no inherent cause/effect relationship with the remaining features of claim 1, is also in line with the wording used for this feature. The expression "whereby", providing the connection of this feature with the preceding features of the claim, can just as well be seen as an indication that this feature relates to an additional aspect of the method as defined by the preceding features, as was also argued by the respondent at the oral proceedings.

2. *Disclosure of document D2*

2.1 It is undisputed that D2 discloses a method for grinding a circular or non-circular workpiece being eccentric from its rotational axis in a plurality of grinding steps according to features (a) - (c), as can be derived e.g. from column 3, lines 10 - 34 and figure 1. It is further undisputed that, as it is the case for the method according to claim 1 of the patent in suit (cf. point 1.2 above), after completion of the final finish grinding step within one revolution of the workpiece, an unground portion remains due to the fact that the workpiece rotates during cut-in of the grinding wheel over a predetermined cut-in angle at the beginning of the final finish grinding step.

2.2 The parties have been of different opinion concerning the disclosure of D2 with respect to the manner in which the unground portion existing after completion of final finish grinding step is machined and the manner in which the grinding wheel is retracted (cf. features (d) - (f) of claim 1) and, furthermore, whether the method of grinding according to D2 encompasses a spark-out grinding step (cf. feature (g) of claim 1).

2.2.1 According to the appellant D2 discloses that after completion of a final finish grinding step and before the grinding wheel is retracted over a predetermined back-off angle defined on the workpiece, a grinding step is performed to grind the unground portion which exists after the final finish grinding step. This grinding step, which in D2 is referred to as a spark-out grinding, serves only to entirely remove the otherwise remaining unground portion and it is

performed, without any advancement of the grinding wheel into the workpiece, over the circumferential length of the unground portion. Thus no spark-out grinding, as meant in feature (g) of claim 1, is performed in the method according to D2.

2.2.2 According to the respondent D2 discloses that, in order to remove the unground portion, a spark-out grinding step is performed as explicitly stated in this document. Furthermore D2 remains silent with respect to the manner in which, after completion of the spark-out grinding, the grinding wheel is retracted.

2.2.3 The Board is of the opinion that in the method of D2, although the term spark-out grinding is employed in this context, it is in fact a grinding step (column 3, lines 34 - 47) in which the otherwise unground portion is completely removed. The only feature in common with spark-out grinding is the fact that it is performed without further advancement of the grinding wheel into the workpiece.

This is how the Board understands the explanation of D2 stating "Since the cut-in feed is executed within a narrow area, the non-ground portion of the workpiece after the above-mentioned grinding, which is proportional to the area A shown in Fig. 1, becomes a small amount. Theoretically, such unground portion can be eliminated by extending the movement of the grinding wheel along the final locus N to the point E which corresponds to the end of the rotational section θ_1 . Practically, the non-ground portion is ground by spark-out grinding after the above mentioned grinding. Since the amount of the non-ground portion is small, the non-

ground portion can be eliminated by very short spark-out grinding" (column 3, lines 34 - 47).

This clearly discloses that, in order to remove the unground portion, grinding without further cut-in advancement of the grinding wheel, and thus along the final locus of the workpiece, is performed. Accordingly with the method of D2 no remaining volume of the unground portion is left on the workpiece after machining.

Concerning the extent of the relative movement of the grinding wheel along the final locus on the workpiece the Board considers that it is limited to the circumferential extent of the unground portion. According to D2 this extent can theoretically be limited to the extent of the unground portion and practically it can be a very short spark-out grinding, the extent of which is not further defined in D2 (cf. also column 7, lines 14 - 16).

It is common ground between the parties and the Board that grinding of the unground portion as indicated above is followed by a, not further defined, retraction of the grinding wheel (cf. e.g. figure 6 comprising a step "RETURN" which can only be associated with a retraction of the grinding wheel).

Consequently the impugned decision does not take account of the complete disclosure of D2 in finding that the method of claim 1 differs from the one according to D2, as compared to the one disclosed in D1, by the further feature defining the presence of a back-off movement (grounds, point 3).

2.3 With respect to a spark-out grinding having, independently of the grinding of the otherwise unground portion, an impact on the quality of the surface of the workpiece extending beyond the unground portion, in the method according to D2 it appears that such a spark-out grinding is neither referred to as being necessary nor that it can be eliminated. In the following it is, in favour of the respondent, assumed that the method of D2 cannot be considered as being such that spark-out grinding is entirely eliminated. This assumption might, as referred to by the respondent, be supported by the description of D2 (column 3, lines 42 - 44).

3. *Novelty*

3.1 The appellant contested novelty with respect to D1 or D2.

Concerning feature (g) of claim 1 it argued with respect to D1 and D2 inter alia that this feature need not be considered in the examination of novelty as feature (g) does not have a technical effect on the method as defined by claim 1. It depends on criteria lying outside the method of claim 1, e.g. quality requirements with respect to a finished workpiece, whether or not spark-out grinding can be eliminated or whether it has to be considered as important in view of the required quality of the surface of the workpiece.

Comparing feature (e) with the method disclosed in D2 according to which at first the unground portion is ground using only profile data which is followed by a retraction using also back-off data, the appellant

expressed the opinion that, depending on the manner in which profile data and back-off data are combined within the composite data referred to in feature (e), this feature cannot be considered as a distinguishing feature.

- 3.2 The Board finds in this respect the reasoning of the respondent, according to which the method as defined by claim 1 is novel with respect to either D1 or D2, more convincing.

In line with this reasoning the Board considers the method defined by claim 1 as being distinguished from the one according to D1 in that, contrary to feature (g), spark-out grinding is performed as can be derived from figure 8 of D1 (grinding between points q_e and q_f extending over one revolution without further advancement of the grinding wheel).

Furthermore the Board considers that the method defined by claim 1 is distinguished from the one according to D2 in that contrary to feature (e) retraction is not effected in accordance with composite data obtained through combining profile data and back-off data. Instead, as outlined above (cf. point 2.2.3), D2 discloses that prior to back-off being initiated, in order to completely remove the otherwise remaining unground portion, grinding without further cut-in advancement of the grinding wheel, and thus along the final locus of the workpiece (i.e. corresponding only to the respective profile data), is performed. Thus, contrary to feature (e), according to D2 two steps are sequentially performed, the first solely based on profile data and the second solely based on back-off

data. Since the manner in which the grinding wheel is retracted is not further defined in D2 the Board considers, as argued by the respondent, feature (f), according to which the back-off angle is greater than the cut-in angle employed during the final finish grinding step, to be a further distinguishing feature.

The Board additionally considers feature (g) as likewise distinguishing the method according to claim 1 from the one disclosed in D2 (cf. point 2.3).

3.3 Since, as can be derived from the following, the method of claim 1 is not considered as involving an inventive step the reasons with respect to novelty need not be further elaborated.

4. *Inventive step*

4.1 Closest prior art

Both parties considered D2 as constituting the closest prior art. The Board has no reason to deviate from this approach.

4.2 Distinguishing features

The Board is, as outlined above (cf. point 3.2), of the opinion that the method according to claim 1 is distinguished from the one disclosed in D2 by features (e) - (g).

4.3 Problem

It is common ground that the first effect according to which the machining time is reduced (cf. point 1.3.2) is an effect which can be derived from distinguishing features (e) and (f).

It is furthermore common ground that feature (g) likewise has the effect of reducing the machining time.

The objective **problem** which can be formulated with respect to this effect can, corresponding to one of the problems referred to in the patent in suit (page 3, lines 33 and 34), be seen in **shortening the machining time**. This problem corresponds to the one considered in the impugned decision (grounds, point 2).

It is undisputed that having regard to distinguishing features (e) and (f) as well as to distinguishing feature (g) in both cases the advantage of shortening of the machining time has to be seen in a correlation with a disadvantage, namely a decrease of quality of the machined workpiece. In the case of features (e) and (f) the decrease of quality comes from the fact that, in order to shorten the machining time, the circumferentially localized unground portion is not entirely removed (cf. point 1.2.4). In the case of feature (g) the decrease of quality comes from the fact that, in order to shorten the machining time, spark-out grinding is eliminated (cf. point 1.3.3) with the result that irregularities dispersed along the entire circumference are not removed.

The **problem** to be solved thus has to be seen in the context of **a trade-off between**, on the one hand, **the shortening of machining time and**, on the other hand, the **quality requirements** for a workpiece which has been ground.

4.4 Solution

The problem referred to above is solved by the method according to claim 1, on the one hand in that retraction is effected as defined by features (e) and (f) in accordance with composite data obtained through combining the profile data and back-off data and on the other hand in that spark-out grinding is eliminated as defined by feature (g).

As indicated above (cf. point 1.3.3) feature (g) is unrelated to features (e) and (f) and contributes separately to the problem being solved.

Features (e) and (f) and feature (g) thus can be considered separately in the evaluation of inventive step.

4.5 Obviousness

Concerning retraction of the grinding wheel according to **features (e) and (f)** it needs to be examined whether, starting from D2 as closest prior art, in an attempt to solve the problem, namely to shorten machining time, the solution in the method of claim 1 according to features (a) - (f) involves an inventive step.

4.5.1 It is common ground that after completion of the final finish grinding step both methods for grinding, namely the one according to claim 1 and the one according to D2, result in the same unground portion remaining on the workpiece (cf. patent in suit, page 3, lines 47 - 49 and D2, column 3, lines 34 - 38).

4.5.2 It is further common ground that in the method of claim 1, due to retraction of the grinding wheel according to features (e) and (f), this unground portion is then removed only partially, since during the grinding of this unground portion the grinding wheel is already backing off from the workpiece, such that a certain volume of the unground portion remains on the workpiece, the size of this volume being entirely dependent on the manner in which, within the composite data referred to in feature (e), profile data and back-off data are combined. In this connection feature (f) provides, in combination with feature (e), for the unground portion being ground during retraction at least to some extent, but does not specify to which extent.

Concerning the manner in which, within the composite data referred to in feature (e), profile data and back-off data are combined, it is undisputed that the more weight is put on the profile data (and consequently the less weight is put on the back-up data), the higher is the quality of the workpiece, by following the required profile more closely, so that the volume of the unground portion remaining on the workpiece is smaller. It is likewise undisputed that this increase in quality is at the expense of more machining time required and vice versa.

4.5.3 Concerning the disclosure of D2 it is undisputed in this respect that the quality of the workpiece is not compromised due to the fact that the unground portion is completely removed with no volume of an unground portion remaining (cf. D2, column 3, lines 34 - 47; point 2.2.3 above). This is due to the fact that, in comparison to feature (e), according to D2 solely profile data are used to remove the unground portion and only thereafter back-off, solely based on back-off data, is initiated.

4.5.4 Examining the question whether the approach of the method according to claim 1 resulting in partial elimination of the unground portion using composite data according to features (e) and (f) involves an inventive step compared to the approach according to D2, the Board is of the opinion that it needs to be considered, as argued by the appellant, that it is a question of circumstances, i.e. quality requirements to be met by a workpiece, whether a small remaining volume of the unground portion can be tolerated or not. This consideration is in line with the statement of the respondent that it depends on circumstances, namely quality requirements, whether the method according to claim 1 can be employed to grind a particular workpiece or not.

Starting from the method according to D2 the Board considers that the method of claim 1 comprising features (e) and (f) is the **result of a deliberate choice** based merely on a quality criterion to be met by a ground workpiece, namely: can a circumferentially localized unground portion be accepted or not.

If the quality requirements are such that less grinding of the volume of the unground portion remaining after finish grinding can be tolerated the **choice** to shorten the machining time at the expense of quality is an **obvious** one for the method according to D2.

Based on such a choice its execution in adapting the method according to D2 is likewise obvious: instead of removing the remaining unground portion completely, but only to a lesser extent, the skilled person will not only follow the profile data as disclosed by D2 but will already have the grinding wheel commence with retraction, based on back-off data. It is merely the result of combining functions which according to D2 are already present in the method it proposes but are performed sequentially. The combination of these known method steps into one single step is a straightforward one, which does not necessitate any essential modification of these or other method steps of the method defined by claim 1 but only a simple reprogramming of the numerical controller.

Consequently the Board is of the opinion that the combination of features (a) - (f) within claim 1 does not involve an inventive step.

- 4.6 Concerning the elimination of the spark-out grinding according to feature (g) it needs likewise to be examined whether, starting from D2 as closest prior art, in an attempt to solve the problem, namely to shorten machining time, the solution of claim 1 including feature (g) involves an inventive step.

As it is the case concerning the combination of features (a) - (f) the Board is of the opinion that the elimination of spark-out grinding according to feature (g) is also the **result of a deliberate choice**, be it one which depends on another quality requirement for the workpieces to be met, namely whether dispersed surface irregularities which are otherwise removed by spark-out grinding can be accepted or not. If the quality requirements permit it, spark-out grinding can be eliminated in order to shorten the machining time. Such a **choice** is an **obvious** one since it is based on normal considerations concerning a trade-off between the quality of machined workpieces on the one hand and a shortening of the machining time on the other hand.

The adaptation of the method according to D2 so as to not involve spark-out grinding does not require inventive skills, since it does not affect the remainder of the method steps of claim 1, but merely involves a simple reprogramming of the numerical controller.

- 4.7 Summarising, the Board concludes that, starting from the method according to document D2 in order to solve the problem, namely to shorten the machining time, the solution according to claim 1 is based on deliberate and obvious choices which follow from considerations concerning a trade-off or balance between the quality obtained for a machined workpiece and the machining time required. Since it furthermore comes within regular design practice to adapt the method according to D2 to enable grinding according to these choices, the method according to claim 1 does not involve an inventive step (Article 56 EPC).

4.8 As indicated above, the method according to claim 1 does not involve an inventive step considering the first effect of features (e) and (f). The second effect as alleged by the respondent (cf. point 1.2.2 above) is a mere "bonus" effect. The third effect is in any case the result of the obvious choice of dispensing of the spark-out grinding.

4.9 Having regard to the impugned decision arriving at a different result concerning inventive step, it needs to be taken into account that apparently the disclosure of D2 has not been considered to its full extent (cf. impugned decision, point 2 and point 2.2.3 above).

5. *Auxiliary requests*

5.1 The method of claim 1 according to **auxiliary request 1**, differs from the one defined by claim 1 according to the main request in that instead of the feature "the back-off angle being greater than the cut-in angle employed during the final finish grinding step" it comprises the feature (h) according to which the cut-in angle employed during the final finish grinding step is not greater than one third of the back-off angle.

The Board is of the opinion that starting from the method according to D2 this feature concerns a mere adaptation of this method with respect to the choice referred to above (section 4.7), which is the result of the mentioned considerations concerning a trade-off or balance between the quality obtained for a machined workpiece and the machining time required. The circumferential length and thus the volume of the

unground portion depends on the size of the cut-in angle and for practical reasons the circumferential length of grinding with respect to the unground portion should exceed the cut-in angle (cf. D2, column 3, lines 34 - 47).

Since concerning the now claimed particular amount by which the back-off angle should exceed the cut-in angle no additional effect has been argued it can, in view of the approach of D2 referred to above, not be considered as contributing to the method according to claim 1 of the first auxiliary request involving inventive step.

The method of claim 1 according to auxiliary request 1 thus does not involve an inventive step (Article 56 EPC).

- 5.2 Claim 1 according to **auxiliary request 4** differs from claim 1 according to the main request by the additional feature (i) according to which the cut-in feed and the final finish grinding step as well as the back-off step are performed within 450 degrees.

Since, as indicated above (cf. point 1.1), the final finish grinding step according to feature (d) is considered as being performed during one revolution of the workpiece, i.e. 360°, feature (i) amounts to an angle of 90° foreseen as back-off angle.

The respondent has not argued that feature (i) leads to any particular effect.

Considering that feature (i) indicates, beyond the revolution required for the completion of the final finish grinding step according to feature (d), a circumferential length for the back-off angle, the Board finds the argument of the appellant convincing that such a back-off angle comes within regular machining practice. The Board in this respect takes also into account that it is evident that the size of the back-off angle has, as long as the grinding wheel is in contact with the unground portion of the workpiece, an effect on the quality of the workpiece and on the machining time, namely the larger the back-off angle the better the quality, but the longer the machining time. Thus a particular value chosen for a back-off angle is again the result of balancing the required quality and the desired shortening of the machining time, depending on given quality requirements to be met under particular circumstances.

The method of claim 1 according to auxiliary request 4 thus does not involve an inventive step (Article 56 EPC).

- 5.3 Claim 1 according to **auxiliary request 5** differs from claim 1 according to the main request by the addition of features (h) and (i) as cited above.

As indicated above, neither one of features (h) and (i) contributes to inventive step. It has neither been argued nor is it otherwise evident that the combination of features (h) and (i), within the combination of features of claim 1, leads to a method involving inventive step. Consequently claim 1 according to auxiliary request 5 cannot be considered as involving

inventive step for the reasons given above with respect to claims 1 according to auxiliary requests 1 and 4.

The method of claim 1 according to auxiliary request 5 thus does not involve an inventive step (Article 56 EPC).

6. Since none of the methods of the claims 1 of all requests can be considered as involving an inventive step the patent has to be revoked.

In view of the above reasoning it could be left open whether claim 1 according to auxiliary requests 4 and 5 infringes, due to the amendments, the requirements of Article 123(2) EPC as alleged by the appellant.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

V. Commare

H. Meinders