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D E C I S I O N
of 6 December 1996

Case Number: T 0585/94 - 3.5.1

Application Number: 84105875.3

Publication Number: 0129090

IPC: G05B 19/405

Language of the proceedings: EN

Title of invention:
Numerical control method and system, and a machine tool controlled by the method or the system

Patentee:
MITSUBISHI DENKI KABUSHIKI KAISHA

Opponent:
Siemens AG

Headword:
Mitsubishi/Numerical control

Relevant legal provisions:
EPC Art. 52(1), 56

Keyword:
"Inventive step - yes"

Decisions cited:
-

Catchword:
-

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Case Number: T 0585/94 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 6 December 1996

Appellant: (Opponent)
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Representative:
-

Respondent: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 31 May 1994 rejecting the opposition filed against European patent No. 0 129 090 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: P. K. J. van den Berg
Members: R. Randes
G. Davies

Summary of Facts and Submissions

I. European patent No. 0 129 090 claiming priority date of 23 May 1983 was granted on 16 August 1989 on the basis of European patent application 84 105 875.3, filed on 23 May 1984.

II. Claim 1 as granted reads (excluding the reference signs):

A numerical control method for controlling a machine tool having a plurality of simultaneously usable turrets, comprising the steps of: supplying data items indicative of cutting conditions for respective tools mounted on the turrets, a machining program, and material conditions of a workpiece to be cut by the machine tool; computing a capability required to cut the workpiece based on said cutting conditions, machining program, and material conditions; determining whether said capability exceeds an allowable capability range of the machine tool, or tools thereof; issuing an output to reduce the cutting conditions when the value of the capability exceeds the allowable capability range to correct the capability required to cut the workpiece into the allowable capability range of the machine tool, or tools thereof; and issuing the reduced cutting conditions to the machine tool.

Claim 6 is directed to a corresponding system.

III. An opposition was filed on 16 May 1990 on the grounds that the subject-matter of claim 1 and the dependent claims did not involve an inventive step (Article 100(a) EPC).

The opponents (appellants) referred to the prior art documents

D1: DE-A-22 32 205 and
D2: DE-C-26 52 574

IV. By decision of 16 August 1991 the opposition division rejected the opposition. This decision was, however, set aside by the board of appeal for formal reasons (T 795/91). During the further prosecution before the opposition division a new prior art document was introduced:

D3: H.J. Jacobs, "Some new solutions to optimize multitool turning", Proceedings of the 14th Annual Meeting and Technical Conference of the Numerical Control Society, Pittsburgh USA, 13-16 March 1977, pp. 169-179.

On 31 May 1994 the opposition division again decided to reject the opposition.

V. On 14 July 1994 the opponents lodged an appeal against this decision and paid the prescribed appeal fee. A statement setting out the grounds of appeal was filed on 21 September 1994.

VI. In a communication pursuant to Article 110(2) EPC, dated 15 February 1996, the rapporteur expressed the preliminary view that the appellants' opinion that the invention was obvious was apparently based on hindsight and that the appeal would probably have to be dismissed.

VII. The appellants replied on 28 March 1996. Their arguments presented in that letter and earlier on in the proceedings may be summarised as follows.

The invention as claimed in claim 1 differed from the prior art known from D1 in that the material of the workpiece was taken into consideration and that the capabilities of the machine tool (such as cutting power, torque etc.) were calculated, not measured. Both D2 and D3 showed, however, that the person skilled in the art of numerical control would have taken account of the properties of the material as a matter of course. Moreover, in D1, also the material would effectively determine the allowable cutting conditions (e.g. the feed speed). Furthermore, the calculation - instead of measurement - of the required capability was obvious, since it merely represented an open-loop control of the same process which according to D1 was controlled by a closed loop. The skilled person would have known that these two fundamental types of control were often interchangeable. The claimed open-loop control was in fact even the less complex of the two. Additionally, D3 gave the skilled person the idea of using a mathematical model of the machining. It was stated in D3 that the allowable torque at the machine spindle should be considered. It was also disclosed that the allowable workpiece deformation, which is a property of the material, must be taken into account.

VIII. The respondents have submitted that neither D1 nor D2 was concerned with pre-calculating a performance, but measuring it. Furthermore, the prior art did not suggest that the material conditions should be considered when computing the capability. D3 did not concern the machining, but the cost of manufacture and did not mention overloading or open-loop control. Moreover, it was difficult to understand and could not be used to support the appellants' arguments.

IX. The appellants request that the decision under appeal be set aside and the patent be revoked. The respondents request that the appeal be dismissed and, as an auxiliary request, that oral proceedings be held.

Reasons for the Decision

1. The appeal is admissible.

2. *Inventive step*

2.1 The claimed invention concerns a method and a system for controlling a machine tool having a plurality of simultaneously usable turrets. The aim of the invention, as formulated in the description, is to provide a numerical control capable of automatically determining the cutting conditions (for example the feed speed) such that the allowable capability ranges are not exceeded. The "capabilities" may include the cutting torque and the cutting power. According to the claimed method, the cutting conditions are computed in an iterative way, i.e. on the basis of the material conditions of a workpiece and preliminary values for the cutting conditions. If these preliminary values exceed the allowed limits the cutting conditions are correspondingly adjusted. The capabilities thus need not be measured; they are computed according to known equations.

2.2 Throughout the proceedings D1 has been generally regarded as disclosing the nearest prior art. It describes a lathe provided with two tools. The cutting force as well as the torque are measured and compared with predetermined upper limits. Either the feed speed or the depth of cut is reduced until the measured values are within the allowed ranges.

2.3 The invention differs from this known lathe control mainly in two respects. Firstly, the capabilities - for example the torque - are computed, not measured. Secondly, this computation is based in particular on the material of the workpiece.

Having regard to the case law of the boards of appeal, it is accepted that the objective problem to be solved must not contain elements of the solution. This has to be done in order to avoid ex-post-facto analyses (cf. T 229/85, OJ 1987, p. 237). Thus, the problem must not contain differences between the invention and the closest prior art which constitute features of the invention. The Board, therefore, considers that the problem to be solved is well represented by the problem proposed in the introductory part of the patent (column, lines 42 to 49), and referred to above (see "aim of the invention" under 2.1)

It could be said that the teaching of D1 also solves this problem. However, the solution identified in the present patent is, as pointed out above, quite different from this known solution.

2.4 Starting with the first difference, the appellants have pointed out that D1 discloses what is effectively a servo control, including a feedback loop, whereas the invention is an open-loop control. The appellants' argument is that it would have required no inventive skill to go from the closed-loop to the open-loop system, especially considering that the known control is, if anything, the more sophisticated one.

In the Board's judgement, however, the prior art does not suggest such a substitution. Although it may appear plausible that, on a general level, the skilled person was aware that a closed-loop control could often be replaced by an open-loop control, no particular

advantage would appear to be gained in this case by the modification. Only with hindsight might one realize the possibility of omitting the torque metre in D1. If, however, D1 is read without knowledge of the invention, the impression would rather be that it is not at all possible to dispense with the measurements. In other words the feature is conveyed as being essential. It is true that, in the very last paragraph of the description, a variation is envisaged which does not measure the torque, but then at least the cutting force is measured. Moreover, it is pointed out that in such a case the main spindle cannot be supervised. The skilled person would thus infer from this teaching that measurements, preferably including the torque, should be performed. The skilled person can hardly be expected, in view of the importance D1 attaches to the measurements, to modify the teaching so that they are omitted. For this step it appears that an explicit pointer would have been needed, and not just general knowledge about control systems. It follows that D1 alone does not render the claimed method obvious.

2.5 A combination of D1 and D2 would not lead the skilled person to the invention either. D2 (which is not pre-published, as is the corresponding German Offenlegungsschrift) mentions in particular, as a conventional technique at that time, the control of a tool in dependence of the hardness of the material to be machined (column 2, lines 11 to 18). However, this document suggests no more than D1 in respect of determining a capability, such as the torque, by calculation.

2.6 Turning now to D3, this document, in fact, mentions the calculation of certain entities. The teaching of that document, however, appears to be very unclear as pointed out by the respondent as well as by the opposition division. The overall aim in D3 appears to

be the optimisation of the production cost and of tool life, even during multicutting or multiturning operations and at tool changes. Thus, the teaching of that document, apparently, is concerned with a general long-term optimization of costs and it is questionable whether it is directly comparable with the different aspects of the invention. However, as the opposition division notes in the contested decision, a calculation of, in particular, the cutting power and torque is part of the optimisation procedure (p. 172, top). Furthermore, it is said that the allowable torque at the machine spindle and the allowable cutting power have to be considered when setting the feed speed (p. 173, 179). The document, however, does not seem to disclose the use of material conditions in the sense of the present invention, i.e. in the form of data used for computations. Thus, even following the teaching of D3, the skilled person would have had no clue that the capabilities depend also on the material conditions. Moreover, even if this had been recognised, it would probably have appeared more reliable to measure them directly, as in D1.

Also, the Board accepts the argument of the respondents that the invention is not distinguished from the prior art, including D3, only in that the material conditions are supplied and used in the system but, above all, in that the capacity is pre-calculated (and not measured). Apparently the predictive control of the invention allows the feed speed to remain at or near the optimum level, while the machine tool path is precalculated and not altered during machining. Altering the feed speed away from an optimized speed will reduce the accuracy and degrade the surface quality (cf. letter filed by respondent on 30 September 1992). It is noted that D3, like D1 and D2, does not describe at all, or even mention the possibility of, an open-loop control.

The Board, therefore, concludes that the subject-matter of claim 1 is not obvious over the teaching of D3 either separately, or in combination with the teachings of D1 and D2.

2.7 The appellants have expressed the opinion, that if it is considered that the inventiveness of the patent relies on the pre-calculation (i.e. calculation before the operation) of the capability of the machine tool, then claim 1 should be restricted correspondingly (cf. letter filed by the appellants on 28 March 1996, page 3, second paragraph). The Board, however, is of the opinion that, even if the inventiveness did rely on said pre-calculation, such restriction would not be necessary. It is sufficient that the subject-matter of the independent claim discloses that the method (or system) is capable of performing said pre-calculating. In such a case, additional features which belong to the prior art, but which the invention according to the independent claim is also capable of performing, should normally not influence the inventiveness of the subject-matter of the claim negatively. Moreover, in the present case, claim 1 is so understood that the pre-calculating steps, in addition to the "normal" pre-calculating steps which are performed before the operation, could be repeated during the operation when necessary (cf. communication of the Board, dated 15 February 1996). Since, this possibility has not been disclosed in any of the documents, it, in fact, contributes to the inventive step.

2.8 The appellants have in their argumentation suggested (cf. under VII above) that it would have been self-evident for a skilled person to change a closed-loop control (e.g. the one according to D1) into an open-loop control, since these two control types were often interchangable. Thereby, it was evident that

the material conditions of the workpiece had to be taken into consideration.

It may be that it is so. However, as can be understood from the above, the Board has in this case come to the conclusion that the cited documents do not present hints that would lead the skilled person to a solution proposed by the independent claims of the patent. The invention may well appear to be self-evident after its presentation and it might even appear that a skilled person could have arrived at the invention; however, the appellants have not been able to convince the Board that the skilled person would have done it.

2.9 It follows from the foregoing that the method of claim 1 as granted involves an inventive step, as does the corresponding system of claim 6. The patent can therefore be maintained as granted.

3. Since the respondents' main request is granted, their auxiliary request for oral proceedings is void.

Order

for these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl P. K. J. van den Berg