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D E C I S I O N
of 27 November 1997

Case Number: T 0937/96 - 3.5.1

Application Number: 84105876.1

Publication Number: 0129091

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Language of the proceedings: EN

Title of invention:

Numerical control system, graphics display unit and machine tool

Patentee:

Mitsubishi Denki Kabushiki Kaisha

Opponent:

Robert Bosch GmbH

Headword:

Simulation of machine tool machining/MITSUBISHI

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no)"

Decisions cited:

-

Catchword:

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Boards of Appeal

Chambres de recours

Case Number: T 0937/96 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 27 November 1997

Appellant:
(Proprietor of the patent) Mitsubishi Denki Kabushiki Kaisha
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Respondent:
(Opponent) Robert Bosch GmbH
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Representative:

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 16 August 1996
revoking European patent No. 0 129 091 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: P. K. J. van den Berg
Members: R. Randes
V. Di Cerbo

Summary of Facts and Submissions

- I. European patent No. 0 129 091 comprising six claims was granted on 11 April 1990 on the basis of European patent application No. 84 105 876.1, filed on 23 May 1984 and claiming priority of 23 May 1983 from an application in Japan.
- II. An opposition was filed by the present respondent and the opposition division in its decision revoked the patent.
- III. This decision was appealed by the proprietor. In a decision dated 10 May 1994 the Boards of Appeal set aside the decision of the opposition division, refusing the proprietor's main and first auxiliary requests and remitted the case to the opposition division for further prosecution on the basis of the second to fourth auxiliary requests.
- IV. In its decision, dated 16 August 1996, the opposition division came to the conclusion that the subject-matter of claim 1 of the main request as well as of claim 1 of the two auxiliary requests was obvious to a skilled person and, again, revoked the patent.

In its argumentation the opposition division relied on the following two documents:

D6: Zeitschrift für wirtschaftliche Fertigung, 1981, vol. 4, pages 153-155,

D2: the article "Recent Trends in Raster-scan Graphic Displays" by Junichi Suzuki in J.E.E. Journal of electronic Engineering vol. 19 (1982), June, No. 186, Tokyo, Japan, pages 74-76,

but additionally in order to relate the prior art according to D6 and D2 to common knowledge also used the following documents:

D4: Zeitschrift für wirtschaftliche Fertigung, 1981,
vol 8, pages 387-390,

D7: "Computer verification of Machine control data" by
L.O. Ward,

Proceedings of the 17th Numerical Control Society
Annual Meeting and Technical Conference 27 to
30 April 1980.

- V. On 16 October 1996, the proprietor lodged an appeal against the decision and paid the appeal fee on the same day. A statement of grounds was received on 12 December 1996.
- VI. In the statement of grounds of appeal the appellant contested the decision of the opposition division and requested that the patent be maintained on the basis of a new set of claims, filed with the grounds.
- VII. In a communication according to Article 11(2) of the RPBA the Board expressed the preliminary opinion that the decision of the opposition division appeared to be correct.
- VIII. On 24 October 1997 prior to oral proceedings, the appellant filed a new set of claims 1 to 6 to replace the claims filed with the grounds of appeal.
- IX. In the course of the oral proceedings held on 27 November 1997 the appellant filed an auxiliary request consisting of further amended claims 1 to 6.

Thus, the appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the claims filed on 24 October 1997 (main request) or on the basis of the claims filed during the oral proceedings (auxiliary request).

Claim 1 of the main request and the auxiliary request read as indicated below. Since claim 1 of the auxiliary request differs from claim 1 of the main request only essentially by additional clarifications, claim 1 of the auxiliary request has in the following text been distinguished from claim 1 of the main request by adding said clarifications within square brackets (i.e. [...]). The text that is identified in bold is only part of claim 1 of the main request and thus not part of claim 1 of the auxiliary request.

Claim 1 of the main and auxiliary requests:

"A system for simulating machining of a workpiece by a machine tool according to an NC program, comprising

(a) an NC controller (40) for outputting display data including movement data defining tool movement during a machining operation according to the NC program, workpiece data defining a shape of the workpiece and of a workpiece holder mechanism, and tool data defining a shape of a machining tool provided to be used according to the NC program;

(b) a tool pattern file for storing a plurality of simplified tool **shapes** [shape data corresponding to] **of** a respective plurality of machining tools selectable for being used according to the NC program, each of said simplified tool shape [data for the respective machining tool] having a **respective** [an] identification

symbol provided for enabling access to the simplified tool shape [data] of the respectively selected tool by specifying the respectively related identification symbol; and

(c) a graphics display unit (50) connected to said NC controller (40) and comprising:

(c_i) interface means (52) for receiving from said NC controller (40) display data

(c_{ii}) display data memory means (53) connected to said interface means (52), for storing display data received from said interface means;

(c_{iii}) data processing means (51) for processing display data received from said display data memory means (53) and [simplified] tool **pattern** [shape] data received from said tool pattern file [by specifying the respective identification symbol for the machining tool respectively selected according to the NC program], so as to generate graphics patterns enabling display, on a CRT (56), of the shape of the workpiece as a shaded image (20) and **the** [of the simplified] shape (12a) of a **respectively selected machining tool as a simplified configuration (12b)** [the simplified shape (12b) of the respectively selected machining tool].

(c_{iv}) a graphics interface (54) for providing graphics patterns generated by said data processing means (51);

(c_v) display memory means (55) receiving, through said graphics interface (54), data of said graphics patterns, said display memory means (55) comprising:

(c_{v1}) a first display memory for outputting data of a graphics pattern according to a respectively first position of said [simplified] tool shape (12b) to be achieved in the course of the NC program, and

(c_{v2}) a second [display] memory for simultaneously receiving data of graphics pattern according to a respectively second tool shape position subsequently to be achieved in the course of the NC program;

(c_{vi}) switching means for alternatively switching over said first and second memories to renew the image to be displayed on said CRT (56);

(c_{vii}) wherein said graphics patterns [stored in said first and second display memory are] **is** (sic!) varied by said data processing means (51) according to the movement data so as to display on said CRT (56) the movement of said machining tool and resulting shape of said workpiece by erasing any interference area (14) at which a machining tip part (13) of said simplified configuration (12b) of said tool shape interferes with the workpiece shape (20) and thus to enable determination of any interference between said machine tool and said workpiece and workpiece holding mechanism;

[and

(c_{viii}) wherein switching over from the one to the other of said first and second display memories is performed when data storing and erasing is completed]."

In addition to the cited independent claims 1 of the main and auxiliary request concerning a system for simulating machining of a workpiece both requests, also, include corresponding independent claims 4 concerning a graphics display unit.

- X. The respondents requested that the appeal be dismissed.
- XI. In the course of the oral proceedings the appellants contested the argumentation of the appealed decision and, in particular, forwarded two new aspects of the present invention, which had not been introduced into the proceedings before.

Firstly they were of the opinion that the invention as identified by feature (b) of claim 1 suggested a quite new approach to the storing of tool shape data. They argued in the following way:

According to the invention said data was simplified and, moreover, the data as such was directly stored in a memory, i.e. the data was stored in the form of x,y-coordinates. The normal way of storing tool shapes at the priority date of the patent was disclosed in document D4, under part 4, "Generierung der Bilddaten...", beginning on page 388, right hand column. In that text it was disclosed (page 389, left hand column, second paragraph) that the tool shape on the screen was generated with the aid of parameters from three different files ("Dateien" - see "Bild 4"). Thus, according to D4, tool shapes as such (in the form of data representing the x,y coordinates) were not stored, but only the corresponding necessary parameters. The generation of image data from said parameters, however, was very time consuming. The present invention had overcome this disadvantage by storing the final tool shape, in spite of the fact that such storing of tool data required much space. Thus, the present inventors had gone against the common trend in this field and realized that the use of expensive but powerful memories led to a very fast simulation arrangement.

Secondly, the appellants were of the opinion that the said memories disclosed in D2 (Figure 7) could not be compared with the display memories identified in the features (c_v) , (c_{v1}) , (c_{v2}) and (c_{vi}) of claim 1 of both requests and in this respect argued as follows:

It was true that D2 provided two memories and that the memories were alternately switched to the monitor for updating the process shown on the screen. However, the said memories according to D2 were buffers and thus the whole content of a memory had to be overwritten each time a new picture was produced. In contrast to this, the invention required that only a certain part of the display memory, namely that used for providing the image data for the next picture on the screen (next tool position), had to be renewed. In other words only the data of the memory that corresponded to a new position of a tool was changed and, therefore, only the old stored data which was invalid at the new position was erased and the necessary new data corresponding to the new position was written into the memory. However, all data of the memory which had not been changed was maintained unmodified and used for displaying the new tool position.

Moreover, according to the appellants the arrangement of D2 used a fixed switching frequency (30 or 60 Hz), whereas the switching according to the invention was performed as soon as the content of the memory to be switched to the display had been renewed.

The appellants agreed that the "CNC-Steuerung" of Figure 4 of the document D6 was comparable, more or less, with the controller (40) in feature (a) of claim 1 of the patent and that the "Simulations-System" and the display unit shown in said Figure were comparable to a certain extent, with the data processing means (51) in feature (c_{iii}) of claim 1 and

the graphics display unit (50) of feature (c). However, they argued that the other features of claim 1, held to be either known or obvious by the opposition division, could not be easily identified on the arrangement disclosed in D6. It was, therefore, not obvious to a skilled person to arrive at the present invention.

The respondents contested strongly the argumentation of the appellants concerning the said two new aspects of invention. They expressed the opinion that the new interpretation of the "tool shape data" and that of the way of functioning of the display memories as had been suggested by the appellants were not at all supported by the description.

Moreover, they argued along the same lines as the opposition division, thereby using in principle only the documents D6 and D2 in their inventive step argumentation. It was concluded that the subject-matter according to claim 1 of both requests was obvious to a skilled person.

Reasons for the Decision

1. The appeal is admissible.
2. *Interpretation of the independent claims in the light of the original description*

Having regard to the appellants' interpretation of the said "tool shape" or "tool shape data" used in feature (b) they referred in particular to the original description, page 6, describing the operation of the invention. The reference at lines 11 to 14 on page 6 to the flowchart in Figure 5 identifies the steps 1 to 3

of the operations of the disclosed embodiment of the present invention and states that (referred to as ref. A)

"tool shape and tool movement information are entered into an input unit at a step 1, and a tool shape 12 is moved according to these data entered in the input unit at a step 2".

In the paragraph bridging pages 6 and 7 it is stated that (ref. B)

"As shown in Figs. 2A and 2B....., the tool shape 12b used is a simplified form converted from the actual tool shape 12a. As many tool shapes 12b as there are tool types are registered in a tool pattern file...".

The Board notes that (ref. A) is the only part which remotely relates to storage of "tool data" in a memory ("information are entered" apparently in a "tool pattern file" - according to claim 1 of both requests). However, the Board cannot infer that this is done "directly" as suggested by the appellants, i.e. such that the "tool shape information" is stored in a memory in the form of x,y-coordinates. In fact, the Board considers that this part of the description of the patent application should be interpreted to mean that tool shape information is stored in a memory (used as a library) in a conventional way, e.g. as disclosed in D4 using parameters.

At the end of (ref. B) it is only stated that the tool shape is registered in the tool pattern file, but not in which form. The Board, moreover, notes that throughout the description of the said original application where the expression "tool shape" has been used, as for example at the beginning of (ref. B), this expression relates to the tool shape on the display

(cf. (ref. B) - note that Figure 2 demonstrates process on the screen) and not the manner or the form in which the tool shape has been stored in the "tool pattern file".

Having regard to the second new aspect of the invention forwarded by the appellants, i.e. that only a relevant area of the display memories are erased and rewritten at the renewal of the image data, the appellants referred, in particular, to the last paragraph of the original description (ref. C) , wherein it is stated that

"With the present invention, as described above, a tool shape and a workpiece shape are displayed, and an area in which the tool shape as moved with respect to the workpiece shape interferes with the workpiece shape is erased. Two display memories are employed in such a manner that while one of the display memories is used, data is **written into** and **erased from** the other display memory".

The appellants were of the opinion that the expression "written into and erased from" in bold in the second sentence should be so interpreted that only the relevant area in the display memory was renewed.

The appellants also referred to page 7, penultimate paragraph, of the original description (ref. D), wherein it is stated, that

"Fig. 7A is a diagram illustrative of simulated workpiece machining, and Fig. 7B is an enlarged view of a circled portion in Fig. 7A. As the tool tip shape 13 which is a portion of the tool shape 12 b moves, there

is created an area 14 in which the tool tip shape 13 interferes with a workpiece shape as displayed. Only the interference area 14 is **erased** from the workpiece shape".

Also in this case according to the appellants the expression "erased" in the last sentence of the citation related only to non-relevant data in the display memory.

The appellants, also referred to Figure 6 and the corresponding text, and expressed the opinion that Figure 6A (showing successive steps a to d) disclosed that only the non-relevant data in the memory was erased at step c ("erase old shape from display memory") and that the new data was written in step a ("write new tool shape in display memory").

The Board, however, cannot agree with the argumentation of the appellants. Starting with Figure 6, it is noted that Figure 6B, showing the process corresponding to the steps of Figure 6A, reveals that in response to the programming step c of Figure 6A to "erase old shape from display memory" the display memory is cleared ("display memory (cleared)"). This, however, normally means that the whole memory is cleared, i.e. all information in the memory is deleted.

The citation (ref. D) describes the tool movement on the screen shown in Figure 7 which according to the description is the third step shown in Figure 5 which shows the general processing procedure of the invention. This third step of Figure 5 detailed in Figure 7 is, however, clearly related to the display of the image and, therefore, (ref. D) can only be interpreted to mean that a renewal of the image is made

on the screen in the way that the interference area on the screen is erased. There is no information about the functioning of the display memories in this citation.

The second sentence of citation (ref. C) apparently means, as also can be understood from Figure 6, that the erasing of data and writing of data is carried out in two steps. However, there is no indication that only a certain part of the image data could be renewed.

Also, the Board notes that in the original claims 1 and 4, the expression "erasing an interference area" is clearly related to the picture on the display and no information is given about the data in the display memory. In original claim 3 it is only stated that means exist for "alternatively switching over said memories to renew a displayed image".

Finally, the introductory part of the original description, which normally should indicate the problem to be solved and the advantages of the invention over the prior art, in no way hints at the said new aspects of the invention suggested by the appellants at the oral proceedings.

The Board therefore takes the view that the invention according to the original application should not be interpreted in the appellants' sense with regard to the said two new aspects. This view concerns the description of the patent as well as the claims of both requests, since the wording of the description as well as the said claims is within the borders of the original disclosure. Thus, the Board considers that the description and the claims of appellants' requests meet the requirements of Articles 123(2) and(3) as well as

of Article 84 EPC; only the appellant's interpretation of the wording of the description and the claims is considered to be incorrect and not supported by the original documents.

3. *Inventive step: Claim 1 of main request*

The Board, like the opposition division, considers document D6 to disclose the closest prior art. D6, like the invention (cf. the introductory part of claim 1) relates to a system for simulating machining of a workpiece by a machine tool according to an NC program. According to Figure 4 of D6 the system comprises an NC controller ("CNC-Steuerung") for controlling a machine tool (bottom unit) to machine a workpiece according to an NC program and a display (left upper unit) connected to said NC controller via a simulation unit ("Simulations System"). Apparently said display and said simulation unit correspond to the graphics display unit (50) according to **feature (c)** of claim 1.

According to D6, page 153, right hand column, chapter 2.1, machining simulation includes the displaying (on the display unit) of the shapes of the tool and of the workpiece, the machining tool holder and the workpiece holder mechanism. Such displaying apparently requires display data for said shapes.

Moreover, in the course of the simulated machining on the display screen (cf. second paragraph of said chapter 2.1), the contours of the movable elements, including the contours of the workpiece, are dynamically changed. Having regard to D6, page 154, left hand column, chapter 2.2, first paragraph, the simulation of an NC-program takes place in real time and the display is updated at short intervals to show a continuous operation.

Since said NC controller (CNC-Steuerung) shown in Figure 4, apparently, provides said display data used for said simulation (see the arrows in Figure 4) feature (a) of claim 1 is considered to be disclosed by D6.

As the opposition division has stated, in D6 the display data received by the simulation unit has to be taken care of and consequently requires storing. For this reason memory means (corresponding to display data memory means 53 of feature **c_i**) storing said display data are required by necessity although such memory means are not expressly mentioned in D6. It would also be self evident for a skilled person that the NC controller in Figure 4 would provide said display data via an interface as specified in feature **c_i** of claim 1.

It appears to the Board that also feature (b) concerning the said tool pattern file is in principle present in D6, although not all of the details of it have been explicitly disclosed therein. At page 154 in D6, right hand column, lines 16 to 14 from below ("Zusätzlich ist noch eine Werkzeugdatei...") D6 states that a tool file is stored and that after each request for a tool, the programmed tool is visualized on the display screen. Although, it is not disclosed in D6 that a tool which is requested has to be identified by a tool symbol, this would be obvious to a skilled person. The appellants in the proceedings also argued that the feature of displaying a **simplified** tool shape would be new over the prior art. However, the Board agrees with the respondents that the shape of the tool shown on the screen in Figure 3 of D6 is to be regarded as a simplified shape. This is, in particular, because at page 153, chapter 2.1, first paragraph D6 clearly states that during simulation all **contours** ("Umrisse")

of the movable elements are dynamically changed. This can only mean that the tool shapes on the screen are of a simplified nature and that the corresponding data must exist in the tool pattern file.

Since the display is visualized on the display unit, the system of D6 also must include data processing means in accordance with **feature (c_{iii})** of claim 1 for processing the display data and tool shape data to generate graphics patterns corresponding to the shapes of the workpiece and the workpiece holder and of the tool and the toolholder. However, according to Figure 3 of D6, it is the workpiece holder that is shaded and not the workpiece as claimed in claim 1. Moreover, the appellants have proposed that Figure 3 of D6, does not show the real image of the screen, but only demonstrates the principle of the simulation with the aid of the different working steps showing schematically the tool and the workpiece. Nevertheless the Board feels that said shading of the workpiece according to this feature is obvious, particularly in the light of D7, mentioned in the introductory part of the present patent description which discloses that during simulated machining a full range of shading can be employed to improve visibility for the user.

Having regard to the processing means, in accordance with **feature (c_{vii})**, the graphics patterns in D6 must be processed according to the movement data in such a way that they are varied so as to display on the CRT the movement of the machining tool and resulting shape of the workpiece by erasing any interference area where a machining tip part of said simplified tool shape interferes with the workpiece shape. In this respect D6 is again referred to at page 154, left hand column, chapter 2.2, first paragraph and, moreover, at said

left hand column, last paragraph, two first sentences, from which it can be understood that the NC program provides the necessary movement data and that the interference area of the workpiece shape is erased.

The Board notes that the features (c_{iv}) and (c_v) of claim 1 are not expressly mentioned and, moreover, that the features (c_{v1}), (c_{v2}) and (c_{vi}) are not disclosed in D6. Thus the subject-matter of claim 1 is accordingly new.

However, D6 on page 153, chapter 2.1, second paragraph, makes clear that dynamical simulation was made possible only with the development of image repeating displays or raster displays. This means that also the arrangement according to D6 must use display memory means in accordance with feature (c_v). Also is it clear that such memory means in D6 must be able to receive data of graphics patterns corresponding to the image to be displayed and therefore it is self-evident that a graphics interface in accordance with feature (c_{iv}) would be used.

Moreover, D2, page 76, chapter "High-class Graphic Display", discloses that in the field of computer aided design and computer-aided manufacturing (CAD/CAM) it was known to use two sets of image memories and alternatively switch between them to improve the quality of the image displayed on a display screen. Thus, the skilled person would immediately consider using such sets of memories in the apparatus of D6 and thus arrive at the features (c_{v1}) and (c_{v2}) and, therefore, also at feature (c_{vi}).

The appellants in the oral proceedings expressed the opinion that the said image memories of D2 were buffers and that the old data therein was just overwritten. The Board agrees that there may be a difference in that the

memories according to the invention are apparently cleared before the new data is written into them (cf. Figure 6B). Clearing a memory before overwriting it is, however, an obvious possibility, so that this difference would not contribute to an inventive step and, moreover, it is not indicated in the claim.

Therefore the subject-matter of claim 1 of the main request is obvious to a skilled person and the invention according to claim 1 does not meet the requirements of Articles 56 and 52(1) EPC.

4. *Inventive step: Claim 1 of the auxiliary request*

The Board considers that the amendments in all of the features before the last additional **feature (c_{viii})** are simply minor clarifications to claim 1 of the main request. No substantial technical difference can therefore be seen in those features of claim 1 of the auxiliary request in relation to the corresponding features of claim 1 of the main request. It is, in particular, noted that the clarification of **feature (c_{vii})**, that the graphics patterns "stored in said first and second display memory are varied", follows from the fact that two display memories are used. Claim 1 of the main request, therefore, already contains this information although it is not explicitly mentioned therein.

However, according to the appellant's argumentation in the oral proceedings **feature (c_{viii})** was introduced in order to make clear that the switching between the display memories according to the invention was different from that of D2, wherein a fixed switching frequency was used. Thus, the appellants wanted to express with that feature that the switching was effected as soon as the "no longer relevant area" area

of the display memory to be switched on had been erased and updated. Thus they suggested that the present invention did not use a fixed switching frequency as in D2.

However, it appears that **feature (c_{viii})** does not express the appellant's intention because it is not stated when after the said "data storing and erasing has been completed" the switching is performed. This feature, therefore, can also be read onto the memory arrangement of D2.

Moreover, as has been made clear above (under reason 2), the Board is of the opinion that the original application does not envisage the case that only one part of the display memory is erased. Therefore, the Board also understands the phrase at page 8 of the original description concerning the switching of the two display memories in which

"data is written into and erased from the other display memory, and when such data storage and removal is completed, the display memories are switched over"

as being the same as that suggested in D2, i.e. a certain switching frequency is used; this appears to be the normal way. Also the introductory part of the original description of the present patent application does not point out or even hint that a different switching technique would be used according to the invention.

Therefore, also the subject-matter of claim 1 of the auxiliary request is considered to be obvious to a skilled person.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Kiehl

P. K. J. van den Berg

