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D E C I S I O N
of 9 June 2004

Case Number: T 0574/00 - 3.5.3

Application Number: 89908860.3

Publication Number: 0401375

IPC: G05B 19/18

Language of the proceedings: EN

Title of invention:

Method of controlling synchronized operation of a machine tool

Patentee:

FANUC LTD

Opponent:

Arnold Müller GmbH & Co. KG
Robert Bosch GmbH

Headword:

Synchronized operation of machine tool/FANUC

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step - state of the art - availability sufficiently
proved"

"Inventive step - no"

Decisions cited:

T 0472/92

Catchword:

-



Case Number: T 0574/00 - 3.5.3

D E C I S I O N
of the Technical Board of Appeal 3.5.3
of 9 June 2004

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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 14 March 2000
revoking European patent No. 0401375 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: A. S. Clelland
Members: D. H. Rees
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. This is an appeal by the proprietor of European Patent No. 0 401 375 from the decision of the opposition division to revoke the patent.

II. At the oral proceedings held before the opposition division, the patentee (appellant) requested maintenance of the patent on the basis of a claim set filed with a letter dated 25 November 1999 and received 6 December 1999. The claims were as follows:

"1. A method of controlling synchronous operation of two motors (10, 11) controlled by digital values, characterised in that: the two motors (10, 11) drive respective first and second workpiece-holding spindles (14, 15), of a machine tool, which simultaneously hold a common workpiece (18) for cutting machining; and a synchronous operation mode command is supplied so that the two spindle motors (10, 11) operate in a synchronous operation mode by inputting to respective control circuits (19, 20) of the two spindle motors (10, 11) a common digital velocity command value which, by means of the synchronous operation mode command, is applied to position control circuits (28) of said spindle motor control circuits (19, 20) whereby the two spindles (14, 15) are not only velocity-controlled in synchronism but are also position-controlled in synchronism whilst they are driving the workpiece (18).

2. A motor arrangement comprising two motors (10, 11) having respective motor control circuits (19, 20) which are operable in a mutually synchronous manner,

characterised in that: the two motors (10, 11) are coupled to drive independently respective first and second spindles (14, 15), of a machine tool, which are operable to hold simultaneously a common workpiece (18) for cutting machining; each motor control circuit (19, 20) comprises a velocity controller (29), a position controller (28), signal input switching means (SW1) for supplying a command signal to either the velocity controller (29) or the position controller (28) selectively, and isolating switching means (SW2) for isolating the position controller (28) from, or connecting it to, the velocity controller (29) selectively; in that synchronous operation mode setting means are provided for controlling the signal input switching means (SW1) and the isolating switching means (SW2) so that in mutually synchronous operation of the first and second spindles (14, 15) the spindle motors (10, 11) will be position-controlled by a velocity command supplied to the position controllers (28) connected to the velocity controllers (29); and in that it comprises command means operable to input said velocity command as a digital value."

III. The opposition division found that the claimed subject-matter was novel but did not involve an inventive step having regard to a combination of documents

E1: "AMK PUMASYN Drehstromregelantriebe, Installation und Inbetriebnahme," Arnold Müller, Antriebs- und Regeltechnik GmbH, Kirchheim-Teck, September 1986; pages 5-1 to 5-12; and

E8: DE-A-3 618 349

The written decision revoking the patent was despatched on 14 March 2000.

IV. Notice of appeal was received on 12 May 2000, the appropriate fee having been paid on 10 May 2000. A statement of grounds of appeal was received on 18 July 2000; it reiterated the request refused by the opposition division and added an auxiliary request based on claim 2 only.

V. Further documents relevant to this decision are

E2: G.Vogt et al., "Hohe Dynamik und großer Drehzahlstellbereich mit Drehstrom-Asynchronmotoren," Technische Rundschau 12/86; pages 86 to 89

E3: DE-A-3 513 775

VI. At oral proceedings held before the board on 9 June 2004 the appellant requested that the decision under appeal be set aside and that the patent be maintained, according to claims 1 and 2 of the main request as filed with the letter of 25 November 1999 or alternatively on the basis of the auxiliary request (claim 2 of the main request).

Both respondents requested that the appeal be dismissed.

VII. The board's decision was announced at the end of the oral proceedings.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.
2. *The status of E1 as prior art*
 - 2.1 It is not disputed that the appellant, having previously contested E1's status, conceded in the oral proceedings before the opposition division that it belonged to the prior art; in consequence, the revocation decision did not go into this question in detail. However, the board accepts the argument, put forward in the grounds of appeal, that it must itself be satisfied on this point since the question of what is or is not prior art does not in fact depend on parties' assessments or acquiescence, but rather on legal conditions derived from the EPC.
 - 2.2 The board would further accept that, as in T 472/92 (OJ 1998, 161), cited by the appellant, practically all the evidence lies in the power and knowledge of Respondent 1 (Opponent 1). In the present case the evidence concerns whether the document E1 was made public before the priority date, rather than a public prior use, but the same principles apply since the documents supposed to prove the availability to the public were in the possession of the opponent and addressed to its customers. Therefore the onus is on the opponent to prove publication.

2.3 As evidence for the publication of E1, a user manual marked with the date September 1986, Respondent 1 has, with letters dated 13 December 1999 (received 14 December 1999) and 28 May 2004 (received 29 May 2004), submitted three "Eidesstattliche Erklärungen", two from its employees and one from an employee of a customer. Both statements of the respondent's employees state unequivocally that the document E1 was distributed, without any indication of a requirement for confidentiality, to a number of customers and other interested companies between the third quarter of 1986 and 2 April 1988, each giving a list of some of the recipient companies. The statement from an employee of one of the companies on the lists states, also with no reservation, that he received five copies of a document having the content of E1 in September 1986, without there being any confidentiality requirement.

2.4 These three statements agree and give sufficiently precise information to be considered as credible by the board, particularly as one of the testimonies is from a person not employed by the respondent and a list of several firms said to have received the same documents has been communicated. Thus the availability to the public of E1 is *prima facie* established. Consequently, according to the general principles governing the taking of evidence, the burden of proof is transferred to the patentee, who contended that the documents at issue were under an obligation of confidentiality. It was argued that "one would normally expect a certain amount of confidentiality to surround circumstances wherein one company is developing an automatic lathe incorporating the drive system of another company" (grounds of appeal page 2, last line, and page 3,

lines 1 to 4). This argument is not however based on concrete evidence. In the absence of a specific requirement of confidentiality on the part of the seller there was no reason for the buyer to consider himself under such an obligation. Any presumption of confidentiality might be expected to be in the other direction, if the buyer was intending to use the drive system to develop an automatic lathe; it would normally be assumed that in such circumstances the seller (Respondent 1) would have a duty of confidentiality. But in the present case, especially in the light of the magazine Article E2, giving considerable technical detail, it seems implausible that the seller had any interest in concealing the details given in E1, or that the buyer was under any obligation to do so. This case is therefore to be distinguished from T 472/92, where there was a positive indication of a special relationship between buyer and seller in the form of a joint venture agreement, so that evidence existed to make a requirement for confidentiality more likely. No such indication has been identified in the present case.

- 2.5 The appellant also points out that the statement of the customer employee does not refer to the document E1 but to a document whose content was the same as that of E1. Nonetheless, this is an unequivocal statement that the content was the same, and leaves no room for uncertainty or doubt as to what was dispatched to the customers. Moreover, the board considers it quite likely that this internally produced document might have been given to customers' development departments in other forms or formats. Hence the board does not consider that the choice of words introduces any doubt as to the authenticity of the evidence put forward.

2.6 The board has not identified any further issues which might cast significant doubt on the evidence, and therefore comes to the conclusion that E1 did indeed belong to the state of the art at the priority date of the disputed patent.

3. *Interpretation of the claims*

3.1 Claim 1 specifies that "a digital velocity command value ... is applied to position control circuits." Since the physical quantities position and velocity as normally understood have different dimensions, this appears paradoxical. The apparent impossibility of applying a velocity command to a position control is only reinforced by reference to Figure 2 of the disputed patent, which shows that the velocity command is input to a subtractor 25 whose other input is quite clearly a position measurement. The description at column 3, line 58, to column 4, line 2, states that "a commanded velocity ... is processed as a position command." The patent is silent as to how this is achieved.

3.2 In the communication dated 14 May 1998 the opposition division took the view (page 3, lines 30 to 33) that the patent had "only broken with the established convention of the art to call any command value which is supplied to a position controller a position command." In its decision at page 5, lines 3 to 14, another view was taken, that this feature contradicts the basic laws of physics; the feature was therefore considered to make no contribution to the art.

- 3.3 Respondent 2 maintained the view that this feature is impossible to realise, at least without adapting the described apparatus in a way which would not be obvious to the person skilled in the art, and should therefore be ignored in the board's consideration of inventive step (see letter of 24 October 2000). It was argued at the oral proceedings that coming to the interpretation of the claim subsequently put forward by the appellant and summarised in the annex to the invitation to oral proceedings issued by the board would itself involve inventive activity.
- 3.4 However, the board notes that there is an interpretation of this feature which neither conflicts with the laws of physics nor requires the described apparatus to be changed; the board considers that the skilled person would have come to the same conclusion when presented with the patent specification, in the light of his or her knowledge of the field.
- 3.5 The "position" command applied to a position control circuit would normally be an instruction to turn the spindle from its current position by a certain angle. Thus for example, document E1, which shows a very similar spindle control arrangement to that of the disputed patent, and which the board takes to represent the prior art with which the skilled person would be familiar, refers to the "Winkelsschrittgeber" (e.g. page 5-4, line 10) and to the "inkrementale Lagesollwertvorgabe" (page 5-5, line 20, emphasis added). In this case a given "position" command signal applied continuously will be carried out repeatedly every operation time unit and will have the effect of causing the spindle to rotate at a certain rate, i.e.

it is in effect a velocity command. As a matter of nomenclature in the disputed patent (and apparently generally in the prior art), a velocity command is that which is applied to subtractor 26 (Figure 2), whereby the velocity error value is applied to the velocity control circuit 29 (see e.g. column 4 lines 29 to 32 and lines 46 to 49 of the patent specification). A position command is that which is applied to control circuit 28 by way of subtractor 25.

- 3.6 Hence, according to this interpretation, applying a velocity command continuously to the position subtractor 25 also controls the velocity. It is possible that the commands might use different units for measuring incremental position / velocity. Thus for example velocity might normally be specified in r.p.m. (revolutions per minute), whereas the incremental position might be specified as the number of angle steps to be turned in the next time unit. But even in this case, in order to apply a velocity command to the position control and achieve the same velocity as if it had been applied to the velocity control, the most processing that would have to be done would be to multiply by a certain fixed factor. This was the interpretation given by the appellant in the oral proceedings, arguing that this simple processing block had been omitted from the patent, but could be supplied by the skilled person without the exercise of inventive activity. However, since there is no mention of any conversion processing in the disputed patent nor any appropriate processing block in Figure 2, the board takes the view that the skilled person would infer that the unit of velocity used to command the velocity control unit would be the same as that used for

position, i.e. number of angle steps per operational time unit.

3.7 Thus the board takes the view that for the purpose of assessing whether the claimed subject-matter evinces an inventive step, this feature is therefore equivalent to a statement that "a digital position command value ... is applied to position control circuits."

3.8 On a second point of interpretation the board does not consider the "switching means" of claim 2 to be limited to mechanical or discrete electrical switches, a position also accepted by the appellant in the oral proceedings.

4. *Inventive step*

4.1 E8 discloses two motors 14, 34 driving respective first and second workpiece-holding spindles 10, 24 of a machine tool, which simultaneously hold a common workpiece 20 for cutting and machining. It further indicates that in order to carry out this machining the motors must be driven synchronously (E8, figure and column 4, lines 10 to 21), and that the motors each have three feedback sensors, for shaft angle 52, 54, speed 48, 50, and torque 56, 58. A control unit 46 sets the desired values of these variables and receives the deviations measured (column 5, lines 18 to 31). Beyond this, no details of the control system are given, other than that it is "conventional" (column 4, lines 42 to 49).

- 4.2 The skilled person wishing to implement this system is therefore faced with the problem of providing a suitable control system, making use of these feedback sensors and capable of operating the motors synchronously.
- 4.3 E1 offers a solution. It discloses a control system for a motor having a synchronous mode of operation in which the control value is the incremental angular position ("inkrementaler Lagesollwertvorgabe" E1, page 5-5, section 5.1.6, "Synchronregelung"). In this mode a command value is supplied to the position control circuit. Attention is directed to points 3.1 to 3.7 above as regards the reference to a velocity command rather than a position command in the disputed patent. The skilled person would infer the need for a command to enter this synchronous mode. In the synchronous mode the motors are not only velocity controlled in synchronism but also position controlled in synchronism (E1, page 5-6, lines 1 to 7).
- 4.4 Claim 1 of the disputed patent specifies that the command value supplied is digital; in E1 the basic operational mode proposed is also digital, and all values input are converted to digital values (page 5-1, lines 11 to 17). Which input is used is also a settable parameter (page 5-9, bit positions 10 and 11). Thus while E1 discusses using pulse trains as the control input in synchronous mode, the board considers that it would be an obvious alternative to supply digital values directly.

4.5 It is further specified in claim 1 that the command value is supplied to each of the motor control circuits. In E1 the synchronous mode is shown as a "master-slave" configuration, whereby the output of the position sensor of one motor is used as the input to another. The appellant has argued that such an arrangement would inevitably be less accurate than one in which the command value is entered in parallel to the two motors. The board is not convinced by this argument, in particular in the light of E1 page 5-6, lines 1 to 7, which suggest that a tolerance of at most a few angular units plus or minus is contemplated. Moreover, E1 does give indications of a parallel mode of synchronous operation; the figure on page 5-5 shows the option of having plural slaves, which would then operate in parallel, in exactly the same way as in the patent, and moreover indicates that the command value need not be derived from a master motor (page 5-5, line 23, "eventuell Zusatzimpulsgeber").

The board therefore considers that if the master-slave configuration were to prove unsatisfactory the skilled person would adopt the alternative teaching of E1 and use a parallel arrangement, so that this feature cannot be seen as lending the claimed subject-matter an inventive step.

4.6 The appellant argued that the synchronous operation foreseen for systems using the control mechanism of E1 would not be suitable or adequate for cutting machining of a common workpiece held by two spindles simultaneously, pointing to the applications put forward in E3, at page 13, line 37, to page 14, line 5. E3 originates from Respondent 1 and relates to similar

subject-matter to E1. It is argued that these applications do not deal with multiple spindles operating on one workpiece, but rather with plural spindles each operating on a separate workpiece, which would not require the same accuracy of synchronisation. The board is not convinced by this argument. Firstly this is just one example of use of synchronous mode, and does not exclude other applications. Secondly, the internal evidence of E1 is that a high degree of accuracy is contemplated (page 5-6, lines 1 to 7). Thirdly, the disputed patent neither claims nor discloses any measures for ensuring accuracy which would not be obtained by applying the teaching of E1 to E8 as discussed above.

4.7 Hence the subject-matter of claim 1 does not involve an inventive step within the meaning of Article 56 EPC and the main request is not allowable.

4.8 Claim 2, the only claim of the auxiliary request, specifies apparatus having features largely corresponding to the method steps of claim 1. The appellant argued that this claim was additionally limited by the "signal input switching means" and the "isolating switching means" and their functions. However, E1 shows two functional modes of the control system in the diagrams at page 5-11, lower figure, and page 5-12. The first is a velocity control mode and the second is a position control mode, which is the mode used for synchronous operation, as discussed above. In the second diagram both a "position controller" and a "velocity controller" are shown, but in the first diagram only the "velocity controller" is shown. Since these diagrams represent modes of operation of the same

control system, it is clear to the skilled person that in the first diagram the position controller is inactive, or "isolated", as claimed. The command input in the first diagram is shown as being directly to the velocity controller, and in the second as being to the position controller. Thus starting from the first mode of operation the effect of a change to the synchronous mode is to (1) bring the position controller out of isolation, and (2) redirect subsequent command values from the velocity control to the position control.

Thus for the skilled person it is clearly implicit that E1 possesses the two switching means claimed. They are in fact realised by a microprocessor, but they are nonetheless switching means.

- 4.9 The first of these diagrams actually shows an analogue input but, as already discussed, the skilled person would have a free choice of the form of input, so that no inventive step is required to use a direct digital input for both velocity and position values.
- 4.10 Hence the board concludes that the subject-matter of claim 2 is also not inventive, and that the auxiliary request is therefore also not allowable.
5. There being no allowable request, it follows that the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

D. Magliano

A. S. Clelland