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D E C I S I O N
of 24 October 1996

Case Number: T 0780/94 - 3.5.1

Application Number: 86101670.7

Publication Number: 0192157

IPC: G05B 19/405

Language of the proceedings: EN

Title of invention:

Machine tool numerical controller with a trouble stop function

Patentee:

TOYODA KOKI KABUSHIKI KAISHA

Opponent:

Robert Bosch GmbH
Siemens AG

Headword:

-

Relevant legal provisions:

EPC Art. 123(2 & 3), 52(1), 56

Keyword:

"Admissible amendments - (yes)"
"Inventive step - (yes)"

Decisions cited:

T 0092/92

Catchword:

-



Case Number: T 0780/94 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 24 October 1996

Representative:

Appellant:
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Decision under appeal:

Interlocutory decision of the Opposition Division
of the European Patent Office posted 25 July 1994
concerning maintenance of European patent
No. 0 192 157 in amended form.

Composition of the Board:

Chairman: R. Randes
Members: C. G. F. Biggio
C. Holtz

Summary of Facts and Submissions

I. European patent No. 0 192 157 was granted on 22 November 1990 on the basis of European patent application No. 86 101 670.7, filed on 10 February 1986, and claiming priority of JP application 31218/85, dated 18 February 1985.

II. Two oppositions were received, requesting the revocation of the patent in its entirety on the ground that the subject-matter of the claims as granted lacked an inventive step (Articles 100(a), 52(1), and 56 EPC). In the course of the opposition proceedings, reference was made mainly to the following documents:

D1 DE-C-1 552 541

D2 US-A-4 386 305

D3 DE-C-2 640 257

D4 Zeitschrift für wirtschaftliche Fertigung, 1983, No. 6, pages 272 to 275; D. KREMPER et al.:
"Flexible numerische Steuerungen"

III. Oral proceedings were held before the opposition division on 22 June 1994, at the end of which the patent was maintained in amended form. The written interlocutory decision was dispatched on 25 July 1994.

IV. On 16 September 1994, Opponent II lodged an appeal against this decision and paid the prescribed fee. In a statement of grounds, received 10 November 1994, the Appellant (Opponent II) requested revocation of the patent in full. A subsidiary request was made for oral proceedings.

In a response received, 30 June 1995, the Respondent (Proprietor) requested that the appeal be dismissed, and made a subsidiary request for oral proceedings.

V. In a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, dated 6 August 1996, the Rapporteur commented on the documents upon which the Appellant relied, namely D1 to D4, and stated a provisional opinion that the subject-matter of claim 1 of the amended patent did not involve an inventive step.

VI. Oral proceedings were held on 24 October 1996. Opponent I was present at the proceedings as a party of right.

The Appellant (Opponent II) argued essentially as follows:

D1 disclosed a machine control apparatus with all the features of the preamble of claim 1. Furthermore, D1 disclosed the emergency stop mode of feature A) and the controlled stop mode of feature B) of the characterising part of the claim. In particular, the distance moved by the movable member in the reduced speed mode could be considered as the predetermined slow-down feed amount specified in the claim. D3 and D4 related to techniques for taking appropriate measures when abnormal operating conditions were detected in similar machines, as defined in the remaining feature C). Since these documents related generally to the same problem, the skilled person would have combined D1 with D3 or D4 to arrive at the claimed apparatus.

The Respondent argued that D1 did not disclose or suggest the second stop mode of feature B), which is not the same as the emergency stop mode or the reduced feed rate mode of D1. The patentee had, in fact, devised a new mode, which was not suggested by D1, and in which it was possible to stop the machine in a

controlled manner before the end of the current machining step. D2 to D4 did not add anything more than D1 and, therefore, even if combined with D1, would not have suggested the claimed invention.

- VII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent requested that the decision under appeal be set aside, and that the patent be maintained on the basis of claims 1 to 3 filed in the oral proceedings (main request), or alternatively on the basis of the first subsidiary request, received 24 September 1996, or alternatively on the basis of the second subsidiary request filed during the oral proceedings.

- VIII. Claim 1 of the main request, which is identical to claim 1 maintained by the opposition division, reads as follows:

"A machine control apparatus (20) for controlling the movement of at least one movable member (11, 12) of a machine tool (10) in accordance with a numerical control programm, said control apparatus comprising:

stop control means (21, 56-58) for stopping said at least one movable member (11, 12); a plurality of trouble sensors (31-34), arranged at various parts of said machine tool (10), for monitoring operating conditions of said machine tool (10); and trouble processing means (21, ACCR, APR) responsive to output signals of said plurality of trouble sensors (31-34) for operating said stop control means (21, 56-58) when said output signal is indicating a serious trouble of said operating conditions,

characterized in that

A) said stop control means (21, 56-58) is adapted to stop said at least one movable member (11, 12) in a first stop mode (MODE 3) in which said at least one moveable member (11, 12) is stopped as fast as possible;

B) said stop control means (21, 56-58) is adapted to stop said at least one movable member (11, 12) in a second stop mode (MODE 4), in which said at least one movable member (11, 12) is stopped slowly in such a way that its actual position is prevented from differing from a nominal position variable, 40 which is stored in said machine control apparatus (20) and which is used to indicate the present position of said at least one movable member (11, 12), wherein a predetermined slow-down feed amount is set as a remaining feed amount and the feed of the respective movable member (11, 12) is discontinued when the respective movable member (11, 12) has been fed by said predetermined slow-down feed amount;

C) said trouble processing means (21, ACCR, APR) determines by way of said output signals of said trouble sensors (31-34) the kind of trouble occurring and operates said stop control means (21, 56-58) to perform one of said stop modes depending on the kind of trouble determined."

Claim 2 of the main request reads as follows:

"A machine control apparatus according to claim 1, characterized in that said stop control means (21, 56-58) is adapted to stop said at least one movable member (11, 12) in a third stop mode (MODE 5), in which said at least one movable member (11, 12) is stopped in such a way that its actual position is prevented from

differing from said nominal position, and in which said at least one movable member (11, 12) can be stopped only when reaching an objective position designated by a presently executed one block of said numerical control program."

Reasons for the Decision

1. The appeal complies with Article 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. *Admissibility of the amendments*

2.1 The Appellant objected that the scope of claim 2 of the main request was broader than that of the granted claim, thereby infringing Article 123(3) EPC. The amendment in question is the definition of the term "objective position" at the end of claim 2, i.e. that said position is "designated by a presently executed one block of said numerical control program". The Board does not consider this amendment to be a broadening of the scope because it is merely a clarification of the meaning of the term and, as such, should not affect the scope of the claim. If anything, the amendment narrows the scope because it eliminates other possible definitions.

The amendment also satisfies Article 123(2) EPC because it is supported by the application as originally filed (see page 9, lines 3 and 4, and page 10, lines 1 to 3).

3. *State of the art and novelty*

3.1 The cited documents, like the patent, are concerned with stopping a moveable member, such as a grinding wheel feed, in a machine tool, such as a grinding machine, when an abnormal operating condition occurs. In particular, the documents are concerned with reducing the operator intervention required when such conditions occur.

3.2 D1 discusses how to control the machine tool feed in a numerically controlled (NC) machine if a problem, such as overload of the cutting spindle, occurs during the machining operation. The complete machining operation is split up into machining steps, each of which is controlled by a block of numerical control data. This data defines the objective position, that is the desired end position, and the feed rate or speed for the movable member in the machining step. If a predetermined degree of overload is detected, D1 proposes reducing the feed rate by a predetermined factor for the remainder of the machining step. At the beginning of the next machining step, the feed rate reduction is cancelled and the feed rate is set to the required value for the new step. If the overload is excessive, the feed is completely stopped (emergency stop mode). This distinction between overload conditions avoids the need for operator intervention in the case of minor or transient overload, caused for example by a hard spot in the workpiece, thus improving the efficiency of the automatic machining operation. D2 discloses essentially the same solution, but with the emphasis on preventing tool breakage.

- 3.3 D3 and D4 are concerned with the general problem of sensing abnormal operating conditions and activating rescue subroutines in numerically controlled machines. However, they are rather vague and conceptual and do not disclose any details of how the machine is stopped, in particular in relation to different stopping modes.
- 3.4 It is common ground that D1 discloses the stop control means and trouble processing means of the preamble of claim 1. D1 also discloses that the stop control means have a mode which stops the movable member as fast as possible, corresponding to feature A) of the characterising portion taken on its own. This is implicit from the known emergency stop ("bekanntem Notabschaltung") mentioned in claim 1 of D1.
- 3.5 The Appellant (Opponent II) argues that D1 also discloses the plurality of trouble sensors from the preamble of the claim. The Respondent argues that D1 only discloses one trouble sensor, which cannot be used to determine different types of abnormal operation (troubles) which are processed by the apparatus of the invention.

The Board agrees with the Appellant that Figure 2 of D1 shows that the feed rate modifier controller 115 comprises two sensors in the form of switches 117 and 118. However, these make up a two-stage device, in which the high pressure switch 118 is operated only after the low pressure switch 117 has been operated to reduce the speed level. The two separate switches therefore represent only one unit. This is in contrast to the preamble of claim 1 in which the trouble sensors are independent in that they are "arranged at various parts of the machine tool" (see letter filed by the Respondent on 30 June 1995, page 1). Despite this difference, the Board considers that D1 represents the nearest prior art.

3.6 The Appellant also argued that D1 discloses the second stop mode of feature B) of the characterising part of claim 1. However, the Board considers that D1 discloses only one stop mode corresponding to feature A). As mentioned above, D1 provides a second mode in which the feed continues at a reduced speed until the end of the current machining step. However, this mode can not be regarded as a **stop mode** in the sense of claim 1. D1 states at column 2, lines 24 to 29 that if the machine is immediately stopped every time a transient overload occurs, the productivity would be adversely affected. The reduced speed mode must therefore be understood as a solution which does not have such a disadvantage. Thus the teaching of D1 is to provide a solution which does not interrupt the operation of the machine, and thus does not provide a second stop mode.

3.7 The remaining feature C) of the characterising part of claim 1 requires the trouble processing means to determine the kind of trouble that has occurred and to select an appropriate stop mode. It appears that the wording of this feature should be interpreted in connection with the independent nature of the trouble sensors discussed above in paragraph 3.5. Thus, feature C) defines that the combination of the processing means and the trouble sensors, arranged at various parts of the machine tool, detects different kinds of trouble and, accordingly, performs the correct stop mode. Such a feature is not disclosed in the arrangement of D1 which, in fact, only discloses an emergency stop mode triggered by the high pressure switch 118.

3.8 Claim 1 of the main request therefore differs from D1 in that the trouble sensors are independent, by the second stop mode of feature B), and the trouble processing means of feature C). Moreover, the

subject-matter of the claim is distinguished from the teaching of D1 by the combination of the characterising features, in that the trouble processing means of feature C) triggers both of the stop modes of features A) and B). Claim 1 is, therefore, novel.

4. *Inventive step (main request)*

4.1 The Board considers that, in view of the teaching of D1, the problem to be solved by the invention is that the machine control apparatus should be designed to execute a complete program of machining operations with a minimum of manual intervention. This problem is well known from the variety of documents cited during the proceedings. The same problem can be derived from D1 at column 2, line 64 to column 3, line 7, for example. Thus, the problem as such is not novel in itself and has apparently been solved. This does not, however, exclude patentability of an alternative solution if the new solution fulfils the requirements of the EPC (see decision on T 0092/92 of 21 September 1993, page 12, reason 4.5, not published).

4.2 It does not appear that feature C), considered separately, is obvious over the teaching of D1. The feed rate controller unit 115 according to D1 contains, in addition to the high pressure switch, only one switch intended for reducing the speed rate (low pressure switch 117). Moreover, neither D1, nor any of the other cited documents discloses more than one stop mode. The documents, therefore, do not hint towards the sensor arrangement of claim 1. However, since most of the arguments raised during the oral proceedings revolved around feature B), the Board considers that this feature should be dealt with first. Only if

feature B) turns out to be obvious, will it be necessary to consider in more detail whether feature C), separately, or in combination with the other features, is obvious or not.

- 4.3 Feature B) defines a second stop mode in which the movable member is stopped slowly in such a way that its position is known. As mentioned above, D1 does not disclose a second stop mode. It also follows from the above that the solution of the reduced feed rate mode is designed not to interrupt the operation of the machine, and that, therefore, D1 does not propose providing an additional stop mode. Finally, nowhere else in D1 is it suggested that the machine should be stopped other than in the known emergency stop mode.
- 4.4 Furthermore, neither of the modes in D1 operates in the manner claimed in feature B). According to this feature, a predetermined slow-down feed amount is set as a remaining feed amount which means that the movable member will travel a predetermined distance after the condition is detected before stopping. Clearly this is not the case for the emergency stop mode of D1, in which no remaining feed amount is set, because the object is to stop the machine as quickly as possible. Similarly the Board cannot find an interpretation of this feature in the reduced speed mode either. At the point in time that the switch 117 detects an overload and the feed rate is reduced, it is intended that the feed should continue until the desired end position at the end of the current block is reached. Thus at the time of the overload, the remaining feed amount is the desired end position, stored in the command register 330, minus the current position, stored in position register 335. This amount is clearly variable and depends on the position of the tool when the overload occurs and the desired end position at the end of the block. Thus it cannot be considered to be a

"predetermined" value as required by the claim. Moreover, the reduced speed mode of D1 can never result in the movable member stopping before the end of the current block as is clearly possible according to claim 1. Finally, in D1, no feed amount is actually "set" at the time of the overload, because the remaining amount is merely a function of values that were set at the start of the block and were not changed by the occurrence of the overload. Therefore, the Board does not consider that D1 discloses the feature of setting a predetermined slow-down amount in the sense of the claim.

4.5 The Appellant argues that the expression "vorherbestimmte Veränderung der Vorschubgeschwindigkeit" (predetermined change in the feed rate), in relation to the reduced speed mode of D1, is equivalent to the claimed predetermined slow-down feed amount. It was argued that, in an NC machine, calculations are performed at time intervals which are constant due to the fixed clocking of such systems. Since speed and distance are related via time, a constant feed rate would equate to a constant feed amount. However, the Board does not agree with this, since the particular relationship between feed rate and feed amount in D1 involves the time to the end of the current block, which as explained above, is not constant, but depends on when the overload occurs. Therefore, these two variables are not related in the manner suggested by the Appellant, so that, in D1, a predetermined feed rate does not imply a predetermined feed amount.

4.6 The Board has also examined whether any other reading of D1 would suggest the second stop mode of the patent. The last paragraph of D1 states that the emergency stop mode triggered by switch 118 can be made to effect a zero rate modification of the count control gate 339

shown in Figure 3. In this case, the gate would stop sending command pulses to the servo system and the movable member would stop. Even if this could result in a controlled stop according to the first part of feature B), a result which is not stated, there is still no suggestion of a predetermined slow-down feed amount according to the last part of feature B). This is because the stop is triggered by switch 118 and has immediate effect.

Another possibility is that the combination of both modes of D1 could be considered to be the stop mode of feature B). The stop would be triggered by detecting a further excessive ("übermäßige" at column 10, line 64) overload at sensor 115. In this case, the amount travelled in the reduced speed mode would depend on the occurrence of the further excessive overload and is, therefore, not predetermined.

Furthermore, in order to arrive at the subject-matter of claim 1, these possibilities would require an additional emergency stop mode, corresponding to feature A), for which there is no suggestion in D1. On balance, therefore, the Board considers that these lines of argument are too tenuous to demonstrate a lack of inventive step.

4.7 The controlled emergency stop mode of feature B) which is triggered by the trouble processing means of feature C) is, therefore, not obvious.

4.8 In summary, D1 can be interpreted as disclosing the known emergency stop mode and, additionally, only a safety mode which is not designed to interrupt the machining operation. The patentee, however, has realized that an intermediate mode is desirable in which the machine responds to an additional abnormal condition to produce a controlled stop. Furthermore, as

mentioned above, the remaining documents D2 to D4 do not add anything to the teaching of D1. Therefore, the Board considers the subject-matter of claim 1 not to be obvious. The machine control apparatus of claim 1 of the main request accordingly involves an inventive step.

5. Since the Respondent's main request is allowable, there is no need to consider the subsidiary requests.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent on the basis of the main request of the patentee.

The Registrar:

The Chairman:

M. Beer

R. Randes

