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D E C I S I O N
of 20 January 2000

Case Number: T 1023/97 - 3.5.1

Application Number: 91900934.0

Publication Number: 0460229

IPC: G05B 19/405

Language of the proceedings: EN

Title of invention:

A system for creating command and control signals for a complete operating cycle of a robot manipulator device of a sheet metal bending installation by simulating the operation environment

Applicant:

AMADA COMPANY, LIMITED

Opponent:

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Headword:

Robot manipulator for sheet metal bending/AMADA

Relevant legal provisions:

EPC Art. 52(1), 56

Keyword:

"Inventive step (yes)"

Decisions cited:

-

Catchword:



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Boards of Appeal

Chambres de recours

Case Number: T 1023/97 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 20 January 2000

Appellant: AMADA COMPANY, LIMITED
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Representative: Grünecker, Kinkeldey
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 28 April 1997
refusing European patent application
No. 91 900 934.0 pursuant to Article 97(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. This appeal is against the decision to refuse the application on the ground that the subject-matter of the claims lacked an inventive step (Article 52(1) and 56 EPC). Inter alia the following documents were cited in the decision:

D1: GB-A-2 211 002

D5: EP-A-0 346 839

D8: Flexible Automation No. 7, 1986, pages 42-44,
"Generationswechsel bei der Programmierung".

II. The appellant filed within the required time limits a notice of appeal, paid the prescribed fee and filed also a statement setting out the grounds of appeal. He requested that the decision under appeal be set aside and a patent be granted on the basis of either the main request or the auxiliary request, both containing a set of two claims. Auxiliarily oral proceedings were requested.

Claim 1 of the main request reads as follows:

"A method of creating control signals for a complete operating cycle of a sheet metal bending installation (500) that includes a bending press (1), a robot manipulator device (4) provided in front of the bending press (1), a magazine with a loader device (5) and a discharge table (6), and a communication means (8a, 9a) for communication with an operator, connected to a central processor unit (7a) for producing a working

simulation of the bending press (1) and the robot manipulator device (4) and creating the control signals,

the method comprising the steps of:

- (a) displaying on a display screen (9a) a cross-section of the bending installation (500) and a sheet metal;
- (b) creating and/or modifying signals for moving the robot manipulator device (4) and/or for actuating the bending press (1) in an i-th stage of operating cycle;
- (c) displaying on the display screen (9a) the movement of at least one of the bending press (1), the robot manipulator device (4) and the sheet metal during the i-th stage as defined in the step (b);
- (d) determining whether the i-th stage is the final stage of the operating cycle; and
- (e) repeating the step (b), (c) and (d) when the i-th stage is not the final stage of the operating cycle and stopping the procedure when the i-th stage is the final stage of the operating cycle;

characterized in that

the control signals are created and/or modified at step (b) on the basis of the operator's manual input through the communication means (8a, 9a) and in that

a possible interference between the metal sheet (23) or a movable part of the robot manipulator device (4) and a fixed structure of the bending press that may occur in the i-th stage is checked after the signals for controlling the robot manipulator and/or the bending press for the i-th stage are created at step (b) and before the determination is made at step (d) as to whether the i-th stage is the final stage of the operating cycle."

The first paragraph of claim 1 of the auxiliary request is identical to the one of claim 1 of the main request. The following paragraphs of claim 1 of the auxiliary request, however, read as follows:

"the method comprising the steps of:

- (a) displaying on a display screen (9a) a cross-section of the bending installation (500) and a sheet metal;
- (b) creating and or modifying signals for moving the robot manipulator device (4) and/or actuating the bending press (1) in the first stage of operating cycle;
- (c) displaying on the display screen (9a) the movement of at least one of the bending press (1), the robot manipulator device (4) and the sheet metal during the first stage as defined in the step (b);
- (d) creating and/or modifying signals for moving the robot manipulator device (4) and/or for actuating the bending press (1) in a second stage of

operating cycle;

- (e) displaying on the display screen (9a) the movement of at least one of the bending press (1), the robot manipulator device (4) and the sheet metal during the second stage, as defined in the step (b);

characterized in that

the control signals are created and/or modified at steps (b) and (d) on the basis of the operator's manual input through the communication means (8a, 9a) and in that

a possible interference between the metal sheet (23) or a movable part of the robot manipulator device (4) and a fixed structure of the bending press that may occur in the first stage is checked after the signals for controlling the robot manipulator and/or the bending press for the first stage are created at step (b) and before the signals for controlling the robot manipulator and/or the bending press in the second stage are created at step (d)."

- III. In a communication annexed to the summons to oral proceedings (held on 20 January 2000) the Board noticed that the independent claims 1 of both the main and the auxiliary requests now corresponded to the precharacterizing part of refused claim 1 but stated that both claims were perfectly clear. However, the Board also expressed the preliminary opinion that the subject-matters of claim 1 of both requests were obvious to a skilled man. It was, in particular

referred to document D8, which was said to relate to "interactive programming".

- IV. In the proceedings before the Board the appellant in summary argued as follows:

The gist of claim 1 of both requests was that the checking of the interference that might occur in a first stage was carried out before the control signals for a second stage were created and/or modified. Thus the checking could be carried out immediately after the control signals for the current stage had been created and/or modified, i.e. before the next stage. Thus the interference could be checked at every stage. The cited documents did not disclose such a method. In D5 for example the interference was checked after the complete operation cycle had been entered.

Reasons for the Decision

1. The appeal is admissible.

Main Request

2. As suggested by the examining division, D5 discloses a method of creating control signals for a complete operating cycle of a robot installation (see the appealed decision, point 1.1, pages 5 and 6). According to D5 the central processor unit 206 includes means operable to permit, by communication means 211 the creation and/or modification of said control signals in the central processor unit 206 for controlling the various phases of the operation of the respective

installation and in particular to command the presentation (on a display means) of the configuration of working parts (see e.g. column 18, lines 21 to 23) of the installation and a work piece (column 18, lines 23, 24) related to any phase selected (see e.g. column 18, lines 16 to 20) for the creation and/or modification of said control signals.

It is true that according to D5 the simulation is not restricted to one phase of the operation of the installation in the sense of the present application. However, D5 discloses a teaching system that automatically during the teaching is checking, whether any interference exists among the robots and workpieces (column 20, from line 22 onwards). It appears that it would be obvious for a skilled person to change this automatic method into an interactive "manual" method if considered suitable and, therefore, make an interference test for example immediately after the programming of each distinct movement performed by the machine. In this respect it is also pointed out that the cited article of document D8 is, in particular, concerned with machine tool interference. It is stated in its introducing part, that in modern simulation techniques the interference check involves stopping simulation at a critical point, i.e. when interference occurs (page 42, left hand column, first paragraph). Later on in that introducing part (D8, page 42, right hand side column) the opinion is expressed that with "interactive programming" it should be possible to check every step of a program on a display ("Wir sprechen lieber von interaktiver Programmierung. Dabei kann bei jedem Zeitpunkt jeder Programmierschritt am Bildschirm auf seine Richtigkeit überprüft werden").

The term "interactive programming" has been mentioned in connection with "interactive grafics" and "interactive simulation" and such programming is apparently seen as the next step of development in this field ("uns reicht der Begriff interaktive Grafik nicht aus"), i.e. every step of a programming sequence should be supported by simulation of the currently programmed step. Such simulation, however, of course must include an interference test.

Neither D5, nor D8 mention explicitly that the methods described could be used for a sheet bending installation. However, the Board takes the view that it is self-evident to a skilled man that they can be used for that purpose, since D5 (although it, in particular, concerns the assembling of vehicles) gives a general teaching of a robot control system and D8 is concerned with the latest development (at that time) in the general field of machine tool programming. Thus it is obvious that the programming technics used in D5 and D8 can be transferred to the plate bending machine disclosed in D1 which machine discloses all the features of the sheet metal bending installation identified in the first paragraph of present claim 1.

The Board, therefore considers that it is obvious to a skilled man to arrive at the subject-matter of claim 1.

3. The subject-matter of claim 1 of the main request, therefore, does not meet the requirements of Articles 52(1) and 56 EPC.

Auxiliary Request

4. Claim 1 of the auxiliary request has been amended in relation to claim 1 of the main request only in respect to its wording, but in substance it fully corresponds to claim 1 of the main request. Also the subject-matter of this claim, therefore, does not involve an inventive step and the claim is not allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Kiehl

P. K. J. van den Berg