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**Datasheet for the decision
of 7 February 2017**

Case Number: T 1475/13 - 3.2.08

Application Number: 98901502.9

Publication Number: 1016490

IPC: B23K11/24, B23K11/25, B23K11/30

Language of the proceedings: EN

Title of invention:
WELDING METHOD

Patent Proprietor:
Kabushiki Kaisha Yaskawa Denki

Opponent:
KUKA Roboter GmbH

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes)

Decisions cited:

Catchword:



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Case Number: T 1475/13 - 3.2.08

D E C I S I O N
of Technical Board of Appeal 3.2.08
of 7 February 2017

Appellant: KUKA Roboter GmbH
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 16 April 2013
rejecting the opposition filed against European
patent No. 1016490 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chair	P. Acton
Members:	M. Foulger
	Y. Podbielski

Summary of Facts and Submissions

I. With the decision dated 16 April 2013, the opposition division rejected the opposition against European patent no. 1 016 490.

II. The appellant (opponent) filed an appeal against this decision. The appeal was filed in due form and within the given time limits.

III. Oral proceedings took place before the Board on 7 February 2017.

IV. The appellant requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed.

V. The sole claim under consideration reads:

" **(A)** A welding method

(B) performed by a welding robot (1)

(C) having a welding gun (4)

(C1) provided with a moving-side electrode (6) and

(C2) attached to an end

of its robot arm for holding a workpiece to be welded

(C3) with a fixed-side electrode and the moving-side

electrode opposite to the fixed-side electrode and

(C4) moving driven by a servomotor (7) or an air

cylinder to hold with pressure the workpiece to be welded, said method comprising the steps of:

(D) fixing the workpiece (9) between the fixed-side electrode and the moving-side electrode;

(E) controlling the robot arm such that the end of the robot arm moves with an external force only in the

direction the moving-side electrode moves,
(F) then moving the moving-side electrode toward the workpiece,
(G) causing the workpiece to be held between the moving-side electrode and the fixed-side electrode and performing welding; and
(H) releasing the holding with pressure for the workpiece to return the moving-side electrode to its original position,
(I) wherein those steps are performed quickly, characterized in that
(C5) the welding gun is provided with the fixed-side electrode (5); and that the step of controlling the robot includes
(E1) after the moving-side electrode comes into contact with the workpiece, pressing the moving-side electrode against the workpiece with a constant force such that the end of the robot arm moves in a direction opposite to the direction in which the moving-side electrode moves with a counterforce."

(Feature references in bold added by the Board).

VI. The following documents are relevant for this decision:

D1: JP 7-290252 A
D1a: machine translation of D1
D2: DE 39 22 524 A1
D5: DE 81 36 950 U
D16: JP 6-31460 A
D16a: machine translation of D16
D17: JP 7-284957 A
D17a: machine translation of D17

VII. The appellant argued essentially the following:

The subject-matter of the claim lacked an inventive step (Article 56 EPC) in the light of the following:

i) D1 as closest prior art:

D1 disclosed a welding method performed by a welding robot. The robot had a welding arm carrying a welding gun. The welding gun had a moving side electrode 22 which was driven by a motor 17. The electrode 23 was "fixed" because it was opposite to the moveable electrode as defined by feature C3 of the claim.

Hence, D1 disclosed all features of the claim with the exception of features E and E1.

The problem to be solved by the patent (see paragraph [0006]) was to provide a welding method which eliminated the need for an equalising mechanism.

D2 (see col. 2, l. 28-30) disclosed a method whereby gravitational effects were compensated without the need for an equalising mechanism. Therefore, in seeking to solve the above problem, the skilled person would have consulted this document.

Although D2 disclosed that the robot arm should be moved to the workpiece without the compensation activated i.e. in a "hard" control state, the skilled person would recognise that as D1 provided a permanent "soft" state due to the spring suspension of the gun, it would be necessary to provide this permanent "soft state" through the control system. Hence, the skilled person would have kept this aspect of D1.

The feature E1 was merely an inevitable consequence of applying the method taught by D2 to the method of D1 because when the movable electrode was pressed against the workpiece, the robot arm would move upwards as a reaction.

Moreover, even if the electrode 23 were not regarded as "fixed" then applying the method of D2 to the method of D1 would result in the equalising mechanism being eliminated and therefore, in any case, the electrode would become fixed. Thus feature C5 of the claim followed inevitably from the combination of the teachings of D1 and D2.

Thus the combination of teachings of D1 and D2 would have led the skilled person to the subject-matter of the claim without an inventive step being involved.

ii) D5 as closest prior art

D5, Figs 7-9 showed a similar method to that of D1 with a moveable electrode 66, a fixed electrode 62, an actuation cylinder 64 fixed to an arm 63. As the use of the welding machine for a robot was specifically disclosed (page 11, 2nd paragraph), arm 63 was clearly a robot arm in the sense of the claim.

Thus, the arguments above in relation to D1 were also directly applicable to D5 and consequently the subject-matter of the claim also lacked an inventive step in the light of the teachings of D5 and D2.

iii) D16 as closest prior art:

D16 disclosed a robot 1 with a fixed electrode 4 and a moveable electrode - also with reference sign 4. This

robot was used for spot welding (paragraph [0011]). According to paragraph [0018] the electrode was moved towards the limit switch 15 as shown in Fig. 5. It was a logical consequence of this movement that the robot arm should move upwards as defined in feature E1 of the claim.

The method of D16 differed from that of the claim in that in D16 the electrode was driven against the "dog" in order to calibrate the electrodes whereas in the claim the electrode was driven against the workpiece itself.

It was common general knowledge that the workpiece itself could be used to calibrate welding guns. This was described in paragraph [0004] of D17, which although referring to problems when using thin objects to calibrate the electrodes, implied the contrary was true i.e. that there was no problem with thick objects. The skilled person was therefore taught by common general knowledge and by D17 that the welding gun could be calibrated directly on the workpiece, at least for relatively thick workpieces. In following this teaching the skilled person would have arrived at the subject-matter of the claim.

The subject-matter of the claim therefore lacked an inventive step.

VIII. The respondent argued essentially the following:

i) D1 as closest prior art:

D1 disclosed a welding method performed by a welding robot. The robot had a welding arm carrying a welding gun which had a moving side electrode 22 driven by a

motor 17. The electrode 23 could not be regarded as "fixed" because it was moveable with respect to the arm.

The welding method of claim 1 of the patent differed from the method of D1 in that method steps C5, E and E1 were provided.

The skilled person would, however, have regarded the problem of vibrations posed by D1 to have already been solved by the second spring of D1. Thus the skilled person would not have had any motivation to consult D2.

Even if the skilled person had consulted D2 this would not have led to the subject-matter of the claim because D2 taught that the arm should be driven to the workpiece with a "hard" control and then only after clamping should the "soft" control be switched on.

Hence, the combination of the teaching of D1 with that of D2 would not have led to the subject-matter of claim 1.

ii) D5 as closest prior art

D5 disclosed a welding device that could be used in a robot. D5 did not, however, disclose anything about the robot. In fact, the arm shown could simply have been mounted on a static post. An arm in the sense of the claim was therefore not disclosed and consequently the further features of the claim relating to the arm (features E and E1) were also not disclosed in D5. D2 related to a device which followed a programmable path (col. 1, l. 21-24 and l. 64-66), hence the teaching of D2 was not applicable to that of D5. The above arguments in relation to the teachings of D1 and D2

were also directly applicable to the combination of the teachings of D5 and D2.

Hence the subject-matter of the claim involved an inventive step.

iii) D16 as closest prior art

D16 was directed towards a calibration method rather than a welding method and thus could not be regarded as closest prior art. Moreover, since the moveable and fixed electrodes both had the same reference number, the sequence described in paragraph [0018] did not directly and unambiguously disclose feature E1 of the claim. Hence the teaching of D16 combined either with the teaching of D17 or common general knowledge did not lead to the subject-matter of claim 1.

The subject-matter of the claim therefore involved an inventive step.

Reasons for the Decision

Inventive step

1. Starting from D1 as closest prior art:

It is common ground that the subject-matter of the claim differs from the method disclosed in D1 at least in that the step of controlling the robot includes:

- controlling the robot arm such that the end of the robot arm moves with an external force only in the direction the moving-side electrode moves (feature E), and in that
- after the moving-side electrode comes into contact

with the workpiece, pressing the moving-side electrode against the workpiece with a constant force such that the end of the robot arm moves in a direction opposite to the direction in which the moving-side electrode moves with a counterforce (feature E1).

Whether D1 disclosed a fixed side electrode was contested by the parties but this question does not affect the reasoning for this decision and therefore need not be dealt with here.

The problem to be solved is to provide a welding method which eliminates the need for an equalising mechanism (see patent [0006]).

It is true that D2 deals with this problem, see col. 1, l. 15-20 and col. 2, l. 28-30. The first feature (E) of controlling the robot arm so that it moves only in the direction the moving-electrode moves is arguably made obvious by D2, col. 2, l. 28-30. The second characterising feature (E1), by contrast, is not disclosed by D2. D2 describes a robot control method which can be used for spot welding (col. 2, l. 39). However, D2 describes that the welding tongs are driven onto the workpiece without load dependent control - i.e. with a "hard" control (col. 2, l. 38-41). Only after the tongs are closed is the "soft" control turned on (col. 2, l. 42-43).

The appellant argues that the skilled person would directly recognise that such a control could take place during closing of the tongs, and that because the spring arrangement of D1 was always active, the skilled person would modify the teaching of D2 so that the soft control would always be active as well.

It is true that the teaching of D2 could be altered and applied to D1. However, D2 already starts from the premise that the welding gun has a spring suspension as in D1 and therefore its teaching should not need further modification when applied to D1 in order to solve the problem posed. Hence, even applying the teaching of D2 to the method of D1 would not lead the skilled person to the subject-matter of the claim which therefore involves an inventive step starting from D1 as closest prior art.

2. Starting from D5 as closest prior art:

D5 does not directly and unambiguously disclose the presence of an arm; indeed the only reference to a robot is on page 11, 2nd paragraph which reads "[e]s ist hauptsächlich zur Ausrüstung für einen Roboter oder für ein industrielles Handhabungsgerät bestimmt". As pointed out by the respondent, the apparatus shown in D5 could simply be fixed rigidly to a post. In this case no arm - movable or not - would be present. The "arm 63" referred to by the appellant cannot thus be considered a robot arm in the sense of the claim. Hence, D5 does not clearly and unambiguously disclose features E and E1 which both require a movable arm. Therefore starting from this document, the skilled person would have no reason to consult D2 which provides a solution for problems associated with programmable machines which need to follow a programmed path as accurately as possible (see col. 1, l. 8-12).

Moreover, even if the skilled person were to combine the teaching of D5 and D2, then, as set out above in relation to D1, the skilled person would have to further modify in a non-obvious way the teaching of D2 in order to arrive at the subject-matter of the claim.

Thus, the subject-matter of the claim also involves an inventive step when considering D5 as closest prior art.

3. Starting from D16 as closest prior art:

Although this document is primarily concerned with a calibration method it does also disclose some steps of the welding method claimed, see paragraph [0011]. It can therefore also be regarded as a suitable starting point for the skilled person.

As argued by the appellant, in the calibration method of D16 described in paragraph [0018], the electrode 4 is moved towards a fixed "dog" 16. However, this paragraph also discloses that the electrode 4 is moved towards the limit switch. This disclosure is ambiguous because both electrodes (fixed and moveable) have the reference sign 4. It is therefore not unambiguously disclosed which of the two electrodes is pressed against the workpiece or, if they both are, in which order. Hence the above feature E1 is not disclosed by the method of D16.

Thus, even applying either common general knowledge as shown by D17, which also does not disclose feature E1, or the teaching of D17 itself to the method of D16 would not lead to the subject-matter of the claim.

4. The subject-matter of the claim therefore involves an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chair:



C. Moser

P. Acton

Decision electronically authenticated