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D E C I S I O N
of 21 March 2003

Case Number: T 0314/00 - 3.2.6

Application Number: 92106430.9

Publication Number: 0544980

IPC: B23H 7/04

Language of the proceedings: EN

Title of invention:

Wirecut electrical discharge machine and method of use thereof

Patentee:

mitsubishi denki kabushiki kaisha

Opponent:

AGIE S.A.

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 83

Keyword:

"New ground of opposition (not admitted)"

"Novelty (yes)"

"Inventive step (yes)"

Decisions cited:

G 0010/91

Catchword:

-



Case Number: T 0314/00 - 3.2.6

D E C I S I O N
of the Technical Board of Appeal 3.2.6
of 21 March 2003

Appellant:
(Opponent)

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Decision under appeal:

**Decision of the Opposition Division of the
European Patent Office posted 17 January 2000
rejecting the opposition filed against European
patent No. 0 544 980 pursuant to Article 102(2)
EPC.**

Composition of the Board:

Chairman: P. Alting van Geusau
Members: H. Meinders
M. J. Vogel

Summary of Facts and Submissions

I. The appeal is from the decision of the Opposition Division posted 17 January 2000 rejecting the opposition against European Patent No. 0 544 980.

From the opposition proceedings the following documents are relevant for the present appeal proceedings:

D1: EP-B-0 056 784

D2: DE-C-3 419 629

D4: US-A-4 392 041

The Opposition Division held that the subject-matter of independent claims 1 and 2 as granted was novel and inventive over the combination of the teachings of D4 and D2. D1 was considered not more relevant than D4.

II. Against this decision an appeal was filed by the Appellant (Opponent) on 27 March 2000, with payment of the appeal fee on that same day. The statement of grounds of appeal was filed on 26 May 2000.

In its statement of grounds of appeal the Appellant referred additionally to the following documents:

D6: CH-B-0 525 061 and

D7: JP-A-51-5692 (with translation in German of its claim 1).

III. Oral proceedings were held on 21 March 2003.

The Appellant requested that the decision under appeal be set aside and the patent be revoked in its entirety.

The Respondent (Patentee) requested that the appeal be dismissed.

IV. The granted independent method claim 1 reads as follows:

"A method of operating a wirecut electrical discharge machine for cutting a workpiece (2) by means of electrical discharge generated in a machining gap wherein the workpiece (2) is opposed to a wire electrode (1), the method comprising the steps of:

- storing a plurality of machining conditions based on dielectric pressure and machined plate thickness combinations in memory, said machining conditions including electrical condition parameters and machining feedrates,
- setting one of said machining conditions, whereby the electrical condition parameters are set constant whilst machining under said one machining condition;
- determining a present machining feedrate (S2); and
- when said present machining feedrate (Fc) is not substantially equal to a set machining feedrate corresponding to the set of said machining conditions, automatically setting an optimum machining condition from detected dielectric pressures (Pu, Pd) and a machined plate thickness (t) estimated by dividing (S7) an area machining

feedrate (S) corresponding to said present machining condition by a detected machining feedrate (Tc)".

Granted independent product claim 2 reads as follows:

"A wirecut electrical discharge machine, comprising:

- a wire electrode (1) arranged for opposing a workpiece (2);
- a plurality of nozzles (3, 4) disposed adjacent to said wire electrode (1) for supplying dielectric to a machining gap formed between said workpiece (2) and said wire electrode (1);
- a plurality of dielectric pressure detectors (13, 14), each of said pressure detectors being operatively connected to a corresponding one of said nozzles (3, 4) for detecting dielectric pressure;
- means (12) for controlling a plurality of electrical condition parameters associated with said wire electrode;
- means for storing a plurality of machining conditions based on dielectric pressure and machined plate thickness combinations in memory, said machining conditions including electrical condition parameters and machining feedrates;
- means for determining an actual machining feedrate (fc);

- means for estimating a plate thickness by dividing an area machining feedrate by said actual machining feedrate;
- means (12) for selecting one of said plurality of machining conditions based on signals produced by said dielectric pressure detectors and said estimated plate thickness when said actual machining feedrate is not substantially equal to a set machining feedrate corresponding to the set of said machining conditions".

IV. The arguments of the Appellant can be summarised as follows:

Sufficiency of disclosure of the invention by the patent in suit (Article 83 EPC) was questionable, as specific parameters (like peak current, pulse width, dwell width and capacitor capacity), to be set for specific machining combinations of dielectric pressure and machined plate thickness or to be changed depending on feedrate/plate thickness and/or dielectric pressure, were not disclosed.

The subject-matter of claims 1 and 2 was obvious in view of D4 on its own or D4 in combination with D2, where necessary with the additional information provided by D1, D6 or D7. Also the combination of teachings of D1 and D2 put into question inventive step of this subject-matter.

V. The Respondent's submissions can be summarised as follows:

The ground of opposition of lack of sufficiency of disclosure was raised only on appeal and therefore constituted a late ground of opposition to the introduction of which the Respondent did not consent.

Inventive step was given in respect of D4 as starting point. The features at least distinguishing the subject-matter of claims 1 and 2 from the disclosure in this document, being the storing of machining conditions based on dielectric pressure and machined plate thickness **combinations** (emphasis added by the Board) and the estimate of the plate thickness by dividing an area machining feedrate corresponding to said present machining condition by a detected machining feedrate, were by no means suggested by D4, nor by D2, nor by any of the other documents on file.

The same applied when starting from D1, which did not relate to machined plate thicknesses but to dielectric flowrates, thus not to dielectric pressures as claimed. The electrical and machining conditions, as shown in Figure 7, were stored in parallel memories, not as combinations as claimed in the patent in suit.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of the ground of opposition of lack of sufficiency of disclosure (Article 83 EPC)*

2.1 The Appellant (see statement of grounds of appeal, page 3, last paragraph; page 4, last paragraph of point 3; page 14, last paragraph) is objecting to the patent not disclosing the specific parameters which should be chosen for the combinations of dielectric pressure and machined plate thickness and what is to be understood by the optimum machining condition as claimed. It is clear that this is to be understood as an objection to lack of sufficiency of disclosure (Articles 83 and 100(b) EPC).

In the notice of opposition of 6 December 1996 (page 1) only the grounds of opposition pursuant to Article 100(a) EPC, as regards lack of novelty and lack of inventive step, have been raised. The opposition division has not introduced the ground of opposition under Article 100(b) EPC of its own motion, nor has it addressed this ground in the decision under appeal.

The objection made by the Appellant thus has to be considered as a new ground of opposition.

2.2 In view of Enlarged Board of Appeal Decision G 10/91 (OJ EPO 1993, 420) a new ground of opposition raised for the first time on appeal may only be considered by the Board with the consent of the patent proprietor. As this is not the case, this new ground of opposition is not admitted.

3. *Novelty (Article 54 EPC)*

Novelty was not an issue between the parties in the appeal proceedings. As none of the documents available in the file discloses all features of claims 1 or 2, the Board is satisfied that the subject-matter of these claims is novel.

4. *Inventive step (Article 56 EPC)*

4.1 The Board considers D4 the closest prior art for discussing inventive step of the subject-matter of claims 1 and 2, as it concerns a method for operating a wirecut electrical discharge machine as well as a wirecut electrical discharge machine and also addresses the same problem insofar as it concerns the adaptation of the machining conditions according to variations in machined plate thickness.

When comparing the subject-matter of those claims with the method as disclosed in D4 the Board notes at least the additional features:

in claim 1:

- a plurality of machining conditions based on machined plate thickness **and** dielectric pressure **combinations** are stored in the memory,
- when the present machining feedrate is not substantially equal to the set machining feedrate corresponding to the set of machining conditions, the optimum machining condition is set from detected dielectric pressures and a machined plate thickness estimated by dividing an area machining

feedrate corresponding to the present machining condition by a detected machining feedrate, thus such area machining feedrates must also have been **stored**.

in claim 2:

- a plurality of dielectric pressure detectors for detecting dielectric pressure,
- means for storing a plurality of machining conditions based on machined plate thickness **and** dielectric pressure **combinations**,
- means for estimating a plate thickness by dividing an area machining feedrate by the actual machining feedrate,
- means for selecting one of a plurality of machining conditions based on signals produced by said dielectric pressure detectors and said estimated plate thickness.

4.2 The features mentioned above assure that when machining workpieces with non-uniform thickness not only the feedrate is adapted to the actual thickness to be machined so that machining is more efficient, but also account is taken of the changes in dielectric pressure due to changes in thickness of the workpiece, in order to adjust the electrical discharge energy in accordance with the stored machining condition based on the sensed dielectric pressure, thereby preventing breakage of the wire electrode.

The object of the invention of the patent in suit is therefore to increase the efficiency of the known method of operating a wirecut electrical discharge machine (see patent in suit, column 1, lines 32 and 33 as well as column 2, lines 36 to 54 and column 3, lines 31 to 37).

4.3 The Appellant argued that D4 provided an equivalent to the claimed estimation of the machined plate thickness by dividing the area machining feedrate by the actual feedrate, in particular when considering its reference to:

- detecting variations in the machining area of a workpiece and setting optimum electrical conditions in accordance with the thickness of the workpiece (column 3, lines 37 to 45),
- the feedrate being in inverse proportion to the workpiece thickness (column 5, lines 51 and 52),
- the thickness t being substantially in proportion to the machining feed speed F (column 6, line 15).

These disclosures proved that when keeping the machining energies substantially constant deriving the machined plate thickness from the actual feedrate was known. Based on this knowledge the step of using the area machining feedrate S as a "proportionality factor" was a mere trivial measure. This was also evident from D1, which (column 1, lines 32 to 38) indicated that already in 1969 Kondo determined the actual machining area (thus as a consequence the machined thickness)

from the electrical condition parameters and the actual feedrate. Evidence thereof could be found in D6 (columns 25 and 26), the patent granted to Kondo in that respect.

Thus the only difference remained in the additional use of detected dielectric pressure values in the method for setting the machining conditions.

D2 provided the information that the actual differential dielectric pressure should be compared with a set differential dielectric pressure and the result should be used when setting the machining conditions (see column 7, lines 43 to 61). Including such information derived from differential pressure values in the matrix already known from D4 for plate thickness versus machining conditions was obvious to the skilled person, requiring no inventive skills. In this respect D1 already suggested the use of more variables in setting machining conditions, see figure 7.

- 4.4 However, considering the claimed subject-matter of the patent in suit it is evident that the method is carried out by, among others, using **stored** values for the area machining feedrate corresponding to the actual machining conditions and dividing these by the actual machining feedrate. The Board observes in this respect that D4 does not give any indication to store such values and to use these for estimating the machined plate thickness. From the cited references to the feedrate being in inverse proportion to the thickness it cannot be derived that an **area** machining feedrate should be used.

Further, neither the reference in D1 to the "Kondo" method, nor D6 or D7 provide such an indication, because the indicated passages do not relate to wirecut electrical discharge machining but to cavity-sinking electrical discharge machining and therefore would not be taken into account by the skilled person. In addition, the surface being worked upon ("aktuelle Bearbeitungsfläche") in cavity-sinking electrical discharge machining is expressed in the dimensions length x length, thus not comparable with the area machining feedrate in wirecut electrical discharge machining, the later being the "surface having been worked upon, i.e. length x length per unit of time".

Thus the available state of the art does not suggest using the area machining feedrate in estimating the machined plate thickness.

- 4.5 The subject-matter of claims 1 and 2 further distinguish themselves from the disclosure in D4 by the feature of storing machining conditions based on **combinations** of dielectric pressures and machined plate thicknesses.

It may be true that D2 suggests the use of a detected differential dielectric pressure to set machining conditions like pulse frequency or pulse amplitude (column 7, lines 53 to 61), this is, however, not done in a manner which makes this teaching "combinable" with the teaching in D4.

In D2 only a dielectric pressure **differential** is detected, not dielectric pressures as such. Further, the control is such that the measured dielectric pressure differential is compared with the set pressure

differential, from which difference a control signal for the machining conditions is directly derived. Thus there is no **storing** in a memory of a plurality of machining conditions based on such dielectric pressure data nor of **setting** the optimum machining condition from detected dielectric pressures on the basis of those stored data, as claimed in claims 1 and 2. Thus, there is a fortiori no indication for the skilled person to **combine** dielectric pressure data with machined plate thickness data to provide a basis for machining conditions to be chosen from.

Therefore the subject-matter of claims 1 and 2 involves an inventive step over D4 on its own or the combination of teachings of D4 and D2.

- 4.6 The Appellant also argued that when taking D1 as closest prior art the subject-matter of claim 1 was obvious in view of this document alone and that of claim 2 was obvious in view of the teachings of D1 combined with those of D2.

The Board considers D1 less relevant than D4 as starting point for the discussion of inventive step as it does not relate to the claimed **wirecut** electrical discharge machining, but to **cavity-sinking** electrical discharge machining.

There is a reference to the possibility of using the teaching of D1 in **wirecut** electrical discharge machining (column 2, line 46), however this does not take account of the situation where there are changes in machined plate thickness, as is a characteristic feature of the method and apparatus of claims 1 and 2 respectively, but not in **cavity-sinking** electrical

discharge machining.

4.7 Further, there is no indication to be found in D1 in respect of the features which are not available in D2 (see point 4.5 above), being:

- using **stored values** for the area machining feedrate for estimating a machined plate thickness, or
- **storing** in a memory a plurality of machining conditions based on machined plate thicknesses and dielectric pressure data (D1 relates to dielectric flowrate Q), or
- **setting** the optimum machining condition from detected dielectric pressures on the basis of those stored data.

Thus, there is a fortiori no indication for the skilled person to **combine** dielectric pressure data with machined plate thickness data to provide a basis for machining conditions to be chosen from, as claimed in claims 1 and 2.

4.8 Thus, either on the basis of D1 alone or in combination with D2, the skilled person cannot arrive in an obvious manner at the subject-matter of claims 1 and 2. This subject-matter therefore involves an inventive step.

4.9 The subject-matter of dependent claim 3 is for a preferred embodiment of the machine of claim 2 (Rule 29(3) EPC), thus also fulfils the requirements as to novelty and inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Patin

P. Alting van Geusau