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D E C I S I O N
of 9 January 2001

Case Number: T 0756/98 - 3.2.6

Application Number: 91121162.1

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Title of invention:
Wire-cut electric discharge machine

Patentee:
MITSUBISHI DENKI KABUSHIKI KAISHA

Opponent:
AGIE SA.

Headword:
-

Relevant legal provisions:
EPC Art. 56, 123(2)

Keyword:
"Main request - amendments - added subject-matter (yes)"
"Auxiliary request - inventive step (yes)"

Decisions cited:
-

Catchword:
-



Case Number: T 0756/98 - 3.2.6

D E C I S I O N
of the Technical Board of Appeal 3.2.6
of 9 January 2001

Appellant: Mitsubishi Denki Kabushiki Kaisha
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 4 June 1998
revoking European patent No. 0 521 193 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: P. Alting van Geusau
Members: T. Kriner
M. J. Vogel

Summary of Facts and Submissions

I. The appellant (patent proprietor) lodged an appeal, received at the EPO on 28 July 1998, against the decision of the Opposition Division, dispatched on 4 June 1998, concerning the revocation of the European patent No. 0 521 193. The appeal fee was paid simultaneously and the statement setting out the grounds of appeal was received at the EPO on 6 October 1998.

II. Opposition was filed against the patent as a whole by the respondent (opponent) and based on Article 100(a) EPC in conjunction with Articles 52(1), 54 and 56 EPC.

The Opposition Division held that the grounds for opposition mentioned in Article 100(a) EPC prejudiced the maintenance of the patent and that therefore the patent was to be revoked.

III. From the documents considered by the Opposition Division, the following documents played a role during the appeal proceedings:

D1: CH-A-655 885

D3: EP-0 056 784

D5: E. Samal und W. Becker, "Grundriss der praktischen Regelungstechnik", R. Oldenbourg Verlag, 1990, Seiten 428 to 435.

IV. Oral proceedings took place on 9 January 2001.

The appellant requested that the decision under appeal

be set aside and that the patent be maintained in amended form on the basis of claims 1 to 13 according to a main request filed during the oral proceedings, or on the basis of an auxiliary request based on the following documents filed during the oral proceedings:

Claims: 1 to 13.

Description: columns 1 to 12 and page 2a.

Drawings: Figures 1 to 13.

The respondent requested that the appeal be dismissed and the patent be revoked.

V. Claim 1 of the main request reads as follows:

"A wire-cut electric discharge machine in which machining is carried out in a gap defined by wire electrode (1) and workpiece (2) comprising:

- a) supply electrodes (5) in electrical contact with said wire electrode (1);
- b) a working power source (8) providing discharge current to said supply electrodes (5);
- c) a voltage detection means (9) for detecting an integrated voltage value between the wire electrode (1) and the workpiece (2) obtained by equalizing the discharge voltage for one or more periods T expressed as $T = t_1 + t_2 + t_3$, wherein t_1 is the on-time where high discharge voltage is applied to the gap, t_2 is the time in which the discharge current flows and t_3 is the off-time

during which discharge ceases;

- d) a current detection means (13, 14) for detecting an integrated current value of said discharge current obtained by equalizing the discharge current for one or more of said periods T; and
- e) means (11, 12) for defining a feed rate between said wire electrode (1) and workpiece (2), and
- f) a control means (Fig. 5, 12; 10)
 - for controlling (Fig. 5a-c) said feed rate defining means (11, 12) for varying, in response to a change in workpiece thickness (Fig. 5a, h), said feed rate (Fig. 5c) so that said detected integrated voltage is maintained to be a predetermined value (Fig. 5b, V), and
 - controlling said integrated current detected by said current detection means (13, 14) so as to increase or decrease (Fig. 5d) the value thereof, in response to said variation of feed rate of the workpiece, such that the electrostatic attractive force (f_1) and the discharge repulsive force (f_2) at the gap is maintained at substantially equal but opposite values and that the integrated voltage becomes constant."

Independent claim 3 differs from claim 1 merely by the wording of feature (f) which reads as follows:

"a control means (Fig. 6, 13; 10)

- for controlling (Fig. 6a-c) said feed rate defining means (11, 12) for varying, in response to a change in workpiece thickness (Fig. 6a, h), said feed rate (Fig. 6c) so that said detected integrated current is maintained to be a predetermined value (Fig. 6b, V), and

- controlling (Fig. 6d) said integrated voltage detected by said voltage detection means (13, 14) so as to increase or decrease (Fig. 6d) the value thereof, in response to said variation of feed rate of the workpiece, such that the electrostatic attractive force (f_1) and the discharge repulsive force (f_2) at the gap is maintained at substantially equal but opposite values and that said integrated current becomes constant."

Independent claim 9 reads as follows:

"A method of machining a workpiece using a wire-cut electric discharge machine having a power source (8) for providing a discharge current to a wire electrode (1) and enabling a discharge across a gap defined by the electrode (1) and workpiece (2), as well as means (10, 11, 12) for defining a feed rate between said wire electrode (1) and workpiece (2), comprising the steps of:

- a) detecting an integrated voltage value between the wire electrode (1) and the workpiece (2) obtained by equalizing the discharge voltage for one or more periods T expressed as $T = t_1 + t_2 + t_3$, wherein t_1 is the on-time where high discharge voltage is applied to the gap, t_2 is the time in which the discharge current flows and t_3 is the

off-time during which discharge ceases, and an integrated current value of said discharge current obtained by equalizing the discharge current for one or more of said periods T; and

- b) controlling in response to a change of workpiece thickness (Fig. 5a, 6a,; h) to vary said feed rate (Fig. 5c, 6c) such that said integrated discharge voltage value (V) or said integrated discharge current value (I) is maintained to be a predetermined value (V or I; Fig. 5b, 6b); and
- c) controlling (Fig. 12, 13) said detected integrated current (Fig. 5d, I) or said detected integrated voltage (Fig: 6d, V), so as to increase or decrease a respective value thereof, in response to said variation of feed rate of the workpiece such that the electrostatic attractive force (f_1) and the discharge repulsive force (f_2) at the gap is maintained at substantially equal but opposite values such that said integrated voltage or integrated current becomes constant."

Claims 1 and 3 of the auxiliary request differ from the corresponding claims of the main request by

- the insertion of the expression "at the gap" in feature (c) after the wording "obtained by equalizing the discharge voltage",
- the insertion of the word "value" in feature (f) after the wording "so that the integrated voltage/current" (claim 1/claim 3) and after the wording "controlling said integrated current/voltage" (claim 1/claim 3);

- the deletion of the feature according to which "the integrated voltage/current (claim 1/claim 3) becomes constant" at the end of feature (f).

By analogy, claim 9 of the auxiliary request differs from claim 9 of the main request by

- the insertion of the expression "at the gap" in feature (a) after the wording "obtained by equalizing the discharge voltage",
- the insertion of the word "value" in feature (c) after the wording "controlling said detected integrated current" and after the wording "or said detected integrated voltage",
- the deletion of the feature according to which "the integrated voltage or integrated current becomes constant" at the end of feature (c).

VI. In support of its requests the appellant relied essentially on the following submissions:

The patent in suit referred to a wire-cut electric discharge machine wherein either the detected integrated voltage between the wire electrode and the workpiece or the detected integrated discharge current was maintained at a constant value by two different control systems. The voltage or current was not only maintained to be a predetermined value by controlling the feed rate, but additionally by controlling the pulse period and the ratio of on-time and off-time. Both control steps were clearly disclosed in the description of the patent in suit, with respect to the mean voltage control in particular in column 7,

lines 26 to 42 and in column 8, lines 1 to 4. Furthermore, the explanation of the operation described in column 9, lines 38 - 55 showed that both control systems cooperated to maintain the voltage or current constant.

Therefore, the subject matter of the amended claims according to the main request was clearly disclosed in the originally filed documents.

The auxiliary request was restricted to a control system which maintained the voltage or current at a constant level solely by controlling the feed rate, as it was described for example in column 7, lines 26 to 42.

The essential difference between the patent in suit and the state of the art was the provision of two independent detection means for detecting an integrated voltage value and an integrated current value at the discharge gap. This allowed one of these values to be maintained at a predetermined value and to actively and independently control the other one so that the electrostatic attractive force and the discharge repulsive force at the gap were balanced.

The machine disclosed in D1 comprised neither detection means for detecting an integrated voltage at the gap, nor detection means for detecting an integrated current. It was true that D1 described means for detecting a mean voltage, however, it did not specify the kind of mean voltage detected by the circuit for measuring the conditions of the discharge machine (10). With respect to the resistors (R1, R2) shown in Figure 2, it had to be concluded that the mean voltage

detected by this circuit was not an integrated voltage at the gap, but a mean voltage depending on the discharge voltage at the gap and the discharge current flowing through the resistor R2.

As a result of the connection between the detected mean voltage and the discharge current it was not possible to independently increase or decrease one of the voltages or currents while maintaining the other one at a predetermined value.

Therefore, features (c), (d) and (f) of claims 1 and 3 and the corresponding features of claim 9 were not disclosed in D1. Since these features were also not suggested by any other document, the subject-matter of the amended claims was new and based on an inventive step.

VII. The respondent disputed the appellant's views. His arguments can be summarized as follows:

The description of the patent in suit did not disclose a control means or control method as defined in claims 1, 3 and 9 of the main request. Only that the voltage or current was maintained at a predetermined value by controlling the feed rate was shown. The statement that the voltage or current could be maintained constant by controlling the pulse period and the ratio of on-time and off-time was a general information describing an alternative but not an additional control method. It was clear from the description as a whole, in particular under consideration of Figures 5 and 6 that the voltage or current was exclusively maintained at a constant value by controlling the feed rate and that the pulse period

was controlled in dependence on and proportional to the feed rate without influencing the constant value of the voltage or current. Furthermore, the patent in suit did not disclose any interaction between the two control systems mentioned above.

Therefore, the claims according to the main request were not allowable.

The subject-matter of claim 1 according to the auxiliary request differed from the wire-cut electric discharge machine disclosed in D1 only in that the current detection means detected an integrated current value which was obtained by equalizing the discharge current for one or more periods T.

For the skilled person it was clear from D1, page 3, left-hand column, lines 22 to 26 that the circuit for measuring the conditions of the discharge machine (10) was provided to detect the mean voltage value of the discharge voltage as defined in feature (c) of claim 1 according to the auxiliary request. The resistors shown in Figure 2 which disclosed more than the description, were not necessary for the detection of this value. Therefore, feature (c) was clearly disclosed in D1.

According to claim 3 of D1, the feed rate defining means had to be controlled so that the conditions of the spark erosion were maintained constant. The statement on page 3, left-hand column, lines 22 to 26 showed that this referred in particular to the mean voltage value at the gap.

Furthermore, as described on page 3, left-hand column, lines 27 to 32 and shown in Figure 2, the pulse

frequency of the discharge machine was controlled via elements 12 and 13 in response to the variation of the feed rate of the workpiece. In accordance with the statement on page 2, right-hand column, lines 40 to 45, the purpose of this control was to improve the balance of the forces acting on the wire electrode.

Since the pulse frequency and the mean current value of the discharge current were correlated to each other, the mean or integrated current value of the discharge current would inevitably also be controlled in response to a variation of the feed rate in such a way that the electrostatic attractive force and the discharge repulsive force were balanced.

Therefore, D1 disclosed feature (f), too.

The detection of the integrated current value according to the patent in suit instead of the detection of the actual value of the discharge current according to D1 could at best be regarded as enabling a closed loop control of the current instead of an open loop control as disclosed in D1.

It was however well known, as for example shown in D5, that an open loop control was similar to a closed loop control and could be substituted by a closed loop control where circumstances made it desirable. Moreover, D3 showed that the alternative uses of either an open loop control system or a closed loop control system was also well known in the field of wire-cut electric discharge machines.

Therefore, starting from D1 it was obvious for the skilled person to provide the known machine with a current detection means for detecting an integrated

current value which was obtained by equalizing the discharge current for one or more periods T, and to use the detected value for controlling the mean current.

Since it was also obvious that the constant mean voltage control described in D1 could be substituted by a constant mean current control, the subject-matter of claims 1, 3 and 9 according to the auxiliary request did not involve an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 Main request

Each of the independent claims 1, 3 and 9 of the main request includes the following features according to which

(i) the feed rate defining means is controlled for varying, in response to a change in workpiece thickness, the feed rate so that the detected integrated voltage value or current value is maintained to be a predetermined value, and

(ii) the detected integrated voltage value or current value is additionally controlled to become constant by controlling the other of the integrated voltage value or current value, in response to said variation of the feed rate

(see feature (f) of claims 1 and 3, and features (b) and (c) of claim 9).

It is correct that both features are disclosed in the originally filed documents of the patent in suit. With respect to a constant mean voltage control, feature (i) is described for example in column 7, lines 25 to 42 of the patent specification (corresponding to the originally filed description, page 9, line 25 to page 10, line 5), and feature (ii) is described for example in column 8, lines 1 to 6 of the patent specification (corresponding to page 10, lines 16 to 20 of the originally filed description). However, there is no disclosure in the originally filed documents that the control according to feature (i) and the control according to feature (ii) are carried out together. The paragraph of the patent specification cited by the appellant (column 9, lines 38 to 55, corresponding to page 12, line 22 to page 13, line 1 of the originally filed description) merely describes that the mean voltage is controlled by varying the feed rate in accordance with feature (i), and that the mean current is controlled, in response to the variation of the feed rate for controlling the discharge repulsive force. There is, however, no indication that the mean current is controlled so that the integrated voltage becomes constant. Considering Figure 5 of the originally filed drawings, it could at best be concluded that the control of the mean current is carried out in a manner so that it does not influence the mean voltage.

Furthermore, page 16, lines 20 to 24 of the originally filed documents (corresponding to column 12, lines 28 to 34 of the patent specification), describes that the mean voltage or mean current may be controlled either

by the feed rate or by suitable on-off pulse rates. This indicates that the control steps according to feature (i) and feature (ii) are disclosed as alternatives which may be used separately, but which are not intended to be used together.

In view of the assessments above, the Board comes to the conclusion that the combination of features (i) and (ii), is not disclosed in the originally filed documents of the patent in suit, and the main request of the appellant therefore does not meet the requirements of Article 123(2) EPC.

2.2 Auxiliary request

Independent claims 1, 3 and 9 of the auxiliary request differ from independent claims 1, 3 and 10 of the patent specification which correspond to the originally filed independent claims 1, 3 and 10, via the following features:

- (A) the integrated voltage value is obtained by equalizing the discharge voltage at the gap for one or more periods T expressed as $T = t_1 + t_2 + t_3$, wherein t_1 is the on-time where high discharge voltage is applied to the gap, t_2 is the time in which the discharge current flows and t_3 is the off-time during which discharge ceases;
- (B) the integrated current value is obtained by equalizing the discharge current for one or more of said periods T ;
- (C) means are provided for defining a feed rate between the wire electrode and workpiece;

- (D) the control means are provided for controlling said feed rate defining means for varying, in response to a change in workpiece thickness, said feed rate so that the detected integrated voltage (or current) value is maintained to be a predetermined value;
- (E) the detected integrated current value (or voltage) value is controlled such that the electrostatic attractive force (f_1) and the discharge repulsive force (f_2) at the gap is maintained at substantially equal but opposite values.

Furthermore the feature of originally filed and granted claims 1 and 3, according to which the integrated voltage value is detected between the supply electrodes has been substituted by the following feature:

- (F) the integrated voltage value is detected between the wire electrode and the workpiece.

Features (A) to (E) are all disclosed in that portion of the originally filed description which refers to the operation of the claimed machine, in particular in the following paragraphs:

page 10, lines 8 to 13 (feature A), page 11, lines 10, 11 (feature B), page 9, lines 17 to 19 (feature C), page 12, lines 22 to 26 and page 14, lines 16 to 19 (feature D), page 12, line 27 to page 13, line 17, page 14, line 26 to page 15, line 2 and page 15, lines 24 to 27 (feature (E)).

Feature (F) is disclosed in Figure 1 in conjunction with page 9, lines 15, 16 of the originally filed

documents. Since it is obviously impossible to detect a machining voltage value between the supply electrodes for the wire electrode, the substitution of the corresponding feature by feature (F), to specify that the machining voltage is detected between the wire electrode and workpiece, constitutes an allowable correction of an obvious error.

Dependent claims 2, 4 to 8 and 10 to 12 of the auxiliary request correspond to originally filed and granted claims 2, 4 to 7, 9, 13, 15 and 17. Dependent claim 13 of the auxiliary request is based on the disclosure on page 10, lines 16 to 20 in connection with Figure 12 of the originally filed documents.

The description according to the auxiliary request has been amended to describe the state of the art disclosed in D1 and to correct clerical errors.

Consequently, the documents according to the auxiliary request do not contain subject-matter which extends beyond the content of the originally filed documents, and the claims of the auxiliary request have not been amended in such a way as to extend the protection conferred. Therefore, they meet the requirements of Articles 123(2) and (3) EPC.

3. *Novelty*

3.1 D1 undisputedly represents the most relevant state of the art. With respect to independent claims 1 and 3 of the auxiliary request this document discloses

a wire-cut electric discharge machine in which machining is carried out in a gap defined by wire

electrode and workpiece (2) comprising:

- (a) supply electrodes (3) in electrical contact with said wire electrode;
- (b) a working power source (1) providing discharge current to said supply electrodes;
- (c) a voltage detection means (10) for detecting an integrated voltage value between the wire electrode and the workpiece (see page 3, left-hand column, lines 22 - 26);
- (d) a current detection means for detecting a current value of said discharge current (see page 3, left-hand column, lines 15 - 17);
- (e) means (9) for defining a feed rate between said wire electrode and workpiece, and
- (f) a control means (11) for controlling said feed rate defining means for varying said feed rate so that said detected integrated voltage value is maintained to be a predetermined value (see claims 3 and 6).

Since it is intended to maintain the integrated voltage at a constant value, it is evident and thus implicit in D1 that the feed rate is also controlled in response to a change in workpiece thickness so that the detected integrated voltage value is maintained at the predetermined value.

Compared to independent claim 9 of the auxiliary request and in correspondence with the features of the

machine listed above, D1 additionally discloses

a method of machining a workpiece (2) using a wire-cut electric discharge machine having a power source (1) for providing a discharge current to a wire electrode and enabling a discharge across a gap defined by the electrode and workpiece, as well as means (9) for defining a feed rate between said wire electrode and workpiece, comprising the steps of:

- (a) detecting an integrated voltage value between the wire electrode and the workpiece and a current value of the discharge current;
- (b) controlling in response to a change of workpiece thickness to vary said feed rate such that said integrated discharge voltage value is maintained to be a predetermined value.

3.2 Since D1 is silent about the kind and the detection of the integrated voltage value it does not disclose that the integrated voltage value between the wire electrode and the workpiece is obtained by equalizing the discharge voltage at the gap for one or more periods T expressed as $T = t_1 + t_2 + t_3$, wherein t_1 is the on-time where high discharge voltage is applied to the gap, t_2 is the time in which the discharge current flows and t_3 is the off-time during which discharge ceases, as described in each of the independent claims of the auxiliary request.

Furthermore, D1 undisputedly does not disclose that the current detection means are provided for detecting an integrated current value obtained by equalizing the discharge current for one or more of the periods T .

According to D1, merely the discharge current is detected for controlling the mono-stable sweep circuit (14).

Consequently D1 does also not disclose a control of the integrated current value detected by the current detection means so as to increase or decrease the value thereof, in response to said variation of the feed rate of the workpiece, such that the electrostatic attractive force (f_1) and the discharge repulsive force (f_2) at the gap is maintained at substantially equal but opposite values.

With respect to claims 3 and 9 of the auxiliary request, D1 additionally does not disclose the provision of means for controlling the feed rate defining means so that the detected integrated current value is maintained to be a predetermined value, and controlling the integrated voltage value detected by the voltage detection means so as to increase or decrease the value thereof, in response to said variation of feed rate of the workpiece, such that the electrostatic attractive force and the discharge repulsive force at the gap is maintained at substantially equal but opposite values.

- 3.3 The respondent's argumentation according to which features (c) and (f) of claim 1 of the auxiliary request are disclosed in D1, and the subject-matter of this claim differentiated from the discharge machine of D1 solely by that portion of feature (d), according to which the detection means detects an integrated current value obtained by equalizing the discharge current for one or more of the periods T, is not convincing.

D1 merely describes that the feed rate is controlled by a circuit (10) for measuring the conditions of the spark erosion, for example by the mean voltage between the electrodes (see page 3, left-hand column, lines 22 to 26). However, D1 neither describes which mean voltage has to be detected, nor the way in which it is determined within the circuit (10). Since the mean voltage mentioned in D1 could be the mean voltage during the period of the firing pulse (T_D), during the period of discharge (T_A), during both periods, or during a whole cycle (T), it is not clear which mean voltage is meant. Therefore, D1 does not unequivocally disclose the detection of the integrated voltage value in accordance with feature c) of claim 1.

The Board agrees with the respondent's statement that as a result of the control of the pulse frequency by the function generator (12), the mean value of the current at the working gap is increased or decreased in response to the variation of the feed rate of the workpiece.

However, there is no indication in D1 that the integrated current value obtained by equalizing the discharge current for at least one period T has to be controlled so that the electrostatic attractive force and the discharge repulsive force at the gap is substantially balanced.

D1 only teaches that the balance of the forces acting on the wire electrode can be improved by controlling the frequency of the pulses in dependence on the processing speed (see page 2, right-hand column, lines 37 to 48). The forces acting on the wire are described as comprising at least the mechanical

tension, the electromagnetic force, the electrostatic attraction force and the discharge repulsive force (see page 1, right-hand column, lines 11 to 18). However, D1 teaches neither the control of a detected integrated current value of the discharge current for balancing forces at the working gap, nor the particular balancing of the electrostatic attraction force and the discharge repulsive force.

Therefore, D1 also does not disclose the control of the integrated current value described in the second part of feature (f) of claim 1.

4. *Inventive step*

4.1 D1 refers to a wire-cut electric discharge machine which prevents an uneven cutting surface by controlling the pulse frequency in dependence on the feed rate (see page 2, right-hand column, lines 40 to 48) and by allowing a discharge of the applied voltage only if the discharge starts within a predetermined time T_1 (see abstract). The pulse frequency is controlled in order to balance the forces acting on the wire electrode, and the discharge is controlled to avoid electrostatic forces which would result in an excessive deformation of the wire.

4.2 Therefore, starting from the state of the art disclosed in D1, the object underlying the patent in suit is to provide an electric discharge machine and a method by which the deformation of the electrode can be prevented in an alternative manner.

4.3 This object is achieved by detecting an integrated voltage value and an integrated current value by

equalizing the discharge voltage and the discharge current for one or more periods T, and by controlling the feed rate so that one of the voltage or current values is maintained to be a predetermined value and by controlling the other one of these values so that the electrostatic attraction force and the discharge repulsive force at the gap are balanced.

- 4.4 These measures are not suggested by the available state of the art.

D5 merely refers to common knowledge in the field of automatic control engineering, and D3 describes a wire-cut electric discharge machine comprising either a closed loop control of the discharge voltage and of the discharge current for controlling the feed rate (see Figure 2 of D3), or a closed loop control of the discharge voltage and an open loop control of the discharge current for controlling the feed rate (see Figure 3 of D3).

However, none of these documents teaches to simultaneously detect an integrated voltage value and an integrated current value, let alone by equalizing the discharge voltage and the discharge current as described in claims 1, 3 and 9 according to the auxiliary request.

Consequently, they are also not suitable to suggest simultaneously controlling the feed rate so that one of the detected values is maintained to be a predetermined value, and controlling the other of the values so that the electrostatic attraction force and the discharge repulsive force at the gap are balanced.

4.5 The respondent's line of argumentation according to which, in the light of the teaching given by D5 and D3, it was obvious to substitute the open loop control of the mean current in the machine of D1 by a closed loop control, is not convincing.

It is true that D5 generally indicates that a closed loop control and an open loop control may be exchanged at will, and D3 shows that this is also valid for a control circuit of a wire-cut electric discharge machine, but this does not mean that the provision of a current detection means for detecting an integrated current value and using this value for controlling the integrated current in the machine according to D1, is an obvious measure.

D1 discloses a control of the pulse rate which indeed inevitably influences the mean current at the gap. However, D1 describes neither that it is intended to actively control the mean current, nor that the pulse rate is controlled for indirectly controlling the mean current.

Hence, there is no reason to detect the mean current value at the gap of the machine according to D1 and to control this value for balancing forces acting on the wire electrode. Consequently, when considering the suggestion of D5 and D3, the skilled person would not provide a detection means for detecting the mean current at the gap, but rather a detection means for detecting the actual pulse frequency which together with the signal for the feed rate could be used for controlling the pulse frequency.

Furthermore, the control of the mean current value

detected at the gap required at least a feed back of the detected value to that control circuit comprising elements 12 and 13, and the provision of means for considering this value for the formation of the signal T. Such a substantial modification of the design of the control circuit shown in D1 can also not be regarded as obvious.

Therefore, the Board is convinced that the documents cited by the respondent do not suggest such a modification of the machine according to D1 so that both, the integrated voltage value and the integrated current value at the gap are detected, and that one of these values is maintained to be a predetermined value and the other one is controlled so that the electrostatic attraction force and the discharge repulsive force acting on the wire are balanced.

- 4.6 Such suggestion is also not derivable from the further available documents which were no longer relied upon by the respondent and which do not come closer than the prior art documents discussed here above.
- 4.7 In view of these assessments, the Board comes to the conclusion that the subject-matter of claims 1, 3 and 9 of the auxiliary request cannot be derived in an obvious manner from the available prior art and accordingly involves an inventive step. These claims together with dependent claims 2, 4 to 8, 10 to 13, the description and drawings of the auxiliary request therefore form a suitable basis for maintenance of the patent in amended form.

Order

For these reasons it is decided that:

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

Claims: 1 to 13;

Description: columns 1 to 12 and insert page 2a;

Drawings: Figures 1 to 13;

all filed during the oral proceedings on 9 January 2001.

The Registrar:

The Chairman:

M. Patin

P. Alting van Geusau