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D E C I S I O N
of 17 September 2002

Case Number: T 0328/00 - 3.4.2
Application Number: 93303351.6
Publication Number: 0581411
IPC: H05K 3/00, B23Q 41/00

Language of the proceedings: EN

Title of invention:
Drilling method and apparatus using variable dwell times

Patentee:
EXCELLON AUTOMATION

Opponent:
Klingelberg Söhne Leiterplattentechnik GmbH,
Zweigniederlassung Kaufbeuren

Headword:
-

Relevant legal provisions:
EPC Art. 123(2), 111(1), 54(2), 56.
ERC R. 55(c)

Keyword:
"Sufficiency of the substantiation of the opposition (yes)"
"Added subject-matter (no)"
"Availability to the public of an operation manual (yes)"
"Inventive step (yes)"

Decisions cited:
T 0182/89, T 0204/91

Catchword:

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Case Number: T 0328/00 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 17 September 2002

Appellant: EXCELLON AUTOMATION
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 20 January 2000
revoking European patent No. 0 581 411 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: A. G. Klein
B. J. Schachenmann

Summary of Facts and Submissions

I. This is an appeal against the decision of the opposition division revoking European patent No. 0 581 411 (application number No. 93 303 351.6).

The grounds of opposition invoked in the notice of opposition were lack of novelty and lack of inventive step (Article 100(a) EPC) with regard to the state of the art represented by the following documents:

E1: "Programmier - und Betriebsanleitung - SYSTEM CNC 25.05 D", Sieb & Meyer electronic, Lüneburg (DE);
and

E2: EP-A-0 461 733.

In the decision under appeal, the opposition division held that the opposition was admissible and that the replacement in granted independent claims 1 and 3 of the expression "one or more" drilling parameters by the expression "at least two" drilling parameters in accordance with the patent proprietor's request did not comply with the requirements of Article 123(2) EPC. In the decision the opposition division also expressed by way of *obiter dictum* its opinion that the subject matter of independent claims 1, 3 and 10 as granted did not define patentable subject matter under Articles 52(1), 54 and 56 EPC having regard to the disclosure of document E1.

II. Oral proceedings before the board took place on 17 September 2002. In reply to an observation made by the Chairman that in the decision under appeal the opposition division had considered by way of

obiter dictum only the patentability of the claims as granted, not however that of the amended claims, so that the latter issue has not yet been decided by the department of first instance, both the appellant (proprietor of the patent) and the respondent (opponent) requested the board to reach a final decision on the issue of the patentability of the subject matter of the claims amended in accordance with the appellant's requests. At the end of the oral proceedings, the decision of the board was given.

III. The appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of a set of claims filed as main request with the letter dated 3 June 2002 and page 2 of the description as filed during the oral proceedings, or on the basis of the set of claims according to one of the six auxiliary requests filed with the letter dated 3 June 2002.

Independent claims 1, 3 and 10 according to the main request read as follows:

"1. A method of drilling holes in a printed circuit board mounted on a worktable movable in a horizontal plane, said worktable comprising a worktable movement assembly for moving said table in said horizontal plane, and comprising a controller for controlling the operation of the drilling machine, said controller transmitting movement instructions to said movement assembly to move said worktable, the method comprising the steps of:

inputting data into said controller, said data comprising a plurality of dwell times wherein said dwell times are selected to provide a relatively short

delay time before drilling said given hole while achieving sufficient hole placement accuracy and wherein said dwell times depend upon and are determined by at least two drilling parameters, including:

- a given diameter of a given drill tool; and
- a desired degree of placement accuracy of a given hole to be drilled;

selecting a first drill tool for drilling a first hole in said printed circuit board wherein said first drill tool has a first diameter;

mounting said first drill tool into a spindle on the drilling machine;

automatically setting a dwell time for delaying drilling said first hole, wherein said setting step includes a step of selecting said dwell time from said plurality of dwell times;

moving said worktable using said worktable movement assembly toward a desired drill location on said printed circuit board for drilling said first hole; delaying drilling said first hole for the duration of said dwell time so that said movement assembly has sufficient time to position said worktable in order to achieve said sufficient hole placement accuracy; and drilling said first hole after said dwell time has elapsed."

"3. A method of drilling a workpiece using a drilling machine, comprising the steps of:

- providing a plurality of predefined dwell times which vary according to at least two predefined drilling parameters;

- selecting a drill tool having a first diameter;

- automatically selecting from said plurality of predefined dwell times and in accordance with said parameters a dwell time corresponding to a set of

conditions of a drilling operation, wherein said dwell time is selected in order to obtain a satisfactory degree of hole placement accuracy and hole quality with respect to a hole drilled during said drilling operation having said set of conditions while optimizing the speed with which said hole is drilled; moving said drill tool and a desired hole drilling location on said workpiece relatively closer in order to close a distance between said drill tool and said location; and delaying initiation of said drilling operation for the duration of said dwell time to allow said distance to become sufficiently small to obtain said satisfactory degree of hole placement accuracy and hole quality."

"10. A drilling machine for rapidly and efficiently drilling a workpiece, comprising:
a worktable movable in a horizontal plane, in use said workpiece being securely mounted on said worktable;
a worktable movement assembly for moving said worktable in said horizontal plane, said movement assembly being capable of moving said worktable in small and precise increments;
a spindle mounted above said worktable, said spindle adapted to have a drill tool mounted therein;
means for automatically changing the drill tool mounted in the spindle; and
a computer controller for controlling said drilling machine system wherein said controller comprises a memory device having a data source stored therein, said data source containing predetermined dwell times that vary in accordance with the diameter of any given drill tool used in a given drilling operation and in accordance with a desired degree of placement accuracy of a given hole to be drilled, so that one of said

dwell times may be automatically and rapidly selected from said data source to correspond to a diameter of the drill tool selected by said automatic changing means and said desired degree of placement accuracy in order to optimize the efficiency of said system and the quality of holes drilled."

Claim 2 and claims 4 to 9 according to the main request are appended to claim 1 and to claim 3, respectively.

The wording of the claims according to the auxiliary requests is not relevant to the present decision.

IV. The respondent for his part requested that the appeal be dismissed.

V. The appellant's arguments in support of his requests are essentially the following:

The statement of grounds of opposition failed to include a substantiation of the objection of lack of novelty and also failed to contain a full reasoning of the objection of lack of inventive step. For this reason, the opposition did not comply with Article 99(1) and Rule 55(c) EPC and was therefore inadmissible pursuant to Rule 56(1) EPC.

The determination of the dwell times according to at least two drilling parameters is directly and unambiguously derivable from the passages of the publication of the original application in column 6, lines 28 to 30, 35 and 46 to 47, and column 6, line 56 to column 7, line 6. The use of the two parameters specified in amended claims 1 and 10 is also supported by the original claim 1 and by the embodiment disclosed

in the original application with reference to Figure 4.

The publication of the alleged prior art document E1 has never been proved. It may well be possible that document E1 was an internal document available only within the company Sieb & Meyer without ever having been made publicly available. But even if document E1 was considered comprised in the state of the art, the presence of an inventive step should be acknowledged for the following reasons.

Document E2 discloses a drilling machine having a tool changer. However, the document is silent as to any dwell time. The use of extended dwell times as required by worktables of a big size and a high inertia leads to a slow drilling rate. This problem is addressed in document E1 which, if considered as prior art, discloses a drilling machine operating with a different dwell time for each drill tool. In document E1, however, although a different optimized dwell time for each drill tool may be obtained from the machine manufacturer, only one single dwell time can be entered in the system for each drill tool, resulting in that all drilling operations carried out by the control system with a particular one of the selectable drill tools are all carried out with the same dwell time. In addition, document E1 merely teaches that big drill holes require a lower drilling precision than small drill holes and is far from suggesting that not all drill holes having the same diameter require the same degree of drilling accuracy and therefore the same dwell time. The latter concept is neither disclosed nor suggested in the alleged prior art and is advantageously used in the invention to increase the flexibility in setting the dwell time of each drilling

operation so that the throughput can be optimized while maintaining a satisfactory hole placement accuracy by selecting the dwell time for drilling a specific hole according to the location precision required by the intended use of the hole.

VI. The respondent's arguments in support of his request can be summarised as follows:

With regard to the question of the admissibility of the opposition, the statement of grounds of opposition contained a detailed discussion of the correspondence between the features of the claimed subject matter and the disclosure of the prior art references and a line of reasoning in relation to the combination of these references. Thus, at least the objection of lack of inventive step was appropriately substantiated, and already for this reason the opposition is admissible.

There is no disclosure in the original application in support of the determination of the dwell times on the basis of "at least two" drilling parameters. The patent identifies the hole diameter as the essential drilling parameter (column 5, lines 45 to 55), and the inclusion in amended claims 1 and 10 of the placement accuracy as an additional essential drilling parameter constitutes additional technical information that has not been disclosed in the original application. In addition, there is no support in the original application for restricting the subject matter of independent claim 3 to at least two parameters without simultaneously restricting the parameters to the two particular parameters specified in amended claims 1 and 10.

The letter of Sieb & Meyer dated 22 November 1999 and

filed during the proceedings before the first instance proves that the system of document E1 has been on the market. In any case, even if it were assumed that the document was initially issued for internal use only, the priority date of the opposed patent is about thirteen years after the date "January 80" shown on the front page of document E1 and it is therefore fair to assume that the disclosure of the document has been made public before the priority date of the patent.

Novelty over the disclosure of document E1 is acknowledged only in so far as document E1 does not mention the control of the drilling operation according to the drilling precision and the desired degree of placement accuracy of each hole to be drilled. It is trivial, however, to take into account the placement accuracy of the drill holes because it is inherent to the disclosure of document E1 that all drilling parameters are to be selected according to the desired degree of placement accuracy. Consequently, the skilled person, seeking to improve both the throughput efficiency and the accuracy of the drilling operation of the system of document E1, must, and not just could or would, program the programmable dwell times of the system as a function of all the drilling parameters influencing both the efficiency and the accuracy of the drilling operation. Accordingly, the skilled person would not only consider parameters such as the speed of the worktable and the parameters listed on pages 20 and 21 of document E1, but would necessarily consider also the desired precision and location accuracy to be assigned to each drill hole, thus arriving at a system operating with different dwell times for each tool diameter.

Reasons for the Decision

1. *Admissibility of appeal*

The appeal is admissible.

2. *Admissibility of opposition*

The appellant objected for the first time in his statement of the grounds of appeal that the opposition had not been appropriately substantiated in the statement of grounds of opposition.

As already pointed out by the board in the annex to the summons to oral proceedings, during the opposition proceedings before the first instance the appellant apparently had no particular difficulty in understanding and countering the arguments put forward in the notice of opposition in support of an alleged lack of inventive step in view of the documents cited by the opponent (respondent), from which it can be concluded that the opposition was adequately substantiated, at least in respect of the alleged lack of inventive step. The appellant did not dispute this view during the subsequent oral proceedings, and the board concludes that the opposition is admissible in so far as at least one of the grounds of opposition invoked by the respondent under Article 100(a) EPC, namely that based on lack of inventive step (Articles 52(1) and 56 EPC), has been properly substantiated as required by Rule 55(c) EPC (see decisions T 182/89, OJ 1991, 391, point 3 of headnote II and T 204/91, not published in OJ, point 5 of the reasons, last paragraph).

3. *Appellant's main request - Compliance of the amendments with the requirements of Articles 123(2) and (3) EPC*

3.1 Claim 1 according to the main request differs from claim 1 as granted in that the expression "one or more drilling parameters" has been replaced by "at least two drilling parameters", and in that the expression "at least one of" preceding the recitation of the two particular drilling parameters considered in the claim has been deleted.

In the original application the dwell times are said to depend upon, and to be determined by "various drilling parameters" (column 6, lines 25 to 31 of the publication of the original application), wherein "one drilling parameter used is the size or diameter of the drill tool" (column 6, lines 35 to 37) and "another parameter [...] is the hole [placement] accuracy" (column 6, lines 46 to 51), the description further specifying "other possible parameters affecting the dwell time" (column 6, line 56 to column 7, line 6). In the board's view, these statements constitute a clear basis for the determination of the dwell time on the basis of two or, alternatively, on the basis of more than two of the drilling parameters, the parameters including the diameter of the drill tool and the degree of hole placement accuracy. The determination of the dwell time on the basis of just two parameters constituted by the diameter of the drill tool and the degree of hole placement accuracy is also supported by the embodiment disclosed in the original application with reference to the table shown in Figure 4 and involving the use of two such parameters (column 7, lines 22 to 26).

Accordingly, there is a clear basis in the original disclosure for the amendments made to claim 1 according to the main request.

- 3.2 Independent claim 3 of the main request differs from claim 3 as granted in that the expression "according to one or more predefined drilling parameters" has been replaced by "according to at least two predefined drilling parameters".

As already put forward in point 3.1 above, the determination of the dwell times according to at least two drilling parameters is directly and unambiguously derivable from the disclosure of the original application. The argument of the respondent that there is no basis in the original application for the limitation to at least two parameters without simultaneously restricting the parameters to the two particular drilling parameters specified in the amended claims 1 and 10 is not convincing because the original claim 3 and the passage in column 6, line 56 to column 7, line 6 of the original description already support the determination of the dwell times on the basis of a plurality of drilling parameters, without these parameters being necessarily restricted to the drill tool diameter and the placement accuracy of the drill hole.

- 3.3 Independent claim 10 of the main request differs from claim 10 as granted in that the dwell times also vary "in accordance with a desired degree of placement accuracy of a given hole to be drilled" and in that the selected dwell time also corresponds to "said desired degree of placement accuracy".

These amendments are also based on the passages of the original disclosure mentioned in point 3.1 above, and in particular on those passages referring to the determination of the dwell time according to the desired hole placement accuracy.

3.4 The additional features of the remaining claims 2 and 4 to 9 are identical to the corresponding features of claims 2 and 4 to 9 as granted.

3.5 The description has been adapted to the amended wording of the claims and supplemented with a brief summary of the relevant content of document E1 to comply with the requirements of Rules 27(1)(b) and (c) EPC. The Board is satisfied that these amendments comply with the requirements of Article 123(2) EPC.

3.6 Since the amendments made to the patent clearly limit its scope of protection, the Board is satisfied that no extension of the protection conferred has occurred.

3.7 Accordingly, the patent documents as amended according to the appellant's main request satisfy the requirements of Articles 123(2) and (3) EPC.

4. *Document E1 - Availability to the public*

Document E1, a booklet containing the programming and operating instructions of the "SYSTEM CNC 25.05 D" of Sieb & Meyer both in German and English, bears the imprint "January 80" on its front page and the heading "software code from November 1980" on the last page of the document. It is therefore reasonable to assume that the booklet was drawn up about twelve years before the priority date (27 July 1992) of the patent in suit. A

booklet containing the programming and operating instructions of a device and having the characteristics of document E1 is usually addressed to the users that have purchased the device, and therefore it can be assumed that the booklet was issued for public use. The instruction at the penultimate paragraph on page 21 of document E1 to ask the machine tool manufacturer for optimum parameters, the detailed description in the letter of Sieb & Meyer dated 22 November 1999 as filed by the appellant during the opposition proceedings of the characteristics of the system series "CNC 25.05", of which the system "CNC 25.05 D" constitutes a low cost version (document E1, first sentence on page 12), and the reference in document E2, a patent document published on 18 December 1991 and relating to a high speed precision drilling system, to a "model 35 controller marketed by Sieb & Meyer GmbH" as being "a commercially available unit" (column 27, lines 37 to 40) constitute further indications that the system disclosed in document E1 was intended to be freely available on the market. In these circumstances, the appellant's contention that the booklet was issued by the company Sieb & Meyer for internal use only is not considered convincing. In addition, although there is no evidence as to the exact date at which document E1 was actually made available to the public, a period of time of twelve years is long enough to assume that the document was in any case made available to the public within this twelve-year period. The plausibility of the further contention of the appellant that the booklet might have been kept confidential until at least the priority date of the patent in suit is so low that, in the Board's view, the burden of proof for this contention would be incumbent on the appellant. The appellant, however, has submitted no evidence

whatsoever in support of his submissions in this respect.

Accordingly, in the present circumstances the Board is convinced that document E1 was made available to the public before the priority date of the patent in suit and that, consequently, this document is comprised in the state of the art.

5. *Appellant's main request - Patentability of the subject matter of the claims*

5.1 Procedural matters

In accordance with the requests made by both the appellant and the respondent during the oral proceedings held before the Board (see point II above), the Board deemed it appropriate to exercise its discretion under Article 111(1) EPC to decide itself on the patentability of the subject matter of the claims according to the appellant's main request, even if this issue has not been considered by the opposition division.

5.2 The prior art

It was undisputed by the parties that - if document E1 was considered as a prior art document - the drilling method and the system "CNC 25.05 D" disclosed in this document represents the closest prior art from which the invention defined in any of the independent claims sets out. This system constitutes the operation control system of a drilling machine (page 1, first sentence and page 13, penultimate sentence of either one of the German and English versions) for drilling a workpiece

mounted on a worktable by means of a drill tool mounted on a spindle, the drill tool being selected among a plurality of drill tools (see page 20, in particular features (a) and (b)). The control system enables control of the movement of the worktable in a horizontal plane (see the XY servo-drive control on pages 89 and 90) as well as manual and programmable automatic drill tool change (see entry "T1 ÷ T15" on page 4). The control system also includes software for controlling the different operations of the drilling machine (pages 3 to 7 and 12), and in particular includes data source identifying each of the selectable drill tools by the corresponding drill diameter and assigning to each of the drill tools a predetermined value for each of a plurality of parameters, which values are input in the control system beforehand (pages 20 and 21 and the example on page 24). The parameters include, among others, the dwell time, i.e. the delay in initiating the drill stroke after positioning of the hole drilling location relative to the drill tool (page 21, penultimate paragraph). Thus, the drilling control operation of the system disclosed in document E1 results in a sequence of drilling operations each carried out with a selected one of the available drill tools, the dwell time of each of the drilling operations being determined by the drill tool selected for the corresponding drilling operation.

Document E2 discloses an automatic drilling apparatus for precision drilling of workpieces such as printed circuit boards, the apparatus comprising a tool changer and a computer controller (abstract together with column 4, lines 32 to 36 and column 27, lines 33 to 47).

5.3 Independent claim 3

The Board will deal with independent claim 3 first for reasons of simplicity.

It follows from the analysis of document E1 in point 5.2 above that the operation of the control system disclosed in the document results in a method of drilling a workpiece using a drilling machine, from which the method defined in independent claim 3 differs essentially in that the plurality of dwell times available for controlling the drilling operation vary not just according to one drilling parameter, i.e. according to the selected drill tool identified by its drill diameter, but according to at least two drilling parameters, the automatic selection of the dwell time corresponding to a set of conditions of a drilling operation being carried out in accordance with the at least two drilling parameters in order to obtain a satisfactory degree of hole placement accuracy and hole quality of the hole drilled during the drilling operation while optimizing the speed with which the drilling operation is performed.

According to the appellant and as discussed in the patent specification (column 2, lines 25 to 29 and column 5, line 52 to column 6, line 2), the technical effect achieved by the distinguishing features identified above is a larger degree of freedom in the selection of the dwell times so as to allow optimization of the drilling rate while at the same time achieving a satisfactory placement accuracy and quality of the drill holes.

Accordingly, the objective problem solved by the method

defined in independent claim 3 with respect to document E1 as the closest prior art is the optimization of the throughput of the drilling machine while at the same time achieving a satisfactory degree of hole placement accuracy and hole quality.

The skilled person, faced with the objective problem formulated above, would understand that the use in document E1 of a different dwell time for each drill tool inherently achieves a predetermined degree of hole placement accuracy and hole quality and a predetermined hole drilling rate. However, the control system of document E1 is designed to accept as an input one single dwell time for each drill tool (page 21, lines 1 to 12), and there is no teaching or indication in the prior art that would lead the skilled person to modify the operation of the control system of document E1 so as to arrive to the drilling method according to claim 3. In particular, even if it were assumed that the skilled person would recognise in the indication in document E1 requiring the operator to ask the machine tool manufacturer "for the optimum dwell times" (page 21, penultimate paragraph) a possibility of improving the accuracy and quality of the drill holes and/or the throughput of the machine, he would then at the most consider the optimization of the dwell time and therefore the drill precision and the drill speed associated with each individual drill tool. This procedure, however, would result in the replacement of the set of dwell times stored in the control system by the new set of optimized dwell times which would in turn be automatically selected according to one single parameter, i.e. according to the drill tool selected for each drilling operation.

The respondent has submitted that the skilled person would regard as an imperative the use of the appropriate dwell time in the drilling operation of each hole in order to drill all holes with the desired degree of placement accuracy and quality, and that for this reason the skilled person would consider, without the exercise of any inventive ingenuity, automatically varying the dwell time assigned to a specific drill tool according to a second parameter relating to the placement accuracy and quality of the hole to be drilled. This line of argument, however, does not persuade the Board as no hint can be found in the prior art that would lead the skilled person to depart from assigning a predetermined dwell time, and therefore a predetermined drilling speed and a predetermined degree of accuracy, to all the drilling operations carried out with the same drill tool as taught in document E1 in order to solve the problem formulated above. On the contrary, the respondent's submission runs counter the disclosure of document E1 that all parameters that might have an influence on the accuracy and the speed of the drilling operation, such as the dwell time and the remaining drilling parameters considered in the document (see parameters (b), (c) and (d) on page 20), are all unequivocally determined by the drill tool selected to carry out the drilling operation. In addition, document E2, the other one of the documents considered during the proceedings, does neither disclose nor suggest drilling with varying dwell times and therefore does not provide any teaching in this respect.

The Board concludes that, having regard to the prior art considered by the parties, the skilled person would not have reached the subject matter of claim 3 in an

obvious way. Therefore, the subject matter of independent claim 3 of the main request involves an inventive step within the meaning of Article 56 EPC.

5.4 Independent claim 1

The drilling method defined in claim 1 differs from the method disclosed in document E1 and referred to in points 5.2 and 5.3 above, apart from the straightforward application to the drilling of printed circuit boards as known from document E2, essentially in that the dwell time depends upon and is determined not only by the selected drill tool identified by its drill diameter, but also at least by a second parameter including a desired degree of placement accuracy of the hole to be drilled.

The technical effect achieved by these distinguishing features is the same as that achieved in respect of the distinguishing features of independent claim 3 (see point 5.3 above). Accordingly, the objective problem is the same as that formulated in point 5.3 above with respect to the subject matter of claim 3.

As pointed out in point 5.3 above, however, none of the prior art references would lead the skilled person to vary the dwell time of a drilling operation to be carried out with a selected one of the drill tools according to an additional drilling parameter, still less according to the degree of placement accuracy of the hole to be drilled.

For this reason, also the subject matter of claim 1 of the main request can be considered to involve an inventive step within the meaning of Article 56 EPC.

5.5 Independent claim 10

The disclosure of document E1 relative to the operation control system of a drilling machine results in a drilling machine for drilling a workpiece comprising a controller, from which the drilling machine defined in independent claim 10 differs essentially in that the dwell times contained in the data source stored in the controller vary not only in accordance with the diameter of the drill tool used in the drilling operation, but also in accordance with a desired degree of placement accuracy of the hole to be drilled so as to optimize the efficiency of the drilling machine and the quality of the holes drilled.

The prior art would not lead the skilled person to a drilling machine having the features of claim 10 for reasons analogous to those put forward in point 5.4 above with regard to the subject matter of claim 1. For this reason, also the subject matter of independent claim 10 of the main request can be considered to involve an inventive step within the meaning of Article 56 EPC.

5.6 For the above reasons, independent claims 1, 3 and 10 according to the appellant's main request are allowable under Article 52 EPC. Dependent claims 2 and 4 to 9 are also allowable by virtue of their dependency on allowable independent claims 1 and 3, respectively.

6. *Auxiliary requests*

Since the subject matter of the claims according to the main request is allowable, consideration of that of the

auxiliary requests is not necessary.

7. The Board concludes that the patent as amended according to the appellant's main request and the invention to which it relates meet the requirements of the convention. Accordingly, the patent can be maintained as amended (Article 102(3) EPC).

Order

For these reasons it is decided:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to maintain the patent in amended form with
 - claims 1 to 10, filed as main request with the appellant's letter dated 3 June 2002,
 - description, page 2 presented at the oral proceedings and pages 3 to 5 as granted,
 - drawing sheets as granted.

The Registrar:

The Chairman:

P. Martorana

E. Turrini