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**Datasheet for the decision
of 6 May 2024**

Case Number: T 2220/22 - 3.5.07

Application Number: 12888094.5

Publication Number: 2919138

IPC: G06F17/50, G06T17/10

Language of the proceedings: EN

Title of invention:

Shape optimization analyzing method and apparatus therefor

Applicant:

JFE Steel Corporation

Headword:

Shape optimizaton/JFE STEEL

Relevant legal provisions:

EPC Art. 56, 112(1)(a)
RPBA 2020 Art. 12(4), 12(6), 13(2), 21

Keyword:

Inventive step - main requests A and B (no)
Admission of request not admitted by the examining division -
auxiliary request 1 (not admitted)
Amendment to case - auxiliary requests 2 to 7 (not admitted)

Decisions cited:

G 0001/19, T 0471/05



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Case Number: T 2220/22 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 6 May 2024

Appellant: JFE Steel Corporation
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 31 May 2022
refusing European patent application
No. 12888094.5 pursuant to Article 97(2) EPC**

Composition of the Board:

Chair J. Geschwind
Members: R. de Man
P. San-Bento Furtado

Summary of Facts and Submissions

- I. The applicant appealed against the decision of the examining division refusing European patent application No. 12888094.5.
- II. The examining division decided that the subject-matter of claim 1 of the main request lacked an inventive step over a well-known computer comprising a display device. The auxiliary request was not admitted into the appeal proceedings.
- III. With its statement of grounds of appeal, the appellant maintained its main request and auxiliary request as main request and auxiliary request 1 and filed new auxiliary requests 2 to 7.
- IV. In a communication accompanying the summons to oral proceedings, the board expressed the preliminary opinion that the main request did not comply with Articles 84 and 123(2) EPC and that the subject-matter of its claim 1 lacked an inventive step over a well-known conventional computer. It further indicated that it was not inclined to admit auxiliary requests 1 to 7 into the appeal proceedings.
- V. With a letter filed in preparation for the oral proceedings, the appellant filed a new main request A and maintained its pending requests as main request B and auxiliary requests 1 to 7. It requested that a question be referred to the Enlarged Board of Appeal should the board be inclined to follow its preliminary reasoning. Such a question could be formulated, for example, as "Is it sufficient to confer technicality to a claim directed to a computer-assisted design method,

that the claim specifies that data calculated by the computer is adapted for being reflected on a physical (tangible) component?".

VI. Oral proceedings were held as scheduled on 6 May 2024. At the end of the oral proceedings, the Chair announced the board's decision.

VII. The appellant's final requests were that the decision under appeal be set aside and that a patent be granted on the basis of the claims of main request A or, in the alternative, of one of main request B and auxiliary requests 1 to 7. The appellant further requested that a question be referred to the Enlarged Board of Appeal if the board was minded not to allow main request A.

VIII. Claim 1 of main request A reads as follows:

"A method of designing an automotive steel-sheet structure in an optimal shape with enhancement of rigidity or crash worthiness as well as reduction of weight, the method being performed by a computer, comprising:

a design-space defining step of defining a portion of a structure model (13) of the automotive steel-sheet structure which is stored in a storage device (7) of the computer as a design space (25) and eliminating part of the structure model (13) in the portion so that the eliminated part serves as the design space (25);

a block-model generating step of generating a block model (27) in the defined design space (25), the block model (27) being formed of three-dimensional elements to extend along surfaces of the structure model (13), and in the block model (27) the three-dimensional elements being finely divided parallel to a surface of the design space (25) having the largest

area, wherein the three-dimensional elements forming the block model (27) are any of pentahedrons, hexahedrons, heptahedrons, and octahedrons, each three-dimensional element including at least one pair of two parallel surfaces;

a coupling step of coupling the generated block model (27) with the structure model (13);

an analyzing step of performing optimization calculation using numerical analysis on the block model (27) on the basis of an analytic condition input by an operator,

wherein the analytic condition includes one of a position at which the structure model is constrained, a position at which a load is applied to the model structure, a volume fraction of material of the steel-sheet structure, maximizing rigidity of the block model, minimizing displacement, and minimizing stress,

wherein, after the optimization calculation is performed, three-dimensional elements forming an optimal shape that satisfies the given analytic condition are left among the three-dimensional elements in the optimization block model, further wherein the optimal shape is adapted for being reflected on a steel-sheet structure shape of the automotive steel-sheet structure; and

a displaying step of displaying, by using a display device (3), a calculation result of the optimal shape as a design of the automotive steel-sheet structure."

IX. Claim 1 of main request B reads as follows:

"A method of designing an automotive steel-sheet structure in an optimal shape with enhancement of rigidity or crash worthiness as well as reduction of

weight, the method being performed by a computer, comprising:

a design-space defining step of defining a portion of a structure model (13) of the automotive steel-sheet structure which is stored in a storage device (7) of the computer as a design space (25) by eliminating part of the structure model (13);

a block-model generating step of generating a block model (27) in the defined design space (25), the block model (27) being formed of three-dimensional elements to extend along surfaces of the structure model (13), and in the block model (27) the three-dimensional elements being finely divided parallel to a surface of the design space (25) having the largest area, wherein the three-dimensional elements forming the block model (27) are any of pentahedrons, hexahedrons, heptahedrons, and octahedrons, each three-dimensional element including at least one pair of two parallel surfaces;

a coupling step of coupling the generated block model (27) with the structure model (13);

an analyzing step of performing calculation on the block model (27), the analyzing step which is a method that includes installing three-dimensional elements in a design space of a certain size and forming an optimal shape that satisfies given conditions by leaving minimum part of the three-dimensional elements that satisfies the given conditions; and

a displaying step of displaying, by using a display device (3), a calculation result of the optimal shape as a design of the automotive steel-sheet structure."

- X. Claim 1 of auxiliary request 1 differs from claim 1 of main request B in that the first two paragraphs have been replaced with the following text:

"A method of enhancing rigidity of an automotive body as well as weight reduction of the automotive body or enhancing crash worthiness of the automotive body as well as weight reduction of the automotive body, the method being performed by a computer, comprising:

a design-space defining step of defining a portion of a structure model (13), which represents the automotive body, of an automotive steel-sheet structure which is stored in a storage device (7) of the computer as a design space (25) by eliminating part of the structure model (13);".

XI. Claim 1 of auxiliary request 2 differs from claim 1 of main request B in that the following text has been inserted after "that satisfies the given conditions":

", the given conditions including a position at which the structure is constrained, a position at which a load is applied, a volume fraction of a material, and at least one of maximizing rigidity, minimizing displacement, and minimizing stress".

XII. Claim 1 of auxiliary request 3 differs from claim 1 of auxiliary request 2 in that the following text has been inserted after "and minimizing stress":

", wherein discretization is performed using an optimization parameter in optimization calculation using numerical analysis".

XIII. Claim 1 of auxiliary request 4 differs from claim 1 of auxiliary request 3 in that the following text has been inserted after "with the structure model (13)":

"in such a manner that original joint portions between the portions eliminated for forming the design space (25) and the structure model (13) are reflected".

- XIV. Claim 1 of auxiliary requests 5, 6 and 7 is based on claim 1 of auxiliary request 1 and includes the same amendments introduced by auxiliary requests 2, 3 and 4.

Reasons for the Decision

1. The application relates to optimising the shape of a three-dimensional model, in particular for automotive steel-sheet structures.

Main request A

2. *Admission into the appeal proceedings*
 - 2.1 Main request A is based on the main request refused by the examining division with amendments intended to address the clarity and added-matter objections raised for the first time in the board's communication.
 - 2.2 Since main request A was filed at the earliest opportunity, i.e. before the final date set by the board for making written submissions, and since the amendments made do not raise new issues, the board considers that its admission into the appeal proceedings is justified by exceptional circumstances (Article 13(2) RPBA).
3. *Inventive step*
 - 3.1 Claim 1 is directed to a method of designing an automotive steel-sheet structure "in an optimal shape

with enhancement of rigidity or crash worthiness as well as reduction of weight".

First, a portion of the structure model is defined which is to serve as a "design space", and this portion is "eliminated" from the structure model. The board notes that the portion that is to serve as the design space may be defined by a human operator by designating coordinates (see paragraph [0039] of the description).

Then, a "block model" is generated "in the defined design space". The block model is a mesh consisting of three-dimensional elements which are polyhedra having five to eight faces (pentahedrons, hexahedrons, heptahedrons, and octahedrons) and at least one pair of parallel faces, and which are "finely divided parallel to a surface of the design spaces having the largest area". Also this step is at least guided by a human operator (see paragraph [0040]).

Next, the block model is "coupled" to the structure model. According to paragraph [0034] of the description, this involves using (representations of) rigid elements, sheet elements or beam elements which are intended to transmit the load from the structure model to the block model. This step is again at least guided by a human operator (see paragraph [0041]).

The operator then inputs an "analytic condition", which includes one of:

- a position at which the structure model is constrained;
- a position at which a load is applied to the model structure;
- a volume fraction of material of the steel-sheet structure;

- maximising rigidity of the block model;
- minimising displacement; and
- minimising stress.

On the basis of this input, an "optimal shape" that satisfies the condition is determined by "performing optimization calculus using numerical analysis". This shape is formed from a subset of the three-dimensional elements of the block model and is "adapted for being reflected on a steel-sheet structure shape of the automotive steel-sheet structure".

The calculated optimal shape is displayed on a display device.

- 3.2 Claim 1 is a computer-implemented method which allows a user to input certain data, carries out a calculation, and displays the result of the calculation. The method can be implemented by suitably programming a well-known conventional computer having conventional display and input devices.

Hence, the subject-matter of claim 1 differs from such a well-known conventional computer in the computer program that it runs. This computer program can contribute to an inventive step only to the extent that it achieves a technical effect going beyond the normal functioning of a conventional computer. Technical effects can occur, in particular, within the computer-implemented process in the form of specific adaptations of the program to the hardware of the computer or at the input and output of this process (see decision G 1/19, OJ EPO 2021, A77, points 85).

- 3.3 Since claim 1 does not define any specific data input mechanism, and since the input data is provided by a

user, the board cannot identify a technical effect (going beyond the normal functioning of a conventional computer) at the input of the method.

- 3.4 The appellant argued that the block-model-generating and coupling steps of claim 1 represented specific adaptations of the program to a computer, as they implemented real-world requirements relating to steel sheets.

However, the block-model-generating and coupling steps of claim 1, as well as the other method steps, are defined at a purely algorithmic level and do not reflect any technical considerations relating to the functioning of the hardware on which the computer program is run. These steps may have been designed to take into account real-world requirements of the automotive steel-sheet structures being designed, but that does not amount to a technical effect within the computer-implemented process.

- 3.5 As to technical effects at the output of the computer-implemented method, the board notes that the claimed method merely displays the "calculation result of the optimal shape as a design of the automotive steel-sheet structure" on a conventional display device. Although the calculations carried out to arrive at the result might take into account technical "real-world" requirements of automotive steel-sheet structures, the calculation result is just data and does not itself represent a technical effect (see G 1/19, point 97).

The appellant argued that the produced data led to a potential technical effect in that the calculated shape was adapted to be produced using steel sheets. This was expressed by the claim feature "wherein the optimal

shape is adapted for being reflected on a steel-sheet structure shape of the automotive steel-sheet structure". In addition, the calculated "optimal shape" resulted in enhanced mechanical properties of rigidity or crash worthiness as well as reduced weight. According to decision G 1/19, point 94, it was sufficient that the intended use was implied by the claim.

The board does not agree. A potential technical effect as the result of a specific "implied" use of the output data can be taken into account in the assessment of inventive step only if the output data has no non-technical other relevant uses (G 1/19, points 95 and 98). In the present case, however, the output data is displayed to the user and can be used, for example, in an iterative design process, which is a non-technical, cognitive activity (cf. G 1/19, point 143). Moreover, the output data produced by the method is not - at least not over the whole scope of the claim - directly usable for building an automotive steel-sheet vehicle structure, as building the structure will normally require further steps, including cognitive steps. Hence, claim 1 does not limit the use of the calculated data to a specific technical use over the whole scope of the claim.

- 3.6 The appellant argued that the fact that the calculated data could be used in an iterative design process could not deprive the claimed method of technicality.

The board notes that the fact that the calculated data can be used for non-technical purposes does not so much deprive the claimed method of technicality but rather shows that the production of the calculated data does not achieve a technical effect over substantially the

whole scope of the claim. A specific technical effect may not be considered as the basis for the inventive-step analysis if the claim is not limited in such a way that substantially all embodiments encompassed by it achieve the effect (G 1/19, points 82 to 84). This means that a "potential" technical effect which is achieved only when the output of a method is put to a specific use can be taken into account in the assessment of inventive step only if that use is the only relevant use of the output (G 1/19, points 94 and 95).

- 3.7 The appellant attempted to draw an analogy with an oscilloscope, which could be used to display electrical waveforms from a circuit when designing the same circuit through prototyping cycles. Although cognitive activities were involved in the use of the displayed output, the oscilloscope was nevertheless a technical tool.

However, an oscilloscope not only displays electrical waveforms but also measures them. A technical effect therefore occurs at the input. The example of an oscilloscope is therefore not relevant to the present case.

- 3.8 The appellant further argued that the board's position meant that the output data of a design process was always linked to cognitive steps and that the board effectively required the inclusion in the claim of a production step. This amounted to requiring a direct link to physical reality and the production of a tangible effect, which was at odds with point 88 of G 1/19 ("the Enlarged Board does not see a need to require a direct link with (external) physical reality in every case") and point 101 of decision G 1/19 ("the

Enlarged Board fully supports the view expressed in T 533/09 (Reasons, point 7.2) that a tangible effect is not a requirement under the EPC").

3.8.1 In point 101 of decision G 1/19, the Enlarged Board rejected "tangibility" as a separate requirement for patentability in addition to the requirement of technicality. The board's reasoning in the present case is indeed based on a lack of a technical effect, not on a lack of a "tangible" effect, and thus in line with point 101.

3.8.2 In points 87 and 88 of decision G 1/19, the Enlarged Board gave two reasons why a direct link with (external) physical reality was not required in every case. First, technical contributions may be established by features within the computer system, i.e. a technical effect can occur in the "internal" physical reality of the computer system. Second, an inventive step can sometimes be based on a "potential technical effect", i.e. an effect achieved only in combination with non-claimed features.

The board acknowledges that such technical effects of the distinguishing features may be present in principle, but considers that they are not present in the subject-matter of claim 1 (see points 3.3 to 3.5 above).

3.9 In view of the above, the board comes to the conclusion that the subject-matter of claim 1 of main request A lacks an inventive step (Article 56 EPC).

4. *Request for a referral*

4.1 The appellant requested that a question be referred to the Enlarged Board of Appeal if the board was minded not to allow main request A.

4.2 Under Article 112(1)(a) EPC, a board, either of its own motion or following a request from a party, is to refer a question to the Enlarged Board if it considers that a decision is required to ensure uniform application of the law, or if a point of law of fundamental importance arises.

Under Article 21 RPBA, a board is to refer a question to the Enlarged Board if it considers it necessary to deviate from an interpretation or explanation of the EPC contained in an earlier decision or opinion of the Enlarged Board of Appeal according to Article 112(1) EPC.

4.3 The appellant argued that the board's approach deviated from the explanations contained in points 88 and 101 of decision G 1/19.

The board disagrees for the reasons given in point 3.8 above.

4.4 The appellant also argued that the board's approach diverged from decision T 471/05, which had not been put into question in decision G 1/19. A referral was therefore necessary to ensure uniform application of the law.

The board notes that the Enlarged Board in decision G 1/19 did not confirm decision T 471/05 but merely noted that, in the context of inventive step, T 471/05

made no reference to the technical or non-technical nature of the method steps under consideration, or otherwise to the COMVIK approach, and that it therefore was of limited relevance to the referred questions (see G 1/19, point 134).

In the present case, the board has come to its conclusion on inventive step by applying the principles set out in decision G 1/19. A perceived or real divergence from the earlier decision T 471/05 does not cast doubts on decision G 1/19 and therefore cannot justify a referral. Indeed, such a referral would be tantamount to asking whether G 1/19 was decided correctly.

- 4.5 For these reasons the board does not accede to the appellant's request to refer a question to the Enlarged Board of Appeal.

Main request B

5. Main request B is identical to the main request refused by the examining division.
6. The appellant did not dispute that the board's inventive-step objection to claim 1 of main request A applies, *mutatis mutandis*, to claim 1 of main request B. The subject-matter of claim 1 of main request B therefore likewise lacks an inventive step (Article 56 EPC).

Auxiliary request 1

7. Claim 1 of auxiliary request 1 differs from claim 1 of main request B in that it is directed to a method "of enhancing rigidity of an automotive body as well as

weight reduction of the automotive body or enhancing crash worthiness of the automotive body as well as weight reduction of the automotive body".

8. *Admission into the appeal proceedings*

8.1 Auxiliary request 1 is identical to the auxiliary request filed on 26 April 2022, i.e. two days before the oral proceedings held before the examining division. The examining division did not admit that request for being late filed and re-introducing subject-matter which had been previously claimed and found to violate Article 123(2) EPC.

Under Article 12(6), first sentence, RPBA, a request which was not admitted in the first-instance proceedings is not to be admitted into the appeal proceedings, unless the decision not to admit it suffered from an error in the use of discretion or unless the circumstances of the appeal case justify its admittance.

8.2 In its statement of grounds of appeal, the appellant argued that the examining division had carried out a "gross and superficial review" of the auxiliary request instead of a correct *prima facie* test. The claims of the auxiliary request were different from the request previously objected to and were "literally based on the description, see e.g. para. [0002], [0004] disclosing that the structure may be the one of an automotive body".

8.3 In point 4.3 of the communication annexed to its summons to oral proceedings, the examining division objected under Article 123(2) EPC to the feature "forming an automotive steel-sheet structure" of then

claim 1, indicating that the application as filed did not disclose "a forming step in the physical world". With its letter dated 4 February 2022 filed in response to the summons, the appellant amended its sole request, replacing the objected-to feature with "designing an automotive steel-sheet structure".

The board agrees with the examining division that claim 1 of auxiliary request 1 is again directed to "forming" - rather than merely designing - an automotive body or steel-sheet structure. In this respect, the board notes that the appellant in point 3.2 of its statement of grounds of appeal confirmed that claim 1 implied the "creation [or] modification of a physical automotive body".

The board therefore agrees with the examining division that auxiliary request 1 seeks to re-introduce a feature which had previously been deleted to overcome an objection under Article 123(2) EPC.

8.4 In addition, the board considers that, at least *prima facie*, the objection under Article 123(2) EPC is justified.

As for the alleged "literal" disclosure of the claims in paragraphs [0002] and [0004] of the description, the board notes that paragraph [0002] describes the background art, not the invention, and that paragraph [0004] relates to optimising the design of a portion of an automotive body, not creating the physical body. Neither paragraph contains a "literal" disclosure of either the claims or the amended feature.

The board is further aware of paragraph [0001], which mentions that the invention relates to "the structure

shape optimization analyzing method and an apparatus therefor for enhancement of the rigidity of the structure such as an automobile as well as weight reduction of the structure or for enhancement of crash worthiness of the structure as well as weight reduction of the structure". However, this sentence refers to the invention as originally claimed. The originally filed claims include independent claims directed to a "shape optimization analyzing method for optimizing part of a structure model using plane elements or three-dimensional elements" and a "shape optimization analyzing apparatus that performs optimization calculation using numerical analysis on a shape of part of a structure model formed of plane elements or plane elements and three-dimensional elements", i.e. claims directed to generating a design, not claims to "forming" - rather than merely designing - an automotive body or steel-sheet structure.

- 8.5 The appellant argued that the amendment made in auxiliary request 1 was justified because the Guidelines for Examination had been amended between the filing of the response to the summons and the filing of the auxiliary request to take into account decision G 1/19, with the amended version no longer referring to the "Infineon" criteria. Although decision G 1/19 had already been out when the summons were issued, the Guidelines were binding on the examining division and had not yet been revised when the appellant had filed its response to the summons. It was therefore reasonable for the board to be lenient and to admit auxiliary request 1.

The board does not agree that parties to first-instance proceedings need not pay attention to decisions issued by the Enlarged Board until they have been incorporated

in the Guidelines for Examination. In the present case, the inventive-step objection contained in the communication annexed to the summons to oral proceedings before the examining division explicitly relied on decision G 1/19. The appellant could therefore have been expected to take the decision into account when filing its reply to that communication.

8.6 The board further observes that the appellant chose not to amend or otherwise defend auxiliary request 1 in response to the clarity and added-matter objections raised in the board's communication.

8.7 For these reasons, the board does not admit auxiliary request 1 into the appeal proceedings (Article 12(6), first sentence, RPBA).

Auxiliary requests 2, 3 and 4

9. Auxiliary requests 2, 3 and 4 add to claim 1 of main request B features further specifying the "analyzing" and "coupling" steps.

10. *Admission into the appeal proceedings*

10.1 Auxiliary requests 2, 3 and 4 were filed for the first time with the statement of grounds of appeal and thus represent amendments of the appellant's case. Their admission is therefore at the board's discretion (Article 12(4), first and second sentences, RPBA).

10.2 The appellant argued that auxiliary requests 2, 3 and 4 added features aimed at highlighting technicality and were a legitimate response to the written decision.

However, the written decision's inventive-step reasoning does not include any crucial elements not already present in the reasoning given in point 5 of the communication annexed to the summons to oral proceedings before the examining division. Auxiliary requests 2, 3 and 4 therefore could (and should) have been filed together with the main request in response to the summons to oral proceedings before the examining division.

Moreover, in the board's view, the amendments made, which do not relate to any further use of the computation results, are *prima facie* unsuitable to address the decision's reasoning.

10.3 The board further observes that the appellant chose not to amend or otherwise defend auxiliary requests 2, 3 and 4 in response to the clarity and added-matter objections raised in the board's communication.

10.4 Hence, the board does not admit auxiliary requests 2, 3 and 4 into the appeal proceedings (Article 12(4) RPBA).

Auxiliary requests 5, 6 and 7

11. Claim 1 of auxiliary requests 5, 6 and 7 adds to claim 1 of auxiliary request 1 the amendments made in auxiliary requests 2, 3 and 4.

12. *Admission into the appeal proceedings*

Since auxiliary requests 5, 6 and 7, which were filed for the first time with the statement of grounds of appeal, are based on auxiliary request 1, which had not been admitted by the examining division and is also not admitted by the board, the board sees no justification

for their admission into the appeal proceedings (Article 12(4) and (6), second sentence, RPBA).

13. Since the requests admitted into the appeal proceedings are not allowable, the appeal is to be dismissed.

Order

For these reasons it is decided that:

1. The request for referral of a question to the Enlarged Board of Appeal is rejected.
2. The appeal is dismissed.

The Registrar:

The Chair:



S. Lichtenvort

J. Geschwind

Decision electronically authenticated