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**Datasheet for the decision
of 9 September 2014**

Case Number: T 1058/10 - 3.2.06

Application Number: 01915575.3

Publication Number: 1268102

IPC: B21H5/02, B22F5/08

Language of the proceedings: EN

Title of invention:

GEAR WHEELS ROLL FORMED FROM POWDER METAL BLANKS

Patent Proprietor:

Stackpole Powertrain International ULC

Opponents:

GKN Corporate Centre / GKN Sinter Metals Holding

Headword:

Relevant legal provisions:

EPC 1973 Art. 54, 56, 84, 100(b), 100(c)

EPC Art. 123(2)

RPBA Art. 12(1), 12(2), 13(1)

Keyword:

Novelty - main request, auxiliary requests 1-4 (no)

Late filed argument - not substantiated by evidence

Amendments - auxiliary request 5 - added subject matter (yes)

Inventive step - auxiliary request 6 (yes)

Sufficiency of disclosure - (yes)

Decisions cited:

Catchword:



**Beschwerdekammern
Boards of Appeal
Chambres de recours**

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Case Number: T 1058/10 - 3.2.06

D E C I S I O N
of Technical Board of Appeal 3.2.06
of 9 September 2014

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 11 March 2010
revoking European patent No. 1268102 pursuant to
Article 101(3) (b) EPC.**

Composition of the Board:

Chairman M. Harrison
Members: T. Rosenblatt
W. Ungler

Summary of Facts and Submissions

I. By its decision posted on 11 March 2010 the opposition division revoked European patent No. 1 268 102. The opposition division decided that the grounds of opposition under Article 100(b) and 100(c) EPC 1973 did not prejudice maintenance of the patent and that the subject-matter of the granted independent claims was new (Article 54 EPC 1973) in view of document

D1 : DE-C-33 25 037,

but did not involve an inventive step (Article 56 EPC 1973).

II. The appellant (patent proprietor) filed an appeal against this decision. Together with the grounds of appeal (16 July 2010), the appellant submitted five sets of amended claims corresponding to a main request and auxiliary requests 1 to 4.

III. In its reply to the appeal grounds and in a subsequent written submission, the respondent (joint opponents) raised objections against the amended claims under *inter alia* Article 123(2) EPC and argued that the subject-matter of the product claims of all requests lacked novelty in view of *inter alia*

D4: US-A-5 366 363.

In regard to inventive step, the respondent relied on a combination of D1 with common general knowledge and/or with the disclosures in

D2: WO-A-92/05897,

D5: GB-A-2 138 723,

D6: JP-A-9 276 967.

In addition to these documents which had already been cited in the opposition procedure, reference was made to further prior art not previously mentioned, including *inter alia*:

D7: EP-A-1 125 655 and its German priority document.

D7 was acknowledged by the respondent as constituting prior art within the meaning of Article 54(3) EPC.

The respondent also reiterated the objections which had been made during opposition based on the grounds of opposition under Article 100(b) and (c) EPC 1973.

IV. In the communication annexed to a summons to oral proceedings, the Board informed the parties that it provisionally concurred with the respondent's novelty objection concerning the product claims of all requests in view of D4 and that the respondent's objection under Article 123(2) EPC, raised in view of amendments to the independent method claims of the main request and the first and second auxiliary requests, also appeared convincing. In regard to the grounds of opposition under Article 100(b) and 100(c) EPC 1973, the Board opined that it was inclined to follow the conclusions reached by the opposition division. Concerning the documents submitted or referred to by the respondent for the first time in the appeal proceedings, the Board noted that discussion of their admittance into the proceedings to deal with any particular request could be required but that it appeared however that none of these was clearly more relevant in regard to the subject-matter of the method claims than the other documents referred to by the respondent in the appeal

- proceedings and which were filed in due time according to Article 99(1) EPC. In regard to D7, the Board noted that it did not appear to directly and unambiguously disclose certain features defined in the method claims.
- V. With its letter dated 8 August 2014 the appellant submitted *inter alia* auxiliary requests 1, 2, 5 and 6.
- VI. Oral proceedings were held on 9 September 2014, during which the respondent withdrew the clarity objections previously raised against the method claims.
- VII. The appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of the main request filed 16 July 2010, or on the basis of one of the first and second auxiliary requests filed with letter dated 8 August 2014, or on the basis of one of the third and fourth auxiliary requests filed 16 July 2010, or on the basis of the fifth auxiliary request filed with letter dated 8 August 2014, or on the basis of the four claims of the sixth auxiliary request as filed during the oral proceedings of 9 September 2014 together with claims 5 to 10 of the sixth auxiliary request filed with letter dated 8 August 2014, in addition to description pages 2, 2a and 3 as filed during the oral proceedings of 9 September 2014 and Figures 1 to 7 as granted.
- VIII. The respondent requested that the appeal be dismissed.
- IX. The independent claims of the **main request** read:
- "1. A method of manufacturing a wheel having two axially adjacent gears formed thereon, comprising preparing a blank with first and second gears (4,6) crudely formed thereon in axially adjacent relationship

by compressing and sintering a shaped mass of substantially metal powder; characterized in that an annular slot (8) is formed between the first and second gears (4,6), the method comprising the steps of: mounting the blank (2) for rotation about a first axis; arranging a respective die (12,10) with each of said first and second gears (4,6) in a manner to permit movement of said dies (12,10) into engagement with said gears (4,6); and roll forming the gears (4,6) on the blank (2) by rotating the blank in meshing engagement with respective dies (12,10) mounted for rotation about second and third axes substantially parallel to the first axis.

2. A method of manufacturing a wheel having two axially adjacent gears formed thereon, comprising preparing a blank with first and second gears (4,6) crudely formed thereon in axially adjacent relationship by compressing and sintering a shaped mass of substantially metal powder; characterized in that the first and second gears are directly adjacent without any slot (8) therebetween, the method comprising the steps of: mounting the blank (2) for rotation about a first axis; arranging a respective die (12,10) with each of said first and second gears (4,6) in a manner to permit movement of said dies (12,10) into engagement with said gears (4,6); and roll forming the gears (4,6) on the blank (2) by rotating the blank in meshing engagement with respective dies (12,10) mounted for rotation about second and third axes substantially parallel to the first axis.

13. A gear wheel having two axially adjacent different

gears formed thereon wherein the wheel is a unitary body consisting of a compressed and sintered mass of substantially metal powder, characterised in that both gears are roll formed thereon according to a method of any one of Claims 1 to 12."

Compared to the main request, the characterising portion of both independent method claims of the **first auxiliary request** is amended as follows (underlining and strike-through added by the Board):

"1. A method of ... characterized by the steps of ~~in that an annular slot is formed between the first and second gears (4,6), the method comprising the steps of:~~ mounting the blank (2) for rotation about a first axis; arranging a respective die (12,10) with each of said first and second gears (4,6) in a manner to permit movement of said dies (12,10) into engagement with said gears (4,6); and roll forming the gears (4,6) on the blank (2) by rotating the blank in meshing engagement with respective dies (12,10) mounted for rotation about second and third axes substantially parallel to the first axis, the engagement of the dies (12,10) with the blank (2) being simultaneous during at least a portion of the roll forming process, and there being formed on the wheel, between the two gears, an annular slot.

2. A method of ... characterized by the steps of ~~in that the first and second gears are directly adjacent without any slot (8) therebetween, the method comprising the steps of:~~ mounting the blank (2) for rotation about a first axis; arranging a respective die (12,10) with each of said first and second gears (4,6) in a manner to permit movement of said dies (12,10) into engagement with said

gears (4,6); and
roll forming the gears (4,6) on the blank (2) by
rotating the blank in meshing engagement with
respective dies (12,10) mounted for rotation about
second and third axes substantially parallel to the
first axis, the engagement of the dies (12,10) with the
blank (2) being simultaneous during at least a portion
of the roll forming process, and the first and second
gears on the wheel being directly adjacent without any
slot (8) therebetween."

The renumbered independent product claim 12 of the
first auxiliary request remains unchanged except for an
amendment of the back-reference from "any one of Claims
1 to 12" (main request) to "any one of Claims 1 to 11".

The respective independent product claims of the
second, third and fourth auxiliary requests also
comprise only corresponding adaptations of the
reference to the respective immediately preceding
(method) claim.

Compared to the independent method claims of the first
auxiliary request, the following additional feature has
been introduced in both respective claims of the **second
auxiliary request** at the same position:

"...roll forming the gears (4,6) on the blank (2) by
rotating the blank in meshing engagement with
respective dies (12,10) mounted for rotation about
second and third axes substantially parallel to and on
opposite sides of the first axis, the engagement of the
dies (12,10) with the blank (2) being simultaneous
during at least a portion of the roll forming process,
and...".

The **third** and **fourth auxiliary requests** each comprise only a single independent method claim. The wording is identical with that of the respective claim 1 of the first and second auxiliary requests, but with the last feature, "and there being formed on the wheel, between the two gears, an annular slot", removed.

The method claims 1 and 2 of the **fifth auxiliary request** are identical to those of the first auxiliary request. In contrast, all product claims are deleted.

The only independent method claim 1 of the **sixth auxiliary request** (including no product claims), is based on claim 1 of the third auxiliary request with the following amendment:

"...roll forming the gears (4,6) on the blank (2) by rotating the blank in meshing engagement with said respective dies (12,10) mounted for rotation about second and third axes substantially parallel to the first axis."

X. The arguments of the appellant as far as relevant for the present decision may be summarised as follows:

a) Main request

The gear wheels according to claim 13 were different from those calibrated or (re-)sized wheels of D4 in regard to their metallurgical structure in the densified or compacted superficial region of the gears. It was part of the common general knowledge of the skilled person that the application of the radially directed forces during the roll forming step according to claim 2 would result in radial "stress lines"

whereas the helically directed forces applied by the apparatus of D4 would produce a different orientation of "stress lines". The investigation of such stress lines was a common problem for the skilled person as was evident from documents submitted during the opposition proceedings. Such metallurgical differences were detectable by known techniques.

b) Fifth auxiliary request

The feature added to claim 1 had verbatim basis in the description in paragraph [0011] of the patent specification. The last paragraph on page 4 of the application as well as the passage bridging pages 5 and 6, as well as Figures 3 and 5, disclosed a slot. In particular in the last line of the penultimate paragraph of page 5, the method step was clearly disclosed by the wording "is formed". It was not excluded by the EPC that a method may be further defined by structural features of a product referred to in the method. Since the step could be put anywhere in the claim it could therefore be added at the end. The exact timing of when the annular slot was formed was irrelevant since it only was relevant that the slot was obtained as a result of the method, irrespective of whether it was achieved during compaction or roll forming.

c) Sixth auxiliary request

D1 did not disclose forming two gears on a single shaped mass or body, the individual gears could also be formed separately and assembled later. The term "toothing" used in the English family member

of D1 did not necessarily imply a gear. A tothing could also be a worm gear, so "tothing" could have been understood to mean simply relating to a tooth. This was different from a gear within the meaning of the claim. Simultaneous roll forming was also not disclosed in D1.

A combination of D1 with either D5 or D6 was not possible without inventive skill, because a complete redesign of the apparatus of D1 would be required; the required adaptations involved a still further step for the skilled person, for which there was no teaching. Starting from D1, the skilled person would only consider working sequentially on respective gears with the machine of D1 instead of simultaneously since otherwise non-trivial adaptations were required for which there was no indication and which thus required a further step. Roll-forming on two differently sized gears of a single workpiece at the same time with two dies mounted on a single movable axle would result in jamming.

XI. The arguments of the respondent as far as relevant for the present decision may be summarised as follows:

a) Main request

The appellant's defence relating to novelty concerning differences in the metallurgical structure of gears obtained by the method of D4 and those according to claim 13 had been made first during the oral proceedings and thus came as a surprise since this had not been mentioned in the written submissions; the respondent had no possibility to prepare for such a defence because

it was based on an allegation of certain facts allegedly belonging to the common general knowledge of the skilled person. No evidence for these allegations had been provided. It was also contested that the appellant's allegations were correct; the existence of differences in stress lines and the availability of well-known techniques to identify these were contested. Both products were obtained by further compacting a preformed sintered gear. A calibrating step according to D4 also implied a radial compaction, so that the same results would be obtained. The subject-matter of the independent product claim thus lacked novelty.

b) Fifth auxiliary request

The added feature was not disclosed as a method step in the general manner in which it had been introduced into the claim.

c) Sixth auxiliary request

The request should not be admitted because it was filed too late and introduced new subject-matter into the proceedings.

D4 disclosed the manufacture of "end formed" gears, so that the meaning of the expression "crudely formed" in the preamble of claim 1 was extended to encompass also end formed gears by the acknowledgement of D4 in paragraph [0004].

The patent did not contain any indication with respect to when a gear had to be considered as being "crudely" formed. This amounted to more than

a clarity objection since the skilled person, in the absence of a well-defined meaning, was not enabled to decide whether crudely formed gears had been achieved or not.

The disclosure in D1 was much broader than what was disclosed in the embodiment of Figures 2 and 3. By the expression "at least one" used in D1, for example in the claim, it was clear that the sintered metal body could comprise one, two, three or more gears. The skilled person would then have understood that each of such respective first, second or third gears would be formed according to the steps defined in the claim of D1 for one gear. In column 2, by the reference to the intended application for the high load gear wheels manufactured according to the underlying invention in automobile gear boxes, multiple gears on gear wheels were disclosed. It was then understood that the production of such multiple gears on gear wheels by the method of D1 was also disclosed. This was implicit from the description of the roll forming of the final gear with the apparatus in column 3, lines 17 to 27. For roll forming first and second gears, the skilled person would have understood that the disclosed apparatus only had to be duplicated and equipped with two tools which would then automatically lead to simultaneous roll forming. An implicit disclosure of a document encompasses all those features which are read along by a skilled person and which inevitably occur.

If the manufacture of the second gears was not considered as disclosed in D1, the problem to be solved would have been to simplify the manufacture

of two gears of a sintered workpiece.

The skilled person would always be motivated to automate manufacturing processes and reduce the number of steps in such a process, as was also apparent from the last lines in column 3 of D1. He would therefore consider manufacturing the two-gear gear wheel in a single process step. The number of possibilities being extremely limited, he would then use a single machine equipped with two die assemblies, with which he could either roll form the two gears sequentially or simultaneously. The latter was an obvious choice for the skilled person, not least because it was more efficient.

The subject-matter of claim 1 was also obvious in view of the combination of D1 with either of D5 or D6. D2 also disclosed simultaneous roll forming operations on gears.

Reasons for the Decision

1. Main request

This request is not allowable since the subject-matter of claim 13 lacks novelty in view of D4.

- 1.1 Claim 13 defines a gear wheel by reference to its process of manufacture. In one embodiment obtained by the method of manufacture defined in claim 2, the gear wheel comprises two directly adjacent gears formed on a unitary body of sintered metal, in which the density at the surface of the gears is higher than in regions further away from the surface as a result of roll forming the crudely formed gears after the sintering.

D4 discloses in Figure 4a a gear wheel of sintered metal comprising two gears directly adjacent one another, without any slot between them. According to the process of manufacture in D4 the gear wheels are obtained by filling a metal powder mass in a press mold, then compacting and sintering it under application of axial and helical forces through a plunger die (column 3, lines 3-21; column 5, line 61 to column 6, line 36). According to column 6, lines 61-63, after compaction and sintering, the workpiece may be calibrated and re-sized by using the same apparatus. During the calibration or sizing steps, the rotary and axial press-forming process used during the preceding compaction step is applied again. The result of the calibration or sizing step is thus a further compaction of the sintered material in the surface region up to a limited depth. A calibrated or sized sintered gear wheel therefore also has an inner structure which is less compacted than the denser surface region of the gears.

The gear wheels of D4 and those according to claim 13 obtained by the method of claim 2 have therefore the same structural features, so that the subject-matter of claim 13 is not new (Article 54(1) and (2) EPC 1973).

- 1.2 In its reply to the appeal grounds, the respondent raised this novelty objection with which the Board provisionally concurred in its communication (cf. IV. above).

The appellant, although arguing in its subsequent written submissions on other novelty objections, did not present any counter-argument or evidence concerning that objection.

Only during the oral proceedings did the appellant refute for the first time the novelty objection in regard to the product claims with respect to D4.

- 1.3 The Board however does not accept the appellant's defence because it lacks substantiation and is based on allegations which are not supported by evidence. Notably, the appellant did not submit any evidence showing that the method according to D4 and those of the patent in dispute would result in different metallurgical structures manifesting themselves in different stress line orientations, let alone that the formation of such differences and their experimental verification belonged to common general knowledge. The appellant referred to documents allegedly already considered in the opposition proceedings. These documents had not been mentioned in the appeal proceedings before and were also not submitted during the oral proceedings. According to Article 12(1) and (2) of the Rules of Procedure of the Boards of Appeal (RPBA), the party's complete case must specify expressly all the facts, arguments and evidence relied on. The appellant's case was not based on such documents.

Since this argument and the alleged knowledge of a skilled person in this area were presented for the first time during oral proceedings before the Board, the respondent had no possibility of providing counter-evidence and also contested the existence of the alleged differences. The Board can accept that the metallurgical structure, such as grain boundaries, in the surface region of the gears may be influenced by the process used for compaction or densification. However, the metallurgical structure present in a given

final product formed according to the claimed methods depends on a number of parameters such as material composition, sintering conditions, strength of forces applied during the compaction by roll forming, temperature or even further treatment steps applied after roll forming which are, contrary to the appellant's view, not excluded *per se* by the claims. None of these parameters is however defined in the claims. The resultant metallurgical structure of the roll formed gears is therefore unknown, even if methods might have been available (and the appellant has presented nothing more than hearsay in this regard), which might have allowed a reliable analysis of metallurgical structure and alleged stress lines in a way which enables a differentiation of certain method steps to be established in a final product.

1.4 In the absence of any supporting evidence for the appellant's allegations, the Board concludes that the gear wheels according to claim 13 and those according to D4 cannot be considered to be different in regard of their metallurgical structure or any other product aspect resulting from the manufacturing process of e.g. claim 2.

2. First to fourth auxiliary requests

Since the amendments in these requests only relate to features in the method claims which do not result in a gear wheel with different features to that known from D4, the subject-matter of the corresponding independent product claims of these requests also lacks novelty (Article 54 EPC 1973).

Although given the opportunity to do so, the appellant did not submit any counter-argument in this respect,

but nevertheless confirmed that it maintained its requests.

Irrespective of whether reasons may have existed for the Board not to admit these requests into proceedings under Article 12 or 13 RPBA, the requests are anyway clearly not allowable as already explained, such that a consideration of admittance criteria was superfluous.

3. Fifth auxiliary request

Irrespective of whether reasons may have existed for the Board not to admit this request into proceedings under Article 12 or 13 RPBA, it is anyway clearly not allowable because at least the amendment made to claim 1 does not meet the requirement of Article 123(2) EPC.

- 3.1 Compared to granted method claim 1, the feature "and there being formed on the wheel, between the two gears, an annular slot" has been added at the end of the claim. This feature defines an additional step in the manufacturing method which is performed in addition to the preparing, mounting, arranging and roll forming steps. It has indeed (almost) verbatim basis in the description of the patent (paragraph [0011]) and of the originally filed and published application (page 5, last line of the penultimate paragraph), as also argued by the appellant. However it is disclosed in the cited passages as a structural feature of a specific embodiment of a gear wheel. There is no disclosure, neither in this passage nor in any other passage of the description (for example [0005] of the patent) of a particular method step for producing this structure.

The subject-matter of claim 1 thus extends beyond the content of the application as originally filed,

contrary to the requirement of Article 123(2) EPC.

- 3.2 The appellant's argument that it was not excluded by the EPC to define further product features in a method claim is unconvincing because the added feature is drafted as a method step and not as a product feature. The appellant argued that the added feature was merely a structural feature of a gear wheel, obtained as a result of other method steps, which did not need to be defined as such. However there is no direct and unambiguous disclosure of a general method arriving at such a product without any specific step, but simply a disclosure of a gear wheel having this feature. Merely because the application is silent as to how a product is formed does not allow the conclusion to be drawn that there is an unambiguous disclosure that the method can permit a slot to be formed at any point in the process. It may be added that the claim would also have failed for lack of clarity due to the expression "being formed" being ambiguous.

The Board also cannot accept the appellant's argument that it was irrelevant at which moment in the sequence of claimed method steps the annular slot was actually formed and that the feature could therefore be put anywhere in the claim. Clearly all other steps defined in claim 1 have to be performed in exactly that manner and order in which they are defined. When adding the feature at the end of the claim, it can then also logically be understood as a step following on from the preceding steps. This is contrary to what follows from the last paragraph on page 4 of the published application, also relied upon by the appellant as a basis for the disclosure of the added feature. There the prior art of forming wheels having two gears is summarised and advantages of the present method are

explained. From this passage it can only be concluded, contrary to the appellant's argument, that the slot has to be "formed" at some moment before roll forming and not thereafter nor as a result of the roll forming step *per se*.

The appellant's further argument that a proprietor should always be allowed to introduce a feature from the application if it were introduced into the claim verbatim from the application as filed, entirely ignores the fact that the **context** in which the feature appears is also part of the disclosure to a skilled person. In the present case, the words "being formed" relate to a product and not a method of manufacture comprising certain steps. Features cannot be simply pulled out of their disclosed context, whether quoted verbatim or not, and then just be introduced into a claim without contravening Article 123(2) EPC unless the skilled person is presented, in the application as filed, with an unambiguous disclosure of the combination of features defined in the claim, be this explicit or implicit.

4. Sixth auxiliary request

4.1 Admittance into the procedure

The Board exercised its discretion to admit this request into the proceedings (Article 13(1) RPBA), contrary to the respondent's objections thereto. The (present) sixth auxiliary request is based on a previous version thereof which in turn had been filed in writing in response to the Board's preliminary written opinion on novelty of the product claims of all the then pending requests (see item V. above). Compared to the third auxiliary request filed with the appeal

grounds, the product claims had consequently been deleted in the previous version of the sixth auxiliary request. The only further amendment made during the oral proceedings in the single independent method claim, i.e. inserting the term "said" in the expression "with respective dies", was requested by the appellant in reaction to a preliminary conclusion reached by the Board on inventive step of claim 1 in the previous sixth auxiliary request. In the preceding discussion leading to that conclusion, arguments were taken into account which had not appeared during the written proceedings. The Board therefore considered the further amendment as an appropriate reaction to those discussions and which could not have reasonably been foreseen or filed earlier. The Board also disagrees with the respondent that the amendment introduced new subject-matter into the proceedings, in particular because the arguments directed against the claim previously on file had not called into question this particular matter. Nor therefore does it increase the complexity of the case. Furthermore, the respondent did not raise any objections under Article 84 EPC 1973 and 123 EPC against this additional amendment and the Board is also satisfied that the respective requirements are met.

4.2 Article 84 EPC 1973

4.2.1 The appellant withdrew its clarity objections raised against the method claims. The Board anyway considers that the claims meet the requirements of Article 84 EPC 1973.

4.2.2 In view of the grounds of opposition raised against the patent under Article 100(b) and (c) EPC 1973, which are considered below, the following remarks are made. In as

far as the objections can be understood, the objections made under both of these grounds of opposition merely concern an objection to lack of clarity of the expression "crudely formed". Even though the term may be broad, and indeed the patent and the application as filed do not comprise any indication as to the limits of the term, this does not mean that it necessarily lacks clarity, particularly in a sense which would not allow the skilled person to carry out the claimed invention. From the wording of the claim it follows that the blank and therewith also the gears crudely formed thereon are prepared by compressing and sintering a shaped mass of metal powder. It can therefore be understood by a skilled person that gears formed on a blank as a result of the compaction and sintering of a mass of substantially metal powder, irrespective of their actual finish achieved with those compaction and sintering operations, can be considered as crudely formed. Thus, in as far as the objection can be understood to fall under Article 100(b) EPC 1973, this is dealt with *infra*.

4.3 Articles 123 EPC and 100(c) EPC 1973

4.3.1 Claim 1 is based on a combination of granted claims 1 and 3. The Board is satisfied that the amendments of claim 1 meet the requirements of Article 123 EPC.

4.3.2 The respondent maintained nevertheless its objection raised under Article 100(c) EPC 1973 concerning the amendment of the description before grant of the patent. Paragraph [0004] was added to the originally filed description and comprises the statement "[D4] which forms the basis for the preamble of independent claims 1 and 13...". The Board disagrees with the respondent's argument that the meaning of the feature

"crudely formed" in the preamble of claim 1, which was already defined in claim 1 originally filed, was broadened by the cited statement so as to extend to methods of preparing blanks with gears already "end formed" thereon. It remains entirely unclear what subject-matter could have been added by this amendment. As explained above (cf. item 1.1), D4 discloses in column 6, lines 62 et seq a method that can be clearly considered to form the basis for the preamble of claim 1. The gears formed as a result of the compaction and sintering operation in this method can be considered to be crudely formed (see also item 4.2.2 above). Other methods also disclosed in D4, which do not rely on such a two-step process and rather "end form" (to use the words of the respondent) the gear wheel in a single step, can simply not be considered to constitute a basis for the preamble of claim 1. The Board thus concludes that the acknowledgement of D4 in paragraph [0004] of the patent in suit does not add subject-matter.

4.4 Article 100(b) EPC 1973

The Board concurs with the opposition division that the objections raised by the respondent in regard of sufficiency of disclosure are mere clarity objections in respect of the breadth of the expression "crudely formed", rather than throwing doubt on the question of whether or not the patent discloses sufficient information in order to enable the skilled person to carry out the invention claimed. The Board considers that the patent contains sufficient information in this respect. The respondent anyway did not argue and/or submit evidence which would demonstrate that the skilled person was indeed faced with major difficulties in the execution of each individual or the entire

sequence of steps defined in the claims. The argument of the respondent that a skilled person received no indication from the patent as to when gears would have to be considered as "crudely" formed (in opposition to "end formed") on the wheel relates to the evaluation of the limits of the protection conferred by the claims, but does not put into question that a skilled person is generally able to prepare blanks with gears thereon by compacting and sintering a mass of substantially metal powder which gears obtained thereby are then considered as crudely formed on the blank.

4.5 Article 54 EPC 1973

D1 discloses in general terms the manufacture of a body of sintered metal having at least one gear thereon, where the sintered body has or does not have a pre-formed gear thereon and in which the final gear is roll formed into the blank, see the sole claim, column 1, lines 14-17, or column 2, lines 3-31. In the case where the blank comprises a pre-formed gear ("*Vorverzahnung*") this can be considered to represent a crudely formed gear within the meaning of claim 1. The Board does not accept the appellant's argument that a general "toothing" (which term is apparently used in a British family member of D1 (the German patent) in place of the German term "*Verzahnung*") would not specifically disclose a gear as defined in claim 1 of the patent in suit. D1 is clearly dealing with the manufacture of gear wheels, see for example column 2, lines 8, 27-31 ("*Zahnrad*", "*Zahnräder*") so that there can be no doubt that "*Verzahnung*" would be understood by the skilled person as referring to toothing forming a gear of a gear wheel. D1 indeed additionally mentions worm gears as a further field of application of the disclosed method (see column 2, line 55). This however does not

alter the disclosure of gears which the skilled person derives unambiguously from the preceding passages.

By the expression "at least" used in the above mentioned passages of the general disclosure, the skilled person implicitly understands that the sintered metal body is also disclosed in a form in which it may comprise more than one gear. Any such body with more than one, i.e. two, three or more gears, will always have two gears. The Board thus concludes that the expression "sintered metal body with at least one gear" (literally in D1: "*mit wenigstens einer Verzahnung versehener Sintermetallkörper*") implicitly discloses to the skilled person also sintered metal bodies with (at least) two gears. Since both of these gears are on the sintered metal body, they can be considered as "axially adjacent" within the meaning of claim 1.

D1 discloses that a gear on such a wheel is manufactured according to the steps defined in claim 1. The Board disagrees however with the respondent's argument that D1 implicitly discloses the formation of both or even more gears on the sintered metal body, with all such gears being manufactured by the steps defined in its claim 1. There is no such implicit disclosure in D1, neither in the passages dealing with the intended field of application nor by the reference therein to multiple gears. Clearly there are other options available to the skilled person to form the second gear on the gear wheel (e.g. the wording of the claim already suggests two alternatives of forming gear wheels based on blanks "with or without preformed gears"), irrespective of whether the skilled person might possibly consider a duplication of the disclosed steps even as the easiest and therefore perhaps most

straight-forward way. The option to form the second gear by exactly the same method steps as the first gear, let alone to form both simultaneously, is therefore not unambiguously disclosed in D1.

In the single embodiment of the generally formulated method disclosed in D1 (see e.g. Figures 2 and 3), an apparatus is used in which the workpiece blank 1 comprising a single gear is mounted for rotation about its own axis. The workpiece can be engaged by two roll forming dies, mounted on two axes parallel to the workpiece axis, on opposite sides thereof. One of the dies is held in a fixed position. The second is movable so as to engage the equally movable workpiece, which in turn moves towards and thereby engages the fixed die. Rotation of at least one of the dies results then in roll forming the single gear. However, no indication is given in this context as to how a second gear might be formed when forming a wheel with two gears. Also the final statement in column 3 relating to the possibility of cold forming the gear in a single step is only made in the context of wheels comprising a single gear.

The Board thus concludes that D1 discloses in its most general sense a method of manufacturing a wheel having two axially adjacent gears formed thereon, in which the first gear is formed according to the steps defined in the preamble and the characterising portion of claim 1.

D1 does however not disclose that a second gear is also crudely formed on the blank by compressing and sintering a shaped mass of substantially metal powder and further roll formed according to the features in the characterising portion of claim 1, let alone simultaneously engaged with respective dies during at least a portion of the roll forming process.

The respondent did not raise or maintain any other novelty objections in respect to other documents referred to throughout the procedure. In particular the respondent did not proceed with its novelty objection based on D7 which the Board, in its preliminary opinion, had already considered to be unconvincing because D7 did seemingly not disclose the use of compacted and sintered wheel blanks. Since no further reasons or arguments were presented by the respondent, and none have been found by the Board, the Board finds no reason to reach a different conclusion in this regard and thus confirms its preliminary opinion.

4.6 The subject-matter of claim 1 is thus new (Article 54 EPC 1973).

4.7 Article 56 EPC 1973

4.7.1 Starting from D1 as the closest prior art to the subject-matter of claim 1, the objective technical problem has to be defined. Since the Board does not accept that the method of D1 when forming the second gear actually simplifies the manufacture of two-gear gear wheels, the problem identified by the respondent also cannot be accepted. The objective technical problem when starting from D1 could however be seen as being how to efficiently form a second gear on a gear wheel, since the skilled person generally wishes to use efficient methods.

4.7.2 The solution to this problem as defined by the features of claim 1 is however not obvious in the light of D1, either alone or in combination with a skilled person's common general knowledge and/or in view of the other prior art submitted by the respondent.

4.7.3 The Board accepts the argument of the respondent that the skilled person would apply the method steps disclosed in D1 also to the manufacturing of the second gear without requiring any inventive skill. Starting from D1, it is however not obvious for the skilled person to roll form the second gear by engagement of the dies for forming the first and second gears simultaneously during at least a portion of the roll forming process. It is of importance here that D1 discloses only a single specific embodiment showing how the first gear is to be roll formed. The skilled person is thus provided with no guidance when considering how to roll form a second crudely formed gear. It may also be added here that the relative position of such a second gear to the first gear in D1 is unspecified. The skilled person could use the same apparatus to perform a second run on some portion of the sintered metal body comprising the second crudely formed gear, if necessary after having replaced the dies used for forming the first gear by an appropriate second die assembly. Alternatively, the workpiece could be transferred to a similar second machine (e.g. sequentially in a production line). Both of these possibilities already presume the presence of two crudely formed gears on the sintered blank, so that the subsequent sequential roll forming of the two gears results, overall, in an efficient manufacture of the two-gear wheel. The previously defined objective problem is therefore already solved by a sequential operation, and it is evident that even further efficiency can be achieved if the operations themselves are carried out rapidly and with a minimum of time between operations. There is however no hint in D1 to perform a second roll-forming operation at least partially simultaneously with the first roll-forming operation. The mention in the last

line of column 3 of a single working step being required to form the gear does not give any hint towards forming a further gear in the same step, particularly since the disclosure in column 3 can only be understood as being made in the context of the specific embodiment using the apparatus shown in Figure 2 which comprises only one die assembly for forming one gear.

- 4.7.4 The Board can accept that the skilled person is generally aware that, in certain cases, a given manufacturing process could be made more efficient when certain steps thereof lend themselves immediately to being carried out simultaneously. It could thus be considered to belong to common practice to explore the feasibility of appropriate measures also in view of a non-disclosed method of forming a second gear in D1. The skilled person would nevertheless not arrive without using inventive skill at the combination of features defined in claim 1. The Board concurs with the appellant that the particular construction of the apparatus disclosed in D1 could not simply be duplicated and mounted in addition to the components of the apparatus shown in Figure 2 of D1. It would rather require a complete re-design of the apparatus, for which D1 provides no teaching or incentive. For example, a second die assembly in a 90° rotated, perpendicular configuration over the workpiece axis, considered as obvious by the respondent, whilst not taught by D1, would not give any hint towards any simultaneous machining even if it might be considered obvious for a sequential machining operation (i.e. first the roller dies as in Figure 2 are used and then this operation is followed by further dies being moved into position to form a second gear after the first dies have been moved out of the way) based on the use

of further dies arranged in the same way as the only disclosed movable dies and workpiece in D1 at a 90° rotated position. Any simultaneous machining from the 90° rotated position would evidently not work because of the changing position of the workpiece due to the workpiece's own linear motion during its roll forming. D1 itself thus contains no hint towards providing simultaneous machining. It is also evident that if a simultaneous solution were to be used as suggested by the respondent, a dedicated control system or a rearrangement of the necessary equipment of some type would be required. The introduction of at least partial simultaneous machining, first by selecting roll-forming as the method of producing the second gear, then to consider a particular arrangement of second die rollers with respect to the only disclosed set of die rollers shown in D1, and then to choose the provision of appropriate structural modifications or a control system implementation to provide simultaneous machining, relies on a hindsight analysis of how the skilled person could arrive through a series of steps at the invention claimed, even though neither D1 nor any other prior art provides a hint to this series of steps, let alone in a roll-forming process.

Also the other allegedly obvious arrangement considered by the respondent in which a second die assembly similar to that shown in Figure 2 would be installed at a certain distance from the first die set along the workpiece axis to roll form an axially adjacent second gear on the small diameter hub portion thereof, is not rendered obvious by common general knowledge. With such an arrangement differently sized gears would be formed. According to the respondent the skilled person would only have to mount the dies of the second assembly on the same axles carrying already the first die assembly

shown in Figure 2. This would however result in a non-working embodiment: if two dies for roll forming differently sized gears on a unitary workpiece are mounted on a single tool axle and simultaneously engage the gears to be roll formed, the entire tool-workpiece arrangement would jam. Although the respondent argued that if jamming did result, the skilled person would then take the step of opting for a multi-axis arrangement for each of the two sets of dies to be moved, no hint towards such a concept is provided in D1, notwithstanding the fact that, in the arrangement shown in the only disclosed embodiment of Figure 2, there is anyway no physical room to arrange such a second roller die arrangement with its own separate shafts along the same axis. It is thus not without hindsight that a skilled person would arrive at such an arrangement when starting from the single disclosed embodiment in D1.

4.7.5 D5 and D6 disclose manufacturing methods for working on two gears on a workpiece with two dies being in simultaneous engagement with the gears on the workpiece. Besides having no motivation to further modify an already efficient sequential method which solves the objective problem, the incorporation of the teaching of these documents, when starting from D1 as closest prior art, would anyway still not lead to the solution defined in claim 1. In both documents the methods disclosed therein employ apparatus in which the workpiece axis is held at a fixed position, contrary to the apparatus of D1 in which the workpiece axis is movable during the roll forming step towards one of the dies being held at a fixed position. The apparatus of D1 and those of D5 and D6 are therefore incompatible in structure, so that the skilled person could not simply combine the teaching of these documents without further

substantial modifications of the apparatus.

D2 discloses simultaneous working on different portions of a single gear, such as the roots and the flanks of the gear teeth (see page 5, line 36 to page 6, line 8). There is nothing derivable from D2 in respect of the manufacture of a second gear, hence nothing that could provide a hint to the skilled person towards the combination of features according to claim 1.

4.7.6 In its preliminary opinion, the Board had stated with respect to the documents submitted for the first time during the appeal proceedings that they did not appear more relevant in regard of the subject-matter of the method claims than the documents submitted in due time according to Article 99(1) EPC. The respondent did not submit any further comment in this respect either in writing or during the oral proceedings. The Board also finds no reason to come to a different conclusion.

4.7.7 The Board thus concludes that the subject-matter of claim 1 is considered as involving an inventive step having regard to the state of the art on file (Article 56 EPC 1973).

4.8 The description of the patent has been amended by indicating D1 as background art and adapting the remaining parts of the description to the amended claims. No objections were raised by the respondent in this respect and also the Board is satisfied that the corresponding requirements of the EPC are met.

Order

For these reasons it is decided that:

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 the following amended form:

Description: pages 2, 2a and 3 filed during the oral proceedings of 9 September 2014;

Claims: 1 to 4 of the sixth auxiliary request filed during the oral proceedings of 9 September 2014; claims 5 to 10 of the sixth auxiliary request filed with letter dated 8 August 2014;

Figures: 1 to 7 as granted.

The Registrar:

The Chairman:



I. Aperribay

M. Harrison

Decision electronically authenticated