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Datasheet for the decision of 14 October 2009

Case Number: T 1308/08 - 3.2.06

Application Number: 02016258.2

Publication Number: 1293649

IPC: F01N 3/28

Language of the proceedings: EN

Title of invention:
Foil made of a ferrite type heat resistant high alloy steel

Patentee:
Nippon Steel Corporation

Opponent:
Emitec Gesellschaft für Emissionstechnologie mbH

Headword:
-

Relevant legal provisions:
EPC Art. 123(2), 76, 54, 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Main request - inventive step (no)"
"Auxiliary requests 1-6 - late-filed - no clear disclosure - not admitted"

Decisions cited:
-

Catchword:
-

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Case Number: T 1308/08 **-** 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 14 October 2009

Appellant: (Patent Proprietor)
Nippon Steel Corporation
6-3, Otemachi 2-chome
Chiyoda-ku
Tokyo 100-8071 (JP)

Representative:
Vossius & Partner
Siebertstraße 4
D-81675 München (DE)

Respondents: (Opponent)
Emitec Gesellschaft für Emissionstechnologie mbH
Hauptstraße 128
D-53797 Lohmar (DE)

Representative:
Rössler, Matthias
KNH Patentanwälte
Kahlhöfer Neumann Herzog Fiesser
D-40210 Düsseldorf (DE)

Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 8 May 2008 revoking European patent No. 1293649 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: P. Alting van Geusau
Members: G. de Crignis
K. Garnett

Summary of Facts and Submissions

I. European patent No. 1 293 649, granted on application No. 02016258.2, was revoked by the opposition division by decision announced during the oral proceedings on 17 April 2008 and posted on 8 May 2008.

Claim 1 of the main request corresponded to claim 1 as granted and read:

"A metal foil made of a ferrite type heat resistant high alloy steel composing a metal honeycomb body(2) for an exhaust gas purification catalyst produced by alternately laminating or integrally winding a flat foil and a corrugated foil,
characterized in that a surface coarseness of said metal foil is in the range of 0.001 to 0.3 μm in terms of the mean coarseness Rac in the width-wise direction of the foil"

II. The decision of the opposition division was based on the finding that the subject-matter of claim 1 of the main request (patent as granted) was not novel when compared with the teaching of each of the documents:

E1 JP 09099218
E2 JP 01266978
E3 JP 08038912.

Although none of these documents explicitly stated that the values disclosed for the surface roughness had been determined in the width-wise direction of the strip, in view of the explanations given in E7 the opposition division saw no reason why these values should not

represent typical values which were equally valid for the materials used in E1 - E3. Anyhow, D24 made it clear that measurements should be taken in the direction showing the greatest roughness and E7, coupled with the experience of the opposition division and the other available indications, made it clear that roughness occurs in the width-wise direction for a rolled product and this would normally be expected to correspond to the width-wise direction for the winding process.

In auxiliary request 1, the subject-matter of claim 1 included a feature of a lower limit of 100 for the number of peaks per inch. The subject-matter of claim 1 of auxiliary request 2 additionally included an upper limit of 2000 for the number of peaks per inch and the range of roughness was limited to the range from 0.1 to 0.3. These amendments, however, were found by the opposition division not to overcome the above deficiency of lack of novelty.
In support of such finding on lack of novelty

E15 JP-A-05038454

was considered as providing typical values for the surface shape and condition of foils used for honeycomb bodies.

III. On 8 July 2008 the appellant (patent proprietor) filed a notice of appeal against this decision and paid the appeal fee. The statement of grounds of appeal was filed on 18 September 2008 together with a request to set aside the decision and to maintain the patent as granted, alternatively to maintain the patent in

amended form on the basis of the claims in accordance with first to fifth auxiliary requests filed therewith.

IV. In a communication dated 28 May 2009 sent in preparation for oral proceedings according to Article 15(1) of the Rules of Procedure of the Boards of Appeal, the Board gave its preliminary opinion on points raised by the parties. It was indicated that the subject-matter of claim 1 of the first auxiliary request appeared to be novel. The subject-matter of the claims of the auxiliary requests 2 to 5 needed to be discussed with regard to the requirements of Article 123(2) EPC.

V. Oral proceedings were held on 14 October 2009. The appellant requested that the decision under appeal be set aside and that the European patent be maintained on the basis of the claims in accordance with the main request, alternatively the first to sixth auxiliary requests, each as filed during the oral proceedings.

The respondents requested that the appeal be dismissed.

Claim 1 of the main request reads:

"A metal foil made of a ferrite type heat resistant high alloy steel composing a metal honeycomb body(2) for an exhaust gas purification catalyst produced by alternately laminating or integrally winding a flat foil and a corrugated foil and by solid phase diffusion bonding contact portions between said flat foil and said corrugated foil,
characterized in that a surface coarseness of said metal foil is in the range of 0.001 to 0.3 µm in terms

of the mean coarseness Rac in the width-wise direction of the foil, and wherein a surface shape and condition of said metal foil is at least 100 in terms of the number of peaks PPI per inch length in the width-wise direction of the foil."

Claim 1 of all auxiliary requests is limited with regard to the claimed ranges in that

- the surface coarseness of the metal foil is in the range of 0.1 to 0.3 µm in terms of the mean coarseness Rac in the width-wise direction of the foil; and
- the surface shape and condition of said metal foil is limited to the range of at least 500 and up to about 2000 in terms of peaks PPI per inch length in the width-wise direction of the foil.

Claim 1 of auxiliary request 1 additionally includes in the preamble that the diffusion bonding is carried out "at a vacuum" and to the characterising portion it is added:
"wherein the surface coarseness is measured for the arithmetic mean coarseness (Ra) stipulated by JIS B 0601-1994 in accordance with JIS using a contact needle coarseness meter stipulated by JIS B 0651-1976 and wherein the contact needle has a radius of curvature of 1 µm at the tip, and measurement is made with a cut-off value of 0.8 mm, a contact needle scanning speed of 0.3 mm/sec and a gauge length of 4 mm and wherein measurement of the surface shape and condition is made by a contact needle type coarseness meter, and under the same condition as that of Rac described above."

Claim 1 of auxiliary request 2 additionally includes in the preamble that the diffusion bonding is carried out by "fitting the honeycomb body so produced into an outer cylinder, and let then heating in vacuum of a degree of vacuum of 3 x 10^{-4} to 5 x 10^{-5} Torr, or in a non-oxidizing atmosphere, at a temperature within the range of 1,100 to 1,250°C for a retention time of 30 to 90 minutes so as to execute the diffusion bonding treatment".

Claim 1 of auxiliary request 3 specifies the diffusion bonding treatment as follows:
"at a vacuum of 10^{-4} Torr and a temperature of 1250°C for the retention time of 90 minutes".

Claims 1 of auxiliary requests 4 to 6 correspond to claims 1 of auxiliary requests 1 to 3 with the additional limitation to an Al-containing high alloy steel as material for the metal foil.

VI. In support of its requests the appellant argued essentially as follows:

The subject-matter of claim 1 of the main request was disclosed in originally filed claims 3 and 5 of the parent application. Accordingly, the requirements of Articles 123(2) and 76 EPC were met.

With regard to novelty, none of the cited prior art documents disclosed a combination of the claimed ranges for the surface coarseness and the surface shape and condition in a width-wise direction. Accordingly, the requirements of Article 54 EPC were met.

Concerning inventive step, E3 represented the closest state of the art. The problem was to improve the diffusion bonding and thereby durability and exhaust gas purification performance. E3 referred to surface roughness of the foils but did not additionally suggest considering the surface shape and condition.
E15 was concerned with the adhesion of a coating material and therefore would not be considered with regard to the problem to be solved. Moreover, the manufacturing method was not disclosed therein and accordingly brazing as an alternative to diffusion bonding could be applied as well. The choice of specific ranges for different surface properties of the foils was not obvious from any cited prior art.

The subject-matter of claim 1 of auxiliary requests 1 to 6 was further limited. A basis for such limitations was present in originally filed Figure 20. This figure was commented on in paragraph [0096] and the disclosure of paragraphs [0078 to 0102] provided further support. Moreover, Example 2 provided evidence for such preferred combinations of features. Therefore, the requirements of Article 123(2) EPC were met.

VII. The respondent argued essentially:

The subject-matter disclosed in originally filed claims 3 and 5 (parent application EP-A-0 985 450) referred to a metal honeycomb body. The subject-matter now claimed referred to a metal foil. The term "composing a metal honeycomb body" was not clear. The lack of clarity resulted from the characteristics of the surfaces which changed in the final metal honeycomb body due to the conditions during manufacturing

(temperature, time, pressure). Accordingly, the requirements of Articles 84, 123(2) and 76 EPC were not met.

The subject-matter of claim 1 lacked novelty. The determination method for the claimed range and the claimed lower limit was not specified in the claim. Accordingly, no exact range or limit was claimed. The subject-matter disclosed in E1 to E3 referred to excellent diffusion joining which necessarily had to rely on the claimed surface characteristics.

Concerning inventive step, E3 represented the closest prior art. Having regard to their function, metal honeycomb bodies such as the one of E3 (as well as the one of the patent in suit) had to be able to support a catalyst, which was possible using an adhesive coating. Hence, the skilled person would consider E15 as highly relevant. E15 referred to suitable metal foils and provided evidence in its table that foils having the claimed range of surface shape and condition were well-known in the manufacture of supporting bodies for catalysts. No inventive step was necessary to use such foils for the honeycomb bodies of E3.

The combination of features claimed in claims 1 of all the auxiliary requests was not originally disclosed. Therefore, the late-filed auxiliary requests should not be admitted in the proceedings.

Reasons for the Decision

1. The appeal is admissible.

2. *Main Request - Amendments*

2.1 The current claim 1 differs from claim 1 as granted in that additionally the following features are included:

(a) "and by solid phase diffusion bonding contact portions between said flat foil and said corrugated foil"

(b) "and wherein a surface shape and condition of said metal foil is at least 100 in terms of the number of peaks PPI per inch length in the width-wise direction of the foil."

Feature (a) has been added to the preamble, feature (b) has been added to the characterising portion.

These features were disclosed originally in independent claim 3 and its dependent claim 5 of EP-A1-0 985 450, which is the parent application of the patent in suit. Support in the description is present in paragraph [0039], which refers to the claimed combination of features. Accordingly, the amended claim meets the requirements of Articles 123(2) and 76(1) EPC 1973.

2.2 The subject-matter of claim 1 refers to a metal foil of a specific type which is manufactured in such a way that a metal honeycomb body for an exhaust gas purification catalyst is present. Figures 1 and 2 show such a metal honeycomb body. Accordingly, the skilled

person would clearly and unambiguously considers such metal honeycomb body as the specified and claimed article. The requirements of Article 84 EPC are met.

3. *Main Request - Novelty*

3.1 Each of E1 to E3 was cited with respect to lack of novelty. E3, which was referred to in particular, discloses a production method for a honeycomb body by diffusion-joining of a flat metal foil and a corrugated metal foil and inserting them into an outer case. The figure shown in E3 relating to the honeycomb body is identical to the one shown in Figures 1 and 2 of the patent in suit. The "rate of junction" of four diffusion bonded metal supports is disclosed in table 1 and corresponds to the degree of diffusion bonding. The surface coarseness Ra of the metal foils is specified to lie within the range of 0.001 to 0.3 µm. Although there is no disclosure with regard to the direction in which the surface coarseness is to be determined, the Board agrees with the opposition division that the skilled person would realistically only consider the width-wise direction for the winding of the foils in the honeycomb body.

3.2 It was not in dispute that no range for the surface shape and condition of the metal foil is disclosed in any of these documents.

3.3 The argument was that the satisfactory diffusion bonding can only be achieved with metal foils having a surface shape and condition within the claimed range. However, there is evidence available which contradicts this statement, namely metal supports 1 to 3 of

Example 2 of the patent in suit, which demonstrate that metal supports having surface characteristics with a combination of Rac and PPI values not falling in the claimed range can also meet the cold push test.

3.4 There is further evidence available which contradicts the above statement, namely in E15, which discloses in table 1 that 18Cr3Al ferrite stainless steel foils nos. 1, 3 and 4 have PPI values of below 100. Accordingly also this disclosure shows that standard metal foils having surface shapes and conditions falling outside the claimed range are also available.

3.5 Accordingly, as the claimed combination of ranges is not disclosed in any one of the cited documents, the combination of features as claimed in the subject-matter of claim 1 is novel (Article 54 EPC).

4. *Main request - Inventive step*

4.1 E3 represents the closest prior art and discloses a ferrite stainless steel metal foil used for constructing a honeycomb body via diffusion bonding as set out under point 3.1 above. E3 discloses that the joint formed by diffusion bonding can be made stable with a contact width between the corrugated foil and the flat foil of around 30 µm.

4.2 The feature distinguishing the claimed subject-matter from the disclosure of E3 is a foil having a surface shape and condition such that the number of peaks PPI is at least 100 per inch length.

4.3 The appellant considered the problem to be solved by such a feature as being to improve diffusion bonding.

4.3.1 The claimed subject-matter refers to an article and not to a process. Additionally, no extent or degree of diffusion bonding is specified for the article and the influence of the combined ranges of surface characteristics is not consistently demonstrated. In this respect the appellant mainly relied on Figure 20 and Example 2 of the patent in suit. However, neither Figure 20 nor Example 2 demonstrates that diffusion bonding is generally improved by the claimed combination of surface coarseness and surface shape and condition.

4.3.2 Figure 20 represents particular embodiments having improved diffusion bonding ratio when the surface coarseness is reduced and the surface shape and condition is increased within the disclosed limits. However, there are a variety of further factors influencing diffusion bonding which are not specified for the underlying embodiments, namely those concerning the material of the metal foils being used, their thicknesses, their bonding width, the back-pressure, the outer cover and other processing conditions. The only information present in this respect concerns the following conditions for diffusion bonding: vacuum at 10^{-4} Torr, 1250°C for 90 min. Such limited information is not sufficient to demonstrate convincingly that the problem is solved over the whole range claimed.

4.3.3 The same considerations apply with regard to Example 2 - referring to nine metal supports - which is the only example disclosing the claimed surface characteristics

in combination. Further defined processing conditions apply such as the material, thickness of the foils, bonding portions, back-pressure and outer shell. No information about the influence of these processing conditions on the bonding ratio is given although the presence of such influence is disclosed in the prior art (E3 refers to foil thickness and bonding width) as well as in the patent in suit, whose
Examples 1 and 3 to 5 demonstrate the influence of foil thicknesses, contact widths and back pressure. Such dependencies can even be seen in Example 2 itself with regard to metal supports 2 and 3 which both meet the cold push test, although these metal supports do not have both of the claimed characteristics since only one value falls within the claimed range (i.e., metal support 3 has a Rac of 0.35 µm, and metal support 2 has a PPI 80, values which are outside of the claimed ranges). This clearly demonstrates that an acceptable diffusion bonding ratio is not only to be obtained with the claimed combination of surface characteristics but can also be obtained when only one of these characteristics falls within the claimed range.

4.4 Therefore, there is no evidence that the subject-matter of the claim provides a solution to the problem of improved diffusion bonding. However, the relevant problem for the assessment of inventive step must be one which is successfully solved by the claimed subject-matter. Therefore, the technical problem which is solved by the claimed subject-matter cannot be improved diffusion bonding. The Board considers that the relevant problem is the further improvement of the manufacture of the metal carrier of E3.

4.5 E3 already suggests the use of Al-containing ferrite type alloy steel for the foil (20Cr5Al in all the metal supports of the examples) and highlights the fact that the surface characteristics are important for diffusion bonding via its disclosure concerning the surface coarseness Ra. Starting from this disclosure, the skilled person would be aware of the general suitability of such foils for diffusion bonding.

4.6 The ferrite type alloy steel which is used as metal foil for a honeycomb body in E15 is also based on this material. Although in E15 the manufacturing method is not disclosed, there is no reason why diffusion bonding as referred to in E3 should not be used. Concerning the metal foils and their surface characteristics, E15 confirms the disclosure of E3 regarding the surface coarseness Ra (paragraphs [0007] - [0009]) and points additionally to the factors of the surface shape and condition. It indicates that an appropriate surface coarseness alone is not sufficient for good adhesion, whether or not it is expressed as Ra, Rz or Rmax. In order to effectively improve the adhesiveness of the catalyst to the metal foil, additionally the surface shape and condition of the metal foil should be 500 µm or less (corresponding to a PPI value of 51) which also improves the durability of the final article. Accordingly, E15 would direct the attention of the skilled person directly to the fact that both surface characteristics are important. Furthermore the Tables in E15 show examples in which the SM values are as low as 90µm or 70µm, corresponding to PPI values of 282 and 363 respectively.

4.7 Accordingly, starting from E3 and looking for an even more suitable metal foil, the combination of the above surface characteristics would be considered, particularly in view of the advantages disclosed in E15. The beneficial influence of such surface characteristics on the final article, including the catalyst, reported there would be reason enough to base a honeycomb body on such metal foils and to investigate the further process conditions (*inter alia* contact width and back-pressure). Since the Tables in E15 show examples in which the SM values are as low as 90µm or 70µm, corresponding to PPI values of 282 and 363 respectively, the claimed range for the surface shape and condition of a number of peaks PPI of "at least 100 per inch length" (corresponding to a SM value of not more than 254µm) overlaps to a large extent with the teaching of E15. Hence, no inventive step would be necessary to arrive at the claimed subject-matter when combining the teaching of E3 with that of E15 (Article 56 EPC).

5. *Auxiliary requests 1 to 6 - Article 123(2) EPC*

5.1 All the auxiliary requests contain an amendment so as to comprise in their claim 1 the feature of the surface shape and condition of the metal foil being "at least 500 and up to about 2000 in terms of the number of peaks PPI per inch length in the width-wise direction of the foil". Additionally, the determination of the claimed ranges is limited to the related JIS-methods disclosed in the description.

5.2 No literal disclosure for the claimed range is present.

5.3 The appellant relied upon the disclosure of Figure 20 in combination with the description on pages 10 to 12 of the patent in suit for support of such a feature, in particular paragraph [0096], and referred also to Example 2.

5.4 The disclosure of such a range cannot be based upon the reference to Example 2, which only refers to isolated and particular metal supports based upon metal foils having a PPI number of either 100 or 500. It would be an unallowable generalisation to extend the scope of the metal supports of the Example 2 with regard to their values for PPI and Rac to other materials and thicknesses of the foils, to corrugated foils having differing peak heights or pitches and to procedures carried out differently (*inter alia* as regards vacuum, temperature, time and back-tension).

5.5 The only reference specifying a PPI number of 500 as well as a PPI number of 2000 is to be found in Figure 20.

5.6 The upper limit of the claimed range (PPI of 2000) is disclosed in Figure 20 and in paragraph [0096]. Figure 20 shows three graphs each based upon three distinct embodiments specified as having a PPI number of 100, 500 and 2000 and Rac values of 0.1, 0.2 and 0.3 µm. These graphs explain the reasons for the limitation of the surface shape and condition expressed as PPI in the present invention. The applied bonding conditions (back-tension, material of the outer cylinder and its dimensions) and material characteristics (nature of the material and thickness of the flat and the corrugated foil, peak height and pitch) of the underlying

embodiments remain unspecified. It is demonstrated for these embodiments that a higher diffusion bonding ratio can be obtained by controlling the surface characteristics such that a higher PPI number for the surface shape and condition is combined with a lower Rac value for the surface coarseness. The description states that the claimed upper limit is justified by practical burdens relating to industrial production (paragraph [0096]) and states that

"Diffusion bonding is conducted at a vacuum of 10^{-4} Torr and a temperature of 1,250°C for the retention time of 90 minutes. As a result, the diffusion bonding ratio of at least 0.3 can be secured by setting PPI to at least 100 as shown in Fig 20. Incidentally, though the upper limit of PPI is not limited, in particular, the range that can be employed without remarkably increasing the burdens to the industrial production is up to about 2000."

Accordingly, Figure 20 represents specific embodiments of the claimed subject-matter but does not disclose clearly and unambiguously that such a range applies also for different process conditions or different metal foils. It would be an unallowable generalisation to extend their scope with regard to their values for PPI and Rac to other materials and thicknesses of the foils, to corrugated foils having differing peak heights or pitches and to procedures carried out differently (*inter alia* vacuum, temperature, time and back-tension).

5.7 Figure 20 discloses also a graph featuring the lower limit of the claimed range (PPI of 500). The same arguments apply as set out above for the upper limit. Additionally, metal supports 3 and 5 of Example 2

discloses that not only the claimed combination of the ranges results in the meeting of the cold push test or durability test. They demonstrate that also with metal supports having only one surface characteristic within the claimed range an improved bonding with regard to the cold push test can be obtained. Accordingly, on the one hand no such range can be clearly and unambiguously derived in general for all claimed honeycomb bodies and on the other no convincing link between the PPI range of 500 to 2000 and the Rac range of 0.1 to 0.3 µm as solving the problem is present.

5.8 The description at paragraphs [0078 - 0102] relied upon in support by the appellant does not give further details concerning the embodiments used for drafting the graphs of Figure 20.

6. Since the subject-matter of claim 1 of all of the appellant's auxiliary requests includes this feature, none of the auxiliary requests meets the requirements of Article 123(2) EPC. Accordingly, these late-filed requests were not admitted into the proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Patin P. Alting van Geusau