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Datasheet for the decision of 24 September 2014

Case Number: T 2431/11 - 3.2.04

Application Number: 02425384.1

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IPC: F04C2/14, F04C2/08, F16H55/08

Language of the proceedings: EN

Title of invention:
Gear pump with spline function generated gear profile

Patent Proprietor:
Morselli, Mario Antonio

Opponents:
MARZOCCHI POMPE S.p.a.
Bosch Rexroth AG

Headword:

Relevant legal provisions:
EPC Art. 100(b)

Keyword:
Sufficiency of disclosure - (no) - undue burden (yes)

Decisions cited:
T 0063/06

Catchword:

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Case Number: T 2431/11 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 24 September 2014

Appellant: (Patent Proprietor)	Morselli, Mario Antonio Via del Carmine, 23 41100 Modena (IT)
Representative:	Faraggiana, Vittorio Ing. Barzanò & Zanardo Milano S.p.A. Via Borgonuovo 10 20121 Milano (IT)
Respondent: (Opponent 1)	MARZOCCHI POMPE S.p.a. Via 63° Brigata Bolero, 15 40033 Casalecchio di Reno BO (IT)
Representative:	Baldi, Claudio Viale Cavallotti, 13 60035 Jesi (AN) (IT)
Respondent: (Opponent 2)	Bosch Rexroth AG Maria-Theresien-Strasse 23 97816 Lohr am Main (DE)
Representative:	Winter, Brandl, Fürniss, Hübner, Röss, Kaiser, Polte - Partnerschaft mbB Patent- und Rechtsanwaltskanzlei Bavariaring 10 80336 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 17 October 2011 revoking European patent No. 1371848 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	A. de Vries
Members:	J. Wright
	C. Heath

Summary of Facts and Submissions

I. On 24 November 2011 the appellant (proprietor) lodged an appeal against the opposition division's decision of 17 October 2011 to revoke European patent EP 1 371 848 and simultaneously paid the appeal fee. The grounds of appeal were received on 27 February 2012.

Opposition was filed against the patent as a whole and based amongst other grounds on Article 100(b) with Article 83 EPC (insufficient disclosure).

The opposition division held that this ground prejudiced maintenance of the patent. It decided not to admit the following document, amongst others, into the proceedings:

D15: Giuseppe Cantore, Court Appointed Expert (CAE) report, Court of Bolognia

II. The following further documents also played a role in the appeal:

Roberto Meneghello: "The Practice of geometric model reconstruction from experimental data points" 26 February 2012.

D18: Giuseppe Catania: "Some considerations on the report entitled "The Practice of geometric model reconstruction from experimental data points", written by Dr Roberto Meneghello", 17 January 2013

D19: Carl de Boor "A Practical Guide to Splines" Springer Verlag 2001.

III. Oral proceedings before the Board were duly held on 24 September 2014.

IV. The appellant (proprietor) requests that the decision under appeal be set aside and that the patent be maintained as granted.

The respondent (opponent) requests that the appeal be dismissed.

V. The wording of the independent claim according to the appellant's sole request (claim 1 as granted) is as follows:

"A gear wheel with a plurality of teeth capable of meshing with the teeth of another corresponding gear wheel, characterised in that the profile of each tooth falls within a band of tolerance of ± 1 /20th of the depth of the tooth (H) with respect to a theoretical profile similar to a profile defined by a natural spline function passing through a plurality of nodal points having pre-established coordinates {X, Y}, expressed in a system of Cartesian coordinates having their origin at the centre (O) of the the pitch circle (P) of the gear wheel, corresponding to tables 1 to 6, also given below, for gear wheels with a number of teeth equal respectively to five, six, seven, eight, nine and ten:

Table 1

X	Y	X	Y	X	Y	X	Y
0.00	20.00	3.93	17.22	5.15	14.26	5.43	11.85
0.37	19.98	4.02	17.07	5.20	14.09	5.45	11.78
0.73	19.93	4.11	16.91	5.21	13.91	5.47	11.69
1.09	19.85	4.19	16.75	5.26	13.74	5.50	11.62
1.44	19.74	4.27	16.59	5.29	13.56	5.52	11.54
1.78	19.58	4.35	16.43	5.32	13.38	5.55	11.46
2.09	19.40	4.42	16.27	5.34	13.21	5.58	11.37
2.39	19.19	4.49	16.11	5.35	13.03	5.61	11.29
2.66	18.97	4.57	15.95	5.36	12.85	5.64	11.21
2.91	18.71	4.63	15.78	5.36	12.77	5.67	11.13
3.13	18.44	4.69	15.62	5.35	12.68	5.71	11.04
3.24	18.29	4.77	15.45	5.34	12.51	5.75	10.97
3.34	18.14	4.83	15.28	5.35	12.43	5.99	10.54
3.45	17.99	4.89	15.12	5.36	12.26	6.20	10.25
3.55	17.83	4.94	14.95	5.37	12.17	6.43	9.99
3.65	17.68	5.01	14.78	5.38	12.09	6.67	9.75
3.74	17.53	5.05	14.61	5.40	12.02	6.93	9.54
3.84	17.37	5.12	14.43	5.41	11.93		

Table 2

X	Y	X	Y	X	Y	X	Y
0.00	19.50	3.51	16.75	4.45	13.98	4.59	12.75
0.34	19.48	3.58	16.64	4.48	13.86	4.60	12.71
0.68	19.43	3.65	16.53	4.49	13.72	4.62	12.66
1.01	19.34	3.71	16.40	4.49	13.59	4.62	12.61
1.33	19.24	3.77	16.27	4.48	13.66	4.63	12.56
1.64	19.09	3.83	16.14	4.47	13.61	4.65	12.51
1.92	18.89	3.94	15.88	4.48	13.56	4.67	12.42
2.19	18.69	4.00	15.74	4.48	13.49	4.68	12.36
2.43	18.46	4.05	15.60	4.47	13.44	4.71	12.30
2.65	18.21	4.06	15.46	4.47	13.37	4.85	11.99
2.83	17.94	4.10	15.33	4.47	13.31	4.99	11.74
2.90	17.81	4.15	15.19	4.48	13.25	5.12	11.55
2.98	17.70	4.20	15.05	4.49	13.18	5.28	11.37
3.04	17.57	4.24	14.92	4.50	13.13	5.44	11.20
3.12	17.45	4.28	14.77	4.52	13.06	5.61	11.04
3.18	17.32	4.31	14.64	4.53	13.01	5.78	10.91
3.25	17.25	4.34	14.51	4.55	12.95	5.97	10.78
3.32	17.12	4.38	14.38	4.56	12.91	6.18	10.65
3.37	16.99	4.41	14.25	4.57	12.85		
3.44	16.88	4.43	14.11	4.58	12.81		

Table 3

X	Y	X	Y	X	Y	X	Y
0.00	19.10	3.05	16.72	3.76	14.75	4.03	13.16
0.33	19.09	3.12	16.61	3.73	14.60	4.05	13.10
0.64	19.05	3.18	16.52	3.76	14.50	4.06	13.05
0.95	18.96	3.19	16.41	3.76	14.39	4.07	12.98
1.25	18.83	3.25	16.32	3.82	14.28	4.09	12.95
1.53	18.69	3.25	16.21	3.84	14.19	4.13	12.86
1.79	18.49	3.32	16.09	3.85	14.04	4.18	12.79
2.04	18.28	3.34	15.98	3.86	13.85	4.25	12.62
2.25	18.09	3.43	15.88	3.88	13.76	4.33	12.45
2.45	17.83	3.42	15.79	3.86	13.73	4.51	12.27
2.59	17.58	3.46	15.67	3.86	13.67	4.57	12.15
2.65	17.46	3.53	15.57	3.89	13.60	4.77	11.98
2.67	17.37	3.52	15.46	3.90	13.56	4.84	11.88
2.78	17.29	3.59	15.37	3.92	13.48	4.95	11.75
2.83	17.17	3.61	15.28	3.94	13.45	5.11	11.67
2.88	17.12	3.65	15.17	3.94	13.36	5.29	11.55
2.94	17.01	3.68	15.06	3.96	13.31	5.43	11.49
2.95	16.92	3.66	14.96	3.97	13.25	5.51	11.45
3.03	16.81	3.74	14.84	3.99	13.24		

Table 4

X	Y	X	Y	X	Y	X	Y
0.00	18.80	2.66	16.68	3.24	14.92	3.50	13.67
0.29	18.78	2.70	16.59	3.26	14.83	3.50	13.61
0.58	18.73	2.74	16.50	3.27	14.73	3.56	13.40
0.88	18.65	2.77	16.41	3.30	14.63	3.63	13.25
1.15	18.53	2.80	16.33	3.31	14.55	3.71	13.12
1.41	18.39	2.83	16.26	3.32	14.45	3.77	13.00
1.64	18.22	2.87	16.17	3.34	14.37	3.85	12.86
1.87	18.03	2.91	16.09	3.35	14.29	3.94	12.74
2.05	17.83	2.94	16.00	3.37	14.15	4.02	12.64
2.21	17.61	2.98	15.93	3.38	14.13	4.12	12.55
2.36	17.36	3.01	15.84	3.39	14.06	4.22	12.47
2.40	17.28	3.04	15.76	3.41	14.02	4.32	12.38
2.45	17.20	3.08	15.67	3.42	13.97	4.42	12.30
2.48	17.12	3.10	15.59	3.44	13.92	4.52	12.24
2.52	17.04	3.12	15.49	3.46	13.83	4.64	12.18
2.56	16.94	3.15	15.42	3.46	13.78	4.74	12.12
2.59	16.85	3.18	15.22	3.47	13.75	4.87	12.08
2.63	16.77	3.20	15.12	3.49	13.72	4.97	12.01

Table 5

X	Y	X	Y	X	Y	X	Y
0.00	18.50	2.48	16.41	2.91	15.00	3.21	13.71
0.27	18.48	2.52	16.33	2.92	14.93	3.24	13.67
0.54	18.43	2.55	16.26	2.95	14.86	3.26	13.63
0.81	18.36	2.57	16.20	2.97	14.78	3.28	13.58
1.06	18.25	2.61	16.12	2.98	14.71	3.37	13.42
1.30	18.12	2.64	16.06	2.99	14.67	3.45	13.30
1.52	17.96	2.67	15.99	2.99	14.57	3.53	13.20
1.71	17.78	2.69	15.92	2.99	14.53	3.62	13.10
1.88	17.59	2.71	15.85	3.02	14.43	3.72	13.00
2.02	17.38	2.73	15.77	3.03	14.38	3.81	12.92
2.15	17.16	2.75	15.71	3.04	14.29	3.91	12.84
2.19	17.09	2.76	15.63	3.06	14.19	4.00	12.77
2.25	16.94	2.78	15.56	3.08	14.14	4.10	12.71
2.27	16.87	2.80	15.48	3.09	14.11	4.19	12.65
2.31	16.79	2.81	15.39	3.11	14.02	4.29	12.60
2.34	16.71	2.83	15.32	3.14	13.89	4.39	12.55
2.36	16.65	2.85	15.24	3.16	13.84	4.49	12.51
2.40	16.56	2.88	15.17	3.17	13.79		
2.43	16.49	2.89	15.08	3.19	13.75		

Table 6

X	Y	X	Y	X	Y	X	Y
0.13	18.24	2.25	16.34	2.59	15.19	2.88	14.02
0.39	18.21	2.29	16.28	2.60	15.13	2.92	13.94
0.65	18.15	2.32	16.22	2.61	15.06	2.96	13.87
0.89	18.05	2.34	16.16	2.63	15.00	3.00	13.79
1.12	17.95	2.36	16.10	2.64	14.94	3.05	13.72
1.34	17.80	2.39	16.04	2.66	14.88	3.10	13.66
1.53	17.63	2.41	15.98	2.67	14.81	3.15	13.59
1.70	17.44	2.43	15.92	2.68	14.73	3.20	13.53
1.84	17.24	2.45	15.86	2.68	14.71	3.26	13.47
1.97	17.03	2.47	15.80	2.68	14.70	3.32	13.41
2.04	16.89	2.49	15.74	2.68	14.69	3.38	13.36
2.06	16.83	2.50	15.68	2.70	14.64	3.44	13.30
2.08	16.77	2.51	15.62	2.70	14.61	3.51	13.25
2.11	16.71	2.52	15.56	2.71	14.51	3.57	13.20
2.13	16.64	2.54	15.50	2.74	14.43	3.64	13.15
2.15	16.58	2.55	15.44	2.76	14.35	3.79	13.06
2.17	16.53	2.56	15.38	2.78	14.27	3.90	13.00
2.21	16.47	2.57	15.31	2.81	14.19	4.01	12.95
2.23	16.41	2.58	15.25	2.85	14.10	4.12	12.90"

VI. The appellant argued as follows:

The theoretical profile defined in claim 1 is derived by natural spline interpolation of all points of the appropriate table, therefore the profile passes through each point.

A gear wheel having teeth following the theoretical profile meshes with a corresponding gear wheel without encapsulation because the tabulated data points are derived from measurements of real gears that mesh without encapsulation. Although there are slight undulations in the profile obtained, such slight

perturbations from the ideal profile are either insignificant or would wear off by running the gear.

Some profiles falling within the tolerance band of claim 1 do not mesh without encapsulation, however these are not in the claim's scope because the claim requires a gear wheel be capable of meshing with a corresponding gear wheel. Furthermore, the skilled person would know which profiles in the band mesh because they are familiar with standard mathematical formulae for generating meshing gear wheel profiles. Alternatively they would be able to check profiles worked by prototyping or graphically modelling them. Therefore, knowing the patent and by applying their general knowledge the skilled person can carry out the invention across the whole area of claim 1.

VII. The respondent argued as follows:

The theoretical tooth profiles of respective gear wheels defined in claim 1 have an undulating profile which would not mesh with a corresponding gear. Such gears would either not fit together or, if they fitted they would immediately jam. In any case they would contact at more than one point along the profile, so they would not mesh. Fluid would be encapsulated in the cavities between contact surfaces.

The skilled person could only find out which profiles in the tolerance band worked by trial and error. This constitutes an undue burden, therefore the patent is insufficiently disclosed.

Reasons for the Decision

1. The appeal is admissible.

2. Background

2.1 The patent concerns gear pumps having a driving and a driven gear wheel, specification paragraph [0001] and [0002]. In this context the gear wheels must mesh without encapsulation, that is without trapping fluid in cavities between interlocked teeth, (specification paragraphs [0004] and [0005]).

To this end claim 1 as granted proposes a gear wheel having a plurality of teeth with particular tooth profiles falling within a tolerance band about a theoretical tooth profile. The theoretical tooth profile is similar to a profile defined by a natural spline function passing through a plurality of nodal points tabulated for five, six, seven, eight, nine and ten toothed gear wheels respectively. The term "natural spline function" commonly refers to the piece-wise polynomial function resulting from spline interpolation of a set of known data points, where each of intervals defined between successive data points is interpolated by a respective polynomial function that passes through the interval's end points such that it is twice differentiable in those points. For a natural spline function the polynomials are cubic and together form a set of cubic polynomials, one for each interval between nodes where the nodes define their end points, and where adjacent polynomials have the same slope at their common node.

2.2 The gear wheel claimed is also limited by the functional feature that it must be capable of meshing with a corresponding gear wheel. Giving the terms their normal meaning, gears mesh when, viewed in profile, the flank of a driving gear's tooth profile contacts that of the driven gear, at a single point which moves as the two flanks roll over one another until they separate.

3. Admissibility of certain documents

3.1 The opposition division decided not to admit D15 into the proceedings. In a communication to the parties dated 12 June 2014, the board noted that D15 was originally submitted (and not admitted) as evidence in support of a selection invention but that in appeal a different passage had been cited by the appellant as evidence in support of sufficiency of disclosure. In this new context it thus represented a response to the negative finding of the opposition division in this respect first made in the decision under appeal. The Board added that since D15 was not complex, its admission would not seriously compromise procedural economy. It therefore decided to admit it into the proceedings, Article 12(4) RPBA.

3.2 The Meneghello Document was filed with the grounds of appeal. It is thus late filed and subject to the discretion afforded by Article 114(2) EPC and Article 12(4) RPBA.

The Meneghello document is, like D15, a technical report submitted as evidence supporting sufficiency of disclosure. The Board is also of the opinion that the document is not complex and its admission would not prejudice procedural economy. Furthermore the

respondent has had enough time to respond to it since he has indeed done so.

3.3 D18 and D19 were filed after the respondent's reply to the grounds of appeal and after the summons to attend oral proceedings. They are therefore subject to the discretion afforded by Articles 13(1) and 13(3) RPBA.

3.3.1 D18 has been filed by the respondent (opponent) as an analysis of and response to the above Meneghello document. Its contents are not particularly complex. The Board considers it would not be equitable to admit Meneghello without admitting D18.

3.3.2 Document D19, a 346 page book, is very complex. Furthermore it has been filed without indications of any specific arguments it is intended to support, let alone with regard to sufficiency of disclosure. In view of its complexity and the lack of supporting argument the Board does not believe it would be reasonable or equitable to admit this document into the proceedings at this late stage.

3.4 In the light of the above the Board the Board exercised its discretion under Article 114(2) EPC to admit D15, the Meneghello document and D18 into the proceedings, but not to admit D19 into the proceedings.

4. Sufficiency of disclosure

4.1 Article 83 EPC requires that the European patent application shall disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

4.2 According to established jurisprudence, an invention is sufficiently disclosed if it can be performed by a person skilled in the art in the whole area claimed, using common general knowledge and taking into account further information given in the description of the patent or patent application, see the Case Law of the Boards of Appeal of the EPO, 7th edition, 2013 (CLBA hereinafter) II.C. introductory portion.

Furthermore, the skilled person must be able to perform the invention without undue burden. Where the skilled person can only establish by trial and error whether his choice of numerous parameters will provide a satisfactory result, this amounts to an undue burden, see CLBA II.C.5.6 and 5.7.

4.3 As explained above, a key element of claim 1 is the theoretical tooth profile (one each for 5-10 tooth gears) that is similar to the profile defined by a natural spline function passing through the tabulated data points.

The decision under appeal found that the resultant profiles using all data points were so irregular that they would not practically mesh, as required by the claim, nor prevent encapsulation. It further held that if, as argued interpolation was only through selected but not all of the tabulated points, this would put an undue burden on the skilled person.

4.4 Contrary to what was argued before the opposition division (cf. decision, page 7, second paragraph) and until recently in appeal (cf. Meneghello, page 8, 2nd paragraph, last sentence), the appellant in the oral proceedings before the Board argues that the spline function profile does pass through *all* the points of a

given table in the claim, and that the resultant profile will mesh and prevent encapsulation. Insofar as the profile passing through all points is concerned the Board can agree with such a reading of claim 1. This reading corresponds to the skilled person's understanding of "natural spline function" (see above) in relation to "a plurality" of nodal points which contextually can only be the plurality given in the table. This point is thus no longer in dispute between the parties.

4.5 It is also undisputed that, based on the nodal points listed in claim 1, parts of the theoretical profiles claimed undulate, that is when set out in a graph these data points produce a profile that is irregular, i.e. that is not smooth but has considerable local variations. See for example figures 1 to 3 in Meneghello, or the tabulated points in the various figures of D18 Figure 1.

4.6 The only point in dispute is thus whether or not the resultant profile and band of profiles as defined in claim 1 can mesh, as required by the claim, and prevent encapsulation. The respondent has consistently argued that a profile passing through all points does not, and indeed from the appellant proprietor's initial response in opposition and appeal that not all points were meant it can be inferred that he initially agreed. In appeal the appellant now however expressly states that the main profile resulting from interpolation through all points does result in a meshing and non-encapsulating gear.

4.7 Normally, as explained in CLBA II.C.8, and in particular T 63/06, after the grant of the patent a legal presumption exists that the patent meets the

requirements of the EPC. In order to establish insufficiency, the burden of proof is upon an opponent to establish on the balance of probabilities that a skilled reader of the patent, using his common general knowledge, would be unable to carry out the invention.

However, when the patent does not give any information as to how a feature of the invention can be put into practice, the presumption of sufficiency of disclosure is weak. The opponent can discharge his burden by plausibly arguing that common general knowledge would not enable the skilled person to put this feature into practice. The patent proprietor then has the burden of proof for the contrary assertion that common general knowledge would indeed enable the skilled person to carry out the invention.

4.8 In the present case the patent provides no information, by tests or otherwise, that would support the claimed meshing and non-encapsulating of the resultant gears. The patent, at specification paragraph [0011] mentions experiments that led to the identification of the tooth profiles, but the relevant data has not been included or provided subsequently in opposition or the following appeal. The respondent-opponent on the other hand has presented a plausible, substantiated case why there would not be meshing and non-encapsulating. Given further the varying positions of the proprietor-appellant in this point the Board concludes that there can be only a weak presumption of sufficiency in the present case, and that the onus now rests on the proprietor to prove sufficiency. In weighing the parties' submissions against each other he can therefore no longer enjoy the benefit of the doubt.

4.8.1 In the respondent's submission of 2 July 2012 in reply to the appeal, see page 5, reference is made to his submission in opposition dated 15 December 2010, in particular figures 1 and 1b which plot the data points of table 3 for a 7 toothed gear wheel (table 3 of the claim) having a pitch circle of approximately 11 mm and an outer diameter of approximately 19mm, that is for a gear wheel of typical dimensions. Further figures 2 to 15 of the same submission show the contact area between an enlarged section of the flank profile of the driving gear with the flank and the corresponding identical driven gear profile at various angles of rotation. It is evident that during rotation the profiles cross and overlap each other due the irregularity of the opposing flanks. He argues that since gear teeth cannot overlap, at worst they would not fit together, at best they would not mesh but touch at more than one point, thereby jamming and encapsulating fluid.

This was reiterated in D18, page 18, first paragraph, and further substantiated in D18 by calculating profiles and their so-called conjugates using natural spline functions applied to *limited* sets of the tabulated data points. A conjugate profile is derived from the main profile under condition of conjugation, that is that the normal to the instantaneous point of contact always intersects to centres of the two gears, D18, page 16, first paragraph. These limited set conjugates already exhibit unphysical anomalies, see D18, figures 5b, 6b, 7b, 8b/c, 9b/c and 10b/c, with interference as above also for these limited set profiles, see D18 figures 10c,d,e and 11c, and page 39, 5th and 6th paragraphs. Thus even for limited set approximations the irregularities and anomalies persist.

4.8.2 The appellant has argued that the irregularities in the profile are not significant enough to prevent meshing or cause encapsulation. The profiles would be based on measurements made on actual meshing and non-encapsulating gear wheels and fluctuations would merely result from measurement error and/or surface roughness.

The Board is unconvinced by this argument. Most importantly, it is in direct contradiction with the Meneghello report commissioned by the appellant himself, which at page 8, second paragraph, states that it is "not possible nor permissible to perform an interpolation passing through each of the digitized points [as] this .... does not allow to obtain a profile that meets the functional requirements" (in reference to the geometric-functional characteristics including meshing and conjugation mentioned on page 2). The tests or empirical data, or even the actual gear from which the measurement data is said to derive, and which might have proven his case, are lacking. Without such evidence the arguments that the irregularities would be insignificant and the profiles mesh and not encapsulate are nothing more than unproven assertions that can be of little weight.

4.8.3 Weighing the various submissions against each other - the respondent's substantiated arguments on the one hand, the appellant's varying positions and unsubstantiated assertions on the other - the Board decides that a gear with a profile defined by a natural spline function passing through all of the tabulated data points (or for that matter only through a limited set) will not mesh and will encapsulate, and thus fails to produce the desired, claimed effect of the invention. For this reason already the claimed invention is insufficiently disclosed.

4.9 In addition, the Board notes that the claim 1 does not define a single theoretical tooth profile (for each number of teeth), but also other profiles that lie in a tolerance band of +/-1/20th of tooth depth with respect to each theoretical profile. The band width corresponds to about 10% of tooth height. This figure, much larger than normal machining tolerances, represents *a range of profiles* as explained elsewhere in the specification and argued by the appellant: experiments on various gears reveal a "range of tooth profiles" (paragraph [0005]); and "...the actual tooth profile falls within a band of tolerance T ...", (paragraph [0011] and figure 1).

As submitted by the appellant, the profiles within this band are not different scaled versions of the basic profile defined by the data. The tolerance band is rather meant to encompass an unlimited number of tooth profiles of varying shape, as long as they give gears that mesh. Only profiles that meet this important functional limitation of the claim are to be protected.

The appellant acknowledges that there are some within the band that do not meet this requirement and should therefore be excluded from protection. Which profiles do and which do not meet this requirement would then, so the argument goes, need to be determined by trial and error.

4.9.1 The question therefore arises as to whether or not such trial and error does not constitute an undue burden on the skilled person for him or her to successfully carry out the claimed invention, see section 4.2 above.

4.9.2 The patent is silent as to how to distinguish a working profile from one that does not. One way would be to prototype, i.e. manufacture, the corresponding gears and measure meshing and encapsulation. Another alternative suggested by the appellant would be to generate the gears mathematically, or model them, using a variety of analytical techniques known to the skilled person, see e.g. the Meneghello report, page 8, last two paragraphs.

4.9.3 Given the myriad of possible profiles, and the effort involved in prototyping or modelling the corresponding gear, this is a daunting task. In particular, the Board holds that this would far exceed routine experimental work. For each possible profile the skilled person must prototype or model two gear wheels and investigate whether or not they mesh without encapsulation. This process of trial and error in the Board's view represents an undue burden for the skilled person.

4.10 In summary the Board concludes that on the balance of probabilities the main gear tooth profiles defined in claim 1, which are central to the invention, do not result in a working gear wheel. Furthermore, the skilled person would not be able to determine which of the remaining profiles within the tolerance band defined in the claim would result in working gears without undue burden. The invention according to claim 1 of the main request is thus insufficiently disclosed, Article 100(b) EPC with Article 83 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

G. Magouliotis A. de Vries

Decision electronically authenticated