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**Datasheet for the decision
of 7 July 2011**

Case Number: T 0284/10 - 3.2.08

Application Number: 02803716.6

Publication Number: 1448916

IPC: F16H 35/02

Language of the proceedings: EN

Title of invention:

Synchronous drive apparatus with non-circular drive elements

Patentee:

Litens Automotive

Opponents:

Schaeffler Technologies GmbH & Co. KG
PEUGEOT CITROEN AUTOMOBILES SA
The Gates Corporation
Beetz & Partner

Headword:

-

Relevant legal provisions:

EPC Art. 100(a)(b)(c)
EPC R. 115(2)
RPBA Art. 15(3)

Relevant legal provisions (EPC 1973):

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Keyword:

"Transfer of opponent status (yes)"
"Admissibility of an appeal (no)"
"Added subject-matter (no)"
"Sufficiency of disclosure (yes)"
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:

G 0004/88, G 0003/97, G 0002/04

Catchword:

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Case Number: T 0284/10 - 3.2.08

D E C I S I O N
of the Technical Board of Appeal 3.2.08
of 7 July 2011

Appellant: Schaeffler Technologies GmbH & Co. KG
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Decision under appeal: Decision of the Opposition Division of the European Patent Office posted 16 December 2009 rejecting the opposition filed against European patent No. 1448916 pursuant to Article 101(2) EPC.

Composition of the Board:

Chairman: T. Kriner
Members: M. Alvazzi Delfrate
E. Dufrasne

Summary of Facts and Submissions

- I. By decision posted on 16 December 2009 the opposition division rejected the oppositions filed by Schaeffler KG, Peugeot Citroen Automobiles SA, The Gates Corporation and Beetz & Partner against European patent No. 1 448 916.
- II. Appellant 1 (The Gates Corporation) lodged an appeal against this decision on 8 February 2010, and paid the appeal fee on the same day. The statement setting out the grounds for appeal was filed on 26 April 2010.
- III. A further appeal was lodged by appellant 2 (Peugeot Citroen Automobiles SA) on 12 February 2010, who paid the appeal fee on the same day and filed the statement setting out the grounds for appeal on 8 April 2010.
- IV. A third appeal was lodged by Schaeffler Technologies GmbH & Co. KG, which stated that it was the successor in title of Schaeffler KG, on 16 February 2010. The appeal fee was paid on the same day. The statement setting out the grounds for appeal was filed on 21 April 2010.
- V. Oral proceedings before the board of appeal were held on 7 July 2011.
- VI. Although having been duly summoned the party as of right Beetz & Partner did not attend the oral proceedings, as announced by letter dated 13 May 2011. In accordance with Rule 115(2) EPC and Article 15(3) RPBA the proceedings were continued without it.

VII. The appeal of Schaeffler Technologies GmbH & Co. KG was found to be inadmissible. Nevertheless, Schaeffler Technologies GmbH & Co. KG (opponent 1) took part in the oral proceedings as party as of right, since the opponent status was found to have been validly transferred to it from the original opponent Schaeffler KG.

VIII. The appellants requested that the decision under appeal be set aside and that the patent be revoked.

The respondent requested that the appeals be dismissed or, in the alternative, that the decision under appeal be set aside and that the patent be maintained in amended version on the basis of the auxiliary request filed with letter dated 16 November 2010 or of one of the second to fourth auxiliary requests filed with letter dated 7 June 2011.

IX. Claim 1 of the patent as granted reads as follows:

"A synchronous drive apparatus, comprising:
a continuous-loop elongate drive structure (10) having a plurality of engaging sections (15);
a plurality of rotors comprising at least a first and a second rotor (11, 12), the first rotor (11) having a plurality of teeth (16) for engaging the engaging sections (15) of the elongate drive structure (10), and the second rotor (12) having a plurality of teeth (16) for engaging the engaging section (15) of the elongate drive structure (10);
a rotary load assembly (26) coupled to the second rotor (12);

the elongate drive structure being engaged about the first and second rotors, the first rotor (11) being arranged to drive the elongate drive structure (10) and the second rotor (12) being arranged to be driven by the elongate drive structure (10), and one of the rotors having a non-circular profile (19) having at least two protruding portions (22, 23) alternating with receding portions (24, 25), the rotary load assembly (26) being such as to present a periodic fluctuating load torque when driven in rotation; characterised in that the angular positions of the protruding and receding portions of the non-circular profile (19) relative to an angular position of the periodic fluctuating load torque present on the second rotor (12), and the magnitude of the eccentricity of the [sic] non-circular profile (19), are such that the non-circular profile applies to the second rotor an opposing fluctuating corrective torque (104) which reduces or substantially cancels the fluctuating load torque (103) of the rotary load assembly (26)."

X. The following documents are relevant for the present decision:

D2: JP -U- 1-95538 (as well as translation in German and two translations in English);

D3: DE -A- 195 20 508;

D24: R. Braune: "Spannungsausgleich" und "Drehmomentkompensation" an Ventiltrieben 5.8.009;

D25: drawings with the title: "Variation des Unrundrades";

D26: drawing with the title: "Chain Tension - 4 cylinder engine";

- D27: drawing with the title: "Camshaft Torque
(Intake+Exhaust) - 4 cylinder engine";
- D28: drawing with the title: "Variation des
Unrundrades";
- D29: Measurements on a synchronous drive apparatus; and
- D31: Parker R.G. "Evaluation of D3 regarding European
Patent Office Appeal", June 7, 2011.

XI. The arguments of the appellants and of opponent 1 can be summarised as follows:

Article 100(c) EPC

Claim 1 had been amended to recite that the angular positions of the protruding and receding portions of the non-circular profile were relative to the angular position of the periodic fluctuating load torque present on the second rotor. However, the application as filed did not disclose this wording, whose meaning was unclear. As a consequence, the claim could be construed in a way which extended beyond the content of the application as filed. In addition, the passages in the description teaching to position the protruding and receding portions to reduce or cancel said fluctuating load torque related to specific embodiments which could not be generalised. Therefore, claim 1 extended beyond the content of the application as filed. The same objection applied to paragraph [0009] of the description, which referred to claim 1.

Article 100(b) EPC

The person skilled in the art would not know how to position the non-circular rotor of the claimed

apparatus, since the meaning of an angular position of the periodic fluctuating load torque present on the second rotor was completely unclear.

Moreover, the patent did not disclose how to measure the floating load torque, which was also information necessary to correctly position the non-circular rotor.

In addition to that, the possible ways of selecting the angular positions of the protruding and receding portions disclosed in the patent in suit related solely to a condition near the resonance of the system, where the system vibration and the torque had a shift of 90°. Therefore, the person skilled in the art was not in a position to carry out the invention at frequencies outside the resonance region.

Additionally, appellant 2 submitted in the written procedure that also the inventions claimed in the remaining claims were not sufficiently disclosed for the following reasons:

- According to claims 2 to 4, 17 to 20 the claimed invention was defined by reference to the maximum elongation of the drive span. However, the patent did not sufficiently disclose what was intended as said maximum elongation, which could be influenced by the elastic nature of the transmission and by the position of the interlocking point.

- Claim 5 related to "a predetermined selected set of operating conditions" of the synchronous drive apparatus, while defining neither the type of conditions nor how they were selected. The same

deficiency applied to claims 6 to 7 and to claims 8 to 10, which corresponded to claims 5 to 7.

- Claims 11 to 16 and 31 to 32 referred to the fluctuating load torque, for which no measuring method was disclosed, as already argued for claim 1. Moreover the patent did not disclose how to determine the natural frequency of the system.

- Claims 21 to 29, 33 to 35 and 37 to 38 were trivial variations or embodiments of the preceding claims. Moreover, in respect of claim 29, the patent did not explain how a fluctuating load torque could be constant.

- The realisation of the minor protruding and receding portions according to claim 36 suffered from the same deficiencies as the realisation of the major protruding and receding portions according to the preceding claims.

- Claims 39 to 49 and claims 50 to 57 corresponded to claims 1 to 16 in form of method of operation and method of construction, respectively. Therefore, they suffered from the same deficiencies as claims 1 to 16.

Moreover, appellant 1 presented in writing the following arguments:

- Claims 30 to 32 focused on the idea that the maximum radius of the non-circular pulley was 135° in advance of the hub load direction when the fluctuating torque was at a maximum. However, this was only true when the non-circular pulley was the crankshaft pulley and the

period of the fluctuating torque was twice the period of rotation of the crankshaft pulley. To the extent that these claims covered other configurations, their subject-matter was not disclosed in the patent.

- Similar considerations applied in view of claims 2, 3, 40, 51 and 53 which mentioned phase relationships between the pulley profile and the fluctuating torque or belt extension.

- Claims 34 and 35 specified the number of lobes that the non-circular pulley possessed. However, the appropriate number of lobes was defined by the specific circumstances. To the extent that these claims covered configurations different from said specific circumstances, their subject-matter was not disclosed in the patent.

- Claims 23 and 24 were inconsistent with claim 1, as the latter required a non-circular profile to be present on one of the first or second rotors, while these claims required that the non-circular profile is present on a third rotor.

Novelty

D3 disclosed in Figures 1 and 3 a synchronous drive apparatus according to the preamble of claim 1. In particular, Figure 3 showed that one of the rotors had a non-circular profile with receding portions 30, 32, 34 and 36, alternating with regions that were to be seen as protruding portions.

It was true that D3 did not explicitly disclose the angular position of said protruding and receding portions relative to an angular position of the periodic fluctuating load torque present on the second rotor. However, it disclosed in column 1, lines 43-52, that the phase of the vibrations introduced into the system was to be taken into consideration. Moreover, D3 stated in column 2, lines 49-54, that the vibrations caused by said non-circular profile superimposed those caused by the arrangement of the engine to shift or respectively eliminate the critical resonance range. Since it was clear that the non-circular profile could not change or cancel the natural frequency of the system, its effect could only be understood as a reduction or shift of the vibration peak. This could only be achieved by the application to the second rotor of an opposing fluctuating corrective torque which reduced or substantially cancelled the fluctuating load torque of the rotary load assembly, as the vibration was always proportional to the torque. Accordingly, the subject-matter of claim 1 lacked novelty in view of D3.

Inventive step starting from D3

In the event that the board considered that D3 did not take away the novelty of the subject-matter of claim 1, it still did not involve an inventive step.

Starting from D3, the object underlying the claimed invention could be seen in selecting a way of carrying out the invention disclosed in this document.

D3 disclosed in claim 6 that the recessions in the non-circular profile could be up to 1% of the diameter of

the rotor. This non-circular profile applied, in the case of a rotor with a diameter of 500 mm, a torque whose amplitude was about half that of the fluctuating load torque according to the embodiment disclosed in paragraphs [0042] to [0045] of the patent in suit.

To reduce the vibration, which was the aim of D3, the person skilled in the art would have tested different angular orientations of said non-circular profile. This experimentation was also rendered obvious by the indication in D3 that the phase of the vibrations introduced into the system was to be considered. By performing these tests he would have found that some directions, corresponding to about 50% of the possible orientations, provided a reduction of the vibrations. The apparatuses tested in those directions already fulfilled all the requirements of claim 1, since they reduced the fluctuating load torque of the rotary load assembly.

Moreover, encouraged by said tests, the person skilled in the art would have also tested, for the orientations providing the better results, different values for the recessions of the non-circular profile. By doing so he would have arrived at a value which provided a corrective torque which substantially cancelled the fluctuating torque without any inventive activity.

Therefore, the subject-matter of claim 1 was obvious in view of D3.

Inventive step starting from D2

D2 related to the problem of equalizing belt tension and disclosed an apparatus with all the features according to the preamble of claim 1.

The arrangement of the rotor with a non-circular profile disclosed in D2 as a solution to that problem, however, instead of improving the equalization of the belt tension deteriorated it. The person skilled in the art would have realised this fact and, knowing that a solution to said problem must exist, would have tried different orientations of the non-circular rotor. By doing so he would have found, in an obvious way, the optimal orientation to equalize the belt tension. A non-circular rotor oriented in this way applied a corrective torque which reduced or substantially cancelled the fluctuating torque, as shown by theoretical calculations in D24 and by the graphs in D25. Said theoretical calculations were confirmed by the experiments to which D28 and D29 related and were also in accordance with Figures 7a to 8b of the patent in suit. Therefore, the subject-matter of claim 1 was also obvious in the light of D2.

XII. The respondent's arguments can be summarised as follows:

Article 100(c) EPC

Claim 1 had been amended to clarify the importance of the periodic fluctuating load torque for positioning the protruding and receding portions. This was the gist of the claimed invention as disclosed not only in originally filed claim 1, but also throughout the

description, for instance at page 9, line 26-29, of the PCT publication. Therefore, claim 1 and paragraph [0009] of the description did not extend beyond the content of the application as filed.

Article 100(b) EPC

The description disclosed in detail how to select the angular positions of the protruding and receding portions of the non-circular profile in accordance with claim 1. As to the preferred embodiments of the dependent claims, they were also disclosed in the description. Therefore, the requirements of Article 100(b) EPC were met.

Novelty

The non-circular profile shown in Figure 3 of D3 comprised receding portions but no protruding portions. Moreover, D3 did not give any indication as to the phase relationship between the angular position of the angular profile and the fluctuating load.

Even if it was clearly impossible to shift the resonance region of the system, which was the declared object of D3, there was nothing to indicate to the reader of this document that a cancellation of the fluctuating load torque was aimed at. Therefore, D3 did not disclose either that the angular positions of the protruding and receding portions of the non-circular profile and the magnitude of the eccentricity of the non-circular profile are such that the non-circular profile applies to the second rotor an opposing fluctuating corrective torque which reduces or

substantially cancels the fluctuating load torque of the rotary load assembly. Accordingly, the subject-matter of claim 1 was novel.

Inventive step starting from D3

Starting from D3, the object of the claimed invention was to reduce vibrations.

D31 showed in Figure 4 that the non-circular profile disclosed in Figure 4 of D3 could not provide enough torque to cancel the fluctuating load torque. Moreover, Figure 3 of D31 showed that, when a corrective torque had an amplitude which was too great, its effect was to increase torque excitation instead of reducing it. Therefore, D3 did not disclose a non-circular profile having a magnitude of eccentricity according to claim 1.

As to the angular position of the non-circular profile, D3 did not suggest to try different positions in order to achieve vibration reduction, since it aimed to shift the resonance region.

Therefore, it was not obvious to achieve the object of the invention according to claim 1.

Inventive step starting from D2

Starting from D2, the person skilled in the art had no reason to try to achieve belt equalization by an arrangement different from that explicitly taught by this document.

Moreover, even in this case he would not have obtained torque cancellation, since the optimal orientation for equalizing the tension on the belt did not provide a torque which cancelled the fluctuating load torque. This was shown in D26 and D27, as well as by the calculations of appellant 1.

Accordingly, the subject-matter of claim 1 involved an inventive step.

Reasons for the Decision

1. Admissibility of the appeals

1.1 The appeals of appellants 1 and 2 are admissible.

1.2 As to the appeal of Schaeffler Technologies GmbH & Co. KG it must be examined if this company, which was not one of the original opponents, had acquired the status of opponent at the moment of filing the appeal.

According to the jurisprudence of the Enlarged Board of Appeal (G 4/88, G 3/97 and G 2/04) for an opponent status to be validly transferred the relevant business assets in the interests of which the opposition was filed must also be transferred.

In the present case, it appears from Schaeffler Technologies GmbH & Co. KG's letter dated 15 June 2010 and its enclosures that, according to extract "HRA 2681 Amtsgericht Fürth", Schaeffler KG (entry 21) was partly transferred to Schaeffler Verwaltung Drei KG (entry 36) by agreement dated 31 December 2009 and, according to

extract "HRA 9349 Amtsgericht Fürth", that Schaeffler Verwaltung Drei KG (entry 1) changed into Schaeffler Technologies GmbH & Co. KG (entry 4).

With a letter dated 31 May 2011, Schaeffler Technologies GmbH & Co. KG further provided extracts from the Ausgliederungs- und Übernahmevertrag of 31 December 2009 between Schaeffler KG and Schaeffler Verwaltung Drei KG from which it appears that the transfer between these two companies encompasses the entire business operations including all assets, liabilities and legal obligations of Schaeffler KG.

On that basis, evidence has been provided of the transfer from Schaeffler KG to Schaeffler Technologies GmbH & Co. KG of the relevant business assets in the interests of which the opposition was filed. Therefore, the opponent status has been validly transferred from the former company to the latter one.

However, since the documents providing said evidence were only produced with letter of 31 May 2011, the transfer of opponent status did not take effect until that date. Hence, at the moment of filing the appeal, Schaeffler Technologies GmbH & Co. KG was not a party to the proceedings. As a consequence, its appeal is not admissible under Article 107 EPC.

Nevertheless, due to said transfer of opponent status, Schaeffler Technologies GmbH & Co. KG has become party as of right to the proceedings (opponent 1).

2. Article 100(c) EPC

Claim 1 has been amended to recite that the angular positions of the protruding and receding portions of the non-circular profile are relative to an angular position of the periodic fluctuating load torque present on the second rotor.

The application as filed does not explicitly mention an angular position of the periodic fluctuating load torque present on the second rotor. Nevertheless, claim 1 as originally filed completely defines the angular positions of the protruding and receding portions by the result to be achieved, namely to apply an opposing fluctuating load torque which reduces or substantially cancels the fluctuating load torque of the rotary load assembly. Therefore, specifying that said angular positions are taken relative to the angular position of the periodic fluctuating load torque present on the second rotor does not change the scope of the claim.

Moreover, originally filed claim 1 disclosed that the angular positions of the protruding and receding portions were taken relative to the angular position of the second rotor, to which the rotary load assembly is coupled. Therefore, claim 1 as originally filed discloses that the periodic fluctuating load torque present on the second rotor is to be taken into consideration for positioning the protruding and receding portions. This is in accordance with page 9, lines 26-29, of the PCT publication, which discloses that an important aspect of the claimed invention is to arrange the timings of the non-circular profile and of

the fluctuations in the load torque of the load torque assembly, both translated into angular positions. Therefore, contrary to the view of the appellants, the teaching to position the protruding and receding portions to reduce or cancel the fluctuating load torque was disclosed in the application as originally filed not only in connection with specific embodiments, but also in relation to the invention in general.

As to the alleged unclear meaning of the angular position of a torque, the appellants have not indicated any reason why, on the basis of this alleged ambiguity, the claim could be construed in a way which extends beyond the disclosure of the application as filed.

In view of the above, the amendment in question does not extend beyond the content of the application as filed. The same applies to paragraph [0009] of the description, which refers to claim 1.

3. Article 100(b) EPC

3.1 The objections raised under Article 100(b) EPC are essentially based on alleged unclarities of the features comprised in the claims. However, an ambiguity in the definition in the scope of the claim does not necessarily render the disclosure of a patent insufficient. The latter deficiency arises only if the ambiguity is such that it renders impossible to carry out the claimed invention. Whether this is the case or not has to be established not only on the basis of the claims but taking into consideration also the description and the drawings.

3.2 In the present case the description of the patent in suit discloses how to select the angular positions of the protruding and receding portions of the non-circular profile of the rotor as well as the magnitude of its eccentricity in order to cancel or reduce the fluctuating load torque in the region of resonance of the claimed apparatus (see paragraphs [0036] to [0045]). The person skilled in the art would have no difficulty carrying out this teaching in other frequency regions by supplementing the disclosure of the patent with his common general knowledge and taking into account the phase shift between the torque fluctuation and the system response.

As to the allegedly unclear meaning of an angular position of the periodic fluctuating load torque present on the second rotor and the lack of a description of the method of measure of said torque, the appellants could not concretely indicate how these purported deficiencies would render the disclosure of the claimed invention insufficient. Moreover, the periodic fluctuating load torque can be measured by standard methods for measuring a torque, which are part of the common general knowledge of the person skilled in the art.

Accordingly, the patent in suit discloses the invention to which claim 1 relates in a manner sufficiently clear and precise for it to be carried out by a person skilled in the art.

3.3 The inventions to which the remaining claims relate are also sufficiently disclosed.

Paragraphs [0036] and [0037] of the description describe how to realise an apparatus with an angular position of the non-circular profile in accordance with claims 2 to 4, while paragraphs [0039] to [0046] provide the necessary information for selecting a magnitude of eccentricity according to claims 17 to 20. Therefore, the alleged lack of clarity of the meaning of a maximum elongation of the drive span does not render the disclosure of the invention according to claims 2 to 4 and 17 to 20 insufficient.

No difficulty has been shown in selecting a fluctuating load torque in the ranges defined in claims 5 to 10 without precisely defining the predetermined selected set of operating conditions.

As already explained in respect of claim 1, no difficulty is seen in determining the fluctuating load torque, which appears in claims 11 to 16, 31 to 32. As to the natural frequency of the system, its determination is possible on the basis of the standard knowledge of the person skilled in the art.

Appellant 2 argued that claims 21 to 29, 33 to 35 and 37 to 38 are merely trivial variants or preferred embodiments of the invention defined in the preceding claims. It cannot be seen why this fact should cause any insufficiency in the disclosure of the invention to which they refer. As to claim 29, the person skilled in the art understands at first, also on the basis of the embodiments in the description (see for instance paragraphs [0012] and [0013]), that it refers to a fluctuating load torque whose amplitude is constant.

For the same reasons given in respect of the protruding and receding portions according to claim 1, the minor protruding and receding portions according to claim 36 could be realised on the basis of the information provided in the patent.

Appellant 1 submitted that, since claims 2, 3, 30 to 32, 34, 35, 40, 51 and 53 cover specific phase relationships and number of lobes of the non-circular pulleys and these parameters are defined by the specific circumstances, the subject-matter of these claims was not disclosed and could not be made to work for configurations different from said circumstances. However, the sufficiency of disclosure is to be assessed on the basis of the claimed invention and not on what the invention may be when the desired effect is to be obtained under different circumstances. Since in the present case no difficulty can be seen in carrying out the invention as defined by these claims, this objection is not convincing.

No inconsistency is seen between claims 23 and 24 and claim 1, as several rotors may have a non-circular profile.

4. Novelty

4.1 For an invention to lack novelty, its subject-matter must be clearly and directly derivable from the prior art.

4.2 D3 undisputedly discloses a synchronous drive apparatus (10), comprising: a continuous-loop elongate drive structure (Zahnriemen 12) having a plurality of

engaging sections; a plurality of rotors comprising at least a first and a second rotor (see claim 1 and Figure 1), the first rotor (Antriebsrad 16) having a plurality of teeth for engaging the engaging sections of the elongate drive structure (see the shape of the belt 12 in Figure 3), and the second rotor (Abtriebsrad 20) having a plurality of teeth for engaging the engaging section of the elongate drive structure; a rotary load assembly (Nockenwelle 24) coupled to the second rotor; the elongate drive structure being engaged about the first and second rotors, the first rotor being arranged to drive the elongate drive structure and the second rotor being arranged to be driven by the elongate drive structure; and wherein the rotary load assembly is such as to present a periodic fluctuating load torque when driven in rotation (see column 2, lines 24-29).

- 4.3 The object of D3 is the reduction of vibrations, in particular the elimination of audible vibration noise (see column 1, lines 28-31). To this purpose the apparatus of D3 comprises means providing an additional irregularity ("Ungleichförmigkeit", see claim 1). Preferred forms of said means are a non-circular or eccentrically arranged driving or driven rotor, a timing belt with varying elasticity or thickness in the longitudinal direction, or one or more resiliently pre-stressed reactive elements. An example of a rotor with non-circular profile is shown in Figure 3 and described in column 2, lines 36-54. This rotor comprises four receding portions (30, 32, 34, 36), alternating with regions, which, as they protrude in respect of the receding portions, are to be considered protruding portions. Due to its non-circular profile the rotor

applies a further fluctuating torque. Whether this further torque reduces or substantially cancels the fluctuating load torque of the rotary load assembly depends on the magnitude of the eccentricity and the angular position of the non-circular profile.

- 4.4 As to the magnitude of eccentricity, D3 discloses in claim 1 that the receding portions measure <1% of the rotor's diameter, in particular between 0.1% and 0.5%. For instance, in the embodiment described in column 2, lines 36-48, they measure 0.3 mm for a rotor of 100 mm diameter. As pointed out by the respondent, which referred to Figure 4 of D31, the amplitude of the torque generated by a non-circular profile with this eccentricity is not enough to completely cancel the fluctuating load torque, whatever the angular positions of the protruding and receding portions are. However, present claim 1 does not quantify the reduction of the fluctuating load torque to be achieved. Therefore, the magnitude of the eccentricity of the non-circular profile disclosed by D3 is in accordance with present claim 1.

The respondent also argued that, when a corrective torque had an amplitude which was too great, its effect was to increase torque excitation instead of reducing it. However, this argument cannot apply to corrective torques with amplitudes smaller than that of the fluctuating load torque (see Figure 3 of D31), as is the case for the torque generated by the non-circular profile described in D3.

- 4.5 However, D3 does neither mention the angular positions of the protruding and receding portions of the non-

circular profile, nor indicate any importance of their positions in relation to the phase of the periodic fluctuating load torque. In particular and contrary to the view of the appellants, the indication of a given phase in column 1, lines 43-51, and column 3, lines 14-20, does not relate to the rotor with non-circular profile, but to the resiliently pre-stressed reactive elements.

The appellants argued that, since it was clear that the non-circular profile disclosed in D3 could not change or cancel the natural frequency of the system, its effect could only be understood as a reduction or shift of the vibration peak. However, even assuming that the person skilled in the art would have realised that it was impossible to achieve a shift or cancellation of the resonance region in the apparatus of D3, a reduction or cancellation of the vibrations in said region is not clearly and directly derivable from this document.

Hence, D3 does not disclose that the angular positions of the protruding and receding portions are such that said further torque reduces or substantially cancels the fluctuating load torque of the rotary load assembly.

Accordingly, the subject-matter of claim 1 is novel.

5. Inventive step

It is undisputed that not all the possible angular positions of the protruding and receding portions of the non-circular profile disclosed in D3 provide a

corrective torque which can reduce the fluctuating load torque but, on the contrary, some of them would increase it. Hence, the object achieved by the claimed invention starting from D3 is to be seen in the cancellation or reduction of mechanical vibrations (see paragraph [0001] of the patent in suit) and not, as argued by the appellants, in merely putting into practice the apparatus described in that document.

This object is achieved by selecting the angular positions of the protruding and receding portions of the non-circular profile relative to the periodic fluctuating load torque present on the second rotor such that the non-circular profile applies to the second rotor an opposing fluctuating corrective torque which reduces or substantially cancels the fluctuating load torque of the rotary load assembly.

- 5.1 D3 does not mention at all the importance of the angular positions of the protruding and receding portions of the non-circular profile. Therefore, it was not obvious for the person skilled in the art to perform tests at different angles to achieve a vibration reduction.

Moreover, even if he had performed such tests, he would have immediately realised that the non-circular profile does not achieve the effect described in D3, namely to shift or reduce the resonance frequency. Hence, he would not have further tested the system disclosed in D3 at different orientations of the non-circular rotor to achieve the object above.

Therefore, it was not obvious to arrive at the subject-matter of claim 1 starting from D3.

5.2 D2 is a less promising starting point. This document undisputedly discloses (see Figures 1(a) and 1(b)) a synchronous drive apparatus, comprising: a continuous-loop elongate drive structure (3) having a plurality of engaging sections, a plurality of rotors comprising at least a first and a second rotor, the first rotor (1) having a plurality of teeth for engaging the engaging sections of the elongate drive structure, and the second rotor (2) having a plurality of teeth for engaging the engaging section of the elongate drive structure; a rotary load assembly (camshaft) coupled to the second rotor; the elongate drive structure being engaged about the first and second rotors, the first rotor being arranged to drive the elongate drive structure and the second rotor being arranged to be driven by the elongate drive structure, and one of the rotors having a non-circular profile having two protruding portions alternating with receding portions, the rotary load assembly being such as to present a periodic fluctuating load torque when driven in rotation.

5.3 The object of D2 is to prevent the variation in the tensile force of the timing belt (see page 3, first full paragraph). However, the arrangement taught by D2 to achieve said object (see page 4 and Figures 1(b) and 2) does not, as acknowledged by all the parties, provide the desired effect.

It is true, as argued by the appellants and opponent 1, that the person skilled in the art would realise this

fact. However, he would have no reason to think that another arrangement with a different orientation of the non-circular rotor would provide a better result, opposite to what is explicitly taught by D2. Therefore, it was not obvious to orient the non-circular rotor at an optimal angular position which succeeded in equalizing the tensioning forces on the belt. Hence, there is no need to consider whether or not said optimal angular position also resulted in a corrective torque which reduced or substantially cancelled the fluctuating load torque.

Under these circumstances, it can be concluded that the subject-matter of claim 1 involves an inventive step also starting from D2.

Order

For these reasons it is decided that:

The appeals are dismissed.

The Registrar:

The Chairman:

V. Commare

T. Kriner