

Publication in the Official Journal *Yes* / No

File Number: T 368/89 - 3.2.1
Application No.: 82 102 909.7
Publication No.: 0 062 877
Title of invention: Continuously variable V-belt transmission.

Classification: F16H 9/18, F16H 55/56

D E C I S I O N
of 17 September 1991

Proprietor of the patent: NISSAN MOTOR CO., LTD

Opponent: P.I.V. Antrieb Werner Reimers GmbH & Co. KG

Headword:

EPC Article 56

Keyword: "Main request : obvious improvement, inventive step (no) -
auxiliary request : steps not derivable from the prior art,
inventive step (yes)"

Headnote



Case Number : T 368/89 - 3.2.1

DECISION
of the Technical Board of Appeal 3.2.1
of 17 September 1991

Appellant :
(Proprietor of the patent)

NISSAN MOTOR CO., LTD
No. 2, Takara-cho, Kanagawa-ku
Yokohama-shi
Kanagawa-ken 221 (JP)

Representative :

Patentanwälte Grünecker, Dr. Kinkeldey,
Dr. Stockmair & Partner
Maximilianstrasse 58
W - 8000 München 22 (DE)

Respondent :
(Opponent)

P.I.V. Antrieb Werner Reimers GmbH & Co. KG
Industriestrasse 3
Postfach 2152
W - 6380 Bad Homburg (DE)

Representative :

Lemcke, Rupert, Dipl.-Ing.
Patentanwälte Dipl.-Ing. R. Lemcke
Dr.-Ing. H.J. Brommer
Bismarckstrasse 16
Postfach 4026
W - 7500 Karlsruhe 1 (DE)

Decision under appeal :

Decision of Opposition Division of the European
Patent Office dated 24 January 1989, posted
15 March 1989, revoking European patent
No. 0 062 877 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : F.A. Gumbel
Members : F.J. Proels
W. Moser

Summary of Facts and Submissions

- I. European patent No. 0 062 877 was granted on 30 July 1986 in response to European patent application No. 82 102 909.7, filed on 5 April 1982.
- II. A notice of opposition to this patent was filed on 16 April 1987 by the Respondents (Opponents) requesting that the patent be revoked in its entirety. The opposition was based on
- D1 : DE-A-21 18 083
D1a : US-A-3 782 213 (corresponding US patent specification)
D2 : US-A-4 143 558
D2a : DE-A-26 50 495 (both documents D2 and D2a derived from the same NL-priority application).
- III. By its decision taken at the oral proceedings on 24 January 1989, issued in written form on 15 March 1989, the Opposition Division revoked the patent on the opposition ground of Article 100(a) EPC.
- IV. The Appellants (Patentees) lodged an appeal against the decision on 26 May 1989, paying the due appeal fee and submitting the Statements of Grounds at the same time.
- In their letter dated 8 November 1989 in reply to this Statement the Respondents cited the further documents:
- D3 : DE-B-12 64 196 and
D4 : DE-C-28 28 347.
- V. On 7 January 1991, the Board issued a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal in which it was indicated that document

D4, although late filed, was considered to be of some relevance and would probably be admitted to the appeal proceedings in the form of its earlier publication DE-A-2 828 347 (D4a).

VI. In the oral proceedings held on 17 September 1991 the Appellants requested that the decision under appeal be set aside and that the patent be maintained on the basis of the following requests:

Main Request

- Main Claim 1 filed on 11 February 1991
- Claim 2 as granted
- Description as granted with the replacement part of page 1 received on 24 January 1989
- Drawings as granted.

Auxiliary Request

- Claims and description as submitted during oral proceedings dated 17 September 1991
- Drawings as granted.

The Respondents requested that the appeal be dismissed.

VII. The respective independent Claim 1 of the main request reads as follows:

"A continuously variable V-belt transmission comprising:

a drive shaft (22),

a driven shaft (40),

a drive pulley (24) mounted to said drive shaft (22),

a driven pulley (34) mounted to said driven shaft (40),

a V-belt (32) running over said drive (24) and driven pulleys (34),

each of said pulleys (24, 34) having an axially fixed conical disc (26, 42), an axially movable conical disc (30,46) provided with a cylinder wall (30a), an axially fixed partition wall member (23) sealably fitted within said cylinder wall (30a) to define within said cylinder wall (30a) a cylinder chamber (28) between said axially fixed partition wall (23) and said axially movable conical disc (30, 46), and at least one of said pulleys (24, 34) having a trough (31) including an annular disc like portion (31a) extending inwardly from said cylinder wall (30a) to define within said cylinder wall (30a) a compensation chamber (29) between said disc like portion (31a) of said trough (31) and said axially fixed partition wall member (23), said compensation chamber (29) opens to the ambient atmosphere,

said axially fixed partition wall member (23) carrying means (87) sealable separating said compensation chamber (29) from said cylinder chamber (28) so as to prevent communication therebetween,

a shift control valve (100), and

means (90, 23b, 23c) establishing communication between said cylinder chamber (28) and said shift control valve (100), which controls fluid pressure acting within the

cylinder chamber (28), regulating the axial movement of the axially movable conical disc (30), wherein

oil is supplied to said compensation chamber (29) from a source of fluid via at least one passage (92) which is so oriented as to direct flow of oil thrown radially outward to be guided toward said compensation chamber (29); thus serving as a centrifugal force compensator, characterised in that

said source of fluid is a lubrication fluid source and said trough (31) includes a tubular portion (31b), having one end connected to said disc-like portion (31a) and an opposite end opening to the ambient atmosphere and extending axially, sufficiently long enough to receive the oil from the at least one passage (92) over the entire range of axial movement of the movable conical disc (30)."

According to Claim 1 of the auxiliary request the following passage is added at the end of the characterising part:

"wherein said at least one passage (92) is located within a cover (21) for axial support of the drive shaft (22) near a spindle portion (23a) of said partition wall member (23) and inclined so as to direct the oil radially outwardly toward said tubular portion (31b) to be guided toward said compensation chamber (29)."

The dependent Claim 2 of the main and auxiliary request has the wording as granted.

VIII. The arguments of the Appellants in support of their requests can be summarised as follows:

All prior art documents concerned with centrifugal force compensation in V-belt transmissions, such as document D1 or D2, disclose solutions according to which oil can flow from the cylinder chamber of the pulley to the compensation chamber through an orifice in the partition wall member separating the two afore-mentioned chambers and/or through the seal of the partition wall in the form of leakage oil. Thus, only the afore-mentioned centrifugal force compensation system is available for a skilled person. Nothing is mentioned in any document that the compensation chamber oil can be supplied from a lubrication oil source although lubrication oil conduits are in general present in V-belt transmissions as can be seen for example from document D4a. The Appellants have first discovered that the oil flow from the cylinder control chamber to the compensation chamber is detrimental to the pulley ratio control and the advantageous effects resulting from the claimed compensation oil supply are greater than the disadvantage caused by stopping the oil discharge from the control chamber to the compensation chamber which has provided an additional cooling effect. Several steps are necessary to modify a pulley system having the known compensation oil supply into a pulley system having the claimed oil supply.

IX. In support of their request that the appeal be dismissed the Respondents put forward the following arguments:

According to Claim 1 of document D1 it is suggested that a second chamber supplied with oil is provided as a compensation chamber. This claim, however, leaves it open wherefrom the oil is supplied. Simply as an example the description and the drawing recommend that the oil can be supplied to the compensation chamber either by leakage oil via the sealing means or an additional orifice in the

partition wall. It is obvious for a skilled person to consider that the oil can also be delivered from a separate oil source such as the lubrication system of the pulley which is in general available in common V-belt systems. The subject-matter of the revoked patent concerns nothing but a less advantageous version of the pulley system shown in document D1, a version in which the designing engineer has dispensed with the requirement for an additional cooling effect which in document D1 is considered to be an essential object to be solved.

Thus an expert would automatically arrive at the claimed solution if he does not insist on the additional cooling effect. The further features of the claimed transmission according to the main and the auxiliary request such as the construction of the trough and the lay out of the oil passages represent nothing but mere workshop modifications and cannot be considered as arguments in support of inventivity.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rules 1(1) and 64 EPC; it is admissible.
2. Main Request:
 - 2.1 The two claims according to the main request are not open to formal objections.
 - 2.2 No objection arises under Article 123(2) EPC, since the features of present Claim 1 have been disclosed in the original claims in connection with Figure 4 and the original description, particularly page 12, lines 18 to 21 and Claim 2 corresponds to Claim 2 as filed.

Furthermore, Claim 1 differs in essence from Claim 1 of the patent only in the sense that features have been transferred from the characterising part to the pre-characterising part, and that an additional feature concerning the axial extension of the tubular portion has been introduced. Thus, obviously the protection conferred has not been extended. Thus, the claims also meet the requirements of Article 123(3) EPC.

- 2.3 The features of the pre-characterising part of Claim 1 are known from document D1 which in its Figure 3 also shows the last feature of this part of the claim concerning the orientation of the passage 11. In document D1, however, the source of fluid for the compensation chamber is the control fluid (as used for the positioning control of the pulley) and not a lubrication fluid source as set out in the characterising part of Claim 1. The further features in the characterising part of Claim 1 concerning the trough 31 of the compensation chamber obviously are also not disclosed in document D1. None of the further citations comes closer to the claimed subject-matter than document D1.

Thus, no objection arises in respect of Rule 29(1a) EPC.

2.4 Novelty

Since no document is available which discloses in combination all features of Claim 1, its subject-matter is novel, see also point 2.3 above, and therefore meets the requirements of Article 54 EPC. Novelty has, in fact, not been disputed by the Appellants in the appeal proceedings so that no further discussion is necessary.

2.5 Inventive step

The assessment of inventive step leads to the following result:

2.5.1 The problem indicated in the patent is derived from the disadvantages of a continuously variable V-belt transmission according to document D2 which is concerned (see column 1, lines 17 and 18) with the further development of the V-belt transmission according to document document D1a which in essence corresponds to document D1. These disadvantages cited in document D2 are considered to consist

- (a) in the pressure drop or the instability of pressure in the control pressure cylinder chamber of the pulley positioning mechanism caused by the control oil released into the compensation chamber via a passage positioned in an axially fixed partition wall member between the control pressure cylinder chamber and the compensation chamber and
- (b) in the lack of any oil supply to the compensation chamber during the periods wherein the control oil pressure is high enough to close the passage so that no further centrifugal force compensation takes place in this situation.

Accordingly, the specification (column 2, lines 55 to 60) of the contested patent states the object of the invention as being the provision of a centrifugal force compensation by means of a simple construction and without communication between the cylinder chamber and the compensation chamber. This object also applies if one starts from document D1 or D1a reflecting the prior art portion of present Claim 1.

2.5.2 In documents D1 and D1a the orifice between the two chambers not only provides the oil supply to the centrifugal force compensation chamber but also is intended to avoid localisation of heat in the pulley by removing the heated oil from the pulley control chamber. If, as in the present case, it is only required to supply the oil to the compensation chamber by a simple construction without wanting an additional cooling effect as claimed in document D1, then any oil source already present in the pulley system is available to the designing engineer to be used for the afore-mentioned purpose. Such separate oil source may be a source of lubrication oil as it is used for additional purposes in document D4a (see Figures 10 and 11).

According to Figure 11 of document D4a the pulley shaft contains two oil conduits 149 and 150. One (149) of them is the supply line for the control pressure of the pulley positioning chamber and the other (150) is the relief line of the torque sensed positioning pressure control. This line 150 is obviously used to lubricate the pulley chain as more clearly demonstrated in Figure 10 (see line 124).

Therefore, in the Board's opinion, the selection of the lubrication oil present in any transmission system as a supply source for the compensation chamber does not involve an inventive step.

The application of the further features indicated in the characterising part of Claim 1, i.e. the structural form of the compensation chamber, necessarily follows for practical reasons if the first feature is adopted. Moreover, the construction shown in Figure 11 of document D4 already has a pulley 132 which in accordance with the claimed transmission already has a trough 133 including an annular disc-like portion extending inwardly and an inner

tubular portion having one end connected to said disc-like portion and an opposite end opening to the ambient atmosphere. Furthermore, it is self-evident that the trough is formed so that it is long enough to receive the oil from the oil supply passage over the entire range of axial movement of the conical disc.

2.5.3 Summarising, the Board is of the opinion that the subject-matter of this Claim 1 does not involve an inventive step. The main request must therefore fail.

3. Auxiliary Request

3.1 Claim 1 of this request differs from Claim 1 of the main request by the additional features that said at least one passage 92 is located within a cover 21 for axial support of the drive shaft 22 near a spindle portion 23a of said partition wall member 23 and inclined so as to direct the oil radially outwardly toward said tubular portion to be guided toward said compensation chamber 29.

3.2 These features are based on the disclosure in the application as filed, page 11, lines 9 to 22 and Figure 4, and limit the scope of Claim 1 with respect to Claim 1 of the main request. Claim 1 of the auxiliary request therefore also meets the requirements of Article 123(2) and (3) EPC.

3.3 The aspects referred to with respect to the novelty of the subject-matter of Claim 1 according to the main request (see point 2.4 above) apply even more so also to the transmission according to Claim 1 as set out in the auxiliary request.

3.4 The claimed solution avoids an additional elongation of the transmission which normally would be necessary for a separate compensation chamber supply passage by

- (a) arranging the supply passage within a cover which is used for axial support of the drive shaft near a spindle portion of the partition wall member and
- (b) by providing the claimed inclination of the passage.

The additional feature (a) makes it possible to locate the passage axially inside the pulley construction so that the system can be made less elongated. The feature (b) further improves this result, since the inclined passageway favours the guidance of the oil thrown against the trough so that it cannot escape at the opening to the ambient atmosphere and thus the trough can be made shorter.

3.5 These two features (a) and (b) are neither known from the cited prior art nor can they be derived therefrom. It further follows from the preceding paragraph that these additional features substantially improve the usefulness of the claimed transmission, since the oil supply to the compensation chamber can be carried out in a simple way without the need of more axial space for the assembly.

Hence, in order to proceed from the known art to the invention one actually needs several steps. Even if the first step, i.e. the use of the lubrication fluid source as an oil supply for the compensation chamber is considered as obvious for a man skilled in the art (see the assessment of the main request), it would still not lead to the subject-matter of Claim 1 of the auxiliary request because the further decisive steps of simplification, as concerns the arrangement of the supply passage, would still be lacking.

3.6 The Board is, therefore, satisfied that the claimed invention does not follow logically from the known art considered above, and comes to the conclusion that the subject-matter of Claim 1 of the auxiliary request is not obvious and hence involves an inventive step within the meaning of Article 56 EPC.

Claim 1 is thus allowable in accordance with Article 52(1) EPC.

3.7 Dependent Claim 2 concerning a particular embodiment of the invention in accordance with Rule 29(3) EPC is likewise acceptable.

The description and drawings take account of the requirements of the EPC and are suitable for maintenance of the patent in amended form.

For these reasons, it is decided that:

1. The decision under appeal is set aside.
2. The main request is rejected.
3. The case is remitted to the first instance with the order to maintain the patent with the documents according to the auxiliary request.

The Registrar:



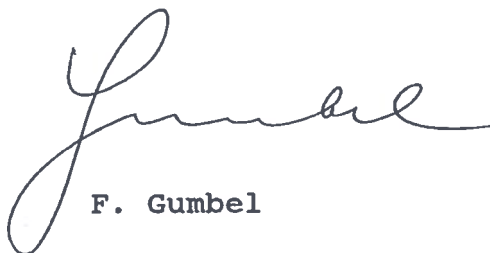
N. Maslin



W. J. J. Oser

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The Chairman:



F. Gumbel