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**Datasheet for the decision
of 13 June 2012**

Case Number: T 2031/08 - 3.5.02

Application Number: 98101237.0

Publication Number: 871281

IPC: H02K 7/10, F16D 41/06

Language of the proceedings: EN

Title of invention:
Alternator pulley

Applicant:
JTEKT Corporation

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-



Case Number: T 2031/08 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 13 June 2012

Appellant: JTEKT Corporation
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Osaka 542-8502 (JAPON)

Representative: TER MEER - STEINMEISTER & PARTNER GbR
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 26 June 2008
refusing European patent application No.
98101237.0 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: M. Ruggiu
Members: G. Flynn
R. Moufang

Summary of Facts and Submissions

I. This appeal concerns the decision of the examining division refusing the European patent application number 98 101 237.0.

In the contested decision, the examining division established the following prior art document references:

D1: US 5 575 366

D2: DE 195 43 718 A1

D3: DE 196 25 659 A1

D4: EP 0 447 026 A1.

The examining division held that the subject-matter of the then claim 1 did not involve an inventive step, either starting from D1 and taking into account D4, or starting from D4 and taking into account common general knowledge.

II. With the statement of grounds of appeal (letter dated 6 October 2008), the appellant submitted an amended set of claims 1 to 7, presented arguments in favour of inventive step, indicated a willingness to introduce further amendments and made an auxiliary request for oral proceedings.

III. The Board summoned the appellant to attend oral proceedings to be held on 13 June 2012.

In an annex to the summons the Board set out its preliminary observations on the appeal. The Board focused on the question of whether the subject-matter

of claim 1 would be obvious to the skilled person starting from document D1 and taking into account the disclosure of document D4 (inventive step, Article 56 EPC). In addition, the Board made observations on the allowability of the amendments made to claim 1 (Article 123(2) EPC) and on clarity (Article 84 EPC)

- IV. With a letter dated 11 May 2012 the appellant filed a new main request and first to third auxiliary requests in preparation for the oral proceedings.

With a further letter dated 11 June 2012 the appellant filed a further, fourth auxiliary request.

- V. Oral proceedings were held before the Board on 13 June 2012. During the proceedings the appellant submitted a further, fifth auxiliary request.

The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request filed with letter dated 11 May 2012 or one of the first, second and third auxiliary requests filed with the same letter, or on the basis of the fourth auxiliary request filed with letter dated 11 June 2012, or on the basis of the fifth auxiliary request filed during the oral proceedings of 13 June 2012.

- VI. Requests

In the following, the feature references (a), (b) etc. have been added by the Board.

Claim 1 of the **main request** reads as follows:

- "1. An alternator pulley comprising:
- (a) an annular driving member (1) connected to an output shaft of an engine via a belt;
 - (b) a driven member (2) disposed on an inner surface of said annular driving member (1) with its center of rotation being substantially coincident with that of said driving member (1);
 - (c) a one-way clutch (3) disposed between said inner surface of said annular driving member (1) and an outer surface of said driven member (2);
 - (d) wherein said one-way clutch (3) includes rollers capable of rolling in locked side direction along which a rotating power of said driving member (2) is transmitted to said driven member or in a free side direction along which said rotation power is interrupted, depending on a relative speed difference between said driving member (1) and said driven member (2) and
 - (e) said rollers (13) are biased for pressing toward said locked side direction and a torque value of said pressing is set to less than a given value in order to permit said rollers to roll quickly from locked positions into free positions,
characterized in that
 - (f) the inner peripheral surface of said annular driving member (1) is circular,
 - (g) said one way clutch comprises an inner race (10) whose inner surface is disposed on an outer surface of said driven member (2) and whose outer surface is provided with a plurality of flat, key-shaped cam surfaces (10a),

- (h) and a retainer (12) disposed between said driving member (1) and said driven member (2) and having a plurality of pockets (12a) receiving said rollers (13), respectively, such that said rollers (13) can come into contact with said inner surface of said driving member (1) and with said cam surfaces (10a),
- (i) wherein spaces of said pockets are defined by said cam surfaces (10a) and said inner surface of said annular driving member (1) to form wedge-shaped spaces between the outer peripheral [sic] surface of the inner race (10) and the inner peripheral surface of the annular driving member (1) in such a manner that said spaces become narrower in said locked side (16) and wider in said free side (17),
- (j) said rollers (13) roll in said pockets (12a) toward said locked side (16) or said free side (17), depending on a relative speed difference between said driving member (1) and said driven member (2),
- (k) wherein said one-way clutch (3) further comprises coil springs (14) received in recesses (12b) continuous with said pockets (12a) for pressing said rollers (13) toward said locked side (16) direction,
- (o) and the value of the torque is set from 0.001 to 4 Nm."

Claim 1 of the **first auxiliary request** differs from claim 1 of the main request by the following additional feature (l) inserted after feature (k):

- (l) "said coil springs (14) being offset towards the inner race (10) inwardly so that the resilient

biasing forces of the springs (14) assist the rotation of said rollers (13) about their respective centers,".

Claim 1 of the **second auxiliary request** differs from claim 1 of the first auxiliary request by the following additional feature (n) inserted before feature (o):

(n) "said alternator pulley further comprising receiving members (15) each of which is engaged with one end of each of said coil springs (14) and bears against each of peripheral surface of said rollers (12),".

Claim 1 of the **third auxiliary request** differs from claim 1 of the second auxiliary request by the following additional feature (p) inserted after feature (o):

(p) "said alternator pulley further comprises rolling bearings (4) mounted on axially opposite sides of said one-way clutch (3) between said driving member (1) and said driven member (2)".

Claim 1 of the **fourth auxiliary request** differs from claim 1 of the second auxiliary request by the following additional feature (m) inserted between features (l) and (n):

(m) "said coil springs (14) being disposed in positions where they press inner sides of said rollers (13) toward the locked side (16) direction,".

Claim 1 of the **fifth auxiliary request** differs from claim 1 of the main request in that:

- feature (f) has been deleted;
- the expression "key-shaped" has been deleted from feature (g);
- feature (k) has been replaced by the following features (k') and (k''):
 - (k') *"wherein said one-way clutch (3) further comprises pressing members for pressing said rollers (13) toward said locked side (16) direction,*
 - (k'') *said pressing members (14) are resilient members which are received in recesses (12b) continuous with said pockets (12a), respectively,";*
- the following additional feature (m') has been inserted after feature (k''):
 - (m') *"said resilient members are disposed in positions where they press inner sides of said rollers (13) toward said locked side (16) direction,".*
- the following additional feature (n') has been inserted before feature (o):
 - (n') *"the alternator pulley further comprising receiving members (15) each of which is engaged with one end of each of said resilient members and bears against each of peripheral surface of said rollers (12),".*

VII. The appellant's arguments may be summarised as follows:

The "flat, key-shaped cam surfaces" of the invention are formed as segments of a circle and are shaped as shown in figure 2 of the application. The cam surfaces are arranged on the inner race of the one-way clutch, rather than on the outer race as in document D1. With this arrangement the rollers do not become detached from their engaged positions due to centrifugal force at high speed.

In the invention the springs 14 slide on the flat key-shaped cam surfaces 10a and exert a force on the rollers that is radially inwardly offset from centre of the rollers 13. This biasing force helps the rollers rotate about their centres.

In document D4 the counter gripping surfaces 30 are not key-shaped in the sense of the present application and not flat because of the presence of the shoulders 30a (see figure 5). Furthermore, the force exerted by the springs is directed towards the centre of the rollers (cf. copy of figure 5 presented in the oral proceedings before the Board).

In D1 and D4 the springs are not radially inwardly offset and do not press inner sides of the rollers. Furthermore, there are no receiving members engaged with the springs and bearing against the surface of the rollers, which help the rollers to rotate.

In view of these differences a combination of documents D1 and D4 would not lead in an obvious manner to the claimed subject-matter.

Reasons for the Decision

1. The appeal is admissible.
2. Novelty and inventive step - Disclosure of document D1
 - 2.1 Document D1 may be considered as representing the closest prior art.
 - 2.2 D1 discloses (see abstract, figures 5 and 6 and column 1, line 10 to column 2, line 39) a prior art vehicular charging generator (i.e. alternator) provided with a one-way clutch 12 installed between a pulley 13 and a rotor shaft 8a (i.e. driven member) of the generator. The one-way clutch comprises a clutch inner 21 (i.e. inner race) installed on the rotor shaft 8a and a clutch outer 22 (i.e. annular driving member) interposed between the clutch inner 21 and the pulley 13. The one-way clutch further includes rollers 23 that are located in wedge-like grooves 22a between the clutch inner 21 and the clutch outer 22. The rollers are pressed by roller springs 24.

As set out in column 2, lines 20 to 29, the pulley 13 is driven in the arrow mark R direction of FIG. 6 by the engine. When the rotation speed of the engine is faster than the rotation speed of the rotor 8 of the generator, the rollers 23 which are being pushed in a direction counter to the arrow mark R by the roller springs 24, move at the inside of the groove 22a in the left-hand direction of FIG. 6. As a result, the rollers 23 wedge in between the clutch inner 21 and the clutch outer 22, thereby transmitting the power of the pulley 13 to the rotor shaft 8a.

As set out in column 2, lines 31 to 39, on decelerating the engine, especially in rapidly decelerating it, the rotation speed of the clutch inner 21 becomes faster than the rotation speed of the clutch outer 22 by the inertia force of the rotor 8. Accordingly, the wedging of the rollers 23 is released since the rollers 23 move in the right-hand direction of FIG. 6 against the spring force of the roller springs 24. Therefore, the rotor 8 is decelerated while converting the rotational energy of the rotor, per se into an electric power, without being decelerated by the deceleration of the engine.

2.3 It is evident from the above that D1 discloses an alternator having all of the features (a) to (e) of the preamble of claim 1 of all requests, with the pulley 13 and clutch outer 22 of D1 together corresponding to the annular driving member of claim 1 and with the rotor shaft 8a of D1 corresponding to the driven member of claim 1.

2.4 Furthermore, in the arrangement disclosed in D1:

- the inner surface of the clutch inner is disposed on the outer surface of the shaft (cf. part of feature (g) of claim 1 of all requests);
- wedge-shaped spaces are formed between the outer peripheral surface of the clutch inner and the inner peripheral surface of the clutch outer in such a manner that the spaces become narrower in the locked side and wider in the free side (cf. part of feature (i) of claim 1 of all requests);
- the rollers roll toward the locked side or the free side, depending on a relative speed

difference between the pulley/clutch outer and the rotor shaft (cf. part of feature (j) of claim 1 of all requests); and

- the one-way clutch comprises springs received in recesses for pressing the rollers toward the locked side direction (cf. part of feature (k) of the main and first to fourth auxiliary requests and features (k') and (k'') of the fifth auxiliary request).

3. Main request

3.1 The subject-matter of claim 1 of the main request differs from the arrangement disclosed in document D1 in that:

- the arrangement of the one-way clutch in claim 1 is "the other way around", with the inner peripheral surface of the annular driving member being circular and the outer surface of the inner race of the one-way clutch being provided with a plurality of flat, key-shaped cam surfaces (cf. features (f) and (g)), whereas in D1, the outer surface of the inner race is circular and the inner surface of the outer race has cam surfaces;
- the one-way clutch of claim 1 includes a retainer that is disposed between the driving member and the driven member and that has a plurality of pockets which receive the rollers, respectively, such that the rollers can come into contact with the inner surface of said driving member and with the cam surfaces (cf. feature (h));

- spaces of the pockets are defined by the cam surfaces and the inner surface of the annular driving member (feature (i));
- the springs of the one-way clutch are coil springs (feature (k)); and
- the value of the torque is set from 0.001 to 4 Nm (feature (o)).

In view of these differences claim 1 of the main request is novel over document D1, Article 54 EPC. The question of whether these differences involve an inventive step is considered below.

3.2 Starting from D1 it would be a routine matter for the skilled person to consider alternative arrangements for the one-way clutch, which may be considered to be the objective problem solved by the first three differences mentioned above.

3.3 Document D4 discloses a roller one-way clutch 10 with a similar basic structure to the one in D1, in as much as it has concentric inner and outer races 12, 14 with a caged-roller one-way clutch 16 located therebetween (see column 3, lines 47 to 53).

According to column 4, lines 29 to 40 of D4:

"The inner race 12 includes counter gripping surfaces 30 with shoulders 30a which allow the inner race to free wheel when the inner race 12 is rotated in a clockwise direction as viewed in FIG. 5. The surfaces 30 will grip the rollers to prevent relative rotation of the races 12, 14 in the opposite direction of rotation of the inner race 12. While the counter gripping surfaces are

shown on the inner race 12 it should be understood that the spacer ring 22 of the present invention is equally suited for use with roller one-way clutches where such gripping surfaces are formed on the outer race.

Furthermore, D4 discloses at column 4, lines 18 to 24 that:

"the roller one-way clutch 10, in addition to rollers 20 includes a cage 24 having pockets 26 in which the rollers 20 and pleated leaf springs 28 are located for suspending the rollers 20 as they grip and release depending upon the direction of relative rotation between the inner and outer races 12, 14. The leaf springs 28 are exemplary, with it being understood that other spring types and other orientations of the leaf springs 28 are contemplated within the scope of the invention".

- 3.4 The Board considers that the counter gripping surfaces 30 of D4 are "cam surfaces" in the terminology of the present application and that together with the cage 12 and the other race, they define "wedge-shaped spaces" (see figure 5). Furthermore, D4 discloses that the counter gripping surfaces 30 may be provided either on the outer surface of the inner race (as in the figures of D4) or alternatively on the inner surface of the outer race, which is the arrangement in D1.

The Board considers that for the skilled person starting from D1 and seeking an alternative one-way clutch arrangement, it would be obvious in view of these disclosures in D4 to change the one-way clutch of D1 such that the cam surfaces are provided not on the

inner surface of the outer race, but on the outer surface of the inner race as shown in D4. In doing so it would be obvious to make the inner surface of the outer race circular in cross-section, as it evidently is in D4 (see figures 1 and 5). Furthermore, it would be obvious to provide a cage with pockets to locate the rollers, those pockets being bounded radially by the cam surfaces on the outer surface of the inner race and the inner surface of the outer race as they are in D4.

- 3.5 Considering the claimed feature that the cam surfaces are flat, key shaped cam surfaces, the Board notes that in D4 the parts of the inner race that grip the rollers appear to be flat (see figures 1 and 5) and hence it would be an obvious matter for the skilled person to provide flat cam surfaces.

The Board considers that in the context of a circular inner race of a one-way clutch the expression "key shaped" does not clearly define any particular shape and hence does not establish any distinction over the cam surfaces in D4. The Board is not convinced by the appellant's argument that the expression "key shaped" means shaped as in figure 2 of the application because many other shapes of keys and keyways exist.

- 3.6 Particularly in view of the fact that D4 mentions that other spring types and other orientations of the leaf springs 28 are contemplated, the Board considers that it would be an obvious matter for the skilled person to use coil springs, which as such are well known.

- 3.7 Finally, the examining division held that the skilled person would arrive at an appropriate torque setting

for the springs by routine trial and error. The Board can see no flaw in this argument and the appellant has not challenged this point.

3.8 Summarising, the Board finds that in view of the prior art disclosed in documents D1 and D4 the subject-matter of claim 1 of the main request does not involve an inventive step, Article 56 EPC.

4. **First auxiliary request**

4.1 Claim 1 of the first auxiliary request differs from claim 1 of the main request by the following additional feature (l) inserted after feature (k):

(l) "said coil springs (14) being offset towards the inner race (10) inwardly so that the resilient biasing forces of the springs (14) assist the rotation of said rollers (13) about their respective centers,".

4.2 In the one-way clutch arrangement disclosed in document D4 the spring 28 is not positioned centrally in the space between the inner and outer races 12, 14, but rather is positioned closer to the inner race 12 than the outer race 14. Hence, in that sense at least the spring is offset towards the inner race inwardly. Furthermore, as is clearly shown by the arrow marked on the copy of figure 5 of D4 presented by the appellant during the oral proceedings (see minutes thereof), the spring 28 pushes the roller 20 in a direction that is at least to some extent toward the outer race. The Board considers that this would help maintain contact between the roller and the outer race and that this

would assist the rotation of the rollers about their centres.

- 4.3 The Board concludes that when combining the teachings of documents D1 and D4 as discussed above in respect of the main request, the skilled person would also come to the subject-matter of feature (1). Hence, the subject-matter of claim 1 of the first auxiliary request does not involve an inventive step, Article 56 EPC

5. **Second auxiliary request**

- 5.1 Claim 1 of the second auxiliary request differs from claim 1 of the first auxiliary request by the following additional feature (n) inserted before feature (o):

(n) "said alternator pulley further comprising receiving members (15) each of which is engaged with one end of each of said coil springs (14) and bears against each of peripheral surface of said rollers (12),".

- 5.2 During the oral proceedings the Board expressed the view that it was generally well known to provide members at the end of springs to protect them where they bear on an object. The appellant did not dispute that this is the case. When combining the teachings of documents D1 and D4 as discussed above, it would be an obvious matter for the skilled person to provide such members to protect the ends of the springs where they bear on the rollers. Hence, the subject-matter of claim 1 of the second auxiliary request does not involve an inventive step, Article 56 EPC.

6. **Third auxiliary request**

6.1 Claim 1 of the third auxiliary request differs from claim 1 of the second auxiliary request by the following additional feature (p) inserted after feature (o):

(p) "said alternator pulley further comprises rolling bearings (4) mounted on axially opposite sides of said one-way clutch (3) between said driving member (1) and said driven member (2)".

6.2 The pulley of document D1 comprises ball bearings 38, 39 mounted on opposite sides of the one-way clutch 31 between the pulley 13 (annular driving member) and the rotor shaft 8a (driven member), see figure 1 and column 6, lines 19 to 37.

6.3 The Board concludes that when combining the teachings of documents D1 and D4 as discussed above, the skilled person would also come to the subject-matter of feature (p). Hence, the subject-matter of claim 1 of the third auxiliary request does not involve an inventive step, Article 56 EPC.

7. **Fourth auxiliary request**

7.1 Claim 1 of the fourth auxiliary request differs from claim 1 of the second auxiliary request by the following additional feature (m) inserted between features (l) and (n):

(m) "said coil springs (14) being disposed in positions where they press inner sides of said

rollers (13) toward the locked side (16) direction,".

7.2 In document D4 it can be seen from figure 5 that the point at which the spring 28 presses the roller 20 is on the radially inner side of the roller. Furthermore, the spring presses the roller toward the locked side direction as discussed above. Thus, when combining the teachings of documents D1 and D4 as discussed above, the skilled person would also come to the subject-matter of feature (m). Hence, the subject-matter of claim 1 of the fourth auxiliary request does not involve an inventive step, Article 56 EPC.

8. **Fifth auxiliary request**

Claim 1 according to the fifth auxiliary request does not include any further features that limit the scope of the claim compared to the earlier requests. Rather, certain features of the earlier requests have been deleted or generalised. In particular, features (k'), (k''), (m') and (n') of claim 1 according to the fifth auxiliary request differ from feature (k) of the main request and features (m) and (n) of the fourth and second auxiliary requests, only in that the previous specific feature "coil springs" has been broadened to "resilient members" in the fifth auxiliary request.

For the reasons already given the Board finds that when combining D1 and D4 as discussed above, the skilled person would arrive at the subject-matter of claim 1 of the fifth auxiliary request without exercising an inventive step, Article 56 EPC.

9. As none of the appellant's requests could form a basis for the grant of the patent, the appeal has to be dismissed.

Order

For the above reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

U. Bultmann

M. Ruggiu