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**Datasheet for the decision
of 15 March 2012**

Case Number: T 2066/09 - 3.2.01

Application Number: 97109508.8

Publication Number: 814012

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Language of the proceedings: EN

Title of invention:
Electric power steering device

Patent Proprietor:
JTEKT Corporation

Opponent:
SAINT-GOBAIN PERFORMANCE PLASTICS RENCOL LTD

Headword:
-

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
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Case Number: T 2066/09 - 3.2.01

D E C I S I O N
of the Technical Board of Appeal 3.2.01
of 15 March 2012

Appellant: SAINT-GOBAIN PERFORMANCE PLASTICS RENCOL LTD
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
3 August 2009 concerning maintenance of
European patent No. 814012 in amended form.

Composition of the Board:

Chairman: G. Pricolo
Members: H. Geuss
T. Karamanli

Summary of Facts and Submissions

I. The appeal of the opponent is directed against the interlocutory decision of the opposition division posted on 3 August 2009, by which European patent No. 0 814 012 was maintained in amended form.

II. The opposition division held that claim 1, which was object of the auxiliary request at that time, met the requirements of Article 56 EPC 1973 with respect to document

US 4415054 (D1), in combination with
EP 0657 340 A1 (D9),

taking into account general technical knowledge as disclosed in documents

Rencol Tolerance Rings: Design Notes, 1994 (D3) and
La bague de tolerance, Mechanic vol. 2, pages 39 to
45, 1963 (D5).

III. Furthermore, in the statement setting out the grounds of appeal, the appellant refers additionally to the following documents:

EP 0 673 827 A1 (D2)

EP 0 535 422 A1 (D4)

"The application of Tolerance Rings in Anti-Theft Steering Column Assemblies"; The Engineering Society for Advanced Mobility,

SAE940808, 3. March 1994 (D6)

Copy of "Global Design News",
1994 (D7)

GB 1 297 340 (D8)

EP 0 630 800 (D10)

JP-A- 021 20178 (D11)
DE 916 370 C (D12).

IV. Oral proceedings were held on 15 March 2012.

The appellant requested that the decision of the opposition division be set aside and that the European patent be revoked.

The patent proprietor (respondent) requested that the appeal be dismissed.

V. Claim 1 in the version which formed the subject of the interlocutory decision of the opposition division reads as follows:

An electric power steering device of a vehicle, comprising:

a pinion (3a) which rotates by steering operation;
a rack (4) engaged with the pinion (3a);
a rotary element (63) screwed on the rack (4); and
a motor (8) which drives the rotary element (63);
wherein the vehicle is steered by the longitudinal shifting of the rack (4) due to the rotation of the pinion (3a);
wherein the steering assistance power is generated along the longitudinal direction of the rack (4) by the rotation of the rotary element (63);
and wherein a torque limiter (50, 50') is provided between the rotary element (63) and the output element (8e) of the motor (8);

the torque limiter (50) has a torque setting element (51) which is radially deformed by being sandwiched between

the rotary element (63) and the output element (8e);

wherein a radial force corresponding to the radial deformation of the torque setting element (51) is exerted on the rotary element (63) and the output element (8e); and

wherein limit torque of the torque limiter (50) corresponds to the radial deformation of the torque setting element (51).

VI. The appellant's submissions may be summarized as follows:

The second embodiment of D1 following fig. 8 discloses a torque limiter in the sense of the invention, since the friction clutch will inevitably have a torque-limiting function under certain circumstances. If a torque limiter is defined as being a connection between two rotary elements that permits slipping between the rotary elements when the torque between them exceeds a given threshold, then fig. 8 of D1 implicitly discloses a torque limiter if the motor supplies enough torque to overcome the frictional engagement of the flanges 181, 182 on the ball nut 163 and the sleeve member 170 respectively.

The second embodiment of D1 only fails to disclose the tolerance ring, which is defined by the last three features of the claim. Taking this embodiment as the starting point for evaluating inventive step, the technical problem to be solved is to set more accurately the limit value of the torque limiter.

A skilled person is aware as part of his common general knowledge that tolerance rings are well known as torque

limiters. Documents D3, D5 to D8 and D10 to D12 provide evidence of this fact. Document D6 in particular discloses the use of a tolerance ring in a steering assembly.

In the first embodiment of D1, referring to figs. 1 to 7, the ball nut 75 is coupled to the armature 73 of the motor 14 by knurling means 77, which are provided in the outer diameter of the ball nut 75. Since no means are foreseen for de-coupling the ball nut 75 from the outer armature, a skilled person would recognize that the arrangement of figs. 1 to 7 of D1 would result in a loss of steering manoeuvrability, should motor lock occur.

Additionally, this problem has already been addressed in document D9 by implementing a slip plate as a torque limiter. Since the skilled person is aware of different forms of torque limiters, it would be obvious to take a tolerance ring into account. Documents D5 and D11, taken as evidence of general technical knowledge, disclose torque limiters realized by tolerance rings. D3 and D6, in particular, show tolerance rings in a steering assembly providing a torque limiting function.

VII. The respondent replied to these arguments as follows:

With respect to the embodiment according to fig. 8 of D1, nothing is mentioned with respect to deficiencies in fail-safe issues in the steering assembly. It is not clear in the appellant's arguments why the skilled person should think about a torque limiting function since D1 states explicitly that even in the event of a failure in the electrical assist, manual fail-safe steering is possible. Furthermore it is not apparent why the skilled person should be directed to tolerance rings

at all. D3 shows different applications of tolerance rings but fails to disclose a tolerance ring in a drive mechanism.

The first embodiment of D1, shown in figs. 1 to 7, does not disclose a torque limiter and consequently discloses no tolerance ring according to the last three features of the contested claim. The problem which is solved by these features is to provide a fail-safe function in the event that the motor is locked in the exciting condition which is cheap, small and easy to configure.

Even if document D9 shows a torque limiter it does not disclose a tolerance ring but a slip plate to allow free rotation of the output shaft in the event of a motor lock. The slip plate is provided between a worm wheel and the output shaft. However, the slip plate of D9 cannot be integrated into the steering assembly according to D1 without extensive modifications.

Additionally, there is no hint in the whole state of the art on file that a tolerance ring could be used as a torque limiter to provide a fail-safe steering function. Documents D3 and D6 only disclose a tolerance ring for a steering column in connection with a theft protection function and that use is not comparable to a power steering assembly with a torque limiter.

Reasons for the Decision

1. The appeal is admissible.
2. The invention as defined by the features of claim 1 involves an inventive step according to Article 56 EPC 1973.

The appellant argued that, when taken as a starting point, both the second embodiment of D1 (fig. 8) and the first embodiment of D1 (figs. 1 to 7) lead to a lack of inventive step.

3. The second embodiment of document D1 as described in col. 6, lines 58 et seq. with reference to fig. 8 discloses

an electric power steering device of a vehicle, comprising:

a pinion which rotates by steering operation (pinion 54, see also col. 3, lines 27 to 38 and fig. 3);
a rack engaged with the pinion (162, ditto);
a rotary element screwed on the rack (ball nut 163; fig. 8); and
a motor which drives the rotary element (175, 151);

wherein the vehicle is steered by the longitudinal shifting of the rack due to the rotation of the pinion wherein the steering assistance power is generated along the longitudinal direction of the rack by the rotation of the rotary element (ditto).

- 3.1 The subject-matter of claim 1 according to the disputed invention differs from the power steering device according to D1 in that
- (a) a torque limiter (50, 50') is provided between the rotary element (63) and the output element (8e) of the motor (8);
 - (b) the torque limiter (50) has a torque setting element (51) which is radially deformed by being sandwiched

between the rotary element (63) and the output element (8e);

(c) wherein a radial force corresponding to the radial deformation of the torque setting element (51) is exerted on the rotary element (63) and the output element (8e); and

(d) wherein limit torque of the torque limiter (50) corresponds to the radial deformation of the torque setting element (51).

3.1.1 The appellant argued that a torque limiter according to feature a) is also disclosed in the fig. 8 embodiment of document D1 since a friction clutch will have a torque-limiting function under certain circumstances.

3.1.2 The Board does not agree. A torque limiter is a technical device designed for the *specific purpose* of transmitting only a torque not exceeding a *predetermined threshold*. The fig. 8 embodiment of document D1 explicitly relates to the functions of the clutch, which is provided "for disengagement of the armature 151 from the ball nut 163 when the electric motor is not energized" in order to "eliminate any necessity of the armature 151 rotating when manual steering occurs" (cf. col. 6, lines 62 to 64 and col. 7, lines 50 to 55).

Thus, in the absence of any indication with respect to a torque limiting function in D1, it cannot be taken as disclosed that the clutch according to fig. 8 is able to provide a torque limiting function for a specific purpose with a predetermined threshold. In the case under consideration, it is not disclosed in D1 that the torque which results by overdriving the frictional engagement of the flanges 181, 182 is in a range in which *steering of a vehicle is still possible*.

3.2 For the same reason, the Board does not agree with the appellant's argument that the solution to the underlying technical problem is to set more accurately the value of a torque limiter with a tolerance ring. Since D1 neither discloses the setting of a torque value nor gives any indication of a problem with respect to fail-safe, the appellant's argument is not convincing.

In fact, the technical problem to be solved by the features a) to d) is regarded as being to provide a fail-safe function and steering manoeuvrability in the case in which the motor is locked in the exciting condition.

3.3 A skilled person being aware of this problem has to choose a solution from among manifold possibilities and the Board is not convinced that it would be obvious to the skilled person to take a tolerance ring into consideration in view of the technical circumstances of the steering apparatus according to fig. 8. Indeed, a variation of the clutch characteristics with electronical or mechanical means would likely be taken into account since the technical effort would be less, compared with the effort to modify the steering assembly according to fig. 8 in order to implement a tolerance ring between the output element of the motor and the rotary element (reference is made in this connection to D9, column 1, line 56 to column 2, line 10).

3.4 It has not been put into question that tolerance rings are well known as torque limiters, as shown in documents D3, D5 to D8 and D10 to D12. However, the appellant was not able to convince the Board that a tolerance ring as a torque limiter in a steering apparatus is an obvious solution to the given problem.

Even document D6, which addresses the use of a tolerance ring as a torque limiting device in a steering assembly, cannot provide evidence of a lack of inventive step in combination with the second embodiment of document D1. D6 discloses a torque limitation for antitheft purposes between a shaft and a locking sleeve in the steering column in order to protect the elements of the locking mechanism, thereby making it possible to turn the steering spindle with a torque (to prevent theft) which is far above that at which a vehicle could be steered.

Consequently, the purpose of this use cannot give a hint to a person skilled in the art to implement a tolerance ring in a device according to fig. 8 of D1.

4. The appellant also objected that starting from the first embodiment of D1 as referred to in figs. 1 to 7, would prove a lack of inventive step.

4.1 The first embodiment of D1 discloses

an electric power steering device of a vehicle,
comprising:

a pinion which rotates by steering operation (pinion 54,
col. 3, lines 27 to 38 and fig. 3);

a rack engaged with the pinion (rack teeth 22, ditto);

a rotary element screwed on the rack (ball nut 75; fig.
3); and

a motor which drives the rotary element (14);

wherein the vehicle is steered by the longitudinal
shifting of the rack due to the rotation of the pinion
wherein the steering assistance power is generated along

the longitudinal direction of the rack by the rotation of the rotary element (ditto).

- 4.2 The subject-matter of contested claim 1 differs from the power steering device according to the first embodiment of D1 by the same features a) to d). This point is not disputed by the parties.
- 4.3 The technical problem to be solved by the features a) to d) is to provide an improved safety function in the event that the motor of the power steering device is locked in the exciting condition.
- 4.4 Again, the Board is not convinced that selecting a tolerance ring as a torque limiter between the rotary element and the output element of the motor in order to solve the problem is possible without any inventive activity.

None of the documents cited by the appellant shows a tolerance ring as a torque limiter for a fail-safe function in a steering apparatus. Furthermore, none of the documents discloses a torque limiter in a steering apparatus between the output shaft of the motor and a rotary element screwed on the rack. Therefore, a skilled person has manifold possibilities in the selection of a certain torque limiter and in the choice of a suitable location of a torque limiting function, which could be anywhere between the rotor of the motor and the rack. Consequently, the Board cannot follow the appellant's argument that the general technical knowledge of a skilled person would be sufficient to implement a tolerance ring as a torque limiter between the rotary element and the output element of the motor in the steering apparatus according to the first embodiment of D1 without an inventive step.

4.5 Even if the teaching of D9 led the skilled person to recognise the necessity of a torque limiting function to assure steering manoeuvrability in the case of a motor lock, the combination of D1 with D9, taken together with the general technical knowledge as disclosed in D3 and D5 to D8 and D10 to D12, cannot prove a lack of inventive step of the subject-matter of contested claim 1 for the following reasons:

4.5.1 As already pointed out under point 3.4, it has not been contested that tolerance rings as such could be used as torque limiters. This fact is shown in the various documents D3 and D5 to D8 and D10 to D12 cited by the appellant. However, there is no indication in these documents which would prompt the skilled person to consider a tolerance ring as a torque limiter for the specific purpose of a fail-safe function in a steering assembly.

Most notably, document D3, fig. 4 refers (as does D6 as discussed under 3.4) to an anti-theft steering column in which the use of a tolerance ring offers a completely different technical effect: in the case of the anti-theft steering column the tolerance ring should avoid rupture in the case of a undesired mechanical load; the tolerance ring in the patent in suit should allow steering in the event of motor damage.

4.5.2 Furthermore, D9 does not show a torque limiter between the output element of the motor and a rotary element screwed on the rack. The slip plate (9) is provided between the worm gear (7) - which corresponds to the output element - and a lock nut (8a, 8b) which is connected to the output element (2) of D9, by means of which the output element transfers motion to the pinion. This means that the technical design and the location of

the torque limiter of the steering assembly according to D9 are considerably different from the assembly of D1.

- 4.6 As a result the Board is not satisfied that a skilled person - even taking into account common general knowledge as shown in D3, D5 and D6 - could deduce from D9 that a tolerance ring as a torque limiter should be installed between the motor and a rotary element which transfers motion to the steering rack.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

K. Götz

G. Pricolo