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Title of invention:
Steered wheel position compensating apparatus for a forklift

Patent Proprietor:
KABUSHIKI KAISHA TOYOTA JIDOSHOKKI

Opponent:
KION Warehouse Systems GmbH

Headword:

Relevant legal provisions:
EPC Art. 123(2)
EPC 1973 Art. 56

Keyword:
Amendments - added subject-matter (no)
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 0630/13 - 3.2.01

D E C I S I O N
of Technical Board of Appeal 3.2.01
of 23 July 2015

Appellant: (Opponent)	KION Warehouse Systems GmbH Ernst-Wagner-Weg 1-5 72760 Reutlingen (DE)
Representative:	Waller, Stefan Geirhos & Waller Partnerschaft Patent- und Rechtsanwälte Landshuter Allee 14 80637 München (DE)
Respondent: (Patent Proprietor)	KABUSHIKI KAISHA TOYOTA JIDOSHOKKI 2-1, Toyoda-cho Kariya-shi, Aichi-ken (JP)
Representative:	TBK Bavariaring 4-6 80336 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 9 January 2013 concerning maintenance of the European Patent No. 1281598 in amended form.**

Composition of the Board:

Chairman W. Marx
Members: Y. Lemblé
P. Guntz

Summary of Facts and Submissions

I. The appeal of the Opponent is directed against the interlocutory decision of the Opposition Division, posted 9 January 2013, to maintain European patent No. 1 281 598 in amended form on the basis of the second auxiliary request filed during oral proceedings on 22 November 2012.

II. In its decision, the Opposition Division held that the amended claims met the requirements of Article 123 and Article 84 EPC and that the subject-matter of the amended claims met the requirements of novelty and of inventive step having regard, *inter alia*, to the following prior art documents:
E2: EP-B-0 596 167,
E3: JP-A-2001-26278 and its abstracts E3a,
E4: EP-A-0 872 405.

III. Oral proceedings were held on 23 July 2015.

The Appellant (Opponent) requested that the decision under appeal be set aside and that the European patent be revoked.

The Respondent (Patent Proprietor) requested that the appeal be dismissed.

IV. Claim 1 of the patent as maintained by the Opposition Division reads as follows (delimitation of features as proposed by the Appellant):

1a) A steering apparatus of a vehicle provided with a steered tire wheel (16) which is steered in correspondence to an operation of a steering wheel (17), the apparatus comprising

1b) first detecting means (26) for detecting an actual position (N) indicating a present rotational position of the steering wheel (17);

1c) second detecting means (39) for detecting a wheel angle (R) of the steered tire wheel (16);

1d) electric type drive means (36) for driving the steered tire wheel (16), said drive means outputting a power output for operating the steered tire wheel (16) in correspondence to a steering wheel operation; and

1e) compensating means (22) for executing a first compensation for compensating an actual position (N) of said steering wheel (17),

1f) said compensating means controlling the power output of said drive means (36) at a time when a deviation is detected between the actual position (N) of said steering wheel (17) detected by said first detecting means (26) and the wheel angle (R) of said steered tire wheel (16) detected by said second detecting means (39), thereby reducing said deviation;

characterized in that

1g) said compensating means (22) resets an angle difference (ΔH) between an operation angle (H) of said steering wheel (17) and the wheel angle (R) of the steered tire wheel (16) at a stop of said steering wheel (17) or a turning back of said steering wheel (17), and

1h) before the first compensation, said compensating means (22) computes a target angle position (No) of the steering wheel (17) on the basis of the detected wheel angle (R) of the steered tire wheel (16), and

1i) in the first compensation, when the deviation from the actual position (N) to the target angle position (No) along the operational direction of

the steering wheel (17) is equal to or less than 180°,

1j) the compensating means (22) executes the first compensation in which the compensating means (22) reduces the power output of the drive means (36) to reduce said deviation,

1k) wherein in the first compensation, the power output of the drive means (36) is reduced so that the steering speed of the steered tire wheel (16) is reduced with respect to the operating speed of the steering wheel (17) in comparison with a compensating inhibiting time when the first compensation is not executed,

1l) wherein in the first compensation, an output command value (Dm) of the drive means (36) is multiplied by a compensating lowering factor (k) to establish a final output command value (Dmt) of the drive means (36) whereby the power output of the drive means (36) is reduced with respect to then when the first compensation is not executed.

Apart from specifying the "compensating means (22)" as "control means (22)", independent claims 7 and 8 respectively repeat *inter alia* all the features of claims 7 and 8 as granted and their characterising parts essentially contain the above-mentioned features 1h) to 1l) of present claim 1.

V. The Appellant's submissions can be summarised as follows:

Claim 1 of the patent was amended in such a way that it contained subject-matter which extended beyond the content of the application as originally filed, contrary to the requirements of Article 123(2) EPC. This also applied for independent claims 7 and 8.

Paragraphs [0043] and [0062] of the original patent application EP-A-1 282 598 (hereinafter called D0) was cited as as a basis for the features 1h) to 1l) which had been added to claim 1 as granted. However, these paragraphs described a particular embodiment of a steering apparatus which encompassed various further features which were to be regarded as essential and were not taken over into the amended claim, thus leading to a series of intermediate generalisations which contravened Article 123(2) EPC:

Feature 1i) introduced the concept of a deviation "along the operational direction of the steering wheel" without mentioning the particular sensor system which permitted to detect the steering wheel operating direction (see in particular paragraphs [0023] to [0026] of D0).

Moreover, the compensation lowering factor k in features 1k) and 1l) was mentioned in paragraphs [0047] to [0048] of D0. These paragraphs also described a second compensation and clearly indicated that this second compensation was performed simultaneously and in connection with the first compensation claimed in 1i) and 1j). That second compensation was, however, not mentioned in amended claim 1. There was no indication in D0 that only the first compensation had to take place.

In the embodiment which was cited as a basis for the amendments, the computation of the target position of the steering wheel was disclosed with reference to a knob 18 defining a predetermined position of the steering wheel. The provision of the knob was not mentioned in amended claim 1, although it should be regarded as essential.

Further, the definition of the "inhibiting time" (see feature 1k)) was unclear. This term could be regarded as being synonymous to the term "inhibiting area" which encompassed further "inhibiting" parameters (see paragraph [0113]; or paragraph [131] of the specification: inhibition of the second compensation). There was no clear disclosure in the original application D0 that the "inhibiting time" was the time allocated to the non-execution of the first compensation.

The steering apparatus according to claim 1 lacked an inventive step in view of the combination of documents E2 with E3 and E4 or E3 with E4.

Concerning the combination E2/E3/E4, the argument advanced by the Opposition Division to justify inventive step (feature 1l)), and according to which it was not possible in E4 to give to the compensation lowering factor a value different from zero, was not correct. The subject-matter defined by claim 1 did not exclude a compensation lowering factor of zero. Paragraph [0078] of the patent specification itself mentioned that the compensation lowering factor K was not limited to the fixed value 0.5 but might be set to a variable value as shown in Fig. 16. This figure, which showed the variation of the compensation lowering factor in function of the deviation angle, disclosed that the compensation could be with a compensation lowering factor of zero ($\Delta\theta$ of 180°) such that the power output would be reduced to zero. This situation corresponded to the by-pass position of the valve 122 shown in Fig. 15 of E4. Even assuming a non-zero compensation lowering factor, in the case the bypass valve 122 in E4 was switched into its open compensation

position, the hydraulic power driving the steering wheels was not reduced to zero because of the provision of the throttle 123 which, by generating a pressure difference between the steering cylinder 112 chambers, ensured that a minimal amount of power was still available to steer the wheels 102. This preserved an active steering during compensation.

Document E3 was another relevant prior art to take into consideration, since it disclosed a steering apparatus having all the features of claim 1 as granted. For the skilled person who started from this known steering apparatus and who wanted to improve the responsiveness of the vehicle to the movements of the steering wheel, it would have been obvious to apply the teaching of E4 which was to execute a first compensation ("position correction") in which the power output of the drive means (see Fig. 15: hydraulic steering cylinder 112 with bypass valve 122) was reduced (see column 27, lines 20-32) when the deviation between the position of the steering wheel and the steered wheel fulfilled a predetermined criterion which was similar to that claimed in feature 1i) of claim 1 (E4: column 20, lines 15-22). The considerations relative to the disclosure of a compensation lowering factor, as made above, also applied to the combination E3/E4.

VI. The Respondent (Patent Proprietor) countered essentially as follows:

The conclusion of the Opposition Division that the amended claims did not violate the requirements of Article 123(2) EPC was correct. There was a clear basis for the amendments in the original disclosure D0. More particularly, the original application disclosed that the second compensation might be performed

independently from the first compensation (see original claims 1 and 2). Paragraph [0092] of D0 explicitly stated that the knob at the steering wheel might be optional. The term "inhibiting time" was literally mentioned in paragraph [0062] of D0. This term simply meant the time at which the first compensation was not executed. The concept of detecting a deviation "along the operational direction of the steering wheel" was disclosed in paragraph [0043] of D0.

The subject-matter of claim 1 involved an inventive step over the combination of documents E2/E3/E4 or E3 with E4 mentioned by the Appellant. The last feature of claim 1 (feature 1l)) was not known from E4 so that any combination involving this document could not lead in an obvious way to the claimed steering apparatus. The apparatus of E4 used a flow divider (Fig. 15: bypass valve 122) and did not need to change the power of the drive means (oil pump), i.e. driving section and correction device were separated.

Reasons for the Decision

1. The appeal is admissible.

2. Admissibility of the amendments under Article 123(2) EPC

2.1 The Board does not agree with the Appellant when it contends that the application as originally filed D0 does not provide a basis for the amendments made in claims 1, 7 or 8.

2.2 The concept of a deviation from the actual position N to the target angle position No "along the operational

direction of the steering wheel", as mentioned in feature 1i), has a clear basis in paragraph [0043] of D0. How the steering angle and the rotational direction are obtained, is explained in detail in paragraphs [0023] to [0026] of D0. The detection of such an angle and rotational direction is something which is well known in the art (see e.g. Fig. 20 of document E4) and is not considered to be an essential aspect of the present invention. Thus, for the person skilled in the art, there is no need to further define in the claim the particular sensor system which permits to detect the deviation along that operational direction.

2.3 Paragraph [0092] of D0 explicitly states that "It is not limited that the steering wheel knob 18 is always provided in the steering wheel 17, and the steering wheel 17 may be one without a knob". Thus, it is not necessary to mention the knob in claim 1 and the objection of the Appellant in this respect is not justified.

2.4 As is apparent from the original claims 1 and 2 of D0, the first compensation is specified in claim 1 and the second compensation is subject-matter of dependent claim 2. This indicates that the second compensation is not closely linked with the first compensation and can be considered as optional. The description of D0 also shows what happens when only the first and not the second compensation is performed. The case where the second compensation is not executed is explicitly stated in paragraphs [0070] and [0071] of D0 and shown in Fig. 15(b). Paragraph [0071] and [0076] of D0 clearly explain the effect of the second compensation (traveling in a serpentine manner avoided when straight moving wanted) which is independent from the effect of the first compensation.

2.5 "inhibiting time"

The following wording of claim 1: "in comparison with a compensating inhibiting time when the first compensation is not executed", when read in combination with features 1k) and 1l) of the claim, merely distinguishes the time when the first compensation is executed from the time when the first compensation is not executed.

The term "inhibiting time" is literally mentioned in parentheses in paragraph [0062] of D0, and it is apparent from the content of D0 that there is a clear basis in the original application for the above interpretation. Paragraphs [0060] and [0061] of D0, which precede this paragraph, when read in combination with Fig. 1 of D0, define the time at which the relation $\Delta\theta \leq 180^\circ$ is not established (column 15, lines 6-8), which is the time at which the first compensation is not executed, i.e the time at which the power output of the drive means is not reduced (step 195: output command value Dm not multiplied by the compensation lowering factor K).
Thus, for the skilled person, there is no reason to confuse this term with the term "compensation inhibiting area", which is used in another context and in a different sense and describes a certain area in a diagram (compare e.g. Fig. 11 and Figs. 19 and 20 of D0).

2.6 In summary, claim 1 does not lack essential features and is not objectionable for inadmissible intermediate generalisation so that the requirements of Article 123 (2) EPC are fulfilled. Similar considerations apply to the objections made in connection with independent claims 7 and 8.

3. Inventive step

3.1 Inventive step starting from document E2

Document E2 describes a system for changing the steering ratio of a steerable vehicle as a function of its speed and, more particularly, a microprocessor-based electronic system that changes the steering ratio (lock-to-lock turns varying from a minimum steer ratio (c) to a maximum steer ratio (d)), as the speed of the motorized vehicle increases (column 1, lines 21-26 and Fig. 5). In other words, a greater turn of the steering wheel will be required to effect an angle change in the steered drive wheel (steering motor 21 driving steered wheel 17) as the speed of the vehicle increases (column 3, lines 4-8).

A concrete application of this principle is shown in Figs. 4a and 4b of E2: a target value for the position of the steered drive wheel is computed on the basis of a velocity signal, obtained from a vehicle velocity sensor, and a steering position reference signal, obtainable from a steering wheel position sensor. A deviation between this speed dependent computed target value and the actual position of the steered drive wheel serves as a drive signal for driving the steered drive wheel through electric type drive means (see column 5, lines 14 to 46). In the teaching of E2, there is no detection of the deviation between the actual position of the steering wheel and a target steering wheel angle derived from the wheel angle of the steered wheel, as computed in E4, and there is no reason to compute such a deviation.

E4, on the other hand, computes such deviation and aims at minimizing discrepancies (oversteering) by proposing a correction device which improves responsiveness (see claim 1 and column 3, lines 10 to 35). There is no

incentive for the skilled person to combine E2 with E4, since these two documents refer to two different control strategies which, *a priori* and without inventive considerations, are not compatible. Additionally, it does not make sense, when starting from the teaching of E2, to determine a deviation from the actual position to the target angle position along an operational direction of the steering wheel (feature 1i)), because E2 is just concerned with the proper implementation of the driver's steering demand, taking into account speed dependent steering ratios.

Therefore the skilled person would not think of combining documents E2 and E4, i.e. they cannot lead in an obvious manner to the claimed subject-matter.

3.2 The combination E3/E4

3.2.1 The Appellant contends that the prior art document E3 showed all the features of claim 1 as granted (features 1a) to 1g) of present claim 1) and that document E4 showed the remaining features 1h) to 1l).

3.2.2 First of all, the Board is not convinced that document E4 discloses that a compensation as claimed in features 1j) to 1l) is executed, whereby this compensation is effected when the criterion mentioned in feature 1i) is fulfilled.

The Board agrees with the Appellant that, in E4, a reduction of the power output of drive means (steering cylinder 112) is obtained by switching the by-pass valve 122 to the open position when a correction is executed (feature 1k) of claim), however there remain important differences between this compensation operation and the claimed features.

3.2.3 First it is noted that the main components of the drive means shown in E4 are hydraulic and not electric. They comprise a valve unit 105 connected to a hydraulic pump 106 which supplies hydraulic oil to a steering cylinder 112, whereby the amount of oil supplied from the valve unit to the steering cylinder is proportional to the rotation amount of the steering wheel (E4: column 26, lines 49 to 53). It is only the switching of the bypass valve 22 which is operated electrically.

3.2.4 According to feature 1l) of claim 1, when read in combination with the other features of the claim and especially features 1d) and 1f), the controller calculates the final output command value Dm of the drive means by making a particular operation, namely by multiplying an output command value Dm of the electric drive means by a specific lowering factor K. Through this feature, there is a direct regulating effect on the electric drive means and its power output (e.g. electrical current) which can be reduced to operate the steered wheel (see paragraph [0032] of the patent specification).

This feature is not shown in E4. The reduction of the power output by the drive means is obtained in E4 by making a subtraction of power from the hydraulic power delivered by the pump 106 and the valve unit 105, that is, when the by-pass valve 122 is switched open, a part of the hydraulic power is taken away, being lost to the tank and dissipated though the throttle 123 (see E4: column 27, lines 20 to 32). It should be clear to the skilled person that this mode of power reduction has not the energetical efficiency of the claimed solution.

3.3 The Board concludes from the above considerations that the subject-matter of claim 1 involves an inventive step. This applies by analogy to independent claims 7 and 8 which also contain the inventive features 1h) to 1l).

4. It follows from the above that the Appellant's arguments fail to convince the Board that the findings of the Opposition Division in the decision under appeal are not correct. Accordingly, the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Vottner W. Marx

Decision electronically authenticated