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File Number: T 487/90 - 3.2.1
Application No.: 82 108 984.4
Publication No.: 0 075 932
Title of invention: Anti-skid brake control system with fail-safe arrangement

Classification: B60T 17/22, B60T 8/88

D E C I S I O N
of 10 March 1992

Proprietor of the patent: Nissan Motor Co., Ltd.
Opponent: 01 Alfred Teves GmbH
02 Siemens AG

Headword:

EPC Art. 56

Keyword: "Inventive step (yes)"

Headnote



Case Number : T 487/90 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 10 March 1992

Appellant :
(Proprietor of the patent)

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Respondent II :
(Opponent 02)

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Decision under appeal :

Decision of Opposition Division of the European
Patent Office dated 29 March 1990, posted on
19 April 1990 revoking European patent
No. 0 075 932 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : F. Gumbel
Members : P. Alting van Geusau
C. Payraudeau

Summary of Facts and Submissions

I. The mention of grant of European patent No. 0 075 932, in respect of European patent application No. 82 108 984.4 filed on 28 September 1982 and claiming a priority of 28 September 1981 (JP 152164/81), was published on 9 September 1987.

II. In notices of opposition filed respectively on 7 and 9 June 1988 the Respondents (Opponents 01 and 02) requested revocation of the patent for the reason that the subject-matter as claimed did not involve an inventive step (Article 100(a) EPC). Respondent II (Opponent 02) also submitted that the patent did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 100(b) EPC).

In respect of the alleged lack of inventive step the oppositions were supported by the following documents:

D1: DE-A-2 557 358

D2: DE-A-2 232 034

D3: DE-A-2 726 738

D4: US-A-3 744 851

III. By a decision given at oral proceedings on 29 March 1990, with written reasons posted on 19 April 1990, the Opposition Division revoked the patent.

The Opposition Division held that the contested patent disclosed the invention in a manner sufficiently clear for it to be carried out by a person skilled in the art but

that Claim 1 did not contain inventive subject matter having regard to the prior art disclosed in D4 and D2.

IV. An appeal was lodged against this decision on 21 June 1990 with payment of the appeal fee on the same day. The Statement of Grounds of Appeal was filed on 24 August 1990.

V. In accordance with auxiliary requests submitted by the parties the Board summoned them to oral proceedings which were held on 10 March 1992.

At the oral proceedings, the Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of Claims 1 to 4, the description pages 1 to 5 and the figures 1 to 3 submitted as the main request at the oral proceedings, subsidiarily on the basis of a first or a second auxiliary request both filed with letter of 6 February 1992. Claim 1 of the last auxiliary request should however be corrected to relate in its characterising part to the fourth fault condition rather than to the first.

Claim 1 of the main request reads as follows:

"1. An anti-skid control system with fault detection, said system comprising:

- a wheel rotation speed sensor (1) coordinated to each wheel;
- an acceleration calculating circuit providing a signal indicating wheel acceleration, or deceleration, respectively;
- a wheel acceleration comparator (4) providing at least the following signals:

- a first acceleration signal (e1) when wheel acceleration is above a first threshold,
- a second acceleration signal (e2) when wheel acceleration is above a second threshold lower than said first threshold;
- a first deceleration signal (e3) when wheel deceleration is below a third threshold, and
- a second deceleration signal (e4) when wheel deceleration is below a fourth threshold lower than said third threshold;
- a vehicle speed sensor (5C);
- a vehicle speed comparator (6) receiving signals from said vehicle speed sensor and said wheel rotation speed sensor (1) for providing at least the following signals:
 - a first slippage signal (E1) when wheel speed is below a first partial value of vehicle speed, and
 - a second slippage signal (E2) when wheel speed is below a second partial value of vehicle speed, lower than said first partial value; and
- a logic circuit (15) providing at least an inlet signal (Ev) to an inlet valve and an outlet signal (Av) to an outlet valve; and
- a fault detecting means;

c h a r a c t e r i z e d i n t h a t

- said fault detecting means comprises AND gates (7, 8, 9, 10) each with an inverting and a non-inverting input terminal for detecting combinations of at least two of said signals and for providing a fault signal in case that at least one of the following combinations is detected each by means of one of said AND gates which combinations are not possible during a faultless operation of the system:
 - a first fault condition whether said first deceleration signal (e3) is not present while said second deceleration signal (e4) is present;

- a second fault condition whether said first acceleration signal (e1) is present while said second acceleration signal (e2) is not present;
- a third fault condition whether said first slippage signal (E1) is not present while said second slippage signal (E2) is present and
- a fourth fault condition whether said inlet signal (Ev) is not present while said outlet signal (Av) is present."

VI. In support of his requests the Appellant essentially submitted the following arguments:

When discussing the systems of Claim 1 having four alternative fault conditions, it is appropriate to divide the conditions into two groups. The first group relates to a system having the fourth fault condition and the other group having one of the first to third fault conditions.

Concerning the first group, the Respondent's argument that such a system would be obvious in view of D4 could not be accepted. This document teaches (see column 7, lines 64 to 68) that the simultaneous presence of a potential at the valves of the non-driven wheels with non-actuated brake may be utilised as a logical decision. In contrast to this, the fourth fault condition of Claim 1 of the invention is detected when signals indicating an open condition of both the inlet valve and the outlet valve are present, which signals are completely different from the signals mentioned in D4 and produce completely different effects in the fault detection system. Therefore this prior art could not give a hint to a system having the fourth fault condition.

Concerning the second group relating to the first to third fault conditions, only wheel conditions signals are used,

whereas D2 describes combinations between valve signals and wheel condition signals. These combinations between valve signals and wheel condition signals necessarily require waiting for a rather long period of time until it becomes possible to decide whether there is a fault or not.

In contrast to this, due to the use of only wheel condition signals, with the system of the invention pursuant to the second group faults can be detected without any time delay.

Moreover, the characterising features teach to investigate, as a fault condition, different levels of a single parameter.

As such type of fault condition check is not known, it cannot be maintained that the application of the second group of fault conditions in an anti-skid control system in accordance with the preamble of Claim 1 would be derived at in an obvious manner when applying the teachings of the prior art.

VII. The counter-arguments submitted in writing and orally by the Respondents were essentially the following:

In addition to the precharacterising features of each of the first claims of the requests, the prior art in D4 shows a number of fail-safe detection possibilities of which one, referred to in column 7, lines 63 to 68, teaches that the simultaneous presence of a potential at the valves of the non-driven wheels with non-actuated brake may be used as a logical decision, which means to base a fault decision on the simultaneous presence of signals which should not be present under normal functioning conditions of the system.

Moreover, in Figure 2 of D4 reference is already made to "physically impossible" acceleration, deceleration, slip and valve signal combinations and, when considering Figure 3, it is immediately apparent that also some combinations of the signals related to a given single parameter are "physically impossible", which means that there is a malfunction of the system if they are nevertheless present. In this respect, it is considered self-evident for the skilled person to recognise that operation of the system is not correct when a second threshold of a parameter is reached without a first preceding threshold being signalled and that naturally the determination of a malfunctioning of the system may be based on a corresponding comparison of signals of one and the same parameter.

Further, also document D2 clearly states on page 14, point 2, that the simultaneous presence of a valve signal and deceleration or slip signals may indicate an error in the normal functioning of the anti-skid system.

A direct disclosure to base the fault detection on one single parameter can be derived from page 6, second paragraph of D2, which discloses that an erroneous slip signal, determined on the basis of wheel velocity signals compared to fixed thresholds, may be used to activate the safety installation.

Considering this prior art, the skilled person was thus not only presented with the same problems with respect to fault detection but this prior art also provides sufficient suggestions to try and use the fault detection combinations claimed in the patent in suit. The patent must therefore be revoked for reason of lack of inventive step of its subject matter.

The Respondents request that the appeal be dismissed.

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 and Rules 1(1) and 64 EPC. It is therefore admissible.

2. Amendments (main request)

2.1 Claim 1 is based on a combination of the subject-matter of the original Claims 3, 4, 5, 8 and 9 and, as regards the fourth fault condition detection, on the preferred embodiment disclosed with respect to Figure 2 of the application as originally filed.

Claims 2 to 4 essentially correspond to original Claims 6, 10 and 15.

All Claims thus comply with the requirement of Article 123(2) EPC.

2.2 As regards the granted patent, new Claim 1 is based on the combination of granted Claims 1 to 5 and 8, and new dependent Claims 2 to 4 correspond to, respectively, Claims 6, 7 and 9.

Thus, given the fact that the present claims are restricted in scope when compared to the granted claims all claims also meet the requirement of Article 123(3) EPC.

2.3 The minor amendments to the description and drawings in in order to correct some obvious errors and to avoid

uncertainty as to the scope of protection do not give rise to objections under the EPC either.

- 2.4 The Board notes that, in this appeal procedure, the Respondents no longer raised the question of sufficient disclosure of the invention (Art. 100(b) EPC). Having nevertheless considered this point of its own motion, the Board does not see any ground for doubt of compliance with this requirement of the EPC.

3. Novelty (main request)

- 3.1 There is agreement between the parties and the Board that D4 represents the closest prior art. This document discloses an anti-skid brake control system with a fail-safe arrangement comprising the combination of features of the precharacterising part of Claim 1.

Respondent II was of the opinion that in view of the disclosures in column 7, lines 64 to 68 of D4, the characterising features of Claim 1 relating to the AND gate with an inverting and a non-inverting input terminal were also implied as a disclosure for the skilled person.

However, this paragraph of D4 solely states that a logical decision may be taken on the basis of the simultaneous presence of a potential at the valves of the non-driven wheels with non-actuated brake, without giving any further explanation in the specification about the construction of the circuit for carrying out this logical decision.

Certainly, an AND gate with an inverting and a non-inverting input terminal could be used for the realisation of such a logical circuit but, in the

opinion of the Board, clearly other alternatives with other components may also be used to realise a circuit for carrying out the logical decision.

Therefore it cannot be maintained that the use of an AND gate in the claimed manner is necessarily implied by the disclosure of D4 and as a consequence this specific feature must be considered as novel over the disclosure of D4. The valid Claim 1 is thus correctly related to the closest prior art as required by Rule 29(1) EPC.

- 3.2 The anti-skid control system according to Claim 1 differs from the system disclosed in D4 by its characterising features. Since the other available prior art documents also do not disclose any of the fault conditions set out in the characterising part of Claim 1, it is concluded that the subject-matter of Claim 1 is novel which was in fact not contested by the Respondents.

4. Inventive step (main request)

- 4.1 As is correctly set out in the introductory paragraphs of the patent specification in suit, in the fail-safe detection system known from D4 it is not possible to detect whether the valve control signals change between high and low levels in a wrong manner, or to detect a failure of the system during braking, in case of the use of the non-actuated brake signal as a fault detection parameter.

In the alternative, each of the fault detection conditions set out in the characterising part of Claim 1 provides a further fault detection means for checking of the anti-skid system when braking.

4.2 Therefore, in the light of the closest prior art, the technical problem underlying the patent in suit is to be seen in the provision of an anti-skid control system with a fault detecting means for more reliable checking of the system also during periods of braking.

Surely, recognition of this problem does not require any inventive activity in view of the normal aim of the skilled person to improve the safety by trying to improve the reliability of failure detection systems.

4.3 As to the solution, it is to be noted that none of the available prior art documents expressly discloses any of the fault conditions set out in the characterising part of Claim 1. For the question whether Claim 1 comprises inventive subject-matter it has therefore to be determined if the prior art considered by the skilled person in this field and including his general technical knowledge would give sufficient suggestion to at least one of the proposed alternative solutions of the underlying problem of the patent in suit.

4.4 Considering D4 further, it was argued by the Respondents that this document contained a clear lead to all of the claimed fault conditions because of the reference to "physically impossible" signals in the table of Figure 2 and the different thresholds shown by the curves of Figure 3 relating to the slip, deceleration and acceleration signals as well as the different values of the inlet and outlet valve signals, which, when being interpreted by the skilled person, would immediately make him realise that the interdependence of these signals would provide additional fault conditions which could be used for the fault detection.

However, the Board notes that D4, as far as the safety installation is concerned once the anti-skid system is activated, essentially relates to a fault detection system which is based on the presence of a continuous potential at the valves. The comparison of the valve signals with a non-actuated brake signal referred to in column 7, lines 63 to 68 may be used for logical decision as a precautionary measure to prevent that the safety installation means also respond to an excessive drive slippage which would lead to valve signals being given without the anti-skid system being activated and without any failure of the electronic system's components.

Further, Figures 2 and 3 of D4 are exclusively used to explain the functioning of the anti-skid system: no reference whatsoever is made to these Figures when explaining the functioning of the safety installation means.

Therefore, in the Board's opinion, the skilled person when objectively assessing the technical content of D4 would only derive the general teaching that the presence of continuous valve signals or, for special circumstances, the comparison of valve signals with other signals may be utilised as a basis for a logical decision for determining whether the anti-skid system is working properly. Hence the Respondent's allegation that the skilled person would immediately have the idea of using the different threshold levels of one signal or, alternatively, the inlet and outlet valve signal comparison of the anti-skid system of D4 for a fault detecting decision is considered to be based on hindsight. Even when taking into account the general knowledge of the skilled person, no suggestion in this direction can reasonably be taken from D4.

4.5 Considering now the disclosures of D2, also relied upon by the Respondents, the Board notes that its teachings are mainly in line with those of D4.

D2 also states that essentially the valve signals should be monitored and when a valve signal is present for longer than a predetermined period a fault may be present. In order to avoid erroneous activation of the safety means the length of the predetermined period may be controlled in accordance with other parameters.

Certainly, there is further stated on page 14, point 2, that the decision whether an error is present may be taken on the basis of a comparison of deceleration or slip signals with the outlet valve signal but the teaching derivable from this paragraph does not go further than the general teaching derivable from D4 that different signals which have a particular relationship may be utilised for a logical decision in respect of fault detection.

The further passage of D2 (page 6, second paragraph) referred to by the Respondents states that the wheel velocity may be monitored in respect of two different successive threshold values which must be exceeded within a predetermined period for checking the reliability of the slip signal. However, here also the threshold signals are not directly used for fault detection but rather the period between the successive occurrences of the signal is monitored and used as a basis for a fault decision.

4.6 Although it is of course plainly clear, after having knowledge of the present invention, that the threshold levels themselves or the inlet and outlet valve signals provide appropriate fault parameters, the prior art in D2 and D4 discloses different solutions to the problem of fault detection which are, in the Board's opinion,

incompatible with the solutions proposed in the contested patent and are therefore not suitable to give the skilled person a hint in this direction.

It is noted that the Appellant also referred to technical advantages such as a quicker response of the safety installation means. The Board notes that in this respect the Respondents failed to give any counter-arguments.

4.7

The documents D1 and D3 cited in the opposition procedure lie further away from the subject-matter of Claim 1 than D4 and D2 and in view of the fact that the Respondents have no longer based arguments on this prior art it is not considered necessary to give a detailed analysis with respect to these documents. It is however noted that also these documents, apart from the general idea of taking a fault decision on the basis of the occurrence of signals which under normal circumstances are not present, do not, in the Board's opinion, contain any suggestion to either one of the fault conditions defined in the characterising part of Claim 1 under consideration.

5. Summarising, the Board comes to the conclusion, that the cited prior art in its totality if considered by the skilled person having a general knowledge in the field of anti-skid systems, does not render the subject-matter of Claim 1 obvious, which, as a consequence, must be considered to involve an inventive step.

Thus the present Claim 1 according to the main request is suited to form the basis for maintenance of the patent. Claims 2 to 4, which relate to preferred embodiments of the anti-skid system according to Claim 1, are also acceptable.

6. Since the main request is allowable there is no need to consider the auxiliary requests.

Order

For these reasons, it is decided that:

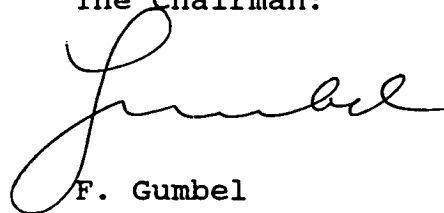
1. ~~The decision under appeal is set aside~~
2. The case is remitted to the first instance with the order to maintain the patent on the basis of the documents according to the Appellant's main request filed at the oral proceedings of 10 March 1992 (see point V of this decision).

The Registrar:



S. Fabiani

The Chairman:



F. Gumbel