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Aktenzeichen / Case Number / N^o du recours : T 538/88 - 3.2.1

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Bezeichnung der Erfindung: **Apparatus for controlling a drive force applied to**
Title of invention: **a compressor.**
Titre de l'invention :

Klassifikation / Classification / Classement : B60H 3/04, B60K 25/00, F16D 27/00

ENTSCHEIDUNG / DECISION

vom / of / du 23 January 1990

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

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Einsprechender / Opponent / Opposant :

Robert Bosch GmbH

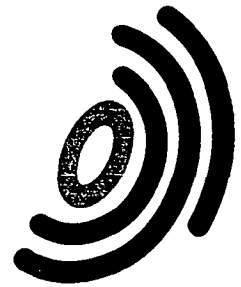
Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé :

"Inventive step (yes)"
Maintenance of the patent in amended form

Leitsatz / Headnote / Sommaire



Case Number : T 538 /88 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 23 January 1990

Appellant : Robert Bosch GmbH
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Representative :

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Decision under appeal : Interlocutory decision of the Opposition Division of
the European Patent Office dated 22 August 1988
concerning maintenance of European patent
No. 0 045 933 in amended form.

Composition of the Board :

Chairman : F. Gumbel

Members : P. Alting v. Geusau

F. Benussi
EPA/EPO/OEB Form 3002 11.88

Summary of Facts and Submissions

- I. European patent No. 0 045 933 comprising four claims was granted on 25 April 1984 on the basis of European patent application No. 81 106 087.0 filed on 4 August 1981.
- II. Opposition to the granted patent was filed by the Appellant on the ground that the granted claims did not define novel and/or inventive subject-matter. The Opponent relied in particular on JP-A-55-100 430 (D12), JP-A-47-41 680 (D13) and US-A-3 877 003 (D14), all these documents being cited after expiry of the time limit of Article 99(1) EPC; translations of D12 (I) and D13 (II) into the German language were provided by the Opponent.
- III. Because of their relevance the Opposition Division allowed documents D12 to D14 to be introduced into the proceedings (Article 114(2) EPC). During the opposition proceedings the Opposition Division presented a German translation of D12 (III). The Opposition Division in their interlocutory decision dated 22 August 1988 maintained the patent in amended form with three independent claims.
- IV. An appeal was lodged against this decision on 22 October 1988 including a Statement of Grounds of Appeal and payment of the appeal fee. The Appellant contended lack of inventive step of the subject-matter of Claims 1 to 3 on the basis of D12 to D14.
- V. Oral proceedings, the summons to which were accompanied by a communication, were held on 23 January 1990.
- VI. In his written and oral statements the Appellant contended that starting from the prior art in D12, which shows all the features of the precharacterising part of Claims 1 and

2, the sole difference resides in the position of the second sensor so that instead of the compressor driving pulley speed the engine speed is sensed. However D13 and D14 already show that V-belt slip is determined on the basis of the difference between engine and generator speeds.

D12, D13 and D14 should be considered as belonging to the same field, in particular having regard to the titles of these patent publications. Therefore the skilled man is led to use the teachings of D13 or D14 for determining slip in the drive arrangement of D12. Furthermore, instead of a generator or a fan also other components are envisaged to be driven in the arrangements of D13 and D14. The Appellant further argued that starting from D14 which discloses a similar control arrangement using counters as in Claim 2 of the patent, Claims 1 and 2 lack inventive step, since it would be obvious to the skilled man that the warning signal supplied in this known arrangement could also be used to disengage the clutch of a compressor shown in D12.

Moreover, the Appellant contended that Claim 3 did not meet the object of the invention because no higher reliability of prevention of damage can be achieved on the basis of only one sensor signal compared with a fixed reference value. No basis for a changing reference value can be found in the application as originally filed. The subject-matter of Claim 3 can also not be regarded as inventive, since it essentially relates to the well known "Watch-Dog" circuit.

The Appellant requested revocation of the patent in its entirety.

VII. The Respondent substantially argued that starting from D12, which document indeed has to be regarded as disclosing the most relevant prior art, the skilled man would not have any reason to combine the teachings of D12 with those of D13 or D14. In the event of compressor jam it is necessary to immediately switch off the compressor to avoid V-belt breakage. In D13 and D14 belt slip is detected to give a warning, however belt breakage will not occur. Therefore, even if the control circuit of D14 shows similarities with the control circuit of Claim 2, no lead to the other features of Claims 1 and 2 can be derived from these documents.

Claim 3 meets the object of the invention in that the claimed arrangement is simple and, even if a fixed reference value is used, slip in the total drive train from engine to compressor motor is taken into account.

The Respondent (patentee) requested that the appeal be dismissed and that the patent be maintained on the basis of the following documents:

Main request: Claims and description presented at the oral proceedings together with the drawings as granted,

Subsidiary request I: only Claims 1 and 2,

Subsidiary request II: only Claim 3.

VIII. The text of the claims is as follows, whereby in Claim 2 a clerical error has been rectified ("phase" should read "face") under Rule 88 EPC.

"1. An apparatus for controlling a driving force transmitted from a vehicle engine via a V-belt power

transmission (10) and an electromagnetic clutch (8) to a compressor of vehicle air conditioning equipment, with sensor means (13,16) comprising a first electromagnetical revolution sensor (13) for generating electric voltage pulses in response to the revolving rate of said compressor and a second electromagnetical revolution sensor (16) for generating electric voltage pulses in response to a second revolving rate of a second element of said apparatus, with control means comprising comparing means (15) connected to said first and second revolution sensors (13,16) for providing a signal to disengage said clutch (8) when the revolving rate of the compressor is reduced below a reference revolving rate, thereby interrupting the power to the compressor,

said apparatus being characterized in that

- (a) said first electromagnetical revolution sensor (13) comprises at one end of a drive shaft (5) of said compressor which drive shaft (5) is made of magnetic material a detected part (11) protruding at a position deviating from the axis of said drive shaft (5) and a detecting unit (13) being disposed opposite to a part of the locus of revolution of the end face of the detected part (11),
- (b) said second revolving rate is the revolving rate of the vehicle engine, and that
- (c) said comparing means comprises a comparator (15) providing said signal to disengage said clutch (8) when
 - (i) the ratio of the amplitude of the electric voltage pulses from said first revolution

sensor (13) to the amplitude of the electric voltage pulses from the second revolution sensor (16) is reduced below a prescribed value or

- (ii) the difference between said amplitudes is increased over a prescribed value.

2. An apparatus for controlling a driving force transmitted from a vehicle engine via a V-belt power transmission (10) and an electromagnetic clutch (8) to a compressor of vehicle air conditioning equipment, with sensor means (13,16) comprising a first electromagnetical revolution sensor (13) for generating electric voltage pulses in response to the revolving rate of said compressor and a second electromagnetical revolution sensor (16) for generating electric voltage pulses in response to a second revolving rate of a second element of said apparatus,

with control means comprising comparing means (15) connected to said first and second revolution sensors (13,16) for providing a signal to disengage said clutch (8) when the revolving rate of the compressor is reduced below a reference revolving rate, thereby interrupting the power to the compressor,

said apparatus being characterized in that

- (a) said first electromagnetical revolution sensor (13) comprises at one end of a drive shaft (5) of said compressor which drive shaft (5) is made of magnetic material, a detected part (11) protruding at a position deviating from the axis of said drive shaft (5) and a detecting unit (13) being disposed opposite to a part of the locus of revolution of the end face of the detected part (11),

(b) said second revolving rate is the revolving rate of the vehicle engine, and that

(c) said control means comprises a first counter (18) connected to said first electromagnetic revolution sensor (13) for counting said electric voltage pulses generated by said first revolution sensor (13) and for providing output signals proportional to said counted electric voltage pulses,

a second counter (19) connected to said second electromagnetical revolution sensor (16) for counting said electric voltage pulses generated by said second revolution sensor (16) and for providing output signals proportional to said counted electric voltage pulses,

an operator (20) connected to said first and second counters (18,19) for providing an output signal corresponding to the ratio of or the difference between said output signals of said first and second counters, and that

said comparing means comprises a comparator (21) connected to said operator (20) for providing an output signal to disengage said clutch (8) when said output signal of said operator (20) deviates from a predetermined value.

3. An apparatus for controlling a driving force transmitted from a vehicle engine via a belt, especially a V-belt power transmission (10) and an electromagnetic clutch (8) to a compressor of a vehicle air conditioning equipment, with sensor means (13) comprising an electromagnetical revolution sensor (13) for generating electric voltage pulses in response to the revolving rate of said

compressor with the amplitude of said pulses being approximately proportional to said revolving rate, said apparatus being characterized in that said control means comprises a discharge circuit (24) for discharging an electric output which increases with time, said discharging circuit (24) being arranged for receiving said electric voltage pulses so that said electric output returns to the zero level when the amplitude of any one of said electric voltage pulses is greater than a predetermined level, and a controller capable of providing an output signal to disengage said clutch (8) when said electric output of said discharge circuit (24) exceeds a prescribed value."

Reasons for the Decision

1. The appeal is admissible.
2. Amendments
 - 2.1 Claims 1, 2 and 3 are in substance combinations of the originally filed Claims 1+2, 1+3 and 1+4, respectively.

Claims 1 and 2 further include details of the first electromagnetical revolution sensor (see original page 2, line 29 to page 3, line 3) whereas in Claim 3 the feature that the amplitude of the voltage pulses generated by the sensor is approximately proportional to the revolving rate of the compressor (see page 7, lines 9-11 of the original description) is inserted. Claims 1 and 2 are now related to V-belt power transmission (shown in Fig. 1 of the application).

Since all amendments have a basis in the application as filed and do not result in extension of the protection

conferred, no objections arise under Article 123(2) and (3) EPC.

3. Novelty

3.1 The nearest prior art document is considered to be JP-A-55-100 430 (D12). Two translations (German) were available to the Board, one provided by the Opponent (Appellant) and one provided by the Opposition Division. The text of these translations, although different in wording, is in the opinion of the Board technically essentially identical, therefore in the following no reference to a specific one of these translations is made but, instead, to "D12" only, as far as the disclosure of this document is concerned.

3.2 The apparatus for controlling a driving force disclosed in D12 comprises all the features of the preamble of each independent Claim 1 to 3. All these claims comprise, with respect to D12, novel features in their characterising part, and therefore the two-part formulation of all claims meets the requirement of Rule 29(1) EPC.

3.3 Since no other document is available which discloses, in combination, all the features of Claims 1, 2 or 3, their subject-matter is novel and therefore these claims meet Article 54 EPC.

Novelty of the subject-matter of the present Claims 1 to 3 has in fact not been disputed by the Appellant, so that no further discussion of this matter is necessary.

4. Inventive step (Claims 1 and 2)

4.1 The subject-matter of the independent Claims 1 and 2 concerns alternatives in which the differences between these alternatives essentially relate to the treatment of

the sensor signals for arriving at a signal for disengagement of the electromagnetic clutch.

4.2 Considering Claim 1, the characterising features (a) to (c) relate respectively to

- (a) constructional details of the first sensor
- (b) the second revolving rate being the vehicle engine revolving rate and
- (c) details of the sensor signal processing and comparison step in order to provide a disengagement signal for the electromagnetic clutch.

As put forward by the Respondent (Proprietor) these features lead to the technical effects that, in contrast to the apparatus disclosed in D12, slippage not only in the clutch but in the whole drive train from the vehicle engine to the compressor rotor is taken into account for providing a clutch disengaging signal. Thereby the clutch is switched off before jamming of the compressor, resulting in slippage of the clutch, occurs and therefore a sensitive and more reliable control is provided (feature (b)). At the same time the apparatus is constructionally relatively simple both as regards the sensor means (feature (a)) as well as the signal processing means (feature (c)).

4.3 Proceeding on the basis of the above referenced prior art it is therefore the object of the invention set out in the first independent claim to provide relatively simple and more reliable means for preventing destructive damage to the compressor as well as damage to the vehicle engine due to overload (see also column 1, lines 20-28 of the valid description).

- 4.4 Considering the object of the invention, the Board holds the view that it can be expected from a person skilled in the art to recognise deficiencies which may arise during use of the known apparatus according to D12 and try to find a solution to overcome them.

Therefore if, despite of the known safety arrangement disclosed in D12, belt seizure still occurs the skilled man would try to find a solution to this problem.

However in the Board's view the prior art documents in combination with the general knowledge of a practitioner do not lead in an obvious way to the solution of Claim 1.

- 4.5 The problem of V-belt seizure due to compressor jamming is solved in D12 by detecting slip in the electromagnetic clutch of which one part is driven by means of a V-belt and the other part is mounted to the compressor rotor. This prior art concentrates solely on slip in the clutch for detecting compressor failure.

It is noted that according to the description the sensors for detecting the slip do not necessarily need to be located in the position shown in Fig. 1 (see also page 7, lines 18-22 of the translation III). However, in the context of D12 it is considered to be evident that they may be placed anywhere as long as they determine the slip in the clutch. Detecting eventual slip in other part of the drive train is, in the Board's opinion, not envisaged in this prior art, nor does D12 give a hint that before the clutch starts slipping, the degree of slip in the belt drive would be sufficient to base a signal upon.

Further, the sensors 17 and 18 in Fig. 1 of D12 as well as the control circuit 19 are only schematically shown and cannot be considered to give a lead to the details specified under features (a) and (c) of Claim 1.

For these reasons, in the opinion of the Board, the skilled man would not be led by the disclosure of D12 to find a solution to the underlying problem of the invention as set out above.

- 4.6 JP-A-47-41 680 (D13) and US-A-3 877 003 (D14) both relate to arrangements for detecting belt slip in a drive train from vehicle engine to driven components, in particular a fan and generator.

However it is observed that belt slip is detected merely to give a warning that belt slip occurs. In both D13 and D14 there is no reference, either explicit or implicit, that belt slip might result in breakage of the belt or that belt slip may also be interpreted as a warning of "jamming" of one of the driven components.

Although D14 is not restricted to a fan and alternator drive, in the sole embodiment disclosed the alternator voltage pulses are used as the reference signal for the alternator speed. The document is silent about the exact nature of detecting means for providing such a speed signal when other components are provided.

Thus, although in D13 and D14 belt slip in a drive train is determined to arrive at a warning signal or even (in D13) at a signal for initiating other engine cooling means, in the opinion of the Board no lead can be derived from these documents to the fact how, when incorporating not only clutch slip but also belt slip in the determination of differences in input and output speeds, a more reliable prevention of belt breakage or engine overload could be achieved.

5. In his arguments the Appellant stressed the point that the titles of D12 to D14 already must be regarded as providing a link between these documents.

However, as set out above, even when taking into account the disclosures of D13 and D14 the teachings of these documents cannot be considered sufficient to enable the skilled man to adapt the apparatus known from D12 in the way as claimed in either Claim 1 or Claim 2, in particular since these documents relate to a different problem to be solved involving belt slip warning - the belt slip itself being unwanted - rather than using the occurrence of belt slip in addition to eventual slip in a clutch as an indication of "jamming" of the driven member.

Further, no details of the detectors are disclosed in D13 and D14. In this respect the Board notes that the Appellant failed to provide any evidence that the detail of feature (a), which results in a simple and compact arrangement of the sensor unit, was known in the art. The argument that feature (a) relates to an obvious development of the sensor shown in Fig. 1 of D12 cannot be regarded as convincing in view of the details adding to the solution of the posed problem.

Therefore, considering normal skills and general technical knowledge of the skilled engineer when confronted with the problem underlying the present invention, it can, without ex post facto analysis, in the Board's opinion not be assumed that the skilled person would have considered combining teachings of D12 with D13 and D14 or vice versa, in a way leading to the subject-matter of Claim 1.

6. The independent Claim 2 differs from the independent Claim 1 solely with respect to feature (c) which comprises an alternative form of control means and comparing means. Although such control and comparing means are in itself essentially known from D14, no lead to the combination of features (a) to (c) in an apparatus defined in the preamble of Claim 2 can be derived from the cited

documents for the same reasons as set out with respect to Claim 1.

7. The other documents cited by the Appellant in the opposition procedure as well as the documents cited in the European Search Report do not appear to be of any importance with respect to the question of inventive activity of the apparatus of Claim 1 and Claim 2. None of these documents is considered to contain a lead to the characterising features of Claim 1 and the Appellant in the appeal procedure has not based any arguments on these documents. The Board does not consider it expedient to give a detailed explanation as to why these prior art documents are not considered particularly relevant.

8. **Formal Acceptability of Claim 3**

- 8.1 The apparatus according to Claim 3 relates to a solution in which only one revolution sensor for generating voltage pulses in response to the revolving rate of the compressor is used. Control means, comprising a discharge circuit for discharging an electrical output which increases with time and a controller giving an output signal to disengage the clutch when the output of the discharge circuit exceeds a prescribed value are provided for deciding on the basis of the single revolution signal if such switching off is necessary.

It is, in the Board's opinion, evident to the skilled man that the rate of electric output which increases with time as well as the said prescribed level and value will be selected in accordance with prevailing circumstances and may be, as suggested by the Respondent, fixed values or values depending upon the engine speed.

Leaving aside whether "floating" values are implicitly included in the apparatus according to Claim 3 or not, the Board considers that even fixed values can be selected such as to give a protection which is under certain circumstances more reliable than in the arrangement of D12: since the fixed value is related to the engine speed, the total drive train from engine to compressor shaft is taken into account rather than only part (such as only the clutch in D12) of it.

Since further the arrangement of Claim 3 using one sensor only is simpler when compared to the arrangement of D12 the apparatus defined in Claim 3 falls within the same object of the present patent as defined in column 1, lines 20-28.

For these reasons the Appellant's contentions that Claim 3 does not give a solution to the proposed problem is not considered convincing.

9. Inventive step (Claim 3)

The Board notes that none of the cited documents disclose or give a lead to a one sensor arrangement for controlling the drive force applied to a compressor. Also none of the cited documents contain a control means such as specified in Claim 3.

With respect to lack of inventive step the Appellant essentially argued that since the principle used in Claim 3, which is considered to relate to the so-called "Watch-Dog" arrangement, is well known, the solution claimed cannot substantiate inventive activity.

However, the Appellant not only failed to provide evidence which proved that the control means specified in Claim 3

are known as such in detail, but also no arguments were presented as to why the skilled man starting from the known apparatus disclosed in D12 would adopt such a "Watch-Dog" arrangement in an obvious manner.

Therefore, in the Board's opinion the Appellant's contentions are not well founded and since, as shown above, no lead can be derived from the documents on file to the proposed solution as claimed, also Claim 3 is considered to be based on an inventive activity.

10. For these reasons, the opposition grounds set out in Article 100(a) EPC do not prejudice the maintenance of the patent in amended form on the basis of the main request, after rectification of a clerical error in Claim 2 under Rule 88 EPC (see VIII of the Statement of Facts and Submissions). Consideration of the subsidiary requests is therefore redundant.

Order

For these reasons, it is decided that:

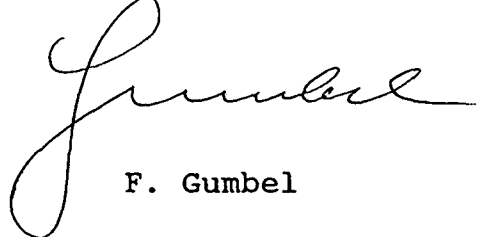
1. The impugned decision is set aside.
2. The case is remitted to the first instance with the order to maintain the patent on the basis of the Claims 1-3 and the description according to the main request filed during the oral proceedings, together with the drawings as granted.

The Registrar:



S. Fabiani

The Chairman:



F. Gumbel

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