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D E C I S I O N
of 25 February 2002

Case Number: T 0994/99 - 3.2.4

Application Number: 90305691.9

Publication Number: 0400907

IPC: F02D 9/02

Language of the proceedings: EN

Title of invention:
Throttle actuator and control system

Patentee:
Lucas Industries Limited

Opponent:
(I) Mannesmann VDO Aktiengesellschaft
(II) Robert Bosch GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56, 113(1), 123(3)
EPC R. 71(2)

Keyword:
"Main request: Amendments - Art. 123(3)"
"Auxiliary request: Inventive step - no"

Decisions cited:
G 0004/92

Headnote/Catchword:
-

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Case Number: T 0994/99 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 25 February 2002

Appellant: (Opponent II)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 23 August 1999 concerning maintenance of European patent No. 0 400 907 in amended form.**

Composition of the Board:

Chairman: C. A. J. Andries
Members: T. Kriner

C. Holtz

Summary of facts and submissions

I. The Appellant (Opponent II) lodged an appeal, received at the EPO on 19 October 1999, against the interlocutory decision of the Opposition Division dispatched on 23 August 1999 which maintained the European patent No. 0 400 907 in amended form. The appeal fee was paid simultaneously and the statement setting out the grounds of appeal was received at the EPO on 29 December 1999.

II. Opposition was filed against the patent as a whole and based on Article 100(a) EPC. The Opposition Division held that the grounds for opposition cited in Article 100(a) EPC did not prejudice the maintenance of the patent in the amended version submitted as a second auxiliary request.

III. The following documents have been considered in the appeal proceedings:

E1: EP-A-0 028 467
E7: DE-A-3 039 521.

IV. Oral proceedings took place on 25 February 2002.

Neither the Respondent (Patentee) nor the Party as of Right in accordance with Article 107 EPC (Opponent I) was represented at the oral proceedings although duly summoned. In accordance with the provisions of Rule 71(2) EPC the proceedings were continued without these parties.

The Appellant requested that the decision under appeal be set aside and the patent in suit be revoked.

The Respondent (Patentee) requested in writing that the appeal be dismissed and the patent be maintained on the basis of the second auxiliary request submitted during the opposition proceedings (main request) or that the decision under appeal be set aside and that the patent be maintained with claims 1 to 3 submitted with letter dated 7 February 2002 (auxiliary request).

The Party as of Right did not formulate a request.

V. Claim 1 of the main request reads as follows:

"A throttle actuator comprising a main throttle which is pivotable over a range of angular positions between a closed position and a fully open position, a return spring (19) biasing the throttle towards the closed position and providing a throttle-closing bias force which increases monotonically with increasing angular displacement of the throttle (2) from the closed position, and a torque motor for driving the throttle, the torque motor having permanent magnet rotor, being operable over a range of substantially 90°, and being directly coupled to the throttle, the actuator (1-21) having a single valued transfer function of throttle angular position against torque motor current over the range of angular positions of the throttle (2), whereby the torque motor (3) has a transfer characteristic of torque against throttle angular position such that, for each value of torque motor current less than or equal to a predetermined maximum value, motor torque decreases monotonically with increasing angular displacement of the throttle from the closed position towards the open position."

Claim 1 of the auxiliary request differs from this

claim only in that it is directed to "a throttle actuator comprising a main throttle of an internal combustion engine induction system", and by the insertion of the word "a" between "having" and "permanent magnet rotor".

VI. In support of his request the Appellant relied essentially on the following submissions:

The most relevant state of the art was represented by E1. This document disclosed all features of the present claims 1, except the one according to which the rotor of the torque motor was a permanent magnet rotor. Since it was obvious for the skilled person that a main throttle of an internal combustion engine induction system had to be operable over 90°, and that any additional means between the rotor and the throttle had to be avoided, the features according to which the rotor for the main throttle was operable over a range of substantially 90° and was directly coupled to said throttle, were implicitly disclosed in E1.

E7 showed that a ferromagnetic rotor, as disclosed in E1, and a permanent magnet rotor were equivalent and resulted in the same transfer characteristic of a corresponding torque motor. Hence it was obvious for the skilled person that the rotor of E1 could be replaced by a permanent magnet rotor as for example disclosed in E7, where circumstances made it desirable. Although E7 did not show a throttle actuator comprising a permanent magnet rotor and a return spring, there was no reason not to use these elements in combination, in particular as E7 did not exclude such a combination.

Furthermore E7 suggested the provision of a rotor which

was operable over a range of substantially 90° and which was directly coupled to a throttle. Therefore, even if such a rotor was not disclosed in E1, its use in the throttle actuator according to E1 was at least obvious, in particular in order to simplify the design of this actuator and to reduce the number of elements of the actuator.

Therefore, the subject-matter of the Respondent's requests did not involve an inventive step.

VII. The Respondent's arguments can be summarised as follows:

E7 did not relate to an actuator comprising a main throttle, but rather related to an actuator for a by-pass throttle which was used to control engine operation when idling. The actuator disclosed in E7 was therefore intended for use in a quite different situation to the throttle actuator of the patent in suit, and also that of E1. In addition, from a safety point of view, there was also a significant difference between control of a main throttle according to E1 and control of a by-pass throttle according to E7. Consequently, there was no motivation for the skilled person to combine the teachings of E1 and E7.

Furthermore, there was no disclosure in E7 of an arrangement including a permanent magnet rotor acting against a return spring to provide a fail-safe capability. In fact it was clearly stated in E7 that, when the rotor took the form of a permanent magnet, a return spring was not required. E7 therefore taught the skilled person away from an arrangement having a permanent magnet rotor in combination with a return

spring.

Consequently the subject-matter of the present claims was not obvious and was based on an inventive step.

Reasons for the decision

1. The appeal is admissible.

2. *Amendments*

2.1 The granted version of the patent in suit comprises two sets of claims. Claim 1 for the Contracting States BE, IT and NL refers to a throttle actuator comprising a main throttle of an internal combustion engine induction system, and claim 1 for the Contracting States DE, ES, FR, GB and SE refers to a throttle actuator comprising a throttle.

Claim 1 of the Respondent's main request is valid for all of the above cited Contracting States and refers to a throttle actuator comprising a main throttle. Since a main throttle is not restricted to a main throttle of an internal combustion engine induction system, the subject-matter of this claim has been extended in comparison to the granted claim 1 for the Contracting States BE, IT and NL.

Consequently the amendments to claim 1 of the Respondent's main request do not meet the requirements of Article 123(3) EPC, and the Respondent's main request is not allowable. This finding, about which the parties have been informed with the Board's

communication of 28 November 2001, has not been challenged by the Respondent.

2.2 The documents of the auxiliary request do not give a reason to an objection under Article 123(2) or (3) EPC.

3. *State of the art*

3.1 E1 discloses a throttle actuator comprising a main throttle of an internal combustion engine induction system (see for example page 7, lines 12 to 14) which is pivotable over a range of angular positions between a closed position and a fully open position (well known by the skilled person and therefore implicit), a return spring (coil spring 40, see page 4, lines 33 to 35) biasing the throttle towards the closed position and (inevitably) providing a throttle-closing bias force which increases monotonically with increasing angular displacement of the throttle from the closed position, and a torque motor for driving the throttle, the torque motor having a rotor (24), the actuator having a single valued transfer function of throttle angular position against torque motor current over the range of angular positions of the throttle (see fig. 3), whereby the torque motor has a transfer characteristic of torque against throttle angular position such that, for each value of torque motor current less than or equal to a predetermined maximum value, motor torque decreases monotonically with increasing angular displacement of the throttle from the closed position towards the open position (see fig. 5c).

However, E1 does not disclose that the rotor

(a) is a permanent magnet rotor,

(b) is operable over a range of substantially 90°, and

(c) is directly coupled to the throttle.

The Appellant's argumentation that features b and c are implicitly disclosed in E1 is not convincing. Although it is well known that a main throttle of an internal combustion engine induction system has to be operable over a range of substantially 90° and that an element which is not absolutely necessary should be avoided in a combustion engine, this does not mean that the rotor of the actuator shown in E1 has to be operable over substantially 90° and to be directly coupled to the main throttle of a combustion engine system. With respect to the turnability of the rotor, E1 is silent, and with respect to the connection between the rotor and the throttle, E1 merely teaches (see page 4, lines 2 to 5) that the output shaft of the actuator may be coupled to the butterfly valve of a carburettor. Since these teachings do not exclude the arrangement of a gear between the rotor and the throttle, the design of the rotor of E1 is not inevitably restricted to features b and c. On the contrary, from figure 1 which shows the rotor in a position where it is biased to a first position (see page 4, lines 33 to 35), it may be concluded that the rotor is not movable over a range of 90°, but rather over a range of at most 45°. As a result it is not possible to couple the rotor shown in figure 1 of E1 directly to a throttle which has to be operable over a range of 90°. Therefore the Board cannot agree that features b and c are implicitly disclosed in E1.

3.2 E7 discloses a first throttle actuator (corresponding to the subject-matter according to claims 1 and 2 of

E7) comprising a throttle (7) which is pivotable over a range of angular positions between a closed position and a fully open position, and a torque motor (1) for driving the throttle, the torque motor having a permanent magnet rotor (3), being operable over a range of substantially 90° (see page 3, lines 13 to 19), and being directly coupled to the throttle (see page 3, lines 6 to 8), the actuator having a single valued transfer function of throttle angular position against torque motor current over the range of angular positions of the throttle (see page 5, lines 15 to 21 in combination with page 3, lines 27 to 30).

Additionally E7 discloses a second throttle actuator(corresponding to the subject-matter according to claims 1 and 3 of E7) comprising a main throttle (7) which is pivotable over a range of angular positions between a closed position and a fully open position, a return spring (10) biasing the throttle towards the closed position and providing a throttle-closing bias force which increases monotonically with increasing angular displacement of the throttle from the closed position, and a torque motor (1) for driving the throttle, the torque motor having a rotor, being operable over a range of substantially 90°, and being directly coupled to the throttle, the actuator having a single valued transfer function of throttle angular position against torque motor current over the range of angular positions of the throttle.

However, the throttle actuators described in E7 comprise neither a main throttle of an internal combustion engine induction system, nor a torque motor having a transfer characteristic of torque against throttle angular position such that, for each value of

torque motor current less than or equal to a predetermined maximum value, motor torque decreases monotonically with increasing angular displacement of the throttle from the closed position towards the open position.

Moreover, the first throttle actuator of E7 does not comprise a return spring biasing the throttle towards the closed position and providing a throttle-closing bias force which increases monotonically with increasing angular displacement of the throttle from the closed position, and the second throttle actuator of E7 does not comprise a permanent magnet motor.

3.3 With respect to the above findings, the subject-matter of claim 1 of the auxiliary request is novel.

4. *Inventive step*

4.1 The most relevant state of the art with respect to claim 1 of the auxiliary request is represented by E1 which, like the patent in suit, refers to a throttle actuator comprising a main throttle of an internal combustion engine induction system.

As shown in section 3.1 above, the subject-matter of claim 1 of the auxiliary request differs from the throttle actuator of E1 in that the rotor

(a) is a permanent magnet rotor,

(b) is operable over a range of substantially 90°, and

(c) is directly coupled to the throttle.

Since it is neither visible nor described in the patent in suit that the use of a permanent magnet rotor instead of a ferromagnetic rotor results in a special technical effect, the problem to be solved when starting from E1 may be regarded as being to provide an alternative throttle actuator having a simple technical design.

In order to provide a simplified throttle actuator, E7 suggests the provision of a rotor which is operable over a range of substantially 90° and directly coupled to a throttle (see page 3, lines 1 to 19). Additionally E7 shows that a ferromagnetic rotor and a permanent magnet rotor are technical equivalents with respect to the transfer characteristics of the corresponding torque motor which may be selected at will (see page 5, lines 15 to 21 in connection with page 3, lines 27 to 37). The provision of a rotor having features a, b and c in an actuator according to E1 is therefore an obvious design possibility for the skilled person in order to solve the problem as set out above.

4.2 The Respondent's argumentation that the skilled person would not combine the teachings of E1 and E7 is not convincing. It is true that E1 refers to a main throttle and E7 to a by-pass throttle of a combustion engine induction system, and that from a safety point of view there is a difference between control of a main throttle and control of a by-pass throttle. However, since both types of throttles belong to the same technical field and the skilled person for main throttles and for by-pass throttles is one and the same, there is no reason not to consider E7 when looking for a solution of a general problem which, as in the present case, is not dependent on a certain type

of throttle.

The Board does also not share the Respondent's opinion that E7 taught the skilled person away from an arrangement having a permanent magnet rotor in combination with a return spring. Although E7 discloses a first actuator comprising a permanent magnet rotor without a return spring, and a second actuator comprising a ferromagnetic rotor and a return spring, a combination of a permanent magnet rotor and a return spring is not excluded by E7. On the contrary, the statement on page 5, lines 3 to 6, according to which a return spring is not necessary when the rotor is a permanent magnet rotor, shows that it is up to the skilled person to decide whether or not to use a return spring in combination with a permanent magnet rotor. In case of control of a by-pass valve as shown in E7, where safety requirements are relatively low, it is likely that he would abandon the use of a return spring in combination with a permanent magnet rotor. However, if there were higher safety requirements, the skilled person would not provide a permanent magnet rotor without a return spring. Consequently, E7 does not teach away from a combination of a permanent magnet rotor and a return spring.

4.3. The Board therefore comes to the conclusion that the subject-matter of claim 1 according to the auxiliary request does not involve an inventive step.

5. During the oral proceedings no new facts or evidence were presented which were needed to reach the present decision. In analogy as to what has been stated in section 10 of the opinion of the Enlarged Board of Appeal in case G 4/92 (OJ EPO 1994, 149) the

requirements of Article 113(1) EPC have been satisfied.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

G. Magouliotis C. Andries