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Bezeichnung der Erfindung: Linear position encoder
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : H03M 1/22

ENTSCHEIDUNG / DECISION
vom / of / du 23 November 1989

Anmelder / Applicant / Demandeur : CATERPILLAR INDUSTRIAL INC.

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé : "Inventive step (yes)"

Leitsatz / Headnote / Sommaire

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Case Number : T 479/88 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal
of 23 November 1989

Appellant : CATERPILLAR INDUSTRIAL INC.
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Decision under appeal : Decision of Examining Division 068 of the European Patent Office dated 22 June 1988 refusing European patent application No. 84 901 924.5 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : P.K.J. van den Berg
Members : W.B. Oettinger
E. Persson

Summary of Facts and Submissions

I. European patent application No. 84 901 924.5, filed under the PCT on 30 April 1984 claiming a priority of 21 February 1984 and published under No. WO 85/03822, was refused by a decision of Examining Division 2.2.01.068 of the European Patent Office dated 22 June 1988.

The reason given for the refusal was that the subject-matter of Claims 1-13 filed on 8 March 1988 did not involve an inventive step having regard to the following prior art documents:

D1: EP-A-7 267
D2: US-A-4 342 910
D3: US-A-3 796 498
D4: FR-A-1 354 422
D5: US-A-4 110 611.

More particularly, it was held that the subject-matter of Claim 1 is an obvious modification of the position encoder of D1 or D5, particularly in view of D2 and in the light of D3.

II. On 11 August 1988 the applicant appealed against that decision, paid the appeal fee and filed a statement of grounds of appeal together with amended versions of the characterising portion of Claim 1.

III. In response to a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, the Appellant amended, on 20 October 1989, the characterising portion of Claim 1 still further and replaced the dependent claims.

With this amendment, Claim 1 reads as follows:

"A position encoder (10) for sensing a plurality of positions of a control member (28) of a vehicle (12), the encoder comprising a base (30) having first and second end portions (32, 34) and a central longitudinal axis (38) passing through the end portions (32, 34); a moveable member (40) having a substantially planar first mounting surface (46) and a first end portion (42), the mounting surface (46) having a plurality of spaced apart pathways (54a-d) extending substantially parallel to one another and to the central axis (38) along the first mounting surface (46), the moveable member first end portion (42) passing through the base first end portion (32) and being connectable to the control member (28), the moveable member (40) being moveable along the central axis (38) between the base end portions (32, 34) in response to movement of the control member (28); a mounting member (62) having a substantially planar second mounting surface (64) positioned substantially parallel to and spaced apart from the first mounting surface (46), the second mounting surface (64) having a plurality of spaced apart pathways (66a-d) extending substantially parallel to one another along the second mounting surface (64), each of the pathways (66a-d) being aligned with a respective one of the first mounting surface pathways (54a-d); a plurality of sensors (68a-d) each having a light emitter mounted on the second mounting surface (64) along a different one of the second mounting surface pathways (66a-d) and being associated with a respective optical transmission path from the light emitter to a respective light receiver; and a plurality of sensible members (72a-d) each mounted on the first mounting surface (46) along the first mounting surface pathways (54a-d), the sensible members (72a-d)

being of a construction and location sufficient for interrupting or failing to interrupt respective ones of the optical paths (70a-d) in response to the position of the moveable member (40) relative to the mounting member (62); characterised in that the light emitters and the light receivers of the sensors (68a-d) are provided by similar U-shaped opto-isolators which are mounted on respective ones of the pathways (66a-d) of the second mounting surface (64) with the arms of the U projecting towards the first mounting surface (46) and each of which includes a light emitter in one arm of the U and a light receiver in the other arm of the U and an optical pathway between the emitter and receiver; and in that the sensible members (72a-d) are fins projecting from the pathways on the first mounting surface (46) towards the second mounting surface (64) for extension into and movement through the U's of the opto-isolators on the respective aligned pathways on the second mounting surface and each fin is of discrete length with gaps along the pathways (54a-d) between and beyond the end of the sensible members."

All further claims are dependent upon Claim 1.

IV. In a further Communication, the Board cited, as proof of the prior art mentioned on page 6, lines 17 ff. in the description ("U-shaped" or "slotted" opto-isolators), the following document:

D6: TRW Optoelectronics Data Book, TRW Optron Texas 1982, page 216.

V. In oral proceedings held on 23 November 1988, the Appellant argued, in response to reservations of the Board in respect of an inventive step, essentially as follows:

D1 discloses an encoder with light emitters mounted on a board above the slidable mask (300) and light receivers mounted on a separate board below this mask.

The claimed invention was conceived as a mass product having high reliability in a rugged environment such as in a vehicle. The encoder of D1 is not suitable for this purpose, particularly for the reason that the mask is a film and its transparent zones would be obscured by dust.

As a primary object, the invention solves this problem by eliminating the transparent windows, viz. replacing them by gaps.

The invention further replaces the emitter and receiver boards by a single board carrying opto-isolators. This reduces the required space and makes the encoder simpler to fabricate.

By using U-shaped opto-isolators, the power required for the light transmitters is reduced and any alignment problems are eliminated.

In order to achieve all these advantages, starting out from D1, the skilled person would have to perform, in fact, three steps.

The first would be to take off the transparent material. This step may be suggested by D2, although it would weaken the mask.

The second would be to replace the emitter and receiver boards by a single opto-isolator board. This step may, in principle, be suggested by D6, but the skilled person would see that the arrangement with U-shaped opto-isolators could not work because their light paths would lie in the wrong

plane. He would, for this reason, probably discard the idea of using U-shaped opto-isolators.

As a third step, in the invention each series of opaque zones cooperating with one sensor is turned up to form a series of fins. This does not only enable it to engage the slot of the respective opto-isolator but avoids also the weakening of the mask by gaps.

This combination of measures constitutes far more than simply applying the teaching of D6 to the encoder of D1 and cannot reasonably be held as obvious to a person skilled in the art.

VI. The Appellant requests that the decision under appeal be set aside and a patent granted on the basis of Claims 1-12 filed on 20 October 1989, with the prior art part of Claim 1 corresponding to that of Claim 1 filed on 8 March 1988, and the description yet to be adapted to Claim 1.

According to the file, the description comprises pages 1, 2, 2A, 3-5, 8 and 13 filed on 8 March 1988, pages 6 and 9-12 as published, and page 7 filed on 20 October 1989.

From this description it follows that the Appellant's request further includes the drawings, 6 sheets, as published.

Reasons for the Decision

1. The appeal is admissible.

2. The amended claims are formally admissible.

Claim 1 is based on the original Claim 6 in conjunction with the description of an embodiment on page 6, line 10 to page 7, line 12; Claims 2-12 are based on the original Claims 2-4 and 7-14.

3. As far as the description is concerned, the Appellant's request (cf. VI) implies in particular that the text on page 2A, lines 20-26 be replaced by the text of the characterising clause of Claim 1 ("Proposal C") and that on page 6, the phrase "In the preferred embodiment" be deleted in lines 16 and 33.

4. The subject-matter of Claim 1 being clearly new, the only issue to be decided is whether it involves an inventive step.

4.1 The Board agrees with the Appellant's submissions (paragraph V) in essentially all respects.

Starting out from the encoder of D1, it would clearly be obvious to try to replace the two separate emitter/receiver boards by a single opto-isolator board, in order to make use of the obvious advantages of "integrated" emitter/receivers, and there may be obvious ways to implement this replacement. However, in the Board's opinion, the kind of implementation claimed is not an obvious one.

4.2 One of the obvious possibilities would seem to be what may be called the most straightforward replacement of each pair of an emitter and receiver, mounted respectively on the uppermost and lowermost board (or vice versa) shown in Figure 2 of D1, by a single emitter/receiver of the kind known from D6, namely a replacement which does not change the direction and location of its light path and does not, therefore, change the direction and location of that part

of the mask (300) which is intended to interrupt or not the light path, or of the mask as a whole. In this replacement, the opto-isolator would form a C in Figure 2 of D1 and it would be mounted on either the upper or lower board, eliminating the other board.

The implementation would be rendered possible by merely cutting the mask into respective strips for allowing the yokes of the opto-isolators to be received in the cuts.

4.3 Another obvious possibility would reside, in order to avoid the necessity of cutting the mask into strips, in discarding the idea of using similar "Slotted Optical Switches" (D6) and using non-standard opto-isolators for C-mounting, having slots of different depths, instead. If they were not available, it would not be a problem to specially design them.

The only problem would be that the different opto-isolators would be in each other's way, but this problem could be solved by a staggered arrangement.

4.4 The skilled person would hardly find, in D1 or D6, any reason for mounting the opto-isolators not so as to form a C, but even if he did consider this possibility the result would not necessarily be the one claimed.

It is clearly obvious that if the opto-isolators are mounted, on one of the boards in Figure 2 of D1, so as to form a U (or an inverted U) their slots could not engage the corresponding parts of the mask.

For this reason, it would appear that the most obvious modification to be made in this case would be discarding the idea of using U-shaped opto-isolators and using emitter/receiver combinations based on the otherwise well-

known reflection principle instead, with the opaque areas of the mask being replaced by non-reflecting areas and the transparent ones replaced by reflecting areas.

4.5 In these circumstances and in the absence of any suggestion in D1 or D6 to consider any further change, the additional changes claimed, consisting of the following features, are regarded, in combination, as non-obvious:

- The opto-isolators are mounted, on their board, so as to form a U (or inverted U) with the slot facing the board carrying the mask, but the individual strips of the mask are turned up so as to engage the slots, whereby no cut-outs weakening the board are required;

- the opaque areas of the strips are replaced by (rigid) fins and their transparent areas are replaced by gaps, i.e. omitted, not surrounded by any "frame".

4.6 From D2 it is known to use rigid parts, but not fins, and gaps, but still framed, between them (Figure 1) as an encoder slide, but not in a multiple slide encoder.

It does not provide an incentive for solving the aforementioned problems arising with the attempts to replace the separate emitters and receivers of a multiple slide encoder (D1) by standard U-shaped opto-isolators (D6).

4.7 None of the other prior art documents on file comes nearer to the claimed invention than those considered above, i.e. D1, D6 and D2.

4.8 The subject-matter of Claim 1 being, therefore, non-obvious, Claim 1 is allowable. So are Claims 2-12, which are dependent upon Claim 1 and which recite further embodiments of the invention according to claim 1.

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 grant a patent according to the Appellant's request as referred to in the foregoing paragraph VI under the proviso that the description is amended as indicated in paragraph 3 of the reasons of this decision.

The Registrar: The Chairman:

S. Fabiani P.K.J. van den Berg