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D E C I S I O N
of 7 June 1994

Case Number: T 0191/93 - 3.4.2
Application Number: 84104945.5
Publication Number: 0127776
IPC: G01L 9/00, G01L 13/02

Language of the proceedings: EN

Title of invention:
Semiconductor differential pressure transducer

Applicant/Patentee:
Hitachi, Ltd.

Opponent:
(01) Endress + Hauser GmbH + Co.
(02) Siemens AG

Headword:
-

Relevant legal norms:
EPC Art. 123(2), 123(3), 84, 56

Keyword:
"Main request: additional subject-matter (yes)"
"1st auxiliary request: protection extended (no)"
"Additional subject-matter (no)"
"Clarity (yes)"
"Inventive step (yes)"

Decisions cited:
T 0169/83, T 0066/85

Catchword:
Amendments introducing new features including the expressions
"much nearer" which are based exclusively on the original
drawings and which are isolated from other features derivable

from said drawings extend the subject-matter beyond the content of the application as filed if, without said other features, the defined subject-matter is ambiguous and thus its features do not provide greater precision (c.f. T 0169/93, OJ EPO 1985, 193).

Case Number: T 0191/93 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 7 June 1994

Appellant: Siemens AG
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Representative: -

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Representative: -

Decision under appeal: Decision of the Opposition Division of the European Patent Office dated 19 November 1992, written decision posted on 22 December 1992 rejecting the opposition filed against European patent No. 0 127 776 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: E. Turrini

Members: M. Chomentowski

M. Lewenton

Summary of Facts and Submissions

- I. The Respondent is proprietor of European patent No. 0 127 776 which was granted on the basis of European patent application No. 84 104 945.5.
- II. An opposition was filed by the Appellant (Opponent) and by a further opponent on the grounds that the granted patent contained subject-matter extending beyond the content of the original application and that it lacked an inventive step having regard to i.a.
- D1 = US-A-4 135 408 and,
D3 = US-A-4 342 231.
- III. The opposition was rejected. The Opposition Division took the view that the expression "much nearer" is based on the "excellent technical drawings" of the opposed patent in particular by measuring the distances shown thereon; thus, there can be no surprise to the public because "the direction of the patent is the same as that of the original patent application", namely concerning the arrangement of the different features; indeed, decisions T 0169/83 and T 0066/85 both emphasize the importance of drawings with respect to additional subject-matter. The Opposition Division also concluded that the opposed transducer was inventive since the skilled person starting from the device known from D3 and trying to make it more compact while keeping it shock-proof as required in the opposed patent would not be incited to take into account the teaching of D1 because it is a different type of transducer, while making the transducer of D3 more

compact can obviously be done otherwise by shortening some parts of the transducer.

IV. The Appellant (Opponent) lodged an appeal against this decision. The further Opponent approved the Appellant's arguments but did not participate any more to the procedure.

V. In a communication accompanying the invitation to oral proceedings requested auxiliarily by the parties, the Board of Appeal expressed the opinion that the subject-matter of the patent appeared to have been extended as compared to the original application and, additionally, to lack an inventive step having regard to D1 and D3.

VI. During the oral proceedings of 7 June 1994, the Respondent submitted three new sets of claims and requested that the appeal be dismissed and the patent be maintained accordingly on the basis of a main request or of a first or second auxiliary request, with the description and drawings as granted. Claim 1 of the main request reads as follows:

"1. A semiconductor differential pressure transducer comprising

(a) a pressure receiving part (10, 11),

(b) first and second pressure receiving diaphragms (12, 13) forming first and second pressure receiving chambers (14, 15) at both sides of said pressure receiving part,

- (c) a compensating diaphragm (16) forming first and second compensating chambers (17, 18) at both sides of said compensating diaphragm in said pressure receiving part,
- (d) a semiconductor differential pressure sensor (21) forming at both sides thereof first and second pressure measuring chambers (26, 27), respectively,
- (e) first and second pressure leading paths (19, 20) for making to communicate said first pressure receiving chamber (14) with said first compensating chamber (17) and for making to communicate said second pressure receiving chamber (15) with said second compensating chamber (18), respectively, whereby said first and second compensating chambers (17, 18) are facing to said first and second pressure receiving chambers (14, 15),
- (f) third and fourth pressure leading paths (28, 29) for making to communicate said first compensating chamber (17) with said first pressure measuring chamber (26) and for making to communicate said second compensating chamber (18) with said second pressure measuring chamber (27), respectively,
- (g) said first pressure receiving chamber (14) and said first pressure measuring chamber (26) and said second pressure receiving chamber (15) and said second pressure measuring chamber (27) communicating with each other through said first

and second compensating chambers (17, 18),
respectively,

- (h1) said compensating chambers (17, 18) are disposed much nearer to said first pressure receiving chamber (14) than said second pressure receiving chamber (15), characterized in that,
- (h2) said compensating chambers (17, 18) are disposed much nearer to said first pressure receiving chamber (14) than to said second pressure receiving chamber (15),
- (i) said semiconductor differential pressure sensor (21) and said first and second pressure measuring chambers (26, 27) are disposed between said second compensating chamber (18) and said second pressure receiving chamber (15) in said pressure receiving part (10, 11) so that said second compensating chamber (18) and said second pressure measuring chamber (27) are disposed between said first compensating chamber (17) and said first pressure measuring chamber (26),
- (j) whereby the first side including said first pressure receiving chamber (14) is the high pressure side and the second side including said second pressure receiving chamber (15) is the low pressure side."

Claims 2 to 7 are dependent claims.

Claim 1 of the first auxiliary request includes, in addition to the features of Claim 1 of the main request, the following feature:

"(k) said semiconductor differential pressure sensor (21) is attached to said pressure receiving part (10, 11) through a hollow support (22)".

Claims 2 to 6 of the first auxiliary request are dependent claims.

There was also a second auxiliary request.

- VII. The Appellant requested that the patent be revoked. He submitted the following arguments in support of his request: The amendments specifying that chambers are "much nearer" to others or than others in the pressure receiving part and which were not mentioned in the application as filed or, for some of them, in the patent as granted, constitute "new surprising matter" for the skilled person reading the original application or the granted patent and render the claims unclear; moreover, deleting the feature that chambers are formed "through" the compensating chambers extends the protection. Thus, these amendments are formally not allowable. Moreover, it is an obvious step for the skilled person starting from D3 and trying to make this known device more compact to bring the semiconductor sensor within the pressure receiving part, because he can achieve this either by simple constructional considerations with D3 alone, or by taking into account the teaching of D1, which relates also to a differential pressure transducer having the sensor within the pressure receiving part.

VIII. The Respondent argued substantially as follows in support of his requests: The amendments specifying that some chambers are "much nearer" to other chambers or than other chambers are based on the drawings of the application as filed and, accordingly, of the patent in suit. This is allowed by decisions of the Boards of Appeal. Starting from the differential pressure transmitter of D3, the skilled person would not be incited to make it more compact because it is already the result of a modification of prior devices with this purpose. Moreover, the skilled person would not be incited to use the teaching of D1 because this document relates to a pressure transducer of a different type, wherein the semiconductor sensor being indeed in the pressure receiving part is attached to a moving element, i.e. the moving partition within a chamber and not to a fixed element; said chamber is not a compensating chamber in the sense of the patent in suit because the semiconductor sensor is directly in contact with incoming pressure.

Reasons for the Decision

- 1. The appeal is admissible.
- 2. *Main request*
 - 2.1 Allowability of the amendments

The features (h1) and (h2), that the compensating chambers (17, 18) are disposed much nearer to the first pressure receiving chamber (14) than the second pressure receiving chamber (15), and much nearer to the first pressure receiving chamber (14) than to the

second pressure receiving chamber (15), are not mentioned in the original application; moreover, no indication about the meaning to be attributed to "much nearer" in (h1) or in (h2), or to the meaning of "much nearer" when comparing (h1) with (h2), is derivable from the application as filed. Indeed, as admitted by the Respondent, the amendment having led to these features is based exclusively on the original drawings. The Appellant has argued that, basing two amendments such as those resulting in (h1) and (h2) exclusively on an appreciation of particular features of the original drawings which were not derivable as being particularly important as compared to the other features shown, can result in legal uncertainty; whereas according to the conclusions of the decision T 0169/83, OJ EPO 1985, 193 (see paragraphs 2.5, 3.6, second part and 3.7, first part) the original drawings can be used for providing greater precision to features, in the present case, new features ("much nearer") have been introduced which, moreover, are not clear. The Appellant's argument is convincing for the following reasons: Indeed, the introduced particular features (h1) and (h2) are selected among other features of the original drawings; however, this selection of features is arbitrary in the sense that it is not directly derivable from the original application that (h1) and (h2) can be isolated from said other features shown in the drawings and greater precision of the features is not achieved because according to present Claim 1 said other features can be chosen different from those shown in the drawings in such a way that the definition of the subject-matter can be ambiguous. In this respect, it is to be noted that the embodiments illustrated in the original application (see also page 4, line 26 to

page 6, line 19 and Claim 4) show the semiconductor differential pressure sensor (21) being attached to the pressure receiving part (10, 11) through a hollow support (22), and more in particular the sensor being welded to a metallic sealing fitting (23) through a support (22) located in a concave portion of the pressure receiving part (10, 11). Moreover, the application as filed (see page 1, line 25 to page 2, line 4) indicates that a previous sensor attached to a moving part was submitted to vibrations with a negative effect, and it is thus derivable that the sensor is to be attached to the pressure receiving part. Thus, a transducer in the sense of present Claim 1 comprising in particular the above-mentioned isolated features (h1) and (h2) and wherein the semiconductor differential pressure sensor is not attached to said pressure receiving part through a hollow support, is not derivable from the application as filed. Therefore, the European patent has been amended in such a way that it contains subject-matter which extends beyond the content of the application as filed and, thus, the main request is not allowable (Art. 123(2) EPC).

3. *First auxiliary request*

3.1 Allowability of the amendments

3.1.1 Contrary to Claim 1 as granted, present Claim 1 does not specify that the first and second pressure measuring chambers (26, 27), which are at both sides of the semiconductor sensor of the transducer, respectively, are formed "through" the first and second compensating chambers (17, 18). However, it is derivable from the drawings and the corresponding

description parts as granted that, contrary to the terms of Claim 1 as granted, said first and second pressure measuring chambers (26, 27) are not formed "through said first and second compensating chambers (17, 18)", but are connected thereto by pressure leading paths (28, 29). The claim as amended thus specifies in accordance with the drawings the particular "serial" disposition of the pressure leading paths and chambers stressed by the Respondent in his argumentation, in particular the feature (g) that the first pressure receiving chamber (14) and the first pressure measuring chamber (26) and the second pressure receiving chamber (15) and the second pressure measuring chamber (27) are communicating with each other through said first and second compensating chambers (17, 18), respectively. Moreover, by cancelling the above mentioned feature that said first and second pressure measuring chambers (26, 27) are formed "through said first and second compensating chambers (17, 18)" which is in contradiction with the drawings and thus ambiguous, the amendment only deletes those features which are in contradiction with the drawings. Thus, the scope of Claim 1 in dispute has not been extended but restricted to the embodiments illustrated by the drawings as granted which, in accordance with Article 69(1) EPC and the Protocol on the interpretation of Article 69, are used to determine the protection conferred. Moreover, the other amendments, for instance (h2) that the compensating chambers (17, 18) are disposed much nearer to the first pressure receiving chamber (14) than to the second pressure receiving chamber (15), shown in the drawings as granted, and (k) that the semiconductor differential pressure sensor (21) is attached to the pressure

receiving part (10, 11) through a hollow support (22), which is based on dependent Claim 4 as granted, result in the claim being restricted more closely to the embodiments illustrated by the drawings as granted. Therefore, the claims of the European patent have not been amended during opposition proceedings in such a way as to extend the protection conferred (Art. 123(3) EPC).

3.1.2 The new feature (k) concerning the hollow support of the semiconductor sensor is disclosed together with the above-mentioned features (h1) and (h2) in particular in the drawings as originally filed. The Appellant has argued that by taking into account in Figure 2 the slight gap between the plate (52) and the third member (51) which is communicating with the second compensation chamber (18) through the pressure leading path (20) and which can thus be considered as being a part of said second compensating chamber (18), the drawing does not show the presently claimed distance relation, i.e. the compensating chamber (17, 18) formed by the first and second compensating chambers (17) and (18) is not disposed much nearer to said first pressure receiving chamber (14) than to said second pressure receiving chamber (15), but at about the same distance. However, this argument is not convincing for the following reasons: it is derivable from the application as filed (see page 8, line 20 to page 9, line 21) that Figure 2 differs from Figure 1 mainly in that the former one shows a construction wherein the first member (10) of the pressure receiving part (10, 11) is equipped with a third member (51) for supporting low side receiving diaphragm and with a further plate (52), so that this construction can be assembled from both

sides because of the symmetry thereof and can thus provide a high working efficiency; yet, there is no derivable indication about a related effect on the compensating chambers; moreover, in the application as filed (see page 2, line 17 to page 3, line 2) the compensation chamber is defined as including a high pressure side compensating chamber and a low pressure side compensating chamber separated by a compensating diaphragm placed at the center of the compensating chamber; thus, the leading path (20) and the slight gap between the third member (51) and the plate (52) cannot be considered as being part of the compensating chamber (17, 18) in the sense of the application as filed and in particular of Figure 2, which shows the so defined compensating chamber (17, 18) which is much nearer to the first receiving chamber (14) than to the second receiving chamber (15). The further argument of the Appellant that the features (h1) and (h2) based exclusively on the original drawings introduce unclarities is also not convincing because said features (h1) and (h2) with their terms "much nearer", in combination with the other features of Claim 1 in dispute, in particular with feature (k), express with greater precision the respective locations and functions of the different elements of the transducer such as the chambers and pressure leading paths in the same relation as that shown in the original drawings. Therefore, the present patent has not been amended in such a way that it contains subject-matter which extends beyond the content of the application as filed (Art. 123(2) EPC).

3.2 Clarity of Claim 1

The terms "much nearer" are not defined in Claim 1 in dispute. However, these terms, in combination with the further claimed features such as the corresponding leading paths, the semiconductor sensor and the indicated relation to high and low pressure respectively, define spatial relative dispositions of the different chambers in the pressure receiving part of the differential pressure transducer in accordance with the drawings of the patent in suit. Therefore, Claim 1 in dispute is clear in the sense of Article 84 EPC.

3.3 Novelty

The novelty of Claim 1 in dispute has not been contested (Art. 54 EPC).

3.4 Inventive step

3.4.1 A semiconductor differential pressure transducer is known from D3 (see column 1, lines 59 to 64; column 2, lines 5 to 32; column 2, line 57 to column 6, line 28; Figure 1, 2a and 2b); this transducer comprises:

- (a) a pressure receiving part (2, 3);

- (b) first and second pressure receiving diaphragms (7, 8) forming first and second pressure receiving chambers (9, 10) at both sides of said pressure receiving part;

- (c) a compensating diaphragm (4) forming first and second compensating chambers (5, 6) at both sides of said compensating diaphragm (4) in said pressure receiving part (2, 3);
- (d) a semiconductor differential pressure sensor (108) forming at both sides thereof first and second pressure measuring chambers (no reference numerals), respectively,
- (e) first and second pressure leading paths (11, 12) for making to communicate the first pressure receiving chamber (9) with the first compensating chamber (5) and for making to communicate the second pressure receiving chamber (10) with the second compensating chamber (6), respectively, whereby said first and second compensating chambers (5, 6) are facing to said first and second pressure receiving chambers (9, 10);
- (f) third and fourth pressure leading paths (22, 105; 23, 106) for making to communicate said first compensating chamber (5) with said first pressure measuring chamber and for making to communicate said second compensating chamber (6) with said second pressure measuring chamber, respectively;
- (g) the first pressure receiving chamber (9) and the first pressure measuring chamber and the second pressure receiving chamber (10) and the second pressure measuring chamber communicating with each other through the first and second compensating chambers (5, 6), respectively;

(h1) said compensating chambers (5, 6) are disposed much nearer to said first pressure receiving chamber (9) than said second pressure receiving chamber (10).

However, contrary to the device in dispute, in the known device

(h2') the compensating chambers (5, 6) are not derivable as being disposed much nearer to the first pressure receiving chamber (9) than to said second pressure receiving chamber (10), but at about the same distance;

(i') the semiconductor differential pressure sensor (108) and the first and second pressure measuring chambers are not disposed between the second compensating chamber (6) and the second pressure receiving chamber (10) in the pressure receiving part (2, 3), but outside the pressure receiving part (2, 3); accordingly, the second compensating chamber (6) and the second pressure measuring chamber are not disposed between the first compensating chamber (5) and the first pressure measuring chamber (26);

(j') moreover, there is no derivable indication that the first side including said first pressure receiving chamber (9) is the high pressure side and the second side including said second pressure receiving chamber (16) is the low pressure side;

(k') finally, although in the known transducer the semiconductor differential pressure sensor (108) is attached to said pressure receiving part (2, 3) through a hollow support (103), said hollow support is not for disposing the sensor (108) within the pressure receiving part (2, 3).

3.4.2 It is to be noted that a differential pressure transducer is known from D1 (see column 2, lines 42 to 50 and Fig. 1) wherein, contrary to the transducer in dispute,

(c') the diaphragm (32) is behind the sensor (20) with respect to the first pressure receiving chamber (25), so that a measuring chamber (22) for the semiconductor differential pressure sensor is directly connected (by the space (23)) with a pressure receiving chamber (25) consisting of a pressure receiving diaphragm (30) and a housing (11) without placing a compensating chamber having a compensating diaphragm therebetween and, moreover,

(d') and (k') the semiconductor differential sensor (20) is not attached to the pressure receiving part but to said diaphragm (32) by the passageway (18).

3.4.3 During the oral proceedings of 7 June 1994, the Appellant has submitted a new prior art document, DE-A-2 657 933, in support of his arguments that it was obvious to dispose the semiconductor sensor within the pressure receiving part. However, this claimed feature is not the only distinguishing feature as compared to D3 but is combined with other distinguishing features. Moreover, the complete teaching of DE-A-2 657 933

cannot be derived directly but necessitates some delay in the procedure without the Appellant having provided convincing arguments for this late submission.

Therefore, DE-A-2 657 933 is disregarded as not being submitted in due time (Art. 114(2) EPC).

3.4.4 According to the patent in suit (see column 1, lines 38 to 44), the transducer of D3 solves the problems of the transducer known from D1 resulting from the effect of shocking pressure applied to the pressure receiving chambers and transmitted directly to the measuring chambers and, moreover, resulting from the feature that the sensor is attached to the diaphragm (32) and is thus submitted to the same vibrations as said diaphragm; however, the device of D3 is not compact. In this respect, it is to be noted that the Respondent's argument that the device of D3 (see column 1, lines 27 to 31) was already made in consideration of a compact construction and that thus the skilled person would not be incited to go further in this direction is not convincing because improving a device and in particular making it more compact is a general task of a skilled person. However, no indication is derivable from D3 for fixing the semiconductor sensor within the pressure receiving part and, moreover, disposing the different chambers in the particular spatial disposition of present Claim 1. As convincingly argued by the Respondent, although D1 (see Fig. 1) provides an indication that the sensor can be disposed within the pressure receiving part, the feature that the pressure sensor of D1 is attached to a moving part of the pressure receiving part whereas the pressure sensor of D3 is attached to a fixed part in relation to the pressure receiving part could incite the skilled person

to consider D1 as belonging to a different type of differential transducer and to disregard it. It is also to be noted that as further convincingly argued by the Respondent, the skilled person starting from the transducer of D3 and trying to obtain a transducer which is shock-proof would not take into consideration for a combination the transducer of D1 because therein a shocking pressure applied to a pressure receiving chamber can be transmitted directly to the measuring chamber. Therefore, since the subject-matter of Claim 1 in dispute is not obvious having regard to the state of the art, it involves an inventive step in the sense of Article 56 EPC and Claim 1 is allowable (Art. 52(1) EPC).

3.4.5 Thus, the first auxiliary request is allowable (Art. 102(3) EPC).

4. *Second auxiliary request*

Since the first auxiliary request is allowable, there is no need to take the second auxiliary request into consideration.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The main request is rejected.

3. The case is remitted to the first instance with the order to maintain the patent according to the first auxiliary request, i.e. with Claims 1 to 6 as presented during the oral proceedings of 7 June 1994 and the description and drawings as granted.

The Registrar:

The Chairman:

P. Martorana

E. Turrini