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D E C I S I O N
of 27 September 2005

Case Number: T 0525/03 - 3.4.2

Application Number: 99907770.4

Publication Number: 1070237

IPC: G01L 3/10

Language of the proceedings: EN

Title of invention:

Magnetising arrangements for torque/force sensor

Applicant:

ABAS Incorporated

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 84
EPC R. 29(2)

Keyword:

"Multiple independent claims; concise: yes"

Decisions cited:

G 0002/98

Catchword:

-



Case Number: T 0525/03 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 27 September 2005

Appellant:

ABAS Incorporated
7401 W. Wilson Avenue
Chicago
Illinois 60706 (US)

Representative:

Kurig, Thomas
Patentanwälte Becker, Kurig, Straus
Bavariastrasse 7
D-80336 München (DE)

Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 27 November 2002
refusing European application No. 99907770.4
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: A. Klein
Members: A. Maaswinkel
M. Vogel

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dispatched on 27 November 2002, refusing the European patent application 99907770.4.

The appellant (applicant) lodged an appeal on 24 January 2003 and paid the appeal fee on the same day. The statement setting out the grounds of appeal was received on 27 March 2003.

II. The examining division objected that the set of apparatus claims was not concise, contrary to the requirements of Article 84 EPC. In particular, independent claims 1 and 13 had the same structural features and differed only in their use as a torque transducer and as a force transducer, respectively, the two kinds of transducer being structurally identical.

III. In the letter containing the grounds of appeal the appellant made reference to the following documents:

D1: WO99/21150

D2: WO99/21151

The appellant requested that the decision to refuse the patent application be set aside and, as an auxiliary measure, requested oral proceedings.

IV. In a Communication pursuant to Article 110(2) EPC the board expressed its provisional opinion that the subject-matter of the independent claims was not objectionable under Article 84 EPC or Rule 29(2) EPC.

The board also noted that the following documents were "incorporated by reference" in document D1:

D3: US-A-5 351 555

D4: US-A-5 520 059

Furthermore, since documents D1 and D2 had so far not been considered at the examining proceedings the board expressed its intention to remit the case to the first instance for resuming the examining procedure.

V. In a reply filed on 14 June 2005 the appellant requested to forward the case to the examining division for resuming the examining procedure on the basis of the following documents:

Claims: 1 - 22 filed with the letter of
10 October 2002;

Description: pages 3 to 6, 8, 9, 11, 13 and 15 to 28
as published;
pages 2, 7, 7a, 10, 12, 14 and 29 filed
with the letter of 13 November 2001;
page 1 filed with the letter of
10 October 2002;

Drawings: sheets 1/18 to 18/18 as published.

VI. The wording of independent claim 1 reads as follows:

" A torque transducer comprising:
a substantially solid shaft (10, 150) mounted to
have torque applied about a longitudinal axis (A-A)
thereof;

the shaft having an integral portion (20, 156) thereof of a magnetisable homogeneous material magnetised to support a magnetic field (24) therein and to emanate an external magnetic field (26) that is a function of stress induced in the shaft by a torque applied thereto; and

a sensor arrangement (35c) comprising at least first and second sensors located adjacent said integral portion (20) on radially opposite sides thereof with respect to said axis (A-A), to detect the external magnetic field, and

a circuit (42) to which circuit said first and second sensors (35c) are connected to generate an output signal representing the applied torque".

The wording of independent claim 13 reads as follows:

"A force transducer comprising:

a substantially solid elongate member (11) having a longitudinal axis thereof and mounted to have a bending moment induced therein by a force (F1: F2) applied thereto in a direction transverse to said axis,

the elongate member (11) having an integral portion thereof of a magnetisable homogeneous material magnetised to support a magnetic field therein, said integral portion being responsive to such a bending moment to emanate an external magnetic field that is a function of the bending moment induced in the elongate member (11) by a force applied thereto; and

a sensor arrangement (32: 34) comprising at least first and second sensors located adjacent said integral portion on radially opposite sides thereof with respect to said axis, to detect the external magnetic field, and

a circuit to which said first and second sensors are connected to generate an output signal representing the applied force".

The set of claims includes a further independent apparatus claim 6, two independent process claims 20 and 21 and dependent claims 2 to 5, 7 to 12, 14 to 19 and 22.

VII. The appellant's arguments may be summarised as follows:

The application was refused on the finding that the apparatus claims were not concise and did not comply with Article 84 EPC. Specifically, objection was raised against apparatus claims 1 and 13. Claim 1 relates to a *torque* transducer, claim 13 relates to a *force* transducer. Claim 1 includes the feature of a *shaft* to which torque is applicable, claim 13 includes the feature of an *elongate member* to which a force is applicable to induce a bending moment therein. In point 3 of the Reasons for the Decision the examining division had argued that there was no structural difference between "shaft" and "elongate member". This is not correct, because not all elongate members are shafts or capable of acting as a shaft. For example, an elongate member for force sensing might be a structural member of some larger unified structure. Many forms of elongate member could be envisaged to which the invention is applicable for force-sensing but which could not be used as a torque-transmitting shaft. Furthermore, the arrangement of sensor devices in *torque* sensing and *force* sensing would generally be different: in *torque* sensing in which the transducer element is an integral portion of the shaft it would

normally be expected that the torque-dependent magnetic field component to be detected varies in a consistent manner about the shaft axis, e.g. for a circular cross-section shaft, the magnetic field component would be expected to be uniform (circular symmetrical) about the shaft axis. However, for a *force* sensor, the bending component induced in the elongate member and the resultant externally detectable magnetic field component produced by the transducer element do not have such a circular symmetry even if the member is of circular cross-section. Therefore for clarity of expression of the set of claims as a whole it would be more appropriate that any dependent claims defining more detailed arrangements of (*torque or force*) sensor devices be appended to a respective independent claim relating to a *torque* sensor or to a *force* sensor.

In the decision it was also argued that the applicants entered the regional phase before the EPO with one single independent apparatus claim, covering a force and a torque transducer without being unclear. However, during the examination procedure the applicant had become aware of two closely related PCT applications published under the numbers WO99/21150 and WO99/21151 (*documents D1 and D2*) which entered the European regional phase, which have a filing date of 21 October 1998 and claim a priority date of 21 October 1997. These documents had been considered by the applicant for potential relevance as state of the art under Article 54(3) EPC in respect of those state designated in the respective European applications. Both of documents are concerned with the application of circumferential magnetisation technology to the measurement of *torque*. Neither of these documents

refers to the application of the technology disclosed herein to the measurement of *force*. Therefore it is considered to be in the applicants' best interest to pursue separate independent claims to a torque sensor and a force sensor. In pursuing this particular attention was given to retaining the priority date of the priority application GB9808792.7 which contained separate independent claims to the torque and force sensing aspects, namely independent claims 1 and 2. Therefore, having regard to the criteria established by the Enlarged Board of Appeal in Decision G 2/98 it is appropriate and proper to pursue the torque and force aspects of the invention in independent claims within the requirement of Article 84 EPC.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments (Article 123(2) EPC)*

In the decision the examining division did not raise any objections under Article 123(2) EPC. Having regard to the application documents on file, the board is satisfied that these provisions are met.

3. *Article 84 EPC*
 - 3.1 The objection under Article 84 EPC in the decision was based on the view of the examining division that the set of apparatus claims was not concise. According to point 1 of the Reasons for the Decision, independent claims 1 and 13 had the same structural features and

differed only in their use as a torque transducer and as a force transducer, respectively. In particular, since these two kinds of transducers were, according to the wording of independent claims 1 and 13, structurally identical, the use of two independent claims was not appropriate in consideration with the nature of the invention. It was added that the terms "shaft" and elongate member" did not include a structural difference, since a "shaft" was normally an "elongate member". Moreover, it was noted that the mounting of a shaft was the same, independent of whether a torque or a bending force was applied to the shaft, since in both cases the shaft was clamped at both its ends by a mounting structure.

3.1.1 Claim 1 defines a *torque* transducer comprising a shaft which is *mounted* to have a torque applied to a longitudinal axis thereof and includes an integral magnetised portion. Upon applying a torque to the shaft a magnetic field is emanated as a function of the applied stress. The device further comprises a sensor arrangement and a processing circuit being arranged to generate an output signal representing the applied torque.

3.1.2 Claim 13 defines a *force* transducer, wherein the transducer is an elongate member. This member is *mounted* to have a bending moment induced therein by an applied force and to emanate a magnetic field that is a function of the induced bending moment. Furthermore the sensor and the processing circuit are arranged to generate an output signal representing the applied force.

3.1.3 The board concurs with the position of the appellant that although a "shaft" may normally be regarded as a particular kind of "elongate member", the reverse is not necessarily true, since an elongate member of rectangular cross-section as shown in Figure 3b of the patent application would not be considered as a "shaft". Therefore the respective magnetised members in claim 1 ("shaft") and in claim 13 ("elongate member") are not necessarily identical.

3.1.4 Furthermore claim 1 defines that the shaft is *mounted* to have torque applied, whereas claim 13 defines that the elongate member is *mounted* to have a bending moment induced by a force. In the opinion of the board the term "*mounted*" has the meaning of "*adapted*" for the specific aim (*measurement of torque or force*) and therefore includes a limitation and thereby a difference between the subject-matter of claim 1 and 13, respectively. It is added that such a definition in terms of *functional* features is not prohibitive, as explained in the Guidelines, CIII, 2.1 "*It is not necessary that every feature should be expressed in terms of a structural limitation. Functional features may be included provided that a skilled person would have no difficulty in providing some means of performing this function without exercising inventive skill*". The same applies to the respective sensor arrangements and the processing circuits which are *adapted* to generate an output signal representing the applied torque and the applied force, respectively, and are thereby also functionally different, because they may include different conversion units for converting the input electric signals into the output units (*Newton-meters or Newton, respectively*).

3.1.5 The board also does not agree with the argument in the decision that the devices would be indistinguishable because the mounting of a shaft was the same, independent of whether a torque or a bending force was applied to the shaft, since in both cases the shaft was clamped at both its ends by a mounting structure: as is readily visible in Figures 2a and 2b of the patent application, the mounting of a shaft in order to exert a torque is quite different from the mounting of an elongate member for measuring a bending force, shown in Figures 3a and 3b.

3.1.6 Therefore it does not appear appropriate to combine the subject-matter of present claims 1 and 13 in a single independent claim. In the decision under appeal it had been noted that the applicants entered the regional phase with one single independent apparatus claim, covering a force and a torque transducer which in the opinion of the examining division had not been unclear. However, that claim was related to a "substantially solid shaft" and the claim enumerated *expressis verbis* its application for measuring torque or bending moment (force). Therefore that claim did not define the transducer apparatuses which are the subject of claims 1 and 13 and which furthermore include the sensor and output circuits.

3.2 It is concluded that claims 1 and 13 are not objectionable for lack of conciseness.

3.3 The set of claims includes a further independent apparatus claim 6 and two independent method claims 20 and 21. In the decision under appeal no objection had

been raised against these claims. Claim 6 defines a torque sensor (*as claim 1*) wherein the shaft has first and second integral portions of a magnetisable material, wherein each portion has a particular magnetisation; the device furthermore includes particular sensors. It appears that defining this subject-matter in a claim appended to claim 1 would render the claim language rather unclear, therefore its definition in a further independent claim appears justified.

Claims 20 and 21 define a process for forming a torque-responsive element for a torque transducer, and a process for forming a force-responsive element for a force transducer, respectively. Since the claimed processes are applied to different articles (*shaft or elongate member*) which are magnetised to emanate magnetic fields as a function of induced stress by applying a torque or a bending moment, respectively, these claims are concise for the same reasons as given for claims 1 and 13.

3.4 Therefore the set of claims meets the requirement of conciseness of Article 84 EPC.

4. *Rule 29(2) EPC*

4.1 Although not subject of the decision under appeal, the board has investigated whether the set of claims also meets the requirements of Rule 29(2) EPC. This Rule was amended by decision of the Administrative Council of 13 December 2001 and entered into force on 2 January 2002 (*OJ EPO 2002, 2 ff*). This Rule applies to all applications pending on that date, for which no

Rule 51(4) EPC communication had been issued, therefore it applies to the present patent application.

4.2 According to CA/128/01 Rev.2, point 6, "New Rule 29(2) should give rise to the same result as strict application of Article 84 and existing Rule 29 EPC, but without the lengthy substantive argumentation presently required. An applicant wanting more than one independent claim in the same category must show convincingly, if the EPO objects, that all the additional independent claims come under one of the exceptions given in the rule".

4.3 Rule 29(2) EPC reads:

"Without prejudice to Article 82, a European patent application may contain more than one independent claim in the same category (product, process, apparatus or use) only if the subject-matter of the application involves one of the following:

- (a) a plurality of inter-related products;
- (b) different uses of a product or apparatus;
- (c) alternative solutions to a particular problem, where it is not appropriate to cover these alternatives by a single claim."

4.4 Independent claims 1 and 13 define alternative solutions to the problem of measuring stress in a transducer comprising an integral portion of a magnetised material in case of applied torque (*claim 1*) or bending moment (*claim 13*). As discussed above, it would not appear appropriate to cover these alternatives in a single independent claim.

4.5 Rather, attempting to redefine the subject-matter of these claims in a more generalising way in one independent claim might lead to an objection under Article 123(2) EPC. As pointed out by the appellant, in view of the Decision G 2/98 such generalisation could furthermore be problematic for Article 87 EPC.

4.6 It is concluded that for the present case the exception enumerated in Rule 29(2)(c) EPC should apply. Therefore in the opinion of the board the provisions of this Rule are met.

5. *Further prosecution*

5.1 Documents D1 and D2

In the Statement of Grounds of Appeal the appellant explained that the applicant had become aware of the existence of documents D1 and D2, which documents might be relevant under Article 54(3) EPC and that it was therefore the applicant's choice to pursue the invention in separate independent claims 1 and 13. In this respect, the following observations are made:

5.1.1 In European patent application 98950604.3, published as WO99/21150 (*document D1*) the following states were designated: CH/LI, DE, DK, ES, FR, GB, IE, IT, NL, SE. The same states were designated in European patent application 98953473.0, published as WO99/21151 (*document D2*). In the present patent application the following states are designated: AT, BE, CH/LI, DE, ES, FI, FR, GB, IT, NL, PT, and SE. Therefore for designated states CH/LI, DE, ES, FR, GB, IT, NL and SE

documents D1 and D2 should be considered for their relevance under Article 54(3) EPC.

5.1.2 Furthermore, it follows from Article 54(4) EPC that for designated states AT, BE and FI the contents of documents D1 and D2 are not to be considered as being comprised in the state of the art.

5.1.3 As to designated states CH/LI, DE, ES, FR, GB, IT, NL and SE documents D1 and D2 should be considered for their relevance under Article 54(3) EPC. In this respect the Board observes the following:

5.1.4 Document D1 discloses in Figure 1(a) a torque sensor device comprising a transducer with a solid shaft having magnetised regions. For the particular magnetic field sensor used document D1 refers to US-patents US-A-5,351,555 (D3) and US-A-5,520,059 (D4), which disclosures are "incorporated by reference", see page 11, end of 2nd paragraph.

5.1.5 It should therefore be considered whether document D1 (and equally D2) discloses relevant prior art under Article 54(3) EPC.

5.2 *Article 82 EPC*

Furthermore, should the disclosure in D1 anticipate the subject-matter of claim 1, the provisions of Article 82 EPC could be in doubt for the set of claims on file, since these would no longer be linked to form a single inventive concept, which, according to the published description, see page 5, line 34 ("Summary of the Invention"), is "...to use the shaft itself as the

magnetoelastic transducer element of a torque sensing arrangement".

6. Since documents D1 and D2 so far have not been considered at the examining proceedings it appears appropriate to remit the case to the first instance for resuming the examining procedure.

The appellant agreed to this course of action.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance for further prosecution.

The Registrar:

The Chairman:

P. Martorana

A. Klein