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**Datasheet for the decision
of 7 December 2018**

Case Number: T 0874/16 - 3.4.02

Application Number: 04784375.0

Publication Number: 1789758

IPC: G01F1/84, G01F25/00

Language of the proceedings: EN

Title of invention:

COMPENSATION METHOD AND APPARATUS FOR A CORIOLIS FLOW METER

Applicant:

EMERSON ELECTRIC CO.

Headword:

Relevant legal provisions:

EPC 1973 Art. 84

RPBA Art. 12(4), 13

Keyword:

Claims - clarity - main request (no) - essential features
missing

Admissibility - auxiliary requests (no)

Decisions cited:

T 0032/82, T 0361/08, T 0144/09

Catchword:



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Case Number: T 0874/16 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 7 December 2018

Appellant: EMERSON ELECTRIC CO.
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Representative: Vossius & Partner
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted on 10 December
2015 refusing European patent application No.
04784375.0 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman R. Bekkering
Members: A. Hornung
G. Decker

Summary of Facts and Submissions

- I. The applicant appealed against the decision of the examining division refusing European patent application No. 04784375.0 on the basis of *inter alia* Article 84 EPC 1973.
- II. With the statement setting out the grounds of appeal, the appellant requested that the decision under appeal be set aside and that, as a main request, a patent be granted on the basis of the claims underlying the appealed decision (i.e. claims as originally filed) or, as an auxiliary measure, on the basis of the claims according to a first or a second auxiliary request.
- III. The board summoned the appellant to attend oral proceedings. In a communication accompanying the summons, the board provided its provisional opinion on the merits of the appeal.
- IV. In response to the summons to oral proceedings, the appellant filed, with a letter of 6 November 2018, amended auxiliary requests 1 and 2 replacing auxiliary requests 1 and 2 as filed with the statement of grounds of appeal.
- V. Oral proceedings were held on 7 December 2018.
- VI. As its final requests, the appellant requested that the decision under appeal be set aside and that, as a main request, a patent be granted on the basis of the claims as originally filed or, as an auxiliary measure, on the basis of the claims of the first or second auxiliary request, both requests filed with the letter dated 6 November 2018.
- VII. Claims of the requests

Main request

Independent claim 1 according to the main request reads as follows:

"A method for providing thermal compensation for a Coriolis flow meter having at least one flow tube; said method comprising the steps of:

generating a first signal representing Coriolis deflections of said flow tube;

generating a second signal representing characteristics of said flow meter, wherein said characteristics include the drive frequency F of said Coriolis flow meter as well as an induced time delay Δt ; and

characterized by the provision of meter electronics for using said first and said second signals to provide thermal compensation for output signals of said Coriolis flow meter."

First auxiliary request

Independent claim 1 according to the first auxiliary request reads as follows:

"A method for providing thermal compensation without the use of at least one thermal sensor for a Coriolis flow meter having at least one flow tube; said method comprising the steps of:

recording a time delay Δt and a drive frequency F from the Coriolis flow meter while recording a mass flow from a master Coriolis flow meter connected in series to the Coriolis flow meter during a calibration phase, and deriving a plurality of calibration constants, wherein during the calibration phase all parameters, except temperature, which have an effect on the flow tube frequency, are held constant;

generating a first signal representing Coriolis deflections of said flow tube;

generating a second signal representing characteristics of said flow meter, wherein said characteristics include the drive frequency F of said Coriolis flow meter as well as an induced time delay Δt , wherein the first and second signals are generated in a temperature range wherein the Coriolis flow meter's behavior is substantially linear;

characterized by the provision of meter electronics for using said first and said second signals to provide thermal compensation for output signals of said Coriolis flow meter;

determining a drive frequency F from said second signal;

deriving a linear frequency calibration constant α_F for zero; and

using said drive frequency F and said linear frequency calibration constant α_F for zero to derive a thermally compensated flow rate."

Second auxiliary request

Independent claim 1 according to the second auxiliary request reads as follows:

"A method for providing thermal compensation without the use of at least one thermal sensor for a Coriolis flow meter having at least one flow tube; said method comprising the steps of:

recording a time delay Δt and a drive frequency F from the Coriolis flow meter while recording a mass flow from a master Coriolis flow meter connected in series to the Coriolis flow meter during a calibration phase, and deriving a plurality of calibration constants, wherein during the calibration phase all parameters, except temperature, which have an effect on the flow tube frequency, are held constant;

generating a first signal representing Coriolis deflections of said flow tube;

generating a second signal representing characteristics of said flow meter, wherein said characteristics include the drive frequency F of said Coriolis flow meter as well as an induced time delay Δt , wherein the first and second signals are generated in a temperature range wherein the Coriolis flow meter's behavior is substantially linear;

characterized by the provision of meter electronics for using said first and said second signals to provide thermal compensation for output signals of said Coriolis flow meter;

receiving a calibrated mass flow rate from a master Coriolis flow meter;

using said first and said second signals and said calibrated mass flow rate to provide said thermal compensation for said Coriolis flow meter;

using said first and said second signals and said calibrated mass flow rate to derive calibration constants for said Coriolis flow meter, wherein said step of deriving said calibration constants includes the step of solving the expression:

$$\begin{bmatrix} \Delta t_0 \\ \alpha_F \\ \alpha_{\dot{m}} \\ \alpha_{\dot{m}F} \end{bmatrix} = \text{pinv}\left(\begin{bmatrix} 1 & (F-F_0) & \dot{m} & \dot{m}(F-F_0) \end{bmatrix}\right) \Delta t$$

1.10

Where

- Δt Flow induced time delay
- Δt_0 Nominal time delay
- \dot{m} Mass Flow Rate
- F Drive Frequency
- F_0 Drive Frequency - nominal zero flow
- α_F Linear Frequency constant for zero

$a_{\dot{m}}$ [sic] Coefficient related to FCF
 $a_{\dot{m}F}$ [sic] Linear frequency (temp) constant; and
using said calibration constants to provide said thermal
compensation for said Coriolis flow meter."

Reasons for the Decision

1. Main request

Claim 1 lacks clarity because it does not define all essential features of the claimed method for providing thermal compensation for a Coriolis flow meter (Article 84 EPC 1973).

1.1 As already pointed out in the board's communication annexed to the summons to oral proceedings, claim 1 attempts to define the claimed subject-matter in terms of the result to be achieved, i.e. "to provide thermal compensation for output signals of said Coriolis flow meter", instead of defining it in terms of technical features responsible for achieving the claimed result (Article 84 EPC 1973).

The only steps in claim 1 which are of any relevance for obtaining the claimed result are (i) generating signals representing Coriolis deflections, the drive frequency F as well as an induced time delay Δt of the flow meter and (ii) providing meter electronics using the signals.

No further information is provided in claim 1. However, these steps have such a broad scope that they are manifestly insufficient to guarantee a thermal compensation for a Coriolis flow meter over the whole scope of claim 1. In other words, essential features for achieving the claimed result are missing in claim 1.

This is contrary to the established jurisprudence of the boards of appeal according to which a claim "must define clearly the object of the invention, that is to say indicate all the essential features thereof. As essential features have to be regarded all features which are necessary to obtain the desired effect or, differently expressed, which are necessary to solve the technical problem with which the application is concerned" (see T 32/82, point 15 of the Reasons).

1.2 According to the application as filed, the invention provides a method and an apparatus for temperature compensation for Coriolis flow meters which avoid the problematic use of thermal sensors (see page 3, lines 12 to 14). In order to achieve this result, a calibration of the Coriolis flow meter must be carried out to derive calibration constants according to equation 1.10. Once the calibration constants are derived, they are used in equation 1.5 to correct the measured flow rate to provide a thermally compensated flow rate. See page 14, line 9 to page 16, line 5; page 18, line 5 to page 19, line 5; figures 10 and 11.

It follows that at least equations 1.5 and 1.10 are essential features missing in present claim 1.

1.3 The appellant presented the following counter-arguments:

1.3.1 The appellant argued that the general idea of the invention concerned thermal compensation for Coriolis flow meters while avoiding the use of thermal sensors. The essential feature of the present invention was the use of first and second signals to provide thermal compensation. Since, on the one hand, this feature relating to the two signals was present in claim 1 and, on the other hand, no thermal sensor was present in claim 1, no essential feature was missing in claim 1 and the requirement of Article 84 EPC 1973 was met.

The board is not convinced by this argument. In order to achieve thermal compensation of a flow meter, the first and second signals must be of a well-defined kind involving specific calibration data and equations (see e.g. page 18, line 5 to page 19, line 5). The application as filed does not disclose how any kind of signal, being merely defined in broad terms by the features of present claim 1, can provide thermal compensation. Beyond that, the board does not see how such broadly defined signals would be capable of providing thermal compensation at all.

- 1.3.2 According to the appellant, no further features were required in claim 1. Indeed, claim 1 was directed to the real use of the flow meter by the end user measuring the mass flow and not to a method for calibrating the flow meter. Calibration of the flow meter was to be carried out during a phase preceding the real use of the flow meter. However, this preliminary phase preparing the actual mass flow measurement was not related to the scope of the present invention. The end user did not need to execute the calibration of the flow meter. Therefore, if additional features were to be added to claim 1 about how the calibration constants were obtained and used for correcting the measured mass flow, the scope of claim 1 and the invention to which it related would unduly be limited.

According to the board, it cannot be deduced from the present claim wording that the method of claim 1 is directed exclusively to the use of a flow meter by an end user not calibrating the flow meter. No mention of such an end use or of such an end user is to be found in claim 1. On the contrary, the board is of the opinion that the wording of claim 1 encompasses thermal compensation methods comprising a preliminary calibration phase. Therefore, the restriction of the scope of the claimed method to a method involving a

calibration phase is not unduly limiting the scope of protection.

- 1.3.3 The appellant contended that the skilled person would know at least from the description how to achieve thermal compensation by using the two signals mentioned in claim 1.

The board cannot agree with this argument. Claims must in principle be clear in themselves when read by the person skilled in the art. In the present case, the method claim 1 does not define the technical steps which are necessary to achieve the result of thermal compensation, e.g. providing calibration data and using equations 1.5 and 1.10. Neither will a person skilled in the art, using normal skills, understand from the wording of claim 1 alone how to achieve the claimed result. Therefore, claim 1 in itself is unclear. This clarity deficiency in the claim wording cannot be rectified by the fact that the description could possibly help the reader to understand the technical subject-matter which the claim was intended to define.

- 1.3.4 The appellant further submitted that claims 13 and 14 as originally filed, defining equations 1.10 and 1.5, respectively, related to a specific embodiment of the invention and that the skilled person would appreciate that other means than this specific embodiment could be employed to provide thermal compensation using the first and second signals.

While it is not excluded that calibration and thermal compensation methods might exist other than the method disclosed in the patent application and using equations 1.5 and 1.10, the board notes that the application as filed does not disclose any alternative method. Moreover, the board, also in view of the appellant's submission that the prior art generally uses thermal sensors for thermally

compensating Coriolis flow meters, does not see why the skilled person would be able to find alternative calibration methods by himself.

2. First auxiliary request

Taking into account the provisions of Article 12(4) RPBA, the board decided to exercise its discretion under Article 13(1) RPBA in not admitting the first auxiliary request into the proceedings.

2.1 Present first auxiliary request has been filed in reply to the board's communication annexed to the summons to oral proceedings. It represents an amendment to the appellant's case as filed with its statement of grounds of appeal. Therefore, in principle, for deciding whether the first auxiliary request is to be admitted into the appeal proceedings, the provisions according to Article 13 RPBA are applicable.

The board is of the view that applying the provisions according to Article 13 RPBA for deciding on the admission of amended claim requests into the appeal proceedings also involves the assessment whether these amended claim requests could have been filed during the first-instance proceedings, i.e. also involves the exercise of discretion under the provisions of Article 12(4) RPBA. See decisions T 361/08, point 13 of the reasons and T 144/09, point 1.17 of the reasons.

In the present case, consideration has to be given to the fact that throughout the whole first-instance examination proceedings, the examining division had raised an objection of lack of clarity against claim 1 for the reason that claim 1 lacked essential features. During the first-instance examination proceedings, the appellant did not file any

claim request, not even in the form of an auxiliary request, for attempting to overcome the examining division's clarity objection, but instead accepted that the patent application was finally refused on the basis of lack of essential features. Only with the statement of grounds of appeal did the appellant file for the first time auxiliary requests aiming at overcoming the clarity objection.

In view of this, the board comes to the conclusion that the present first auxiliary request could and should have been filed during the first-instance examination proceedings and, therefore, does not fulfill the criteria of Article 12(4) RPBA for admitting claim requests.

- 2.2 The appellant argued that the board raised some new clarity objections in the communication annexed to the summons to oral proceedings. The first auxiliary request was filed in order to overcome *inter alia* these new clarity objections. Therefore, the first auxiliary request should be admitted into the appeal proceedings. The appellant provided no reason why no amendments, e.g. as an auxiliary measure, were filed during the first-instance proceedings for attempting to overcome the clarity objection of the examining division.

The board notes that the objection of lack of essential features raised in the board's communication was not a "new" clarity objection since it corresponded essentially to the objection of lack of essential features raised by the examining division in their communications.

3. Second auxiliary request

- 3.1 The second auxiliary request is not admitted into the proceedings under Article 13 RPBA for the following reason:

Claim 1 of the second auxiliary request has been filed in response to the summons to oral proceedings. It has been amended with the intention to overcome the clarity objections raised in the annex to the summons to oral proceedings. However, the amendments of claim 1 do not deal with all the clarity objections. In particular, claim 1 still lacks at least the essential feature about how the claimed result of providing thermal compensation for a flow meter is actually achieved, i.e. it is not clear from claim 1 how the calibration constants Δt_0 , α_F , $\alpha_{\dot{m}}$, $\alpha_{\dot{m}F}$ referred to in present claim 1 are used to calculate the thermally compensated output signal \dot{m} of the flow meter under test. In other words, claim 1 still lacks the essential feature corresponding to equation 1.5, as objected to in points 6.1.1 and 6.1.2(c) of the annex to the summons to oral proceedings. In view of the late state of the proceedings, the fact that present claim 1 still lacks clarity for at least partly the same reasons as claim 1 of the main request (see point 1.2 above) and the need for procedural economy, the board decided not to admit the second auxiliary request into the proceedings under Article 13 RPBA.

- 3.2 The appellant argued that the amendments of claim 1 of the second auxiliary request addressed the clarity objections raised in the annex to the summons to oral proceedings. Moreover, the examining division found that a claim corresponding to present claim 1 would be allowable with respect to the EPC requirements.

The board acknowledges that claim 1 attempts to address some of the clarity objections raised in the annex to the summons to oral proceedings. However, not all clarity objections are dealt with (see point 3.1 above). Therefore, present claim 1 still lacks clarity. In view of this, the question whether the examining division would effectively have found allowable a claim which was never filed before it, is not

relevant for deciding upon the admission of present claim 1 of the second auxiliary request into the appeal proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



M. Kiehl

R. Bekkering

Decision electronically authenticated