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D E C I S I O N
of 3 February 1998

Case Number: T 0352/94 - 3.4.2

Application Number: 87906225.5

Publication Number: 0320508

IPC: G01F 1/84

Language of the proceedings: EN

Title of invention:

Improved parallel path coriolis mass flow meter

Patentee:

Micro Motion Incorporated

Opponent:

Endress + Hauser Flowtec AG

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56

Keyword:

"Main request (as granted): novelty (yes); inventive step (no)"
"Auxiliary request: novelty (yes); inventive step (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0352/94 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 3 February 1998

Appellant: Endress + Hauser
(Opponent) Flowtec AG
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Reinach BL1 (CH)

Representative: -

Respondent: Micro Motion Incorporation
(Proprietor of the patent) 7070 Winchester Circle
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Colorado 80301 (US)

Representative: Vossius & Partner
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 4 March 1994
rejecting the opposition filed against European
patent No. 0 320 508 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. 0 320 508, which was granted on the basis of European patent application No. 87 906 225.5 comprising a Figure 2 for illustrating an acknowledged prior art. The only independent claims of the set of 20 claims of the European patent specification read as follows:

"1. A Coriolis meter for measuring the mass flow rate of a fluid comprising

a pair of flow tubes (130, 130') each being substantially free of pressure sensitive joints;

means (180) for vibrating each of the flow tubes in a pre-determined sinusoidal pattern;

means (160, 160', 161, 161') for sensing deflecting of said flow tubes caused by Coriolis forces induced by the fluid flowing through said flow tubes, and

means operative in response to said sensed deflection for determining mass flow rate of the fluid. (read ",")

inlet and outlet manifolds (100, 100') for respectively conducting fluid into and out of said flow tubes and being connected to respective ends of said flow tubes, wherein said inlet manifold (100) divides said fluid flowing from an inlet orifice (101), of said Coriolis meter and located in said inlet manifold, between said flow tubes and wherein said outlet manifold (100') combines said fluid exiting from said flow tubes and

flowing into an outlet orifice (101') of said Coriolis meter and located in said outlet manifold, characterized in that each of said manifolds (100, 100') comprises:

a transition piece (110, 110') having first and second ends (101, 101', 401) and first and second orifices (301, 302) respectively disposed therein, and a passageway (303) between said first and second ends, said fluid being capable of flowing from said first orifice (301) to said second orifice (302) in said inlet manifold (100) and from said second orifice (302) to said first orifice (301) in said outlet manifold (100'), wherein said passageway (303) has a cross-sectional area that gradually changes from a first value at said first orifice to a second value, different from the first value, at said second orifice (302);

a mounting block (120, 120') formed of a weldable material having oppositely situated first and second surfaces (702, 704) thereon, said mounting block being disposed on said transition piece (110, 110') with the first surface (702) in abutting contact with said second end (401), said mounting block also having a first opening (700) inwardly extending from said first surface (702) which at said first surface (702) is substantially identical in cross-sectional area with that of said second orifice (302) and is aligned with said second orifice (302), said mounting block also having a pair of second openings (703) inwardly extending from said second surface (704) to said first opening (701) and in fluid communication therewith,

each of said second openings (703) having slidably received an associated one of said flow tubes (130, 130'), said mounting block further comprising:

a projection (707) formed in said mounting block (120, 120') and radially extending inward into a corresponding one of each of said second openings (703) so as to locally reduce the diameter of said corresponding second opening, wherein each of said first surface (702) such that each of said projections (707) abuts against an external wall of a corresponding one of said flow tubes (130, 130') and wherein each of said projections also has a smaller mass than that of the remainder of said mounting block whereby during a welding operation each of said projections is capable of deforming before the remainder of said mounting block deforms in order to provide a substantially fluid-tight circumferential weld between the end of the corresponding flow tube and said mounting block."

"13. A manifold (100, 100') for a parallel path Coriolis mass flow meter, which conducts a fluid to or from (read "from") a pair of flow tubes (130, 130') utilized in said meter, a transition piece (110, 110') having first and second ends (101, 101' 401) (read "(101, 101', 401)") and first and second orifices (301, 302) respectively disposed therein, and a passageway (303) between said first and second ends, characterized in that further

said passageway (303) has a cross-sectional area that gradually changes from a first value at said first orifice (301) to a second value, different from the

first value, at said second orifice (302);

and in that said manifold comprises:

a mounting block (120, 120') formed of a weldable material having oppositely situated first and second surfaces (702, 704) thereon, said mounting block being disposed in said transition piece (110, 110') with the first surface (702) in abutting contact with said second end (401), said mounting block also having a first opening (701) inwardly extending from said first surface (702) which at said first surface is substantially identical in cross-sectional area with that of said second orifice (302) and is aligned with said second orifice (302), said mounting block also having a pair of second openings (703) inwardly extending from said second surface (704) to said first opening (701) and in fluid communication therewith, each of said second openings (703) having slidably received an associated end of one of said flow tubes (130, 130'), said mounting block further comprising:

a projection (707) formed in said mounting block (120, 120') and radially extending inward into a corresponding one of each of said second openings (703) so as to locally reduce the diameter of said corresponding second opening, wherein each of said projections is located at a pre-defined depth from said first surface (702) such that each of said projections (707) abuts against an external wall of a corresponding one of said flow tubes (130, 130') and wherein each of said projections also has a smaller mass than that of the remainder of said mounting block whereby during a

welding operation each of said projections is capable of deforming before the remainder of said mounting block deforms in order to provide a substantially fluid-tight circumferential weld between the end of the corresponding flow tube and said mounting block."

II. The appellant (opponent) filed an opposition against the patent, on the grounds that, in particular, the subject-matter of claim 13 was not novel having regard to inter alia E12: US-A-3 944 261, that the subject-matter of claim 1 did not involve an inventive step having regard to a prior art document showing a device similar to that Figure 2 of the opposed patent and to E12, and that the dependent claims were not inventive either having regard to the prior art and the knowledge of the person skilled in the art.

III. The opposition was rejected.

The Opposition Division took the following position:

Opponent's argument, that the wording "manifold for Coriolis mass flow meter" does not restrict the scope of claim 13, cannot be accepted. Having regard to the tube connector of E12, the projections in the mounting block shown therein are not "radially extending inward into a corresponding one of said second openings", as in said claim 13. Therefore, claim 13 is novel.

Starting from Figure 2 of the opposed patent as the closest prior art, it is intended to improve the welded joints in the manifold in order to reduce the danger of cavitation and the effects of vibration; this problem

is not immediately evident from the prior art and it is solved in claim 13 in particular by using projections in the mounting block for welding to the tubes. The only document showing such projections is E12 but, since this other manifold is not for Coriolis meters and since it is distinguished by the feature about the radial inward projections of the mounting block, the subject-matter of claim 13 involves an inventive step. Claim 1 concerns a Coriolis flow meter and thus a more restricted device of the same type as claim 13; it is also patentable for the same reasons.

- IV. The appellant (opponent) lodged an appeal against this decision.
- V. The respondent (proprietor) filed, during the oral proceedings of 3 February 1998, which he had requested auxiliarily, inter alia a first auxiliary request, whereby, the word "**arranged**" is inserted in the first line of claim 13 as granted, before the words "for a parallel path", and whereby the words "*said projections is located at a pre-defined depth from*" were inserted in the last part of claim 1 as granted, between the words ", wherein each of" and "said first surface (702) such that each of said projections (707)", this last amendment being admittedly a correction of an error in the printed specification which had been already mentioned, for instance in the decision under appeal.
- VI. The respondent requested that the patent be maintained in the form as granted (Main request) or in amended form in particular according to the First auxiliary request, and submitted the following arguments in

support of his requests:

The manifold for a Coriolis flow metre of claim 13 as granted comprises, according to the Guidelines for Examination in the EPO, part C, Chapter IV, 7, 6, characteristics implied by the particular use of this device, so that it is distinguished from the manifold of E12, which is not for this purpose. Therefore, the subject-matter of this claim is novel.

Since E12 is not directed to a manifold for a Coriolis flow meter, the skilled person of these meters would not take into account this document for a solution of his problems. Moreover, there are features in claim 13 as granted, concerning in particular the mounting block, which is of a weldable material and which comprises a part which is small as compared to the remainder of the mounting block which, even in the form of the projections shown in E12, is not derivable from this document; in particular, these small parts are mentioned in the patent in suit as being "sacrificial members" which are important for obtaining a welded connection of the tube to the mounting block while keeping other parts at lower temperature, and this information is not to be found in E12. Therefore, even by taking into consideration E12 when starting from Figure 2 of the patent in suit, claim 13 involves an inventive step.

This is even more the case for the more restricted manifold of claim 13 of the First auxiliary request, which is "arranged for" the Coriolis flow meter and thus more specific.

VII. The appellant requested that the decision under appeal be set aside and that the patent be revoked, and argued substantially as follows in support of his request:

The manifold for a Coriolis flow meter of claim 13 of the patent in suit is distinguished from the manifold known from E12 only in that the latter is not specified as being "for" the same purpose. However, as stated in particular in decision T 287/86 of 28 March 1988, unpublished, an indication of purpose in a device claim has to be interpreted to the effect that the claimed device is suitable for the indicated purpose, but not that it is limited to this purpose. Therefore, the subject-matter of this claim lacks novelty over E12.

As can be seen from Dubbel, "Taschenbuch für den Maschinenbau", Springer-Verlag Berlin, Heidelberg, New York, 1981, page 862, Paragraph 1.3.5, technically skilled persons are aware of the problem of cavitation. This document, filed during the oral proceedings, should not be disregarded because it was necessary as an answer to written observations of the Board. Starting from the manifold for a Coriolis flow meter of Figure 2 of the patent in suit, the skilled person would thus be aware of the problem of cavitation and would look for means for solving this problem, for instance by providing a smooth flow for the fluids, in particular at the connection of tubes, as shown in E12. In this document, he would find all the features of said claim 13 and, more in particular, the projections in the mounting block of weldable material which are small as compared to the remainder of said mounting

block, these projections being also for directing the energy to the parts to be assembled when welding those parts, thereby achieving the same effect as in the patent in suit. Therefore, the skilled person would, possibly with addition of some of his expertise if necessary, arrive in an obvious way to a manifold suitable for a Coriolis flow meter. Thus, this claim does not involve an inventive step.

By amending "manifold for a parallel path Coriolis mass flow meter" into "manifold arranged for a parallel path Coriolis mass flow meter", there is no appreciable change in the scope of the patent, so that the First auxiliary request is not allowable for the same reasons.

Reasons for the Decision

1. *Admissibility of the appeal*

The respondent had made objections concerning the content of the statement of grounds of appeal and requested that the appeal be rejected as inadmissible. This request has been withdrawn and, since the objections in this respect have not been found convincing, the appeal is admissible.

2. *Main request*

2.1 Novelty

2.1.1 A manifold (270, 270') for a parallel path Coriolis mass flow meter is acknowledged in the patent in suit (see in particular column 5, lines 3 to 5 and column 7, line 42 to column 9, line 6; Figure 2). This Coriolis flow meter, which conducts a fluid to or from a pair of flow tubes (130, 130') utilized in said meter, has a transition piece (281, 281') having first and second ends and first and second orifices (280, 280') respectively disposed therein, and a passageway between said first and second ends.

However, contrary to claim 13 of the patent in suit, the acknowledged manifold illustrated by Figure 2 does not comprise features of the second part of said claim 13, for instance that said passageway has a cross-sectional area that gradually changes from a first value at said first orifice to a second value, different from the first value, at said second orifice.

2.1.2 Another manifold is known from E12 (see the whole document; see in particular column 1, line 5 to column 2, line 32); however, contrary to claim 13 in dispute, this other manifold is indicated as being a bifurcated tubing connector for joining discrete fluid streams into a single stream, more specifically for providing a smooth flow profile to blood in an extracorporeal blood handling system, and not as being for a parallel path Coriolis mass flow meter.

The appellant has argued that, at least with reference to the jurisprudence in one of the Contracting States, i.e. Germany, the words "for a parallel path Coriolis mass flow meter" of claim 13 in dispute do not result in any restricting effect on the scope of protection conferred by the patent and thus are not to be taken into account when assessing the patentability of the invention in suit. The same applied having regard to the above-mentioned decision T 287/86 (cf. in particular point 2.1(d) of the reasons), which stated that it is generally accepted that any indication of a purpose in a device claim has to be interpreted to the effect that the claimed device has indeed to be suitable for the indicated purpose, but not that it is limited to this purpose.

However, as convincingly argued by the respondent with reference to the Guidelines for Examination in the EPO, part C, Chapter IV, 7, 6, characteristics implied by the particular use of a device should be taken into account when e.g. deciding the novelty of the device, an example being given relating to hook for a crane as compared with a known fish hook of similar shape, the differences in size being implied by the difference in use. As further credibly argued by the respondent, in the present case, the use of the manifold for a parallel path Coriolis mass flow meter clearly implies that flow tubes are to be attached to a manifold compatible with the mechanical oscillations to which the flow tubes are submitted when measuring the mass flow of a fluid transiting through said flow tubes. Indeed, said necessary feature specifying how the flow tubes are attached to the manifold, and thus the

resulting "suitability" of this other known manifold for a Coriolis meter, is not directly and unambiguously derivable from E12 and the respirators or anaesthesia apparatuses shown therein.

2.1.3 The further prior art documents are less relevant.

2.1.4 Therefore, the subject-matter of claim 13 in dispute is novel in the sense of Article 54 EPC.

2.2 Inventive step

2.2.1 It has not been disputed that the manifold for a mass flow meter illustrated in the patent in suit by Figure 2 represents adequately the closest prior art. As mentioned here above in paragraph 2.1.1, this manifold does not comprise features of the second part of claim 13.

According to the patent in suit (see column 4, lines 8 to 17, see also column 8, line 4 to column 9, line 6), the fabrication of the known meters of Figure 2, wherein in particular it is extremely difficult to weld the small mass of each flow tube to the large mass of each manifold while they are assembled, is time consuming and hence costly; moreover, at high flow rates, cavitation can occur in the fluid as it exits the meter, this, in turn, causing vibrations that could lead to measurement inaccuracies.

As specified by the patent in suit (see column 9, lines 7 to 34), the feature of claim 13 that the passageway (303) of the transition piece (110, 110')

has a cross-sectional area that gradually changes from a first value at said first orifice (301) to a second value, different from the first value, at said second orifice (302), results in the elimination of abrupt change in the direction of the fluid flow and thus of the likelihood that the pressure of the fluid will markedly drop anywhere within the transition piece.

2.2.2 First, against appellant's argumentation that the subject-matter of claim 13 results in an obvious way from the common consideration of the device of Figure 2 of the patent in suit and of E12, the respondent has argued that, starting from a Coriolis mass flow meter according to Figure 2 of the patent in suit, the person skilled in the art would not take into account the teaching of E12 because this document does not relate to this specific technical field, but more in particular to the field of medical instruments. However, as convincingly argued by the appellant, E12 (see in particular column 2, lines 5 to 13) also relates to bifurcated tubing connectors in general and is thus a document which the skilled person would consult; since moreover this document indicates that in said general connector a smooth flowing is achieved and since the problem of cavitation which is observed in particular at the inlet and/or the outlet of many devices is general and always present to said skilled person, as can be seen from Dubbel, a textbook used by technicians in all fields, he would have taken advantage, in his meter, of this feature of the connector of E12 of a transition piece (12) having a passageway (24) with a cross-sectional area that gradually changes from a first value at a first orifice

to a second value, different from the first value, at a second, opposed orifice, for preventing cavitation in particular at the outlet of his meter.

In this respect, it is to be noted that Dubbel, although submitted during the oral proceedings, i.e. at a late stage, has not been disregarded because it is in the form of a textbook and provided only to confirm, as an answer to written observations of the Board, previous arguments on general knowledge about cavitation (Article 114(2) EPC).

2.2.3 The manifold (10) known from E12 (see the whole document) is comprised in an apparatus and transports a fluid to or from a pair of flow tubes (18, 20) utilized in said apparatus; as mentioned here above, there is also a transition piece (12) having first and second ends and first and second orifices respectively disposed therein, with a passageway (24) between said first and second ends having a cross-sectional area that gradually changes from a first value at said first orifice to a second value, different from the first value, at said second orifice.

Said manifold also comprises a mounting block (14) having oppositely situated first and second surfaces thereon, said mounting block (14) being disposed in said transition piece (12) with the first surface in abutting contact with said second end; said mounting block (14) also has a first opening inwardly extending from said first surface which at said first surface is substantially identical in cross-sectional area with that of said second orifice and is aligned with said

second orifice of the transition piece (12); said mounting block (14) also has a pair of second openings (32, 34) inwardly extending from said second surface to said first opening and in fluid communication therewith; each of said second openings (32, 34) has slidably received an associated end of one of said flow tubes (18, 20).

Said mounting block further comprises projections (the concentric ridges or energy directors (58, 60), the projection (56) around said mounting block (14) shown in Fig. 2 as comprising the other ridges (58, 60)) formed in said mounting block (14) and radially extending inward into a corresponding one of each of said second openings (32, 34) so as to locally reduce the diameter of said corresponding second opening, wherein each of said projections (56) or a part (58, 60) thereof is located at a pre-defined depth from said first surface such that each of said projections abuts against an external wall of a corresponding one of said flow tubes (18, 20), in order to provide a substantially fluid-tight circumferential connection between the end of the corresponding flow tube (18, 20) and said mounting block (14).

2.2.4 The respondent has argued that the mounting block (14) of E12 is not formed of a weldable material in the sense of the patent in suit. However, as convincingly argued by the appellant, according to E12 (see column 3, lines 1 to 17; column 4, lines 6 to 68) energy directors (56, 58, 60) may be provided to the mounting block (14), in particular to the fittings (32, 34) therein where the tubes (18, 20) are fitted,

this being done to facilitate welding, in particular ultrasonic welding, whereby ultrasonic welding energy is concentrated. Therefore, using a weldable material for the mounting block is obvious in view of E12.

The respondent has also particularly stressed that the feature of claim 13 in dispute, that each of said projections of the mounting block has a smaller mass than that of the remainder of said mounting block whereby during a welding operation each of said projections is capable of deforming before the remainder of said mounting block deforms in order to provide a substantially fluid-tight circumferential weld between the end of the corresponding flow tube and said mounting block, is not derivable from E12.

However, as convincingly argued by the appellant, the text of E12 specifies the purpose of the projections (56; 58, 60) in the mounting block (14) as being "energy directors" which concentrate the ultrasonic energy to a part of said projections which, at least in the drawings of E12 and without any further information, are also derivable as having a smaller mass than that of the remainder of said mounting block and thus can also be considered as achieving the same result as the "sacrificial member" which is mentioned in the patent in suit (see column 10, lines 15 to 30). Concerning the further arguments of the respondent that the materials mentioned in E12 for the manifold for medical purposes would not be adequate for a Coriolis meter, it is not relevant in that sense that, as convincingly argued by the appellant, the patent in suit does not disclose any particular material and that, moreover, a plurality of materials are used in

existing meters of this type.

2.2.5 For the person skilled in the art of manifold for parallel path Coriolis mass flow meters starting from the manifold of this type of Figure 2 of the patent in suit, it was obvious to take also into account the teaching of E12 since a solution to the constant problem of cavitation is disclosed therein in form of a connector with gradually changing cross-sectional area providing a smooth flow between one end thereof connected to two parallel tubes and the other end thereof connected with only one tube. By doing this, additionally, the welding energy is directed to the parts to be united, thereby solving the other problem, concerning manufacturing, mentioned here above. Thus, the skilled person will arrive to a manifold which comprises all the structural features which are indicated in claim 13 in dispute and which, if necessary with some adaptation based on general knowledge of Coriolis manifolds, is **suitable for** the indicated purpose of equipping a parallel path Coriolis mass flow meter.

2.2.6 Consequently, the subject-matter of claim 13 in dispute does not involve an inventive step in the sense of Article 56 EPC.

Therefore, the grounds of opposition mentioned in Article 100 EPC prejudice the maintenance of the main request, i.e. the patent in the form as granted, so that this main request is not allowable (Article 102(1) EPC).

3. *First auxiliary request*

Claim 13 of the first auxiliary request concerns a manifold arranged for a parallel path Coriolis mass flow meter, i.e. a manifold which consists of structural parts of adequate materials assembled in an adequate way in view of its use as a manifold for a Coriolis meter. Indeed, such a manifold is "suitable" for this purpose. However, there can be manifolds which are not arranged for this purpose, but for another purpose, and which yet, either by chance or by minor adaptation measures based on general knowledge, are found to be "suitable" for this purpose. Therefore, the subject-matter of claim 13 of the first auxiliary request represents a more restricted scope of protection than the manifold of claim 13 as granted, which was for a parallel path Coriolis mass flow meter, i.e. in accordance with the above-mentioned decision T 287/86, "suitable" for said purpose. For the reader of claim 13 of the first auxiliary request, it is directly and unambiguously derivable that the features of the manifold are specifically designed for the mentioned purpose, as well with respect to the structural features of the parts of the manifold as with respect to the way they are assembled. This manifold has been adequately disclosed in the patent as granted and in the patent application as filed, and it is clearly defined in said claim 13 (Article 123(3), 123(2) and 84 EPC).

Since claim 13 of the patent as granted has been found novel, claim 13 of the first auxiliary request, which concerns a more restricted type of this manifold, is also novel in the sense of Article 54 EPC.

The skilled person starting from the manifold of the parallel path Coriolis mass flow meter of Figure 2 of the patent in suit and trying to solve the problem of cavitation in this known device would be aware of the general teaching of E12 concerning the smooth flow profile presented by the hollow contoured configuration of the transition piece (12). Moreover, he would be aware that he could find in this document, with the projections (58, 60) of the mounting block (14), some solution of his problem of the difficulty for assembling the manifold, i.e. the difficulty to weld the small mass of each flow tube to the large mass of each manifold, which are time consuming and hence costly. Thus, as mentioned here above with respect to the main request, he could arrive to a device "suitable" for a Coriolis flow meter. However, as convincingly argued by the respondent, the skilled person starting from the manifold of the flow meter of Fig. 2 of the patent in suit and arranging it, i.e. specifically designing it, would not, in view of the oscillations to which the flow tubes are to be submitted, take into consideration the tube connection of E12 because it is not directly derivable as being adapted for this purpose. Therefore, the subject-matter of claim 13 of the first auxiliary request is not obvious having regard to the state of the art and thus involves an inventive step in the sense of Article 56 EPC.

Claim 1 of the first auxiliary request is identical with the text which had been agreed by the proprietor and respondent for granting the patent and only differs from the text of the printed specification, which is erroneous, by the amendment provided now. Claim 1 concerns a Coriolis meter equipped with a manifold having the features of the manifold of claim 13, and is thus also novel and involves an inventive step for the same reasons as those mentioned in relation to claim 13 (Articles 54 and 56 EPC).

Therefore, taking into consideration the amendments made by the proprietor and respondent and resulting in the first auxiliary request, which meets the requirement of the Convention, the patent can be maintained on this basis (Article 102(3) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Opposition Division with the order to maintain the patent in amended form on the basis of the claims of the First auxiliary request presented at the oral proceedings, the description to be adapted and the drawings as granted.

The Registrar: The Chairman

P. Martorana E. Turrini