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D E C I S I O N
of 25 November 2003

Case Number: T 0548/99 - 3.4.2

Application Number: 91310158.0

Publication Number: 0485135

IPC: G01F 1/58

Language of the proceedings: EN

Title of invention:
Magnetic flow meter

Patentee:
KABUSHIKI KAISHA TOSHIBA

Opponent:
Endress + Hauser Flowtec AG

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - main request (no)"
"Auxiliary request too late - not admitted"

Decisions cited:
-

Catchword:
-



Case Number: T 0548/99 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 25 November 2003

Appellant: KABUSHIKI KAISHA TOSHIBA
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 26 March 1999
revoking European patent No. 0485135 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: A. G. Klein
Members: M. A. Rayner
V. Di Cerbo

Summary of Facts and Submissions

I. The appellant (=patentee) appealed against the decision of the opposition division to revoke European patent number 485135 (application number 91310158.0). The patent concerns a magnetic flowmeter.

II. In its decision, the opposition division made reference *inter alia* to the following documents:

D7 US-A-4 357 835

D10 Tietze, Schenk, "Halbleiter-Schaltungstechnik", 9, Berlin, 1989, Introduction and pages 926-929.

The opposition division found that the subject matter of claim 1 attached to its decision lacked an inventive step in view of documents D7 and D10. Features involving voltage to current conversion and current to voltage conversion, while novel over document D7 are, as demonstrated by document D10, conventional in solving problems with voltage transmission over distance. The division also mentioned that other documents in the prior art give a hint to applying a conversion principle to electromagnetic flowmeter systems.

III. In its notice of appeal, the appellant requested setting aside of the decision and maintenance of the patent as granted or in amended form. In its statement setting out the grounds of appeal, the appellant argued against the other documents in the prior art mentioned by the opposition division as not giving any hint towards applying the technique disclosed in document

D10 to the electromagnetic flowmeter of document D7. Oral Proceedings were requested should the board be unable to accede to the request of the appellant.

IV. Oral proceedings were appointed for 25 November 2003 consequent to the auxiliary request of the appellant. In a communication attached to the summons, the board commented *inter alia* that it was not clear upon which claims the requests of the appellant were based. It seemed that only the claim as granted was specified in the appeal. Furthermore, the appeal was concerned largely with prior art not essential to the reasoning of the opposition division leading to its negative conclusion. The reasoning involved rather more considering it obvious to use a conventional solution, such as that disclosed in document D10, for problems associated with transmitting voltage over a transmission line. The board doubted whether any inventive step is involved in using a standard voltage to current conversion in the device of document D7. Moreover, the board intended, if possible, to reach a decision at the end of the oral proceedings. If filing of further submissions was intended, this should be done at least one month before the oral proceedings. Late submissions of any description, especially if so complex as to delay unduly or prevent resolution of the issues at the oral proceedings, ran the risk of not being taken into consideration by the board.

V. In a facsimile transmission dated 27 October 2003 in advance of the oral proceedings, the appellant requested the patent be maintained with claim 1 as amended during opposition proceedings, i.e. as attached to the decision of the opposition division. At the oral

proceedings, the appellant designated this claim as main request and also filed a handwritten amended claim 1 forming the basis of an auxiliary request.

VI. The case of the appellant can be summarised as follows:

Requests

Maintenance of the patent on the basis of claim 1 attached to the decision of the opposition division (main request) or of claim 1 filed at the oral proceedings (auxiliary request).

Wording of Independent Claim

Main request - Claim 1

"A magnetic flowmeter comprising a sensor (1) comprising a measuring tube (5) for fluid flow therethrough; exciting coil means (8) for generating a magnetic field across the measuring tube at right angles to the direction of fluid flow; a pair of electrodes (6,7) facing each other in the tube and arranged on an axis at right angles to the direction of the magnetic field and to the direction of fluid flow; a control circuit (9,10) having means for receiving an alternating voltage generated across the electrodes (6,7) when the coil means is excited to produce an alternating magnetic field and a fluid flows through the tube, said voltage representing the rate of fluid flow through the tube; said control circuit also including means for converting said voltage to a current proportional to the voltage; and converter means (2) located remote from the sensor (1) and

connected thereto by a signal cable (3) through which said current flows; said converter means comprising an exciting circuit (37) for exciting the coil means (8) to generate the alternating magnetic field; and means (31-36) for producing a voltage signal proportional to the current in the signal cable, said voltage representing the rate of fluid flow through the tube."

Auxiliary request - Claim 1

"A magnetic flowmeter comprising a sensor (1) comprising a measuring tube (5) for fluid flow therethrough; exciting coil means (8) for generating a magnetic field across the measuring tube at right angles to the direction of fluid flow; a pair of electrodes (6,7) facing each other in the tube and arranged on an axis at right angles to the direction of the magnetic field and to the direction of fluid flow; a control circuit (9, 10) having means for receiving a alternating voltage generated across the electrodes (6,7) when the coil means is excited to produce an alternating magnetic field and a fluid flows through the tube; said control circuit also including means for converting said voltage to a current proportional to the voltage; said converter means (2) located remote from the sensor (1) and connected thereto by a signal cable (3) through which said current flows; said converter means comprising an exciting circuit (37) for exciting the coil means (8) to generate the alternating magnetic field; and means (31-36) for producing a voltage signal proportional to the current in the signal cable, said voltage representing the rate of fluid flow through the tube; said control circuit (10) including a

preamplifier (9) for sensing the voltage across said pair of electrodes (6, 7), an operational amplifier (13) which has one input terminal to which the output of the preamplifier is applied and another input terminal to which a constant voltage is applied and which produces a base signal representing the deviation of the voltage across said electrodes from said constant voltage, and a transistor (15) having a base and a collector-emitter path through which a current flows when the base is supplied with the base signal, said current being supplied to said signal cable (3) as said current signal; said control circuit (10) further comprising a series circuit of a first and second Zener diodes (16, 17) connected in a forward direction between a collector and emitter of said transistor (15), a junction point of said first and second Zener diodes (16, 17) being connected to the other input terminal of said operational amplifier so as to supply said constant voltage."

Substantive patentability

According to the present invention the apparatus is divided into two sections (a) the sensor circuit which includes a voltage current conversion circuit, but is unpowered, and (b) the remote converter which includes a power supply, an exciting circuit for the sensor, and a conversion circuit for producing an output signal. Consequently the sensor can be suitably positioned relative to the conduit containing the fluid whose flow is to be measured, while the converter circuit can be arranged in a more suitable remote environment, and connected by a transmission line carrying a signal current. By contrast, in document D7 a voltage signal

is transmitted, and errors due to capacitance effects in the transmission line are avoided by the use of a shielded cable. There is no hint towards the solution proposed by the invention.

So far as document D10 is concerned, this does not mention electromagnetic flowmeters at all. There is thus no recognition of the specific problem of deciding where to locate the different parts of the circuit such as the exciting circuit, the power supply and the signal separating circuit of the present invention and thus no recognition or suggestion of the principle of having all these at a location remote from the sensor. On the contrary, this document does not even appear to consider the question of what driving means might be required by the sensor, and where it should be located. In some cases there is a voltage to current conversion at the signal generating (i.e. sensor) end to produce a current signal on the transmission line. However an additional power supply is presumably required at the same end of the line as the sensor. Where a resistive type of sensor is considered, no special driving or excitation circuit such as the circuit of the present invention is suggested.

Admissibility of the auxiliary request

The auxiliary request is based on claims which have always been present in the patent specification. The respondent made no substantive response to the summons to oral proceedings, so that the oral proceedings was the first chance the appellant had to reply to the case of the respondent. In addition, the specific remarks made by the board in the communication attached to the

summons to oral proceedings indicated to the appellant that document D10 did not provide a teaching sufficient to solve the problem of a remote converter unit.

VII. The case of the respondent can be summarised as follows:

Requests

Dismissal of the appeal.

Arguments

Document D7 discloses a flowmeter with a spatial separation between the measuring tube signal generation and converter means remote therefrom. Thus the difference in the subject matter claimed resides in voltage to current conversion of the signal transmitted through the cable. The problem addressed is thus that of signal transmission in general and is not restricted to electromagnetic flowmeters, the structure of which is in any case known from document D7. Just this problem is dealt with in the disclosure of document D10, where current conversion is disclosed to avoid signal falsification. It is obvious to the skilled person to apply the known solution to the signal transmission problem to the known flowmeter. Accordingly, the subject matter of claim 1 lacks an inventive step. The respondent pointed out repeatedly during the oral proceedings that no reference to a power supply was present in the claim being discussed.

The auxiliary request should no be admitted because filing at the oral proceedings is too late.

VIII. At the end of the oral proceedings, the board gave its decision.

Reasons for the Decision

1. *Admissibility of the appeal*

The appeal complies with the provisions mentioned in Rule 65(1) EPC and is therefore admissible.

2. *Prior art documents*

2.1 Document D7

An electromagnetic flowmeter is shown in figure 1 where a low-frequency excitation current is supplied to coil 15 of an electromagnet. The excitation circuit 11 includes a pair of switches 12 and 13, connected to power supply 14 and periodically actuated in alternate directions to apply power to the coil to produce a rectangular wave establishing a magnetic flux field in flow tube 16. The fluid to be metered is conducted through flow tube 16 of the flowmeter primary and intercepts the magnetic field therein to induce a voltage in the fluid which is transferred to a pair of electrodes 17 and 18 mounted at diametrically-opposed positions on the tube. The voltage yielded by electrodes 17 and 18 is supplied via signal lines 21 and 22 of a transmission line to a converter 23. Output from the converter leads to a DC signal suitable for

transmission in industrial process control applications. Errors due to the capacity of the electrical double layer on each electrode and the stray capacity of the signal transmission line are reduced by using shielded cables.

2.2 Document D10

This document mentions preamplifying small sensor signals, as with for example pressure sensors or thermistors, in advance of transmission over a long line. It is said to be simpler to transform the sensor signal into a current signal proportional thereto. A current is not falsified by line resistances. A voltage controlled current source converts the sensor potential to a current the voltage being reconstituted across R_1 as shown in Figure 26.58. A further simplification of signal transmission is possible by ensuring current taken up by the sensor and the voltage controlled current source is constant, in which case signal and service current can use the same line, which powers the sensor and the operational circuitry (see Figure 26.59).

3. *Substantive patentability*

3.1 Document D7 can be considered to represent the closest prior art document, it also being concerned with a flowmeter configured with a square wave excited coil for a measuring tube with electrodes which pick up a voltage representing fluid flow, remote conversion circuitry connected by a cable being provided. Novelty of the subject matter of claim 1 with respect to the disclosure of document D7 is therefore provided by the control circuit also including means for converting

said voltage to a current proportional to the voltage and the converter comprising means for producing a voltage signal proportional to the current in the signal cable.

- 3.2 The novel features address the problem of signal falsification consequent to its transmission over the cable in view of the characteristics thereof. This is a general problem with signal transmission in the sensor field, which is even already recognised in document D7 itself, which discloses its mitigation by shielding the cable. The skilled person knows however that the problem of transmission line falsification is not restricted to any specific cable characteristics or type of sensor such as the flowmeter as disclosed in document D7, but exists in general in the sensor field and indeed this is illustrated by document D10, where a solution to the problem of signal falsification between a sensing part and a converting part is taught using voltage to current conversion. The main line of argument of the appellant for inventive step cuts in at this point in the chain by challenging the relevance of document D10 basically because it is not directed to flowmeters with the features claimed. However, this challenge is doomed to fail in the view of the board because it starts from document D10, i.e. it premises on bypassing the fact that the closest prior art and starting point for the invention is just such a flowmeter, namely that provided by the teaching of document D7, having a flowmeter with the two part configuration referred to by the appellant, i.e. with alternating excitation circuitry remote from the flow tube and detected signal transmitted along transmission line. From this starting point, i.e. the flowmeter

features being intrinsically present, and having the general transmission problem to solve, the board sees no bar in a flowmeter being at issue to the obvious application of the general text book solution of current conversion as known from document D10. The board thus reached the conclusion that use of current conversion to mitigate the problem of falsification in signal transmission was an obvious measure for the skilled person in relation to the flowmeter of document D7. Whether or to what extent any cables are shielded is a separate matter, which does not influence this conclusion.

Another line of argument of the appellant concerned a power supply not being necessary in the sensor, i.e. not being at the same cable end as the measuring tube. However, as the respondent pointed out, claim 1 contains no reference to a power supply, so that this argument cannot be considered relevant.

3.3 Therefore, the board concluded that the subject matter of claim 1 of the main request cannot be considered to involve an inventive step within the meaning of Article 56 EPC.

4. *Auxiliary request*

4.1 The board was surprised by this request as the appellant had already specified in response to the comments of the board in the communication attached to the summons that the claim for consideration at the oral proceedings was that attached to the decision of the opposition division. The case of the respondent at the oral proceedings was, as the board expected,

directed against this claim which the appellant had confirmed as that up for discussion in advance of the oral proceedings.

- 4.2 The auxiliary request first made at the oral proceedings involved a relatively long and complex claim submitted in three handwritten pages not previously presented for consideration. The board formed the view that it simply was not reasonable to expect the respondent or itself to be able both to check the claim for compliance with Articles 84 and 123 in the context of whether the claim really corresponded to a combination of claims 1, 2 and 7 as granted (in fact it does not) and then to deal with substantive issues associated with whatever then evolved from the claim within the time frame of the oral proceedings.
- 4.3 Since the respondent presented arguments related to documents and issues already in the file, the board did not see this as offering a reason for permitting the appellant to file a fresh claim. Moreover, the appellant was given a chance to respond to the comments of the board, and indeed did so, before the oral proceedings. Thus, the comments of the board in the communication attached to the summons also provide no reason for admitting the amended claim.
- 4.4 Therefore none of the submissions of the appellant could convince the board that the auxiliary request did not fall squarely into the category warned by the board in the summons to oral proceedings as running the risk of not being admitted. Accordingly, as the claim could not be dealt with adequately within the timeframe of the oral proceedings, the board complied with the

request of the respondent and did not admit the auxiliary request.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

P. Martorana

A. G. Klein