

Veröffentlichung im Amtsblatt	Ja/Nein
Publication in the Official Journal	Yes/No
Publication au Journal Officiel	Oui/Non

Aktenzeichen / Case Number / N^o du recours : T 594/88 - 3.4.1 ✓

Anmeldenummer / Filing No / N^o de la demande : 81 100 927.3 ✓

Veröffentlichungs-Nr. / Publication No / N^o de la publication : 0 033 977 ✓

Bezeichnung der Erfindung: Ultrasonic blood flow measuring apparatus ✓
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : A61B 10/00, G01S 7/62, G01 F1/66, ✓
G01P 5/00

ENTSCHEIDUNG / DECISION
vom / of / du 8 February 1990 ✓

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet : Kabushiki Kaisha Toshiba

Einsprechender / Opponent / Opposant : Siemens Aktiengesellschaft

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56 EPC

Schlagwort / Keyword / Mot clé : "Inventive step (yes)"

Leitsatz / Headnote / Sommaire



Case Number : T 594/88

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 8 February 1990

Appellant :
(Opponent)

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Respondent :
(Proprietor of the patent)

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Representative :

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Decision under appeal :

Decision of Opposition Division of the European
Patent Office dated 19 July 1988 and dispatched
on 3 October 1988 rejecting the opposition filed
against European patent No. 81 100 927.3
pursuant to Article 102(2) EPC.

Composition of the Board :

Chairman : K. Lederer

Members : E. Turrini

C. Payraudeau

Summary of Facts and Submissions

- I. European patent No. 0 033 977 was granted in response to European patent application No. 81 100 927.3.
- II. An Opposition was filed against the European patent by the Appellant (Opponent) and full revocation of the patent requested.

During the opposition procedure the Appellant cited inter alia the document US-A-3 939 707 (D3) and argued that the subject-matter of Claim 1 of the contested patent was not inventive in view of this prior art.
- III. The Opposition Division in its decision rejected the opposition.
- IV. An appeal was lodged against this decision. In the Statement of Grounds, the Appellant requested that the decision of the Opposition Division be set aside and the patent be revoked. In a further letter, the Appellant cited the document DE-A-27 19 118 (D4) as rendering obvious when taken in combination with D3, the subject-matter of Claim 1 of the patent in suit.
- V. In a letter, the Respondent (Patentee) requested that the appeal should be dismissed.
- VI. At the oral proceedings requested by both parties, the Appellant maintained his request that the decision under appeal be set aside and that the patent be revoked.

The Respondent requested as main request that the appeal be dismissed, i.e. that the patent be maintained as granted, and as auxiliary request that the patent be maintained in

amended form on the basis of a new narrower Claim 1 presented at the oral proceedings and Claims 2 to 9 as granted.

VII. Claim 1 of the main request reads as follows:

"An ultrasonic blood flow measuring apparatus comprising:
means (11) for transmitting an ultrasonic beam into a tissue under examination in response to an electrical driving pulse and for receiving an ultrasonic echo reflected from the tissue to convert the same into an electrical signal;
means (15-1, 15-2, ...15-n) for generating the electrical driving pulse of said transmitting and receiving means (11); and
means (20) for detecting a tomogram signal from the electrical signal;
means (24) for extracting Doppler frequency shift components due to the velocity of blood flow in the tissue from the electrical signal;
means (34, 28) for generating marker signals indicative of a location where the velocity of the blood flow is measured and of the direction of the blood flow and of the ultrasonic beam which contains the Doppler frequency shift components;
means (35) for calculating an angle θ defined between the direction of the blood flow and the direction of the ultrasonic beam which contains the Doppler frequency shift components;
means (31) for obtaining the velocity of the blood flow in accordance with the Doppler frequency shift components and the angle θ ; and
means (22) for displaying a tomogram of the tissue and markers in response to the tomogram signal and the marker signals, respectively."

Claims 2 to 9 are dependent on Claim 1.

VIII. The arguments presented by the Appellant as far as Respondent's main request is concerned were essentially as follows:

Document D3 discloses an ultrasonic blood flow measuring apparatus based on the Doppler effect having a screen on which is displayed a marker line indicative of the direction of the ultrasonic beam which contains the Doppler frequency shift components.

There could not be any invention, when starting from that document to try automatizing the system, this being a common aim in any technical field. Document D4 would suggest to the man skilled in the art to generate on the screen a second movable marker line controlled by the operator, which would cause by its positioning parallel to the direction of the blood flow an automatic evaluation of the angle between the two marker lines and eventually of the blood velocity. Indeed, in the part of document D4, which analyses the state of the art, reference is made to ultrasonic systems suited for automatizing the measurement on a screen of the distance between two image points e.g. by moving the position of two marker points until they are superposed to the two image points. The skilled man would only need to adapt the teaching of document D4 to his particular purpose of measuring an angle (i.e. by substituting marker lines to marker points).

Once the angle is measured, the automatic computation of the blood flow does not present any technical difficulty.

Why it has not been proposed, before the priority date of the patent in suit, to modify the measuring system according to document D3 by including means for an

automatic determination of the angle and finally of the blood flow, could be ascribed to economic reasons, e.g. avoiding having to increase the number of onerous electronic components. In other words the skilled man was not confronted with any technical difficulties.

Thus, the skilled man would merely with the knowledge of the prior art arrive without inventive ingenuity at the subject-matter of Claim 1.

IX. The Respondent argued essentially as follows:

The skilled person who knew the ultrasonic blood flow measuring apparatus according to document D3, was faced with the problem of rendering easier and quicker the calculation of the angle between the direction of the ultrasonic beam and the direction of the blood flow.

The suggested solution consisting in providing a second marker in the direction of the blood flow and means for computing automatically the value of said angle and subsequently the velocity of the blood flow, was simple and effective. None of the prior art documents gave a hint at the posed problem or at its solution. In particular, the state of the art referred to in the document D4 had a completely different purpose, namely that of simplifying and rendering more reliable the measurement of the distance between two points on a screen. Document D4 would therefore not help the skilled man to arrive at the invention set out in Claim 1 of the patent in suit.

Finally, it looked unreasonable to consider that the skilled man would have renounced to provide a second marker generator and use it for the automatic calculation of the angle, in order to avoid a too complicated and

costly circuitry. Neither the addition of a second marker generator nor the automatic angle computation would notably increase the cost of the apparatus considered as a whole.

It should therefore be concluded that the skilled man in the art was simply not in the position to think of this possibility, i.e. the measuring apparatus of Claim 1 involved an inventive step.

Reasons for the Decision

1. The appeal is admissible.
2. Main request.
 - 2.1 The Board is satisfied that the patent specification, corresponding to the main request, does not infringe Article 123(2) EPC. In this respect the Appellant did not raise any objection either.
 - 2.2 Novelty
 - 2.2.1 Document D3 discloses a method to obtain a measurement of flow of liquid in a blood vessel and thereby also an ultrasonic blood flow measuring apparatus comprising:

means for transmitting an ultrasonic beam into a tissue under examination in response to an electrical driving pulse and for receiving an ultrasonic echo reflected from the tissue to convert the same into an electrical signal (Fig. 1; column 1, lines 4 to 24; column 3, lines 22 to 26);

means for generating the electrical driving pulse of said transmitting and receiving means (column 2, lines 8 to 19);

means for detecting a tomogram signal from the electrical signal (column 1, lines 20 to 24; column 3, lines 28 to 31);

means for extracting Doppler frequency shift components due to the velocity of blood flow in the tissue from the electrical signal (column 3, lines 32 to 36; column 4, lines 17 to 21);

means for generating marker signals indicative of a location where the velocity of the blood flow is measured and of the direction of the ultrasonic beam which contains the Doppler frequency shift components (Fig. 1; column 4, lines 12 to 21 and 51 to 61); and

means for displaying a tomogram of the tissue and markers in response to the tomogram signal and the marker signals, respectively (Fig. 1; column 4, lines 38 to 61).

The subject-matter of Claim 1 differs from the disclosure of document D3 in that:

the means for generating marker signals generate also a marker signal indicative of the direction of the blood flow, said signal being displayed on the displaying means;

means are provided for calculating the angle defined between the direction of the blood flow and the direction of the ultrasonic beam which contains the Doppler frequency shift components; and

means are provided for obtaining the velocity of the blood flow in accordance with the Doppler frequency shift components and the angle.

2.2.2 Document D4 describes at page 2 various known ultrasonic measuring systems. In said systems the distance between

two points on a screen is measured. For this purpose in one example means are provided for permitting the operator to bring two markers in coincidence with the two image points whose distance has to be measured and means are also provided for calculating said distance.

The subject-matter of Claim 1 differs mainly from the above mentioned state of the art in that the markers are marker lines and not spots, in that the means for calculating the distance between two markers are replaced by means for calculating an angle between the two marker lines, and in that means are provided for extracting Doppler frequency shift components due to fluid velocity in a blood vessel and for calculating this velocity by means of a mathematical function of these components and of the calculated angle.

2.2.3 The remaining cited documents do not come closer to the subject-matter of Claim 1.

2.2.4 Thus the subject-matter of independent Claim 1 is considered to be novel within the meaning of Article 54 EPC.

2.3 Inventive Step

2.3.1 Document D3 represents, in the Board's opinion, the nearest prior art. Indeed the system described in this document has all the features of the system of Claim 1 apart from the means for improving and automatizing the steps of evaluating the blood flow velocity.

2.3.2 Starting from the disclosure of document D3, the general objective problem to be solved is to provide an ultrasonic blood flow measuring apparatus having partly automatized means for correcting the error resulting from the angle

between the axis of the ultrasonic beam and the general direction of the blood vessel.

- 2.3.3 Said problem is solved by the features which distinguish Claim 1 from the disclosure of document D3 and which essentially consists in providing means for generating and displaying under control of the operator a second marker line indicative of the direction of the blood flow, means for calculating the angle between the two marker lines and means for accurately calculating the velocity of the blood flow.
- 2.3.4 While merely the technical problem cannot per se contribute to the presence of an inventive step, it being a common aim in any technical field to automatize as much as it is reasonably possible the evaluation of physical parameters, the solution to said problem is not considered by the Board to be obvious for the following reasons:
- 2.3.5 In order to solve the problem, the skilled man would certainly consider the prior art in the field of ultrasonic tomographic displaying and measuring systems. He would thus be expected to find document D4 which describes such systems.

In the part of the description of document D4 concerning the state of the art, he would learn that it is possible to measure the distance between two points on a screen by providing two marker points which can be moved by the operator to overlap the two image points whose distance has to be measured (page 2, lines 10 to 18) and the distance between the two marker points being then easily calculated by an associated computer (page 2, lines 18 to 20).

This suggestion however would not help the skilled technician to arrive at the apparatus of Claim 1, because the automatic evaluation of the distance between two points is not directly correlated with the automatic evaluation of an angle. Moreover, document D3 shows that both the direction of the ultrasonic beam in the form of a marker line and the representation of the vessel, through which the blood flows, are displayed on a screen (Figure 1). The skilled man has therefore all the elements to calculate the angle between the ultrasonic beam direction and the vessel axis. He would therefore see no reason why a second marker line, parallel to the longitudinal axis of the vessel, should be generated.

Also the other suggestion contained in document D4 of measuring the distance between the two points by displaying a marker line on the screen, which can be displaced and rotated until the two points are covered (page 2, lines 26 to 35) does not help the skilled man in solving his problem. Firstly in this example, D4 relates again to the measurement of the distance between two points and secondly the use of only one marker line, and not of two, is proposed.

The Appellant's view that the invention in suit consists merely in an automatization idea, which is common in any technical field, cannot be shared by the Board.

It is true that it can be considered normal practice, not going beyond the capabilities of the average technician, to utilise means for automatically calculating the blood flow velocity, once the value of the angle and of the Doppler frequency shift components are known. The Board is however of the opinion that the idea of using a second marker line generator controlled by the operator so as to

give the direction of the blood flow in order to simplify and improve the calculation of the angle is not merely an automatisisation step, but rather a different approach to measure said angle, which contributes to solve the said problem.

Also the objection of the Appellant that the skilled man aware of document D3 did not propose means for generating the second marker signal parallel to the blood flow direction simply because he wanted to avoid an excessive number of electronic components, cannot be followed by the Board. There is no reason to think that this would have deterred the skilled person at least to try such a solution, if he had thought of such a possibility.

2.3.6 The other cited prior art documents are not more relevant for judging the inventive step of Claim 1 and thus need not be discussed here.

2.3.7 Thus the subject-matter of Claim 1 is considered to involve an inventive step within the meaning of Article 56 EPC and the Grounds of Opposition mentioned in Article 100(a) EPC do not therefore prejudice the maintainance of Claim 1 as granted.

2.3.8 Claims 2 to 9 are dependent on Claim 1 and for this reason they are also considered to be allowable. Thus, the Grounds for Opposition mentioned in Article 100(a) EPC do not prejudice the maintenance of Claims 2 to 9 either.

3. Auxiliary Request

The main request having being considered allowable by the Board, it is not necessary to discuss Respondent's auxiliary request.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar

The Chairman

M. Beer

K. Lederer