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D E C I S I O N
of 5 March 1996

Case Number: T 0677/93 - 3.4.1

Application Number: 84305232.5

Publication Number: 0135326

IPC: G01R 33/34

Language of the proceedings: EN

Title of invention:
Nuclear magnetic resonance apparatus

Patentee:
PICKER INTERNATIONAL LIMITED

Opponent:
Siemens AG

Headword:
NMR apparatus/PICKER INTERNATIONAL

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (denied)"
"Neighbouring technical field"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0677/93 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 5 March 1996

Appellant: (Opponent)
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Representative:
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Respondent: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office dated 21 May 1993 rejecting the opposition filed against European patent No. 0 135 326 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: G. D. Paterson
Members: R. K. Shukla
H. J. Reich

Summary of Facts and Submissions

I. European patent No. 0 135 326 relates to a nuclear magnetic resonance (NMR) apparatus. It was opposed on the ground that the subject-matter of the patent did not fulfil the requirement of Articles 52 to 57 EPC (Article 100(a) EPC), in particular, the requirement of inventive step in view of prior art document:

D1: DE-A1-2 452 851.

The Opposition Division introduced into the opposition proceedings the following prior art documents which had previously been cited during the examining proceedings:

D2: Physics in Medicine and Biology, vol. 27, no. 3, March 1982, pages 443 to 447; and
D3: GB-A-2 056 086.

II. Independent claim 1 of the patent as granted has the following wording:

"An NMR apparatus including a coil arrangement for the application of and/or sensing of RF fields during examination of a body by means of the apparatus characterised in that said coil arrangement comprises at least two separable parts (10A, 51 and 10B, 53) adapted to be assembled around a body to be examined to form said coil arrangement and said parts include coupling means (55, 57, 59, 61) whereby said parts can be releasably held in position with respect to one another when so assembled."

III. In its decision, the Opposition Division rejected the opposition for the following reasons:

Document D2 or D3 constitutes the closest prior art, and discloses an NMR apparatus corresponding to the precharacterising part of claim 1. The characterising portion of the claim solves the problem of providing an NMR apparatus having a coil arrangement which can be positioned as closely as possible around the body under examination. Document D1 is concerned with low frequency therapeutic treatment and not with high frequency diagnosis, so that a person skilled in the field of NMR would not be led to look for solutions in the technical field to which document D1 pertains. Furthermore, even if the teaching of document D1 were combined with that of document D2 or D3, the skilled person would not arrive at the claimed invention, because in document D1 the coil parts are permanently connected together by a hinge and are therefore not separable.

IV. The Opponent lodged an appeal against the above decision and requested that the patent be revoked in its entirety, since the claimed subject matter did not involve an inventive step with regard to the documents cited during the opposition proceedings and the following document, which was cited in the European Search Report:

D4: GB-A-2 094 482.

The Appellant (Opponent) also referred to the following patent applications, which do not form state of the art according to Article 54 EPC, but which were filed around the same time as the application forming the basis of the opposed patent:

D5: DE-A1-3 323 657,
D6: EP-A-142 760.

The Appellant presented essentially the following arguments in support of its request.

As can be seen from the disclosure in documents D2 and D3, it is generally known in NMR imaging that high frequency receiver coils should fit the object under examination as closely as possible. Also, the skilled person would be aware of the fact that for imaging body portions, such as the neck, the prior art one-piece coil cannot be positioned closely around the neck due to the irregular shape and size of the human body. As the problem facing the skilled person in the present case is purely of mechanical nature, the skilled person would not limit the search for a solution to the problem to the NMR field, but would also consider technical fields such as the clamps and clips for hose pipes. Such clamps and clips are formed of separable parts and can be assembled around the pipe to hold it tightly.

It is also known in the medical field (see document D1, Figure 3) to employ a coil made of two parts which are connected together at one end by a hinge and at the other end by a separable connection, the construction thereby allowing the coil to be opened. A modified construction of the coil having separable connections at

both the ends is mechanically equivalent to the construction of the coil shown in document D1, so that the use of such a modified construction for an NMR coil would be obvious to the skilled person.

A further indication that the claimed invention lacks an inventive step is the fact that about the same time as the application for the patent under dispute was filed, patent applications D5 and D6 directed to similar arrangements to the one claimed in the patent under dispute were also filed .

V. The Respondent (Patent Proprietor) requested that the appeal be dismissed, and presented essentially the following arguments in support of its request. An additional document (D7:Journal of Magnetic Resonance 63 (1985), pages 622 to 628) was filed at the oral proceedings held on 5 March 1996 before the Board.

The construction of a clamp or a clip for a pipe involves purely mechanical considerations, whereas in an NMR imaging coil, close fitting is required to achieve good electrical coupling between the coil and the body. Moreover, in the design of an NMR imaging coil, its structural integrity and resistance are important considerations. An NMR imaging coil having separable parts would necessarily have extra contact resistance and lower structural integrity compared to a conventional one-piece NMR coil. Furthermore, as can be seen from Figure 3 of document D7, it was known in the art that with the type of coils available at the priority date of the opposed patent, a close fitting of the NMR imaging coil around the body produced a non-uniform field within the body. In view of these considerations, the use of a coil arrangement having separable parts in an NMR apparatus was not obvious for the skilled person.

The teaching of document D1, which relates to a low frequency therapy apparatus, is too remote to be considered by the person skilled in NMR imaging technique. Furthermore, in document D1, no reason is given for the construction of a coil in two parts with a hinge connection. Since, neither document D1, nor any other cited document, mentions the problem encountered in positioning a coil closely around a body having irregular size and shape, the skilled person does not get any hint from the prior art to the claimed solution.

The fact that several applications directed to closely related inventions were filed around the same time as the application for the patent under dispute, does not establish that the claimed subject matter was obvious to the skilled person. On the contrary, when commercial pressure arises, considerable inventive ingenuity may be expended to solve established problems. Moreover, if, as held by the Appellant, the problem underlying the present patent was well known and its solution obvious to the skilled person, then RF coils in accordance with claim 1 of the patent would have appeared soon after the invention of NMR imaging apparatuses, i.e. in 1976, instead of about seven years later.

VI. At the conclusion of the oral proceedings it was announced that the appeal is allowed and the patent is revoked.

Reasons for the Decision

1. In the present appeal, the only question which is at issue is that concerning inventive step.

1.1 Document D3 constitutes the closest prior art and discloses an NMR apparatus including a coil arrangement for the application and/or sensing of RF fields during examination of a body by means of the apparatus (see Figure 1 and the corresponding description in page 2, lines 75 to 98). The coil arrangement in document D3, however, has no separable parts.

The NMR apparatus according to claim 1 of the opposed patent is thus distinguished over the prior art in that the coil arrangement in the former comprises at least two separable parts adapted to be assembled around a body to be examined to form said coil arrangement, and in that said parts include coupling means whereby said parts can be releasably held in position with respect to one another when so assembled.

The coil arrangement of the NMR apparatus according to the opposed patent can be assembled around a body part to be imaged, and thereby dispenses with the need to slide it over an irregularly shaped body as in the case of a conventional one-piece coil. This would enable one to reduce the dimension of the coil arrangement so that it fits more closely around the body part. As is known in NMR imaging (see, e.g. document D2, "Introduction"), such a tight coupling of the RF field with the body part improves signal-to-noise ratio of the image.

The problem underlying the present invention is therefore to improve signal-to-noise ratio in an NMR apparatus, such as disclosed in Document D3.

1.2 As mentioned earlier, it is already known from document D2, that in the NMR imaging of head portion of a body a reduction in the diameter of the RF coil to half the whole-body coil diameter improves the signal-to-noise-ratio of the head images. Similarly, in the NMR apparatus of document D3 (see page 3, lines 43 to 52), the ratio of the major axis to minor axis of a receiver coil for head scanning is smaller than that of a receiver coil for body scanning. It is further disclosed in the above cited text that the coils are made as small as possible to effect a tight coupling.

In connection with signal-to noise ratio, it was submitted by the patent Proprietor that electrical techniques, such as a particular design of the RF coil or image processing were also available to the skilled person, so that the mechanical solution as proposed by the present invention was not obvious. Although, the Board accepts that electrical solutions such as mentioned above were available to the skilled person, the prior art documents D2 and D3 clearly teach that a tight RF coupling between the RF coil and the body part is a prerequisite for a relatively high signal-to-noise-ratio, and that such a coupling can be achieved by physically positioning the RF coil as closely as possible to the body part. Also, in the Board's view, the skilled person would realise that in examining body parts such as the neck, the prior art coil of document D3 cannot be positioned so as to fit the neck closely, since the prior art coil must have sufficiently large diameter so as to slide over the entire body.

In looking for a solution to the above problem, the skilled person, in the present case an engineer in the biomedical field, would not confine the search to the field of NMR technique, but would also consider other neighbouring fields where the above problem of

positioning a coil close to a body having irregular shape and size, is likely to occur. Contrary to the submission of the patent Proprietor, therefore, in the Board's view, the skilled person would regard document D1 as relevant to the problem .

Document D1 discloses a coil arrangement which comprises two parts 4,4' connected together at one end via a hinge 4a and at the other end via a plug and socket connection 4" (see page 3 and Figure 3). Although the reason for the construction of Figure 3 is not explicitly stated in the document, the skilled person would understand from Figure 3 that the coil arrangement can be assembled around a body part to be examined, and thereby would not need to be slid over the entire body. The skilled person would therefore, according to the Board's opinion, be led to apply this teaching from document D1 to an NMR apparatus as known from document D3. Furthermore, in the Board's view, it was well within the expertise of the skilled person to realise that a modified coil arrangement having separable connections (such as 4") at both the ends of the parts 4 and 4' would also enable an in-situ assembly of the coil around the body part and thereby a tight RF coupling.

In connection with the incorporation of the two part construction of the coil arrangement of document D1 in the NMR coil of document D3, so as to provide a close coupling of the RF field to the body, the patent Proprietor submitted that such a structure would impair structural integrity and increase ohmic resistance of the coil (due to additional contact resistance), whereas a close RF coupling would produce a non-uniform RF field within the body. The skilled person, it was argued, would not, therefore, be led to such a construction of the NMR coil. Although the Board accepts that the separable connections are likely to introduce contact

resistance, the skilled person would expect this increase in resistance to be compensated by the lowering of the overall resistance of the coil which would result from its relatively small size. Also, since in the present case the skilled person is mainly concerned with improving signal-to-noise ratio, in the Board's view, he would accept the above disadvantages (i.e. lower structural integrity and non-homogeneity of the RF field) as the necessary trade-off for an improved signal-to-noise ratio.

As regards the submission of the patent Proprietor that the fact that several patent applications directed to a two-part arrangement of the RF coil were filed around the same time is indicative of inventiveness of the subject-matter of the opposed patent, the Board would like to point out that such a spurt of activity may be due to non-technical reasons, and, therefore, does not necessarily indicate inventiveness of the claimed subject-matter.

1.4 For the foregoing reasons, in the Board's judgement, the subject matter of claim 1 does not fulfil the requirement of inventive step within the meaning of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is allowed and the patent is revoked.

The Registrar: The Chairman:

M. Beer G. D. Paterson