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Case Number: T 0763/11 - 3.4.01

Application Number: 03778662.1

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IPC: G01R33/3415

Language of the proceedings: EN

Title of invention:
HIGH-FREQUENCY SYSTEM FOR AN MR APPARATUS WITH MULTIPLE TRANSMIT CHANNELS

Applicants:
Philips Intellectual Property & Standards GmbH
Koninklijke Philips N.V.

Headword:

Relevant legal provisions:
EPC 1973 Art. 83

Keyword:
Sufficiency of disclosure (no)

Decisions cited:

Catchword:

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Case Number: T 0763/11 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 29 February 2016

Appellant: (Applicant 1)	Philips Intellectual Property & Standards GmbH Steindamm 94 20099 Hamburg (DE)
Appellant: (Applicant 2)	Koninklijke Philips N.V. High Tech Campus 5 5656 AE Eindhoven (NL)
Representative:	de Haan, Poul Erik Philips International B.V. Philips Intellectual Property & Standards High Tech Campus 5 5656 AE Eindhoven (NL)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 7 December 2010 refusing European patent application No. 03778662.1 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Assi
Members:	H. Wolfrum
	D. Rogers

Summary of Facts and Submissions

I. European patent application 03 778 662.1 (publication No. EP 1 585 990 and WO2004/061469) was refused by a decision of the examining division for a number of reasons, including lack of clarity and support by the description (Article 84 EPC) and insufficiency of disclosure (Article 83 EPC) of the claims of the request then on file.

II. The applicants lodged an appeal against the decision.

With their statement setting out the grounds of appeal the appellants contested the findings of the examining division and requested that the decision under appeal be set aside and a patent be granted on the basis of the claims on which the appealed decision had been based.

Furthermore, an auxiliary request for oral proceedings was made.

III. The appellants were summoned to oral proceedings.

In a communication pursuant to Article 15(1) RPBA the Board addressed *inter alia* problems of lack of clarity and insufficiency of disclosure for the claims on file.

IV. In response, the appellants provided by letter of 25 January 2016 explanations *inter alia* in support of sufficiency of disclosure and filed in this context drawings of alternative circuit lay-outs for multiplexer-distributor networks (Figures 1a, 1b, 2 and 3) as well as several literature references as alleged proof of the skilled person's common general

knowledge. The appellants completed their submissions with a further letter dated 26 January 2016, filing a set of amended claims 1 to 8 and a further literature reference.

V. In the oral proceedings, which took place on 29 February 2016, the compliance of the claimed subject-matter with the requirements of Article 83 EPC was discussed. The appellants reiterated their request to grant a patent upon the basis of claims 1 to 8 filed under cover of the letter of 26 January 2016.

VI. Independent claim 1 of the appellants' request reads as follows :

"*1. A high-frequency system for an MR apparatus comprising: a high-frequency coil arrangement formed by a plurality of resonator elements (104) interlinked which each other via capacitors by which the resonance characteristic of the arrangement is determined, and*

a transmit unit (106) that applies output signals to each of the resonator elements (104),

a receive unit (116) with a plurality of receive channels assigned to the resonator elements and

each of the resonator elements (104) is connected to a changeover switch S, by means of which, depending on the operating mode, the resonator element (104) concerned is connected to a terminal to the corresponding inputs of the receive unit (116) or to a terminal to the corresponding outputs of the transmit unit (106),

wherein the transmit unit (106) includes

a plurality of transmit channels, one transmit channel being assigned to each of the resonator elements 104 ,

a plurality of controllable high-frequency signal generators (113) to generate low-power transmit signals and by means of which the amplitudes and phases of the high-frequency signals supplied to the resonator elements (104) via the transmit channels of the transmit unit (106) can be individually preselected

a plurality of high-frequency amplifiers (107), each high-frequency amplifier (107) having one input and one output, the inputs of which receive the low-power transmit signals via a first controllable multiplexer/distributor network (108) and the high-frequency amplifiers' (107) output signals are distributed over the transmit channels via a second controllable multiplexer/distributor network (109), characterized in that the transmit unit (106) further includes

a first controllable distributor network (108) connected with the inputs of the high-frequency amplifiers (107), wherein the first distributor network (108) controllably distributes one or more low-power input signals over the inputs of the high-frequency amplifiers (107), and

a second controllable distributor network (109) connected with the outputs of the high-frequency amplifiers (107) and with the plurality of resonator elements (104), wherein the second controllable distributor network (109) controllably distributes output signals of the high-frequency amplifiers (107) over a plurality of terminals (1-8) of the transmit unit (106), each terminal (1-8) being connected to one resonator element (104),

a control unit (110) controlling the first and second controllable distributor networks (108, 109) in such a manner that the distribution of the one or more low-power input signals over the inputs of the high-frequency amplifiers (107) and the distribution of the

output signals of the high-frequency amplifiers (107) over the terminals (1-8) is variable."

Claims 2 to 7 are dependent claims. Claim 8 is directed to an MR apparatus comprising a high-frequency system as claimed in any one of claims 1 to 5.

VII. The appellants' arguments, as far as relevant for the present decision, may be summarized as follows:

The skilled person was capable of devising operational first and second controllable multiplexer/distributor networks on the basis of the information provided by the application description and his common general knowledge. On page 4, lines 3 to 14, the application description as originally filed specified the functionalities of the networks, notably that "*input signals of the transmit unit may be distributed as desired over the high-frequency amplifiers by means of the first multiplexer/distributor network*" so that it "*is then possible, e.g. to supply just one of the input signals simultaneously to all of the parallel-connected high-frequency amplifiers, or to at least several of them*" and that "*… the output signals of the high-frequency amplifiers are distributed over the transmit channels via the second multiplexer/distributor network*" rendering it possible "*to add up all the output signals of the high-frequency amplifiers in order thereby to supply only a few of the transmit channels or even just one single transmit channel with increased or maximum transmit power*" and "*to distribute the output signal of each individual high-frequency amplifier uniformly over all the transmit channels*", all resulting in a high-frequency system which "*in*

accordance with the invention thereby ensures the maximum flexibility and variability in the generation of the high-frequency field in the examination volume".

Moreover, the reader of the application description learned from the statement of the object of the invention given on page 3, lines 24 to 27: "*to provide a cost-effective high-frequency system for an MR apparatus, the transmit unit of which is capable of supplying a plurality of transmit channels with high-frequency transmit signals in the most flexible and variable manner possible*", and the preceding discussion on page 3 of the disadvantages of conventional MR apparatuses that, on the one hand, the use of a plurality of high-power transmitting amplifiers was extremely cost-intensive and thus disadvantageous and that, on the other hand, the use instead of a plurality of low-power transmitting amplifiers was not expedient since the flexibility and variability in the generation of the high-frequency field in the examination volume would be severely restricted.

On the basis of these pieces of information together with the common general knowledge about signal-distribution networks and, in particular, high-frequency combiners which avoid unmatched impedances (such as Wilkinson and Gysel combiners, the Butler-matrix or the 3dB-Hybrid combiner), the skilled person was clearly in a position to devise the required multiplexer/distributor networks. All that was required were conventional and commercially available RF lumped elements, such as RF switches, power dividers, power combiners and attenuators.

Examples of such networks for the cases of two or four transmit channels were shown by Figures 1a, 1b, 2 and 3

as filed with the letter of 25 January 2016. In particular, the example of a network of splitters and controllable diode switches shown by Figures 1a and 1b was a simple and straightforward circuit layout which could in principle be used for both networks. An extension to a larger number of channels might require a lot of tedious and boring work, but was nevertheless easy and obvious.

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 and Rule 99 EPC and is, therefore, admissible.

2. Sufficiency of disclosure (Article 83 EPC 1973)

2.1 Claim 1 on file is directed to a high-frequency system which is capable of transmitting "*input signals*" from a "*plurality of signal generators*" via a "*first controllable multiplexer/distributor network*" over the inputs of a "*plurality of high-frequency amplifiers*" and further from the outputs of the amplifiers via a "*second controllable multiplexer/distributor network*" over a plurality of "*transmit channels*" to a "*plurality of resonator elements*", with "*one transmit channel being assigned to each of the resonator elements*".

The question to be answered is whether or not the notional skilled person was in a position to devise without undue burden, solely on the basis of the information provided in the application documents and common general knowledge, multiplexer/distributor networks with the required functionalities.

2.2 Although, as uncontested by the appellants, the provision of the two multiplexer/distributor networks is decisive for ensuring the maximum flexibility and variability in the generation of the high-frequency field in the examination volume and thus for meeting the object of the invention cited in point VII above, there is in fact not a single piece of concrete information to be found in the application documents as filed as regards the necessary elements and structure of the two networks. The sole drawing of the application shows each of the networks as an empty rectangle.

The appellants' argument that the networks' functionalities as described in the application provided the necessary information which enabled the skilled person to put the claimed networks into practice is not convincing for the simple reason that the said functionalities constitute nothing but statements of desired properties. At best, these properties imply certain constraints to be observed in the design of an operational network but they do not provide any guidance for the task of devising a functional circuit design.

2.3 As regards the literature references produced by the appellants as evidence for the common general knowledge of the skilled person, it is noted that they refer exclusively to passive networks, *i.e.* to networks with a fixed, non-controllable distribution of signals.

Thus, the appellants have failed to provide pertinent evidence that controllable signal-networks, let alone multiplexer/distributor networks having the required functionalities belonged to the skilled person's common

general knowledge at the priority date of the present application.

2.4 The examples of Figures 1a, 1b, 2 and 3, which the appellants filed with the letter of 25 January 2016 as illustrations of allegedly straightforward circuit designs for controllable multiplexer/distributor networks, concern, without exception, networks for which the numbers of signal generators, high-frequency amplifiers, transmit channels and resonator elements are all the same.

Apart from the fact that the suggested circuit designs are fairly complex so that it is already doubtful whether the skilled person could have devised any of them without undue burden, these hypothetical examples fail to prove that the skilled person was in a position to conceive network circuit designs for which the various numbers of signal generators, amplifiers, transmit channels and resonator elements would differ from each other. In this context, it remains particularly obscure what a first and a second multiplexer/distributor network should look like if the number of high-frequency amplifiers is less than the number of transmit channels.

Moreover, none of the examples suggested is truly operable. In Figures 1a and 1b the arrangement of signal splitters is unclear. The circuit arrangement according to Figure 2 suggests an arrangement consisting of two rows of 4-pole switches which are stacked in the direction of signal propagation and have different pole assignments each. The pole assignments indicated being fairly intricate, it is unclear whether the circuit arrangement would allow, for example, to apply the output signal of any one of the four high-

frequency amplifiers, in one mode of operation, to only one of the resonator elements and, in another mode of operation, simultaneously to all of the resonator elements. The network suggested by Figure 3 comprises a combiner and a certain number of switches, the precise arrangement and operation of which are obscure. Moreover, it is by no means apparent how the suggested network would have to be adapted to the case of more than two RF coils. In the oral proceedings the appellants' representative did not offer any clarifying explanation.

In summary, it is thus to be noted that the task to devise a "*transmit unit*", and notably a "*first*" and a "*second controllable multiplexer/distributor network*" thereof which would fulfil the claimed functions constitutes a complex and elaborate task, which task could not be performed without undue burden on the basis of common general knowledge at the priority date of the present application, and certainly not within the whole ambit of claim 1 on file.

2.5 Consequently, the application does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a skilled person and thus does not comply with the requirements of Article 83 EPC 1973.

Order

For these reasons it is decided that:

For these reasons it has been decided :

The appeal is dismissed.

The Registrar: The Chairman:

R. Schumacher G. Assi

Decision electronically authenticated