Paper No. 21

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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ON BRIEF

Before THOMAS, HAIRSTON and CARDILLO, Administrative Patent Judges.

HAIRSTON, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 17 through 36 and 39. In a first Amendment After Final (paper number 7), claims 18 and 37 through 39 were cancelled, and claims 17, 19 and 30 were amended. In a second Amendment After Final

[1] Application for patent filed February 22, 1993.

(paper number 13), claim 30 was further amended. Accordingly, claims 17 and 19 through 36 remain before us on appeal.

The disclosed invention relates to a magnetic resonance imaging system that uses both low and high temperature superconductors.

Claim 17 is illustrative of the claimed invention, and it reads as follows:

17. A system for producing a homogenous magnetic field within an imaging volume of a magnetic resonance imaging apparatus, comprising:

a primary coil situated about the imaging volume, said primary coil comprising a low temperature superconducting material for exhibiting a primary magnetic field which contributes to the homogenous magnetic field within the imaging volume; and

a correction coil situated about the imaging volume and coaxial with said primary coil, said correction coil being disposed closer to the imaging volume than said primary coil, said correction coil comprising a high temperature superconducting material, said correction coil being smaller in size than said primary coil so that said correction coil exhibits a correction magnetic field which is lesser in strength than said primary magnetic field within the imaging volume, said correction magnetic field and said primary magnetic field in combination for generating the homogenous magnetic field within the imaging volume.

The references relied on by the examiner are:

Kuroda	4,412,195	Oct. 25, 1983
McDougall et al. (McDougall)	4,701,736	Oct. 20, 1987
Siebold	4,881,035	Nov. 14, 1989
Overweg et al. (Overweg)	4,931,735	Jun. 5, 1990
Breneman et al. (Breneman)	5,194,810	Mar. 16, 1993 (filed Dec. 26, 1991)

Claims 17, 20 through 22, 25 through 27, 29, 31, 32, 34 and 35 stand rejected under 35 U.S.C. § 103 as being unpatentable over McDougall in view of Breneman.

Claims 24, 28, 33 and 36 stand rejected under 35 U.S.C. § 103 as being unpatentable over McDougall in view of Breneman and Siebold.

Claims 19 and 30 stand rejected under 35 U.S.C. § 103 as being unpatentable over McDougall in view of Breneman and Overweg.

Claim 23 stands rejected under 35 U.S.C. § 103 as being unpatentable over McDougall in view of Breneman and Kuroda.

Reference is made to the briefs and the answer for the respective positions of the appellants and the examiner.

OPINION

We have carefully considered the entire record before us, and we will reverse the 35 U.S.C. § 103 rejection of claims 17 and 19 through 36.

Appellants and the examiner all agree that the coils 2 through 5 in the reference to McDougall are fabricated from a low-temperature superconductor material. The examiner's position (Answer, pages 4 and 5) is that the coils 4 and 5 are primary coils, and the coils 2 and 3 are correction coils. According to the examiner's reasoning:

> McDougall discloses the device of claims 17, 22, 25, 29, 34 except for the correction coils comprising a high-temperature superconducting material, rather than a low-temperature superconducting material. Breneman discloses an NMR device using superconducting coils. In column 6, lines 54-64, Breneman discusses the use of high-temperature superconducting coils. Further, in column 2, lines 54-57, McDougall teaches the use of either low-temperature superconducting coils or non-superconducting coils. McDougall and Breneman establish that it is known in the art of NMR devices to use low-temperature superconducting coils, high-temperature superconducting coils and non-superconducting coils. It would have been obvious to one of ordinary skill in the art to use in the McDougall device high-temperature superconducting correction coils, as taught by Breneman, to derive the obvious advantages of such a substitution. The advantages include at least reduced cooling costs when compared to cooling a low-temperature superconducting coil. Further, it is common in a variety of arts in a variety of devices to substitute high-temperature superconducting coils for low-temperature superconducting coils. (Answer, page 6).

We agree with the examiner that "it is known in the art of NMR devices to use low-temperature superconducting coils, high-temperature superconducting coils and non-superconducting coils," that the two innermost coils 2 and 3 of McDougall could conceivably be correction coils for the field generated by the two large outermost coils 4 and 5 to thereby generate a homogeneous magnetic field, that it would be cost effective to use all high-temperature superconducting coils, and that column

6, lines 54 through 64 of Breneman sets forth superconducting transition temperatures and materials for both low and high-temperature superconductors. On the other hand, we agree with the appellants' argument (Brief, page 12) that the reference to Breneman teaches at column 6, lines 48 through 51 that the superconducting wire/coil 36 may be of a low-temperature superconductor material or a high-temperature superconductor material. In view of this teaching in Breneman, appellants argued (Brief, page 12) that:

> [O]ne would have at most been motivated to have used all high temperature superconducting materials or all low temperature superconducting materials for the coils 2 to 5 in McDougall. Breneman, on the other hand, does not provide any suggestion that only some of the coils 2 to 5 in McDougall should be formed of a high temperature superconducting material while other coils 2 to 5 should be formed of a low temperature superconducting material. Thus, the combination of Breneman with McDougall fails to suggest the claimed invention. (Emphasis added).

We agree with appellants' argument that the applied references would have suggested the use of "all" low-temperature superconducting material or "all" high-temperature superconducting material. If a combination of low-temperature and high-temperature superconducting materials was used in McDougall, then separate cooling chambers would be required for the two different superconducting materials. See Breneman at

column 6, lines 54 through 58. The added cost for the two cooling chambers would offset any cost savings resulting from use of high-temperature superconducting materials in McDougall. Even if a high-temperature superconducting material is used, the applied references neither teach nor would they have suggested the specifically claimed placement of the high-temperature superconducting material with respect to the low-temperature superconducting material. The teachings and suggestions of the applied references certainly would not have led the skilled artisan to a combination of the two superconducting materials as required by the claims on appeal. The only source for such a teaching is appellants' disclosed and claimed invention, and it is not available to the examiner in an obviousness rejection. The 35 U.S.C. § 103 rejection of claims 17, 20 through 22, 25 through 27, 29, 31, 32, 34 and 35 is reversed.

Turning to the additional references to Siebold, Overweg and Kuroda, we find that the reference to Siebold teaches that it is known to use a non-conductive material (column 4, lines 55 through 58) in the bore of a magnetic resonance imaging device, and that it is known to use shielding structures (column 5, lines 21 through 24) in such a device. As indicated on page 10 of the specification, the concept of freezing-in of a magnetic field is well known in the art, and this concept is implemented throughout the reference to Overweg. The reference to Overweg

also discusses the use of correction coils in magnetic resonance imaging devices. The Abstract in the reference to Kuroda discloses well-known shaped coils. Unfortunately, none of these references contains a teaching to the effect that it is well known in the art to use a combination of low and high-temperature superconductors in a magnetic resonance imaging device. The 35 U.S.C. § 103 rejection of claims 19, 23, 24, 28, 30, 33 and 36 is reversed.

DECISION

The decision of the examiner rejecting claims 17 and 19 through 36 under 35 U.S.C. § 103 is reversed.

REVERSED

JAMES D. THOMAS)
Administrative Patent Judge)
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KENNETH W. HAIRSTON) BOARD OF PATENT
Administrative Patent Judge) APPEALS
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) INTERFERENCES
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Appeal No. 95-2402
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