CORRECTED: JULY 26, 2001

United States Court of Appeals for the Federal Circuit

00-1159
(Interference No. 102,854)

IN RE ROEMER

Boris Haskell, Paris and Haskell, of Arlington, Virginia, argued for appellants.

William LaMarca, Associate Solicitor, Office of the Solicitor, U.S. Patent and Trademark Office, of Arlington, Virginia, argued for appellee. With him on the brief were John M. Whealan, Solicitor; Stephen Walsh, and Linda Moncys Isacson, Associate Solicitors.

Appealed from: United States Patent & Trademark Office
Board of Patent Appeals & Interferences

United States Court of Appeals for the Federal Circuit

00-1159
(Interference No. 102,854)

IN RE ROEMER

DECIDED: July 24, 2001

Before MICHEL, LOURIE, and RADER, Circuit Judges.

RADER, Circuit Judge.

In a patent interference proceeding, the Board of Patent Appeals and Interferences held the claims of Dr. Peter B. Roemer's reissue patent application unpatentable over United States Patent No. 4,595,899 (the Smith patent). Punchard v. Roemer v. Mansfield, Patent Interference No. 102,854 (Sept. 29, 1999). Because the Board erred in determining that the Smith patent precludes patentability for claims 1-4, 33, and 34 of the Roemer reissue application, this court reverses that portion of the Board's judgment. Because the Board did not construe claims 5 and 7-15 of the Roemer reissue application nor review their patentability over the Smith patent, this court vacates the portion of the Board's judgment holding these claims unpatentable.

I.

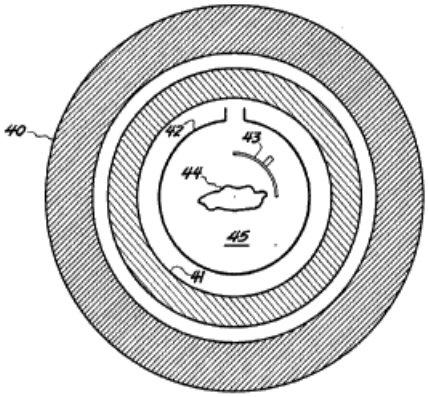
United States Patent No. 4,737,716 (the Roemer patent) lists Dr. Roemer and John S. Hickey as inventors. The Roemer patent discloses a set of shielded gradient coils for nuclear magnetic resonance imaging (MR). A typical MR apparatus includes a large

magnet, a radio frequency (RF) producing coil, and gradient coils. The magnet produces a magnetic field that causes the spin vectors of certain protons (e.g., ^{13}C, ^{1}H, ^{31}P) in a sample to orient themselves with the field, thus creating a "background" field. The RF coil then pulses energy at the sample, causing the protons to flip their spin directions at various energies, depending on the proton's environment. When the energy pulse is turned off, the flipped protons realign themselves with the background field, thereby releasing the energy absorbed when flipping. The gradient coils provide a linear (x,y,z) reference so the machine can detect the exact location of these energy releases. The MR apparatus then measures this released energy and converts it into an image.

Since the early 1980s, when nuclear magnetic resonance became a diagnostic tool for the human body, MR equipment and techniques have undergone continuous improvements of image quality, acquisition speed, and quantitative accuracy. To enhance the efficiency of the MR apparatus, the main magnet is generally located close to the imaging volume (e.g., the space occupied by the patient). Locating the magnet close to the imaging volume, however, also brings the magnet close to the gradient coil. The changing magnetic fields from the gradient coil induce eddy currents from nearby conducting media. These eddy currents have an adverse effect on the spatial and temporal quality of the background magnetic field, thereby distorting image quality and accuracy.

The Roemer patent discloses and claims a solution to this problem. As depicted in cross-section below, around the imaging volume 45 lies RF coil 42, surrounded by the gradient coil set 41, and further surrounded by the main magnet 40. The gradient coil set includes a gradient coil and a second coil having an opposite current to the gradient coil, located between the gradient coil and the main magnet. This opposing current coil

essentially cancels out the current of the gradient coil thereby preventing eddy current effects on the main magnet.



Claim 1 of the Roemer patent recites:

> 1. A gradient coil set for an MR apparatus comprising a plurality of radially disposed fingerprint coils adapted to be placed within a main field magnet, each of said coils adapted to provide a respective surface current distribution, the total magnetic field resulting from the coaction of said surface current distribution having a predetermined gradient in a predetermined single dimension within a predetermined area inside said coil set and a substantially zero value outside said coil set, whereby magnetic forces between said coil set and said field magnet are substantially eliminated.

(Emphasis added). The Roemer patent issued on April 12, 1988.

In 1989, Dr. Roemer filed a reissue application in which he copied claims of United States Patent No. 4,733,189 (the Punchard patent) to William F.B. Punchard and Robert D. Pillsbury. Similar to the Roemer patent, the Punchard patent discloses and claims a MR apparatus and method for suppressing eddy currents by constructing an active shield of secondary coils around the gradient producing coils. Dr. Roemer requested the United States Patent and Trademark Office (USPTO) to declare an interference between the Roemer reissue application and the Punchard patent. The examiner formulated a count

with language identical to the Punchard patent's claim 15, which Dr. Roemer added as claim 27 to the Roemer reissue application. The count recites:

> A method of suppressing eddy currents induced in components of a magnetic resonance imaging system by electromagnetic gradient-producing elements, the method comprising:
>
> disposing an active electromagnetic shield element about each of said gradient-producing elements in a magnetic resonance imaging system, and driving said active shield element with a current of opposite direction to minimize the external field of said gradient-producing element.

During the interference proceeding, the USPTO administrative patent judge found the count unpatentable over the Smith patent. The Smith patent also discloses shielding a MR apparatus with the use of a second set of coils. According to the Smith patent, a set of coils may surround the outside of the main magnet to produce a counter magnetic field. The shield in the Smith patent has a different purpose from the Roemer invention. Specifically, the Smith invention provides far field magnetic shielding to protect the room in which the MR apparatus is located from adverse magnetic effects.

The patent judge concluded that all pertinent claims of the Punchard patent, and thus all of Dr. Roemer's copied claims, correspond to the count. The patent judge then held all these claims unpatentable over Smith. Dr. Punchard requested the patent judge to add the rest of the claims of the Roemer reissue application to the interference, to find that all of the Roemer reissue application claims correspond to the count, and to add United States Patent No. 4,978,920 (the Mansfield patent) to the interference.

The Mansfield patent also discloses and claims screening coils that surround a gradient coil to reduce eddy current effects. After the patent judge redeclared the interference, adding the Mansfield patent, Dr. Roemer amended his reissue application to

add two claims similar to claim 20 of the Mansfield patent. One such claim, which Dr. Roemer added as claim 33, recites:

> 33. A gradient coil system for use in an NMR apparatus including a coil set for producing a desired gradient magnetic field within a defined volume, said coil set comprising:
>
> a first coil situated at a first location which defines the volume and at least one second coil situated at a second location, which embraces the volume,
>
> the first coil having a first predetermined pattern of conductors to produce a first current distribution within the first coil to produce a first magnetic field, said at least one second coil having a second predetermined pattern of conductors to produce a second current distribution within the second coil to produce a second magnetic field, and
>
> wherein the second magnetic field produced by the second coil coacts with the first magnetic field produced by the first coil such that the resultant magnetic field on the opposite side of the second coil to the first coil is substantially zero, and the resultant magnetic field on the opposite side of the first coil to the second coil constitutes the desired gradient magnetic field, and in which the first and second predetermined patterns of conductors are different from each other and in which the first current distribution is different from the second current distribution.

The other claim, which Dr. Roemer added as claim 34, is almost identical to claim 33 but recites a plurality of second coils, as opposed to "at least one second coil."

As noted above, the patent judge had designated the count unpatentable over Smith. In a departure from normal interference procedure, the parties then conceded that "whichever claims [of the patents and application at issue] properly . . . designated as corresponding to the count are unpatentable over Smith." The Board concluded that all of the Roemer reissue application claims (and, therefore, all of the claims copied from the Punchard and Mansfield patents) correspond to the unpatentable count. Only Dr. Roemer has appealed this determination. This court has jurisdiction to hear the present appeal under 28 U.S.C. § 1295(a)(4)(A).

II.

This court reviews legal questions, such as obviousness, without deference. In re Gartside, 203 F.3d 1305, 1316, 53 USPQ2d 1769, 1776 (Fed. Cir. 2000). This court reviews the Board's underlying factual findings for substantial evidence. Id. The proper construction of either a claim or a count is a question of law that this court reviews without deference. DeGeorge v. Bernier, 768 F.2d 1318, 1321, 226 USPQ 758, 760 (Fed. Cir. 1985).

"A count defines the interfering subject matter between two or more applications or between one or more applications and one or more patents." 37 C.F.R. § 1.601(f). Typically, the USPTO determines which claims correspond to the count in order to determine the subject matter of the interference. Id. ("Any claim of an application or patent that is designated to correspond to a count is a claim involved in the interference . . . ."); 37 C.F.R. § 1.603. Once the USPTO determines that a claim corresponds to the count and is thus a part of the interference, the USPTO may then consider the patentability of that claim. 37 C.F.R. § 1.633(a); 37 C.F.R. § 1.641 (allowing an administrative patent judge to raise the issue of patentability sua sponte as to claims designated to correspond to a count). These rules also limit determinations of patentability in an interference proceeding to claims, not counts. 37 C.F.R. § 1.633(a); 37 C.F.R. § 1.641. This court has also acknowledged that the Board and patent judges are to assess the patentability of claims, not counts. Rowe v. Dror, 112 F.3d 473, 477, 42 USPQ2d 1550, 1552 (Fed. Cir. 1997).

In a departure from these rules, Dr. Roemer has nonetheless accepted the patent judge's determination that the count is not patentable. In fact, during the interference Dr. Roemer agreed that any claim in the Roemer reissue application that corresponds to the

count is unpatentable over the Smith patent. Generally, the patent judge would have determined which claims in the Roemer reissue application correspond to the count in order to determine which of such claims are part of the interference. The patent judge could then have compared the claims that were properly in the interference to the Smith patent to determine which claims were unpatentable over Smith. Instead, Dr. Roemer's concession allowed the Board to take a short cut to determining invalidity of the claims at issue. See Maier v. Hanawa, 26 USPQ2d 1606, 1609 (Comm'r Pat. and Trademarks 1992) ("The 'same patentable invention' requirement . . . concerns only the relationship between the Count and the claims sought to be additionally designated. It does not concern general patentability over the prior art.").

Regardless, on appeal Dr. Roemer does not contest the Board's process in determining that his claims are unpatentable. Rather, Dr. Roemer argues that the Board erred in concluding that claims 1-5, 7-15, 33, and 34 correspond to the count.

The interference regulations state: "All claims in the applications which define the same patentable invention as a count shall be designated to correspond to the count." 37 C.F.R. § 1.603. The rules further explain: "Invention 'A' is the same patentable invention as invention 'B' when invention 'A' is the same as (35 U.S.C. 102) or is obvious (35 U.S.C. 103) in view of invention 'B' assuming invention 'B' is prior art with respect to invention 'A.'" 37 C.F.R. 1.601(n). Dr. Roemer does not dispute the Board's construction of the count. Thus, to assess whether the Board correctly determined correspondence between the claims at issue and the count, this court will first review the Board's construction of these claims, then compare the construed claims to the count as construed by the Board.

The Board held that claim 1 of the Roemer reissue application, as properly

construed, does not require a linear gradient. In order to function properly, a MR apparatus requires a substantially linear gradient. See, e.g., Roemer reissue application, col. 1, ll. 13-30. Claim 1 recites: "A gradient coil set for an MR apparatus." (Emphasis added). The claim further recites structure requiring the coil set to be within the main field magnet and to provide a "predetermined gradient" in a single dimension. Thus, according to the plain language of the claim, the "predetermined gradient" is substantially linear.

Moreover, the written description of the Roemer reissue application describes the gradient field as being linear, or substantially linear, throughout. See, e.g., col. 1, l. 66-col. 2, l. 2. The written description, however, also suggests that although a shorter coil length upsets the linearity of a gradient field, a shorter coil may be preferable because shorter coil lengths lower the stored energy in the magnetic field. Col. 6, ll. 3-9. The same section of the written description explains that the coil length can be adjusted, along with other variables, "until a reasonable combination of linearity, current density, power requirements and overall length is obtained." Col. 5, l. 68-col. 6, l. 2. The written description does not imply that the resulting gradient does not need to be substantially linear. Rather, it explains that linearity can be partly sacrificed in order to achieve other desirable characteristics in the MR apparatus. Thus, the correct construction for the "predetermined gradient" limitation is that claim 1 recites a magnetic field with a substantially linear gradient.

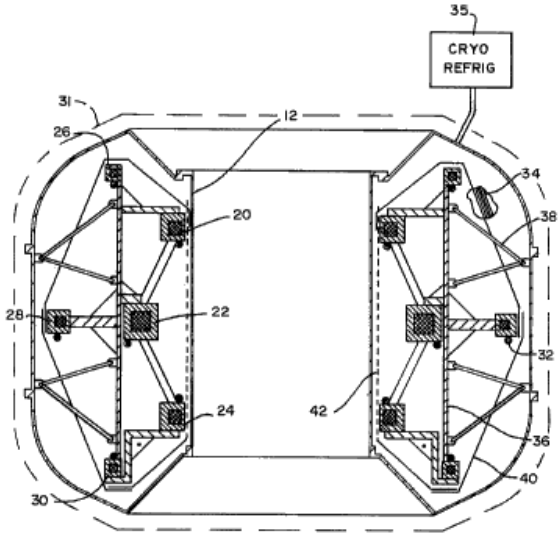
Furthermore, claim 1 requires a gradient coil set for a MR apparatus wherein the external magnetic field of the coil set is substantially zero in the near field. The language of claim 1 requires a structure with the gradient coil set, including the shielding coil, located within the main magnet ("a plurality of radially disposed fingerprint coils adapted to be placed within a main field magnet"). The claim further requires the magnetic forces

between this coil set and main magnet to be "substantially eliminated." Thus, the limitation that "the total magnetic field" of the gradient coil set has "a substantially zero value outside said coil set" requires a substantially zero magnetic field in the near field, i.e., between the gradient coil and the magnet.

In construing the count, the Board held that the language of the count "does not require a substantially zero field everywhere on the side of the screen facing away from the gradient-producing element." Punchard, slip op. at 17. Thus, the Board held that the count does not recite near-field screening. The Board did not address whether the count recited a linear gradient. The count itself does not disclose application of the recited method to a MR apparatus. Furthermore, the Board held the count to be unpatentable over the Smith patent, which, as described below, does not disclose shielding a main magnet from a gradient producing magnet while maintaining a linear gradient.

The Board relied on the Smith patent as relevant prior art in determining whether claim 1 recites the same patentable subject matter as the count. The Smith patent discloses far-field shielding of the external field developed by the main magnet's uniform field. As depicted below in cross-sectional view from the Smith patent, the main magnet coils 20, 22, and 24, are surrounded by the shielding coils 26, 28, and 30. Thus, the Smith patent discloses shielding coils arranged outside the main magnet to protect the room from the uniform main magnetic field, not to protect the uniform field from eddy current effects of any gradient producing magnet as recited in claim 1. See, e.g., the Smith patent, col. 2, ll. 25-32 ("In accordance with the present invention reduced external fields are realized in a NMR magnetic structure while maintaining a uniformity of magnetic field in the NMR inspection area. A magnetic structure in accordance with the invention employs a first

plurality of coils provided about a volume for producing a first uniform magnetic field through the volume.") (emphasis added).



At the end of the written description, the Smith patent states: "The use of the external field cancelling method being presented here can allow the gradient fields to be produced with greatly reduced problems due to the eddy currents." Col. 10, ll. 58-61. This assertion, however, is not accompanied by any teaching of how to adopt the Smith invention for use as a shield for gradient fields. The Smith patent does not disclose any of the complex mathematics required for positioning the shielding coils about the gradient producing coils to suppress the external field while still obtaining a substantially linear internal gradient field. Moreover, the Smith patent does not teach or suggest how to specially design a shielding field to meet the requirements of a linear gradient field, nor does it suggest the need to do so.

In short, the Smith patent gives "only general guidance as to the particular form of the claimed invention or how to achieve it." In re O'Farrell, 853 F.2d 894, 903, 7 USPQ2d 1673, 1681 (1988). This "obvious to try" suggestion of the Smith patent does not render

claim 1 of the Roemer reissue application obvious, In re Deuel, 51 F.3d 1552, 1559, 34 USPQ2d 1210, 1216 (Fed. Cir. 1995), nor does it supply substantial evidence that claim 1 corresponds to the count. See Punchard, slip op. at 22 (stating that the Board actually found that "using Smith's shielding technique with a gradient coil will cause some distortion of the linearity of the internal gradient field."). Thus, the Board erred in its conclusion that claim 1 corresponds to the count and is thus unpatentable over the Smith patent.

Claims 2-4 are dependent on claim 1 and, thus, recite the same limitations of a linear gradient and near field screening as claim 1. The Board, therefore, also erred in finding that these claims correspond to the count. Claims 5 and 7-14, however, do not depend on claim 1. Dr. Roemer did not separately argue the construction of these claims or any reasoning that these claims do not correspond to the count either to the Board or to this court on appeal.[1] On appeal, Dr. Roemer baldly asserts that "reexamined patent claim 1 is exemplary of the invention and is patentable (and claims 2-5, 7-15 . . . are patentable therewith)." The Board found that because Dr. Roemer did not argue these claims separately, they must stand or fall together. Rowe, 112 F.3d at 478 ("[W]here the party urging patentability does not separately address the patentability of each claim corresponding to a count, the Board has reason to treat all claims together."). Thus, without making any reviewable fact findings as to the patentability of claims 5 and 7-15, the Board held these claims unpatentable. Because this court has held claim 1 to be patentable, this court remands to the Board to construe, make findings of fact, and determine the patentability of claims 5 and 7-15.

---

1 Dr. Roemer does make additional arguments for the patentability of claim 9. It is unclear to this court, however, whether any of these arguments were made to the Board. Regardless, the Board did not make any specific fact findings as to whether claim 9

The Board further entered judgment that claims 33 and 34 of the Roemer reissue application correspond to the count and are unpatentable over the Smith patent. This determination rested on Dr. Roemer's characterization that claims 33 and 34 are essentially the same as claim 20 of the Mansfield patent, which the Board held to correspond to the count.

Claims 33 and 34 recite: "A gradient coil system for an NMR apparatus including a coil set for producing a desired gradient magnetic field." (Emphasis added) Thus, for the same reasons described above for claim 1, this court holds that the "desired gradient magnetic field" of claims 33 and 34 must be linear. Furthermore, the claims recite: "the resultant magnetic field on the opposite side of the second coil to the first coil is substantially zero." Because the claims recite that the coils are used in a MR apparatus, the coils are inherently located within the main magnet and thus provide near field shielding. The Board thus erred in concluding that claims 33 and 34 correspond to the count.

Dr. Roemer argues that if this court finds claim 33 patentable, this court should instruct the USPTO to declare an interference between the Roemer reissue application and the Mansfield patent. The proposed interference would be between claims 33 and 34 of the Roemer reissue application and claims 20-24 of the Mansfield patent. The inventor of the Mansfield patent, however, has not appealed the Board's determination that claims 20-24 of the Mansfield patent are unpatentable. Although this court has found claims 33 and 34 to be patentable over the Smith patent, this court's decision does not affect the Board's judgment as to any of the claims of the Mansfield patent. Because claims 20-24 of the

---

corresponds to the count.

Mansfield patent remain unpatentable, the Board cannot declare an interference between the Roemer reissue application and the Mansfield patent.

Also, because it is not dispositive to the issues at hand or to this court's review of the Board's judgment, this court will not address the propriety of the USPTO's declaration of an interference based on an unpatentable count.

CONCLUSION

Based on the foregoing claim construction, this court reverses the portion of the Board's judgment holding that claims 1-4, 33 and 34 of the Roemer reissue application are unpatentable over the Smith patent. This court further vacates the portion of the Board's judgment that claims 5 and 7-15 of the Roemer reissue application are unpatentable and remands to the Board to construe these claims and determine their patentability over the Smith patent.

REVERSED-IN-PART, VACATED-IN-PART, and REMANDED.