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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte RUI LIAO, YEFENG ZHENG, MATTHIAS JOHN, ALOIS NOETTLING, and JAN BOESE

Appeal 2016-006305
Application 12/858,494
Technology Center 3600

Before THU A. DANG, ELENI MANTIS MERCADER, and SCOTT B. HOWARD, *Administrative Patent Judges*.

MANTIS MERCADER, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's Final Rejection of claims 1–36, which constitute all the claims pending in this application. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

CLAIMED SUBJECT MATTER

The claimed invention is directed to determining angulation of the c-arm image acquisition system for aortic valve implantation. Abstract.

Claim 1, reproduced below, is illustrative of the claimed subject matter:

> 1. A method for determining an angulation of a C-arm image acquisition system for aortic valve implantation, comprising:
>
> automatically detecting, by a processor, one or more anatomic landmarks of an aortic root in a 3D image;
>
> defining, by a processor, a plane representing an aortic annulus direction in the 3D image based on the detected one or more anatomic landmarks;
>
> determining, by a processor, a viewing angle at which to position the C-arm image acquisition system for X-ray image acquisition by the C-arm image acquisition system, wherein the viewing angle provides a viewing plane that is perpendicular to the defined plane; and
>
> controlling the C-arm image acquisition system to be positioned at the determined viewing angle that provides a viewing plane that is perpendicular to the defined plane.

REFERENCES

The prior art relied upon by the Examiner in rejecting the claims on appeal is:

Lienard et al. ("Lienard")	US 2002/0006185 A1	Jan. 17, 2002
Viswanathan	US 2006/0079745 A1	Apr. 13, 2006
Cai et al. ("Cai")	US 2007/0274579 A1	Nov. 29, 2007

Adrie C. M. Dumay et al., *Determination of Optimal Angiographic Viewing Angles: Basic Principles and Evaluation Study*, IEEE Transactions on Medical Imaging, Vol. 13, No. (March 1, 1994).

Michael Gessat et al., *A Planning System for Transapical Aortic Valve lmplantation*, SPIE Vol. 7261, Medical Imaging (2009).

Razvan loan Ionasec et al. *Dynamic model-driven quantitative and visual evaluation of the aortic valve from 4D CT*, Med Image Comput Comput Assist Interv. ("MICCAI"), 686–94 (2008).

REJECTIONS

Claims 1–5, 10–18, 23–29, and 34–36 stand rejected under 35 U.S.C §103(a) as being unpatentable over Gessat in view of Ionasec and Lienard.

Claims 6, 19, and 30 stand rejected under 35 U.S.C §103(a) as being unpatentable over Gessat in view of Ionasec and Lienard and further in view of Cai.

Claims 7, 20, and 31 stand rejected under 35 U.S.C §103(a) as being unpatentable over Gessat in view of Ionasec and Lienard and further in view of Cai and further in view of Dumay.

Claims 8, 9, 21, 22, 32, and 33 stand rejected under 35 U.S.C §103(a) as being unpatentable over Gessat in view of Ionasec, Lienard, Cai, Dumay and further in view of Viswanathan.

ANALYSIS

Claims 1, 7, 15, 20, 26, and 31 rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement

Appellants argue that paragraphs 22–25 of the specification clearly describe the limitation of "determining a viewing angle" in sufficient detail that one skilled in the art would reasonably conclude that the inventor had possession of the claimed invention (App. Br. 4). In particular, Appellants contend paragraphs 22–23 describe that a plane representing an aortic annulus direction is defined based on the detected anatomic landmarks and an optimal viewing angle is determined that is perpendicular to the defined plane (*id.*). According to Appellants:

> Paragraph [0024] describes that an optimal viewing angle is automatically determined from multiple viewing angles that are perpendicular to the defined plane representing the aortic annulus direction. Paragraph [0024] provides a detailed list of optimization parameters (e.g., relative positions of the detected anatomic landmarks, such as the hinges, commissure points, coronary ostia, and aortic root centerline) that can be used to define an objective function which can be optimized to determine the optimal viewing direction. Paragraph [0024] provides criteria which may be optimized to select an optimal viewing angle (e.g., in one possible implementation: (a) the coronary ostia should be visible on the boundary of the projected aortic root; (b) the viewing angle should be close to an anterior posterior (AP) C-arm angulation; and (c) the three aortic cusps should be well separated in one implementation; and in another possible implementation: the projection of the commissure points appears between the left and right coronary ostia and the centerline of the aortic root is parallel to the viewing direction). Paragraph [0024] describes that "[a]n objective function can be defined based on one or more optimization parameters and the objective function can be optimized to determine the optimal viewing direction" and "one skilled in the art can devise an objective function that weights various optimization parameters, and well known optimization techniques can be used to optimize the objective function."

App. Br. 4–5.

We do not agree. We agree with the Examiner, as acknowledged by Appellants,[1] that the optimization parameters are described in the Specification only as parameters that *can be used* to mathematically select an optimal viewing angle, but the Specification does not disclose how the parameters are used to mathematically select the optimal viewing angle (Ans. 21). We agree that the three example criteria described are only the

[1] *See, e.g.*, App. Br. 4, 5, 7; Reply Br. 3.

desired result from performing the optimization, namely that the resulting angle should provide the described viewing characteristics (*id.*). As the Examiner finds, stating that these may be optimized using various weights to select a viewing angle without providing any example or description of how this might be accomplished does not provide support for how Appellants' claimed invention actually performs the optimization to achieve the claimed function (*id*,).

Here, we agree that:

> While paragraph 24 states that that one skilled in the art can devise an objective function that weights various optimization parameters and that "well known optimization techniques" can be used to optimize the objective function, it is not sufficient for purposes of the written description requirement to disclose simply that one skilled in the art could devise a way of achieving a claimed function. Under the written description requirement claims may fail to satisfy the written description requirement when the invention is claimed and described in functional language but the specification does not sufficiently identify how the invention achieves the claimed function. *Ariad*, 598 F.3d at 1349 ("[A]n adequate written description of a claimed genus requires more than a generic statement of an invention's boundaries.") *(citing Eli Lilly*, 119 F.3d at 1568).

Ans. 21–22.

We agree with the Examiner that the Specification does not describe "determining a viewing angle" in sufficient detail that one skilled in the art would reasonably conclude that the inventor had possession of the claimed invention, especially when the Specification does not provide any disclosure of a mathematical formula or algorithm for such a determination. Appellants could have provided supporting evidence for their assertion that one skilled in the art can devise an objective function that weighs various optimization parameters and that "well known optimization techniques" can be used to optimize the objective function, but did not.

Accordingly, we affirm the Examiner's rejection of claims 1, 7, 15, 20, 26, and 31 under 35 U.S.C. § 112, first paragraph.[2]

Claims 1–5, 10–18, 23–29, and 34–36 under 35 U.S.C §103(a)

Appellants argue that although Gessat describes that a user selects landmarks of a segmented aortic root, in Gessat the user-selected landmarks are used to calculate geometric constraints for the size and position of the aortic valve implant, not to define a viewing plane at which to position a C-arm image acquisition system for X-ray acquisition by the C-arm image acquisition system (App. Br. 10–11). Appellants assert that Gessat shows different views of the simplified root model in Figure 3, however none of these views represent a viewing angle for X-ray image acquisition by a C-arm image acquisition system and there is no description of a determination of a viewing angle of the C-arm image acquisition system that providing a viewing plane perpendicular to a defined plane representing an aortic annulus direction (App. Br. 11).

We do not agree with Appellants' arguments. The Examiner finds, and we agree, the functional portion of the limitation at issue is determining

[2] Should there be further prosecution the Examiner should consider whether a rejection under 35 U.S.C §101 is applicable as the claims appear to be directed to mental steps performed by a physician evaluating the angle to take the best image of interest constituting an abstract idea. We note that mere automation of those steps do not convert the claims to statutory subject matter.

a viewing angle providing a viewing plane that is perpendicular to the defined plane (Ans. 26). We agree with the Examiner that the angle determination is recited only in relation to the defined plane itself within the 3D image (*id.*). We agree that Gessat's Figure 3 correspondingly provides such a viewing angle because the resulting viewing plane is perpendicular to the defined plane shown in the image as required by the claim (*id.*). As the Examiner further notes, the claim does not specify the axis on which the angle is measured, which means that any viewing angle parallel to the plane as shown in Figure 3 by definition is a viewing angle providing a viewing plane that is perpendicular to the defined plane (Ans. 26–27). The Examiner notes, and we agree, that the claim does not recite a determination of a viewing angle "of the C-arm image acquisition system," but rather only recites determining an angle providing a viewing plane that is perpendicular to the described plane (Ans. 27).

Appellants further argue that although, Lienard describes positioning an X-ray apparatus at a viewing angle, there is no description in Lienard of controlling to X-ray apparatus to be positioned at a determined viewing angle that provides a viewing plane that is perpendicular to a plane representing an aortic annulus direction that has been defined in a 3D image (App. Br. 13). Furthermore, Appellants assert that there is no reason that one of ordinary skill in the art would modify the teachings of Lienard to provide a viewing angle allegedly taught in the image of the simplified root model in Figure 3 of Gessat (*id.*).

One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *In re Keller*, 642 F.2d 413, 426 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 1097

(Fed. Cir. 1986). We agree with the Examiner that Gessat is not relied upon to teach the function of controlling the C-arm system to be positioned at the determined viewing angle, but rather, Lienard is instead relied upon to teach the actual controlling of the C-arm system (Ans. 27). In other words, Gessat is relied upon to teach the functional language of determining a viewing angle that provides a viewing plane that is perpendicular to the defined plane, and does not rely on Gessat to further teach controlling a C-arm image acquisition system to be positioned at the determined viewing angle (*id.*). Lienard is relied upon to teach the limitation of controlling the C-arm image acquisition system to be positioned at the determined viewing angle that provides a viewing plane that is perpendicular to the defined plane (*id.*).

We further agree with the Examiner that the combination does not rely on impermissible hindsight because Lienard describes not only controlling a C-arm imaging system such that the axis of the beam is perpendicular to the long axis of a vessel portion of interest (Ans. 27–28 citing paras. 22, 25, and Fig. 1), but also that positioning the C-arm system in the described manner allows for acquisition of images as preferred angles (Ans. 28 citing paras. 37 and 51).

Thus, we affirm the Examiner's rejection of claim 1 and for the same reasons the Examiner's rejection of claims 1–5, 10–18, 23–29, and 34–36, not argued separately.

Claims 14, 25, and 36

Appellants further argue that the probabilistic boosting tree classifiers of Ionasec do not determine transfer functions for visualizing a segmented aortic root using 3D volume rendering (App. Br. 16). Therefore, Appellants assert that the cited prior art does not teach or suggest "automatically determining transfer function parameters for 3D volume rendering of the segmented aortic root based on one or more quantitative properties of the 3D image using trained approximation functions," as recited in claims 14, 25, and 36 (*id.*).

We do not agree. We agree with the Examiner's findings as stated in the Answer:

> the parameter $L_i|x_s,Y_s,Z_s$ is disclosed in Ionsec [sic] as the *probability* of a landmark at location $L_i|x_s,Y_s,Z_s$, and is therefore a parameter used in 3D volume rendering as described in Sections 2.1 and 2.2. Section 2.2 of Ionasec teaches a 3D volume rendered root and valve model which uses a training set of positive and negative sample landmark positions to automatically train a discriminative classifier (i.e.[,] a transfer function as shown in equation 3) to detect landmark locations for volume rendering an aortic valve (Section 2.2 describes training a discriminative classifier *H* using a Probabilistic Boosting Tree; Figure 3 shows the volume rendering of the aortic valve overlaid on the aorta). The landmark parameters are then used for global fitting of a 3D model such as seen in Figure 3 (Section 2.2). The 3D volume rendering provided by the model can be seen in Figures 3 and 4. Examiner notes that the claims do not define or limit what constitutes a transfer function, or what may constitute a transfer function parameter beyond that the parameters are based on one or more quantitative properties of a 3D image using trained approximation functions. Furthermore, while Applicant asserts that the discriminative classifier taught by Ionasec do not determine a transfer function, Applicant has not provided any basis on which Examiner's interpretation of the training of such a discriminative classifier as shown in equation 3 is incorrect as applied to the determination recited in the claims. Section 2.2 describes the trained function as used in the estimation of the visual aortic valve model, and Applicant has not provided arguments distinguishing this function and its parameters from those recited in the claims.

Ans. 30. Accordingly, we also affirm the Examiner's rejection of claims 14, 25, and 36.

DECISION

The Examiner's rejection of claims 1–36 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).