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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ALEXANDER BENJAMIN BROST,
SEBASTIAN KAEPPLER, MARTIN OSTERMEIER,
NORBERT STROBEL, WEN WU, and TERRENCE CHEN

Appeal 2018-001118
Application 14/368,833
Technology Center 3700

Before JAMES P. CALVE, WILLIAM A. CAPP, and LEE L. STEPINA, *Administrative Patent Judges*.

CAPP, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants[1] seek our review under 35 U.S.C. § 134 of the final rejection of claims 1, 2, 4, 5, 13–18, 21–23, 25, 26, and 34. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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[1] Siemens Aktiengesellschaft and Friedrich-Alexander-Universität Erlangen-Nürnberg are the Applicants and real parties in interest. Appeal Br. 1.

THE INVENTION

Appellants' invention relates to tracking catheters in fluoroscopic images. Spec. ¶ 2. Claim 1, reproduced below with paragraph indentation added, is illustrative of the subject matter on appeal.

1. A method comprising:
   tracking a first catheter in a plurality of frames of a fluoroscopic image sequence; and
   estimating cardiac and respiratory motion of a portion of a heart in each of the plurality of frames based on
   a position of a second catheter determined from
      the tracking of the first catheter using a trained motion estimation model,
      the trained motion estimation model trained based on tracking the first catheter and the second catheter in a sequence of training images.

THE REJECTIONS

The Examiner relies upon the following as evidence in support of the rejections:

Rasche	US 6,473,635 B1	Oct. 29, 2002
Willis	US 2005/0203375 A1	Sept. 15, 2005
Barbu	US 2009/0062641 Al	Mar. 5, 2009
Xu	US 2009/0163800 Al	June 25, 2009

The following rejections are before us for review:

1. Claims 1, 2, 4, 5, 13, 17, 18, 21–23, 25, 26, and 34 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Xu, Rasche, and Barbu.

2. Claims 14–16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Xu, Rasche, Barbu, and Willis.[2]

[2] Claims 3, 6–12, 19, 20, 24, and 27–33 are objected to as being dependent upon a rejected base claim, but the Examiner indicates that these claims would be allowable if rewritten in independent form. Final Action 4.

OPINION

Unpatentability of Claims 1, 2, 4, 5, 13, 17, 18, 21–23, 25, 26, and 34 over Xu, Rasche, and Barbu

Claim 1

The Examiner finds that Xu discloses the invention except for motion estimation based on: (1) the spatial relationship between two catheters (or probes); and (2) training. Final Action 4–6. The Examiner relies on Rasche as disclosing respiratory motion measured based on the position of two catheters (probes). *Id.* "Rasche therefore teaches of the combination of the respiratory motion signal and the electrocardiogram or cardiac signal with respect to the motion of the catheter relative to the heart." *Id.* The Examiner concludes that it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Xu with the teachings of Rasche to measure respiratory and cardiac motion signals based on catheter (probe) positions. *Id.* at 5–6.

With respect to trained motion estimation, the Examiner relies on Barbu as disclosing catheter detection and tracking in a fluoroscope image sequence with training data and training images. *Id.* at 6. The Examiner concludes that it would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify Xu with the teachings of Barbu. *Id.* According to the Examiner, a person of ordinary skill in the art would have done this to detect and track the catheter tip in a fluoroscopic image sequence. *Id.*

In traversing the rejection, Appellants concede that Rasche relates to determining the position of a medical instrument relative to a moving organ of the body. Appeal Br. 5. However, according to Appellants, Rasche does not teach estimating cardiac and respiratory motion based on position of a

second catheter that is determined by tracking a first catheter using a trained motion estimation model. *Id.* at 5–6. Appellants contend that Rasche merely deals with a change of position of the patient during treatment. *Id.* at 6.

> [D]etermining the change of position of a patient based on the relative position of two reference probes, as described in the cited portions of Rasche, does not teach or suggest at least "estimating cardiac and respiratory motion of a portion of a heart in each of the plurality of frames based on a position of a second catheter determined from the tracking of the first catheter" as in claim 1. That is, the cited portions of Rasche do not teach or suggest a position of one reference probe determined from the tracking of another reference probe. The cited portions of Rasche do not teach or suggest "a position of a second catheter determined from the tracking of the first catheter" in claim 1.

Id.

Furthermore, Appellants accuse the Examiner of relying on an overly broad claim construction. *Id.* at 6–7. Appellants contend that, properly construed, Rasche does not teach "a position of a second catheter determined from the tracking of the first catheter." *Id.* at 7. Finally, Appellants argue that the passage of Barbu on which the Examiner relies fails to teach the entire second or "estimating" limitation of claim 1. *Id.*

In response, the Examiner notes that Appellants' claim language is very broad. Ans. 7. In particular, the Examiner states that "*trained motion estimation model*" is a very broad term. *Id.* at 8. Furthermore, the Examiner states that, under the broadest reasonable interpretation, claim 1 is directed to determining cardiac and respiratory motion of the heart based on the respective positions of two interdependent catheters. *Id.* at 7. The Examiner concludes that Xu, Rasche, and Barbu, taken in combination, teach tracking

the position of multiple catheters with respect to cardiac and respiratory motion in training images. *Id.*

In response to Appellants' argument that Rasche only tracks movement of the entire patient, but not cardiac/respiratory movement, the Examiner states that Rasche teaches monitoring positions of a catheter and reference probe and determining cardiac and respiratory motion based on the positions of the catheter and probe. *Id.* at 5.

> [A]s is well known in the art, the Rasche reference is directed to combined effect of the respiratory and cardiac motion signal with respect to the position of a catheter or medical instrument. Rasche reference furthermore teaches that the relative positions of two probes is used determine change of position of patient during treatment and that "the position in space of the catheter 4 relative to the patient reference probe 21 is subsequently used to convert the position in space of the catheter 4 relative to the 30 image data set and hence relative to the heart" (col. 6, ll. 20-29). Since the reference explicitly teaches the dependency between the position of the probe and the catheter, clearly the position of one is dependent on the position of the other.

Id. at 6.

In response to Appellants' argument regarding the Barbu reference, the Examiner states that Barbu was used to address the training images limitation. *Id.* at 7. The Examiner reminds Appellants that this case involves a Section 103 rejection and, as such, it is not necessary that Barbu teach every limitation of the claim. *Id.*

Xu is directed to a method for real-time cardiac visualization that includes acquiring fluoroscope imagery from two planes. Xu, Abstract. The invention assists a medical practitioner in performing cardiac RF catheter ablation procedures. *Id.* ¶¶ 9, 33, 47, 52. The location of a catheter (electrophysiology device) is marked within the fluoroscope imagery from

each of the two planes. *Id.* Abstract. Xu's method determines a three dimensional ("3D") location of the catheter. *Id.* In step S77 of Xu's method, breathing motion is calculated using a combined 3D trajectory. *Id.* ¶¶ 78–83, Fig. 7. In step S78, the method compensates for calculated motion. *Id.*

Rasche is directed to a method and device for determining the position of a catheter relative to a beating heart. Rasche, Abstract, col. 3, l. 60 – col. 4, l. 23. Rasche determines the spatial position of a catheter and a reference probe while simultaneously acquiring a periodic motion signal of the heart. *Id.,* Abstract, Fig. 1. Rasche also utilizes a stored, pre-operatively acquired 3D image data set of the patient. *Id.* col. 4, ll. 28–39. A control and arithmetic unit determines the position of the catheter relative to the heart from the data supplied and on the basis of a 3D image data set. *Id.* col. 4, ll. 53–57. An image of the anatomy surrounding the catheter is thereby displayed on display device 13. *Id.*

> [B]y observing the images displayed, in which each instantaneous position of the catheter or the catheter itself can be superposed, the attending physician can thus see where exactly the catheter is situated. He or she can thus very accurately address given points, for example within the heart, because according to the proposed method the eigenmotion of the heart is taken into account for determining the position of the catheter relative to the heart.

Id., col. 4, ll. 59–66. Contrary to Appellants' argument, the reference probes in Rasche are not limited to merely determining a change of position of the patient during treatment. Appeal Br. 6. Reference probe 6 may be attached to the surface of a patient's body. Rasche col. 4, ll. 20–22. Furthermore, Rasche discloses that:

> Because the position of the reference probe relative to the body organ is also known in this 3D image data set and the actual spatial position of the reference probe was measured, a conversion formul[a] can be determined therefrom; the measured spatial position of the [catheter] . . . can thus be simply converted, for example by means of a simple co-ordinate transformation, into its position relative to the body organ. The invention thus enables exact determination of the position of a [catheter] . . . , introduced into the body of a patient, relative to a periodically moving body organ . . . and also the tracking of motions of the instruments.

Id. col. 2, ll. 50–62. More particularly, with respect to reference probe 21 identified in the Appeal Brief, Rasche discloses:

> The position in space of the catheter **4** relative to the patient reference probe **21** is subsequently used to convert the position in space of the catheter **4** relative to the 3D image data set and hence relative to the heart.

Id. col. 6, ll. 26–29. In short, the Examiner's finding that the positions of Rasche's catheter and reference probe are interdependent is supported by a preponderance of the evidence.

Barbu discloses a method and system for detecting and tracking an ablation catheter tip in a fluoroscopic image sequence. Barbu Abstract. Catheter tips are detected in each frame of a fluoroscopic image sequence using marginal space learning. *Id.* We agree with the Examiner that:
(1) the claim term "trained motion estimation model" is broad; and
(2) applying a broad but reasonable interpretation, Barbu discloses a trained motion estimation model as claimed.

Appellants' arguments regarding the Barbu reference fail to apprise us of Examiner error. Appeal Br. 7. In the first instance, Appellants' arguments amount to an individual attack on a single reference. However, it is well settled that non-obviousness cannot be established by attacking

references individually where the rejection is based upon the teachings of a combination of references. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986); *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). Secondly, the argument merely recites a claim limitation and then makes a naked assertion that Barbu fails to disclose the limitation. Appeal Br. 7. As such, it fails to rise to a level of a separate argument for the patentability of claim 1. *See* 37 C.F.R. § 41.37(c)(1)(iv) ("A statement which merely points out what a claim recites will not be considered an argument for separate patentability of the claim"); *see also In re Lovin*, 652 F.3d 1349, 1357 (Fed. Cir. 2011) (Rule 41.37 requires more than recitation of the claim elements and a naked assertion that the elements are not found in the prior art).

Finally, the Examiner has articulated a sound reason as to why a person of ordinary skill in the art would have combined the references in the manner proposed in the rejection. Final Action 5–6. Such reasoning is not persuasively challenged by Appellants. *See generally* Appeal Br.

In view of the foregoing discussion, we determine the Examiner's findings of fact are supported by a preponderance of the evidence and that the Examiner's legal conclusion of unpatentability is well-founded. Accordingly, we sustain the Examiner's unpatentability rejection of claim 1.

Independent Claims 17 and 22

Appellants argue claims 17 and 22 under respective separate headings in the Appeal Brief. Appeal Br. 7–9. In traversing the rejection of each of these claims, Appellants rely solely on arguments that we previously considered and found unpersuasive with respect to claim 1 and find equally unpersuasive here. *Id.* We sustain the rejection of claims 17 and 22.

Claims 4 and 25

Appellants argue claims 4 and 25 together. Appeal Br. 9–10. We select claim 4 as representative. *See* 37 C.F.R. § 41.37(c)(1)(iv). In traversing the rejection, Appellants argue that the passage of Barbu that the Examiner relies on fails to disclose that the training images are of the same patient as the fluoroscope image sequence. Appeal Br. 9.

In response, the Examiner essentially maintains that a person of ordinary skill in the art, reading Barbu's entire disclosure in context, would understand that the patient who is undergoing treatment is the same patient from which training data is obtained. Ans. 14 (*citing* Barbu ¶ 5).

Appellants' invention, as well as that of the prior art, including Barbu, are involved with radio frequency catheter ablation of heart tissue. *See, e.g.*, Xu ¶ 9 ("In RF catheter ablation, an RF catheter may be used to destroy abnormal electrical pathways in heart tissue."); Barbu ¶ 3 ("the ablation . . . destroys, or ablates, the tissue at these locations and interrupts the triggers for the heart arrhythmia"). Persons of ordinary skill in the art understand that cardiac ablation procedures require accuracy in the placement of electrodes. *See, e.g.*, Xu ¶ 7 ("In order to accurately place the electrodes, it may be necessary to visualize the heart using a medical imaging device. As the heart is constantly in motion, and the location of tools in and around the heart must be known"). Given the precision requirements of the procedure and the sensitivity of the human tissue that is being treated, i.e., the human heart, it is implicit in Barbu that the training data is obtained from the same patient that is undergoing treatment. We think a person of ordinary skill in the art would not understand Barbu in any other way, nor do we think a person of ordinary skill in the art would need to be explicitly instructed to

use the same patient for training as will undergo treatment. In that regard, we note that Rasche utilizes a stored, pre-operatively acquired 3D image data set of the same patient that is undergoing treatment. Rasche col. 4, ll. 28–39.

As persons of scientific competence in the fields in which they work, examiners are responsible for making findings, informed by their scientific knowledge, as to the meaning of prior art references to persons of ordinary skill in the art and the motivation those references would provide to such persons. Absent legal error or contrary factual evidence, those findings can establish a prima facie case of obviousness. *In re Berg*, 320 F.3d 1310, 1315 (Fed. Cir. 2003). In our opinion, the Examiner's interpretation of Barbu is reasonable and well within the Examiner's competency under *Berg*, particularly in light of the disclosure in Rasche demonstrating that it was known to use stored, pre-operatively acquired 3D image data sets of the same patient that is undergoing treatment. Rasche col. 4, ll. 28–39. Appellants provide neither evidence nor persuasive technical reasoning to support any other reasonable conclusion based on the evidence of record.

We sustain the rejection of claims 4 and 25.

Claims 5 and 26

Appellants argue claims 5 and 26 together. Appeal Br. 10. We select claim 5 as representative. In traversing the rejection, Appellants argue that the passage of Barbu that the Examiner relies on fails to disclose that the training data is "a number of frames of the fluoroscopic image sequence prior to the plurality of frames of the fluoroscopic image sequence." Appeal Br. 10.

In response, the Examiner states that Barbu teaches conducting the training and detecting catheter tip candidates in fluoroscopic images. Ans. 15. Barbu teaches that "[o]nce the PBT classifiers are trained for each level, the classifiers can be used to detect catheter tip candidates in input fluoroscopic images." Barbu ¶ 21. Barbu further teaches that catheters are detected using the classifier trained for each learning level. *Id.* The temporal sequence of claim 5 can be discerned from the disclosure in Barbu. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (a reference need not satisfy an *ipsissimis verbis* test). Thus, the Examiner's finding of fact is supported by a preponderance of the evidence.

We sustain the rejection of claims 5 and 26.

Claims 2, 13, 18, 21, 23, and 34

Each of these claims depend from an independent claim whose rejection we have previously sustained and which are not separately argued by Appellants. We sustain the Examiner's rejection of claims 2, 13, 18, 21, 23, and 34. *See* 37 C.F.R. § 41.37(c)(1)(iv) (failure to separately argue claims).

Unpatentability of Claims 14–16 over Xu, Rasche, Barbu, and Willis

Appellants do not argue for the separate patentability of claims 14–16 apart from arguments presented with respect to claim 1, which we have previously considered. Accordingly, we sustain the Examiner's rejection of claims 14–16. 37 C.F.R. § 41.37(c)(1)(iv).

DECISION

The decision of the Examiner to reject claims 1, 2, 4, 5, 13–18, 21–23, 25, 26, and 34 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)(1)(iv).

AFFIRMED