



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/040,345	09/27/2013	Luis Alberto CRUZ	VAR-13-019-US	9418
78145	7590	12/20/2019	EXAMINER	
Murabito, Hao & Barnes LLP (Varian)			CHOI, JAMES J	
111 North Market Street			ART UNIT	
Suite 700			PAPER NUMBER	
San Jose, CA 95113			2881	
			NOTIFICATION DATE	
			DELIVERY MODE	
			12/20/2019	
			ELECTRONIC	

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Officeaction@mhbpatents.com
ipdocket@varian.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte LUIS ALBERTO CRUZ

Appeal 2018-007614
Application 14/040,345
Technology Center 2800

Before BEVERLY A. FRANKLIN, KAREN M. HASTINGS, and
N. WHITNEY WILSON, *Administrative Patent Judges*.

WILSON, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant¹ appeals under 35 U.S.C. § 134(a) from the Examiner’s September 13, 2017 decision finally rejecting claims 1, 7–11, 16, 17, 22, 23, 25, and 26² (“Final Act.”). We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We affirm.

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies Varian Medical Systems Inc. as the real party in interest (Appeal Br. 4).

² Claims 2–6, 12–14, 18, and 19 have been withdrawn from consideration. Claims 15, 20, 21, 24, and 27 are cancelled (Final Act. 3).

CLAIMED SUBJECT MATTER

Appellant's disclosure relates to an energy degrading device for attenuating energy of a particle beam with reduced emittance growth (Abstract). An energy degrader comprises an emittance control material that can preferentially scatter the beam particles that is incident on a surface with a shallow angle (*id.*). The energy degrader may be composed of carbon nanotubes, which may serve to preferentially scatter beam particles towards the central beam axis as well as attenuate energy thereof (*id.*). Details of the claimed structure are set forth in representative claim 1, which is reproduced below from the Claims Appendix to the Appeal Brief:

1. A radiation therapy system comprising:
 - an accelerator operable to generate a particle beam; and
 - an energy degrader comprising carbon nanotubes and coupled to said accelerator, wherein said carbon nanotubes are configured to both attenuate energy of said particle beam to a predetermined value by virtue of particle scattering and constrain spatial emittance growth by virtue of particle interactions with the particle beam, wherein said particle scattering causes said spatial emittance growth of said particle beam, and wherein further said carbon nanotubes are oriented substantially in an incident direction of said particle beam at an entrance of said energy degrader.

REJECTIONS

1. Claims 1, 8, 11, 16, 23, 25, and 26 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tombrello³ in view of Moyers⁴ and Wang.⁵
2. Claims 7 and 9 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tombrello in view of Moyers and Wang, and further in view of Tsoupas.⁶
3. Claims 9, 10, 17, and 22 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tombrello in view of Moyers and Wang, and further in view of Bert.⁷

DISCUSSION

Appellant does not argue any claim or rejection separately (*see*, Appeal Br. 23–24). Accordingly, we focus our discussion on the rejection of claim 1. *See* 37 C.F.R. § 41.37(c)(1)(iv). The remaining claims will stand or fall with claim 1.

The Examiner’s findings underlying this rejection are set forth at pages 4–5 of the Final Action. In part, the Examiner finds that Tombrello discloses each limitation of claim 1, except that Tombrello does not

³ Tombrello Jr. et al., US 2013/0032731 A1, pub. Feb. 7, 2013 (and ultimately issued on March 25, 2014 as US 8,678,012 B2).

⁴ Moyers et al., US 5,440,133, issued August 8, 1995.

⁵ Y. Wang et al., “Energy loss of charged particles moving in cylindrical tubules,” *Physical Review A*, Vol. 66, 04294 (2002).

⁶ Tsoupas et al., US 2010/0230620 A1, published September 16, 2010.

⁷ Bert et al., US 2011/0303858 A1, published December 15, 2011.

explicitly disclose (1) that the source for generating a particle beam is an accelerator, (2) that the energy of the particle beam is attenuated to a predetermined value, and (3) that the attenuation of the particle beams is attributed to the nanotubes, and that the nanotubes are oriented in substantially an incident direction of said particle beam at an entrance of said energy degrader (*id.*).

With respect to difference (1), the Examiner finds that it was known that accelerators could be used to generate proton beams and, therefore, it would have been obvious to use an accelerator as described in the claims because use of such an accelerator was known for this purpose and Tombrello did not specify a specific source to generate the proton beams (Final Act. 4).

With respect to difference (2), the Examiner finds that Moyers discloses a system which takes into account beam attenuation to achieve a desired energy level for a specific kind of treatment (*id.*) The Examiner determines that it would have obvious to precisely control Tombrello's particle beam to achieve a specific (i.e. predetermined) energy in order to optimize specific treatments (Final Act. 5).

Finally, with respect to difference (3), the Examiner finds that Wang discloses an experimentally determined relationship between proton energy loss and the distance the beam travels through nanotubes oriented substantially in an incident direction of said particle beam (Ans. 5, citing Wang, Figs. 5–7, p. 2, col. 1). The Examiner determines that it would have been obvious to orient the nanotubes oriented in an incident direction of the particle beam because:

“a person having ordinary skill in the art would have been motivated to look for ways to improve control and predictability of the beam characteristics through each part of the system in order to obtain a desired final beam quality, including taking into account the predetermined attenuation characteristics of nanotubes arranged substantially in the beam direction, in the manner taught by Wang.”

(Final Act. 5).

Appellant argues that the combination of Tombrello, Moyers, and Wang does not teach or suggest an energy degrader comprising carbon nanotubes that serve to both attenuate the energy of a particle beam and constrain spatial emittance growth of the beam (Appeal Br. 15).

In particular, Appellant first argues that Tombrello does not teach carbon nanotubes configured “**to constrain spatial emittance growth by virtue of particle interactions with the particle beam,**” because Tombrello relies on heavy metal scattering to redirect the beam (Appeal Br. 16). Appellant argues that Tombrello’s discloses a beam guiding apparatus where the beam passes through a helix annular channel, which can be carbon nanotubes, which has “*scattering centers*” which serve to guide the beam (Appeal Br. 16, citing Tombrello, ¶¶ 10, 12, 15, 22). According to Appellant, Tombrello only discloses the use of carbon nanotubes as a support for the heavy atoms which are used to guide the beam (i.e. constrain its spatial growth) (Appeal Br. 18).

In response, the Examiner agrees that Tombrello does teach that its scattering centers guide the beam, but finds that the carbon nanotubes disclosed by Tombrello “*will contribute to beam control*” (Ans. 2). The Examiner finds that carbon nanotubes “*will inherently provide beam*

shaping, directing, and attenuation,” and points to Wang as supporting this finding (Ans. 2–3, citing Wang, p. 66). In this regard, Wang states that “one of the most fascinating aspects is the interaction of charged particles with carbon nanotubes” and “carbon nanotubes may be used as waveguides for transporting and focusing charged particle beams” (Wang p. 66).

Appellant does not contest this specific finding of inherency. Accordingly, Appellant’s argument that Tombrello does not disclose or suggest carbon nanotubes “configured “to constrain spatial emittance growth by virtue of particle interactions with the particle beam” is not persuasive of reversible error.

Appellant’s second argument is that although Tombrello discloses using carbon nanotubes to prevent build-up of electrostatic charge, it **“provides no indication of particle interaction between the carbon nanotubes and the proton beam that act to constrain beam spatial emittance growth”** (Appeal Br. 19). In effect, this is the same as the first argument discussed above, and is not persuasive for the same reasons.

Third, Appellant argues that Tombrello teaches away from the claimed invention (Appeal Br. 21). Appellant contends that Tombrello is directed to a proton beam guide apparatus where high depth of penetration (travelling distance) is the objective (Appeal Br. 22). As support for this contention, Appellant points to Paragraphs 54 and 55 of Tombrello which respectively state: “These calculation shows that *substantial penetration* of a proton beam even in strongly bent glass capillaries *could be obtained,*” and “[t]his result indicates that there is a well-defined acceptance angle for propagation of protons through annular nanotubes” (*id.*). Therefore, according to Appellant, Tombrello suggests to a person of skill in the art that

proton beam attenuation as the beam traverses the guide is undesirable because this would run counter to the asserted objective of achieving a high penetration depth (Appeal Br. 23). Appellant argues this means that a person of skill in the art would be led away from the proposed combination of Tombrello with Moyers and Wang, as these each suggest proton beam attenuation, which is undesirable for Tombrello (*id.*).

The foregoing argument is not persuasive of reversible error.

Whether a reference teaches away from a claimed invention is a question of fact. *See In re Harris*, 409 F.3d 1339, 1341 (Fed. Cir. 2005). “A reference may be said to teach away when a person of ordinary skill, upon reading the reference ... would be led in a direction divergent from the path that was taken by the applicant.” *In re Haruna*, 249 F.3d 1327, 1335 (Fed. Cir. 2001) (quoting *Tec Air, Inc. v. Denso Mfg. Mich., Inc.*, 192 F.3d 1353, 1360 (Fed. Cir. 1999)). “When a piece of prior art ‘suggests that the line of development flowing from the reference’s disclosure is unlikely to be productive of the result sought by the applicant’ the piece of prior art is said to ‘teach away’ from the claimed invention.” *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (quoting *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994)). A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *See W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1550 (Fed. Cir. 1983). However, “[t]he prior art’s mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed....” *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004).

In this instance, as noted by the Examiner and as discussed above, the evidence of record suggests that Tombrello's nanotubes inherently attenuate the proton beam. Thus, the evidence teaches that some attenuation of the proton beam is not incompatible with Tombrello's objective. Moreover, as found by the Examiner, while Tombrello does favor high beam energies, beam therapy, which is Tombrello's goal, does not require maximizing beam energy in lieu of all other concerns (Ans. 4–5), citing Moyers 6:53–56 and 6:64–7:16 as showing that effective beam therapy requires control of the beam energy.

Thus, as found by the Examiner, Tombrello does not teach away from the combination with Moyers. In fact, the two references appear to be compatible and combinable in the manner suggested by the Examiner.

Accordingly, we determine that Appellant has not shown reversible error in the rejection of claim 1 over Tombrello in view of Moyers and Wang. Therefore, we affirm that rejection. Because Appellant does not make different arguments for any other claim (see, Appeal Br. 23–25), we also affirm the rejections of the remaining claims.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	References(s)/Basis	Affirmed	Reversed
1, 8, 11, 16, 23, 25, 26	103(a)	Tombrello, Moyers, Wang	1, 8, 11, 16, 23, 25, 26	
7, 9	103(a)	Tombrello, Moyers, Wang, Tsoupas	7, 9	
9, 10, 17, 22	103(a)	Tombrello, Moyers, Wang, Bert	9, 10, 17, 22	
Overall Outcome			1, 7–11, 16, 17, 22, 23, 25, 26	

TIME PERIOD FOR RESPONSE

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).

AFFIRMED