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.
12/330,583	12/09/2008	Christoph Boehm	ROA 0096 PA/24532US	1112

67491 7590 02/04/2013

DINSMORE & SHOHL, LLP
FIFTH THIRD CENTER
ONE SOUTH MAIN STREET
SUITE 1300
DAYTON, OH 45402

EXAMINER	
HIXSON, CHRISTOPHER	

ART UNIT	PAPER NUMBER
1777	

NOTIFICATION DATE	DELIVERY MODE
02/04/2013	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):

william.jividen@dinsmore.com
alicia.pickering@dinsmore.com
beth.bane@dinsmore.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte CHRISTOPH BOEHM

Appeal 2011-011950
Application 12/330,583
Technology Center 1700

Before RICHARD TORCZON, MARK NAGUMO, and CHRISTOPHER L. CRUMBLEY, *Administrative Patent Judges*.

CRUMBLEY, *Administrative Patent Judge*.

DECISION ON APPEAL

Christoph Boehm ("Appellant") seeks relief under 35 U.S.C. § 134(a) from the Examiner's final rejection of Claims 1-15.[1] We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

STATEMENT OF THE CASE

The appealed claims are directed to a microfluidic element for thoroughly mixing a liquid with a reagent. Claim 1, set forth below, is illustrative of the subject matter on appeal:

> 1. A microfluidic element for thoroughly mixing a liquid with a reagent used for analyzing the liquid for an analyte contained therein, the microfluidic element comprising:
>
> a cover layer;
>
> a substrate; and
>
> a channel structure enclosed by the substrate and the cover layer, wherein the channel structure includes an elongate mixing channel, whose length is at least ten (10) times as large as the greater cross-sectional dimension of its cross-sectional area, and an output channel, wherein the mixing channel has an inlet opening and an outlet opening, and the mixing channel is adapted for mixing the reagent contained therein with the liquid flowing through the inlet opening into the mixing channel, and wherein the outlet opening of the mixing channel is in fluid communication with the output channel, and the outlet opening is located closer to the middle of the length of the mixing channel than the inlet opening.

Boehm argues the patentability of Claims 1-8, 10, and 12-15 together, and argues that Claims 9 and 11 are patentable for the same reasons as

[1] Application Ser. No. 12/330,583, entitled *Microfluidic Element For Thoroughly Mixing a Liquid With a Reagent*, filed December 9, 2008, claiming priority to EP 07024210.2 filed December 13, 2007. The real party in interest is listed as Roche Diagnostics Operations Inc.

Claim 1. All claims therefore stand or fall together with Claim 1. 37 C.F.R. § 41.37(c)(1)(vii); *Hyatt v. Dudas*, 551 F.3d 1307, 1311-14 (Fed. Cir. 2008).

The Examiner relies upon the following evidence of unpatentability:

Kellogg	US 2002/0027133 A1	Mar. 7, 2002
Goldberg	"Protein degradation and protection against misfolded or damaged proteins." Nature, vol. 426, (2003), pp.895-899.	
Handique	"Nanoliter Liquid Metering in Microchannels Using Hydrophobic Patterns." Analytical Chemistry, vol. 72, (2000), pp. 4100-4109.	
Erickson	"Influence of Surface Heterogeneity on Electrokinetically Driven Microfluidic Mixing." Langmuir, vol. 18, (2002), pp. 1883-1892.	

The Rejected Claims

Claims 1-8, 10, and 12-15 stand rejected under 35 U.S.C. §103(a) as obvious over Kellogg in view of Erickson.

Claim 9 stands rejected under 35 U.S.C. §103(a) as obvious over Kellogg in view of Erickson, and further in view of Handique.

Claim 11 stands rejected under 35 U.S.C. §103(a) as obvious over Kellogg in view of Erickson, and further in view of Goldberg.

The Issue Presented

The issue before us on appeal is whether the prior art, when properly combined, teaches or suggests a microfluidic element having "an elongate mixing channel whose length is at least ten times as large as the greater cross-sectional dimension of its cross-sectional area."

ANALYSIS

Microfluidic elements are useful in diagnostics for analyzing small amounts of a liquid, e.g., blood. These elements generally comprise a substrate having a particular channel structure that guides the flow of the fluid over the substrate, and may facilitate mixing and/or analysis of the subject fluid. Centripetal force (rotation of the substrate) is commonly used to force the fluid through the microfluidic channels, though other forces such as electro-osmosis may also be used. Spec. ¶ 0039[2]; Erickson 1884, col 1.

It is a known problem that fluid flow in a microfluidic environment is laminar, meaning the fluid flows in straight lines without turbulence, and therefore the fluid undergoes little mixing. Spec. ¶ 0006. In the parlance of fluid dynamics, fluids experiencing a laminar flow are said to have a low Reynolds number. Erickson 1884, col. 1-2. On the other hand, flow environments with a high Reynolds number are turbulent, and therefore mixing is much easier to achieve. *Id.*

Appellant attempts to encourage mixing in the microfluidic environment by claiming a microchannel structure having particular characteristics. Specifically, the channel structure has an "elongate mixing channel, whose length is at least ten times as large as the greater cross-

[2] We refer to the Boehm specification as "Spec."

sectional dimension of its cross-sectional area." Claim 1. The mixing channel is also said to have an "outlet opening … located closer to the middle of the length of the mixing channel than the inlet opening," which is said to facilitate mixing. *Id.*

The Examiner rejected Claim 1 as obvious over Kellogg in view of Erickson. According to the Examiner, Kellogg teaches a microfluidic element having all elements of the claimed device, including an elongate mixing channel, but does not disclose the dimensions of the mixing channel sufficiently to determine whether the length-to-cross-section dimension limitation is met. Ans. 3-4.[3] To supply this missing element, the Examiner relies on Erickson, which is said to teach a mixing channel length of as much as 200 times the channel width. *Id.* at 4.

On appeal, Boehm challenges the Examiner's conclusion of obviousness, arguing that a person of ordinary skill in the art would not have combined Erickson with Kellogg. App. Br. 7. According to Boehm, Erickson's disclosure is in the context of an electro-osmotically driven microfluidic element, therefore it cannot be combined with Kellogg's microfluidic element which uses centripetal force. *Id.* Boehm reasons that "[d]ue to the use of centripetal force in Kellogg … flow likely occurs at higher Reynolds numbers than those in the mixing systems mentioned by Erickson, wherein mixing occurs via convention [sic, convection]." *Id.*

We are unconvinced that the Examiner erred in combining Kellogg with Erickson. Though the subject of the Erickson reference is electrokinetically driven microfluidic mixing, the disclosure of the reference

[3] We refer to the Appeal Brief filed March 14, 2011 ("App. Br.") and the Examiner's Answer mailed May 2, 2011 ("Ans.").

is not so limited. References are "not limited to what the patentees describe as their own inventions or to the problems with which they are concerned. They are part of the literature of the art, relevant for all they contain." *In re Lemelson*, 397 F.2d 1006, 1009 (C.C.P.A. 1968). The passage cited by the Examiner begins with "In general most microfluidic mixing systems, whether pressure or electrokinetically driven…" Erickson 1884, col. 1. As the Examiner correctly pointed out, Erickson "was clearly not limiting his overall statement to the specific embodiments illustrated in his article." Ans. 8.

Appellant's attempt to distinguish the references because Kellogg uses centripetal force, and therefore "flow likely occurs at higher Reynolds numbers than those in the mixing systems mentioned by Erickson" is similarly unconvincing. Not only is this attorney argument unsupported by any evidence, it is attorney *speculation* that Kellogg's flow "likely" occurs at a higher Reynolds number. Furthermore, this speculation is inconsistent with Appellant's specification, which notes that the fluid flow in Boehm's centripetally-driven microfluidic element is "predominantly laminar" (i.e., low Reynolds number). Spec. ¶ 0006.

We find that the passage of Erickson cited by the Examiner discusses microfluidic mixing generally, and teaches that in laminar or diffusion-dominated mixing regimes (low Reynolds number) it is known that "mixing tends to be slow and occur over relatively long distances and times." Erickson 1884, col. 2. This is the problem faced by Boehm in the presently claimed device as well. Given the teaching of Erickson, one of ordinary skill in the art would have understood that in such devices – no matter what method is used to drive the fluid through the channel – increasing the length

of the mixing channel would promote mixing of the fluid. As the claimed length-to-width ratio of the elongate mixing channel (at least 10:1) is within the range disclosed in Erickson (up to 200:1), we find that the claimed range is taught or suggested by the prior art.

CONCLUSION

For the foregoing reasons, we find that the prior art in combination teaches or suggests all elements of the appealed claims. We therefore affirm the rejection of Claims 1-15 as obvious under 35 U.S.C. § 103(a).

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

AFFIRMED

tc