

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* HUA YANG and  
STEVEN A. SUNDBERG

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Appeal 2008-1955  
Application 11/005,456  
Technology Center 1700

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Decided: April 30, 2008

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Before PETER F. KRATZ, CATHERINE Q. TIMM, and  
MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 the final rejection of claims 1-10. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

We AFFIRM.

INTRODUCTION

Appellants claim a method of making a microfluidic device comprising a substrate with grooves in the surface, adding a first coating subunit to the surface, and adding a second coating subunit that binds to the

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first coating subunit (claim 1). The invention forms biopolymer adsorption resistant coatings for microfluidic devices (Spec. 2).

Claim 1 is illustrative:

1. A method of manufacturing a microfluidic device, the method comprising:
  - (a) providing a first substrate comprising a surface with microscale grooves fabricated into the surface;
  - (b) adding a first coating subunit to the surface; and
  - (c) adding a second coating subunit that binds to the first coating subunit.

The Examiner relies on the following prior art references as evidence of unpatentability:

|            |              |               |
|------------|--------------|---------------|
| Hillman    | 5,164,598    | Nov. 17, 1992 |
| Kennedy    | 5,876,675    | Mar. 2, 1999  |
| Fitzgerald | 6,498,010 B1 | Dec. 24, 2002 |

The rejections as presented by the Examiner are as follows:

1. Claims 1-3, 7, and 10 are rejected under 35 U.S.C. § 103(a) as being obvious over Hillman.
2. Claims 8 and 9 are rejected under 35 U.S.C. § 103(a) as being obvious over Hillman in view of Kennedy.
3. Claims 4-6 are rejected under 35 U.S.C. § 103 over Hillman in view of Fitzgerald.

With regard to claim 1, the Examiner finds that Hillman discloses applying one or more reagents, which may be dissimilar, to form uniform reagent coatings on a surface so that a subsequently applied sample undergoes a desired reaction (Ans. 3 and 4). The Examiner further finds that Hillman's disclosure to coat successive reaction chambers with first and second reagents provides a suggestion for applying successive binding

coatings because it would have been an obvious variation to provide the concept of successive or cascading reactions in view of Hillman (Ans. 4). The Examiner further states that Hillman's disclosure that “[t]he same or different reagents may be introduced into the capillary or in successive reaction units” demonstrates that Hillman “envision[s], if not expressly teach[e], successive reactive coatings, which coatings would bind at least end to end if they are in successive reaction units” (Ans. 6).

The Examiner concludes that it would have been obvious to carry out the method of Hillman and apply the reagent coatings successively to provide an alternate means of providing successive reactions as taught by Hillman (Ans. 4).

## OPINION

### 35 U.S.C. § 103 REJECTION OVER HILLMAN

Appellants argue claims 1 and 2. We select claim 1 as the claim on which to decide this appeal. Appellants' argument regarding claim 2 (App. Br. 6), does not amount to a separate argument because the same issue is raised with regard to claim 1 (i.e., that having overlapping, bound coatings in Hillman's device and method is neither taught nor desirable because it would render Hillman's device and method unsatisfactory for their intended purpose). Accordingly, the focus of the decision is on Appellants' claim 1.

Appellants argue that if Hillman's reagent coatings were bound to one another in an overlapping fashion, then the underlying coating would not be available for reaction because it is covered by the overlying coating (App. Br. 4-5). Accordingly, Appellants argue that modifying Hillman to include overlapping, bound reagents would render the invention unsatisfactory for

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its intended purpose (App. Br. 5). Appellants contend that there is no reasonable expectation of success in carrying out Hillman's invention with overlapping, bound reagents because the overlapping reagents would not permit the sample to react with the underlying reagent (App. Br. 5).

Appellants argue that Hillman fails to teach or suggest "adding a second coating subunit that binds to the first coating subunit" as recited in claim 1 (App. Br. 5). Appellants contend that Hillman does not teach or suggest that the reagent coatings in successive chambers or capillaries touch or bind end-to-end (App. Br. 6 and Reply Br. 4).

We have considered Appellants' arguments and are unpersuaded for the reasons given below.

We begin by construing the claim term "binds" in the claim phrase "a second coating subunit that binds to the first coating subunit."

During examination, claim terms are given their broadest reasonable interpretation consistent with the Specification. *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004). The Patent and Trademark Office applies to the claim terms the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant's Specification. *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997).

Appellants have not defined the term "binds" in the Specification. However, Appellants describe that "many suitable coating procedures are encompassed by the present invention, three such procedures are preferred: 1) adsorptive modification through Van der Waals['] force, hydrogen

bonding or electrostatic interaction; 2) direct covalent modification through a silane bond; and 3) indirect covalent modification through a silane or polymer linker” (Spec. 8-9). Appellant’s state:

These examples [of the various reactive groups] are intended to be illustrative and do not limit the types of reactive group interconversions which are useful in conjunction with the present invention. Additional starting materials and reaction schemes will be apparent to those of skill in the art. (Spec. 12).

Appellants further indicate that, in the embodiments including more than one subunit, a first subunit is attached to the substrate and the second subunit is added together with any reagents necessary to affect the “coupling” of the first and second subunits (Spec. 31). Appellants disclose that “many different variations on the strategy of building the coating up in a step-wise manner and the underlabeling strategy are available and will be apparent to those of skill in the art” (Spec. 31). Appellants indicate that the “examples [in the Specification] are offered to illustrate, but not to limit the claimed invention” (Spec. 32).

Appellants’ Example 8 demonstrates a strategy for coating microfluidic devices via van der Waals’ force, hydrogen bonding or electrostatic interaction (Spec. 33). Example 8 includes treating the surface of the microfluidic device with Repel-Silane-ES (Spec. 51). The treated surface is then coated with poly (ethylene oxide) (PEO) to adsorptively modify the treated microfluidic surface (Spec. 52).

Based on the above disclosures in Appellants’ Specification, we construe the claim term “binds” as including any form of interaction between two subunits (i.e., coatings) such as chemically coupling, van der Waals’ forces, hydrogen bonding, or electrostatic attraction.

Hillman discloses methods of manufacturing testing devices having internal chambers into which fluids are drawn by capillary action (Hillman, col. 1, ll. 19-22). Hillman discloses that as the sample traverses various chambers and capillaries in the device, it will encounter one or more reagent(s) therein (Hillman, col. 4, ll. 6-10). Hillman discloses that the same or different reagents may be introduced into the capillary or in successive reaction units to perform a cascading reaction (Hillman, col. 17, ll. 4-6). Hillman discloses that the reagents may be bound to the walls of the capillary or reaction chamber (Hillman, col. 6, ll. 10-13; col. 14, ll. 46-47). Hillman further discloses that the reagents may be diffusively (i.e., non-covalently and weakly bound) or non-diffusively bound (i.e., adhered, absorbed, adsorbed or covalently-linked) to the surface of the device (Hillman, col. 6, l. 68, col. 7, ll. 1-4). Hillman discloses that reagents may be sprayed, painted, introduced into the chamber as a liquid, lyophilized or evaporated, adsorbed, covalently conjugated or the like (Hillman, col. 16, ll. 12-15).

In the Figure 4 embodiment, Hillman discloses that the semi-chamber 136 has two reagents indicated by slanted lines and crosses (Hillman, col. 21, ll. 51-53). Hillman discloses that both of the reagents are bound to the surface of the chamber 136 (Hillman, col. 21, ll. 53-61).

Hillman discloses that the testing devices may be made of acrylonitrile-butadiene-styrene (ABS), which, however, exhibit poor reagent coatings because ABS is hydrophobic (Hillman, col. 14, ll. 48-63). To eliminate the hydrophobicity of the ABS, Hillman discloses either treating the ABS with argon plasma or providing a protein coating, such as albumin, to render the ABS surface hydrophilic (Hillman, col. 14, ll. 64-68 and col.

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15, ll. 1-7). Hillman discloses in Example 9 forming a testing device out of argon plasma treated ABS, which has a reagent coated on the ABS (Hillman, col. 30, ll. 55-68 and col. 31, ll. 1-12).

“Section 103 forbids issuance of a patent when ‘the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.’” *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734 (2007). In considering the question of the obviousness of the claimed invention in view of the prior art relied upon, we are guided by the basic principle that the question under 35 U.S.C. § 103 is not merely what the references expressly teach but what they would have suggested to one of ordinary skill in the art at the time the invention was made. *See Merck & Co., v. Biocraft Labs., Inc.*, 874 F.2d 804, 807 (Fed. Cir. 1989) and *In re Keller*, 642 F.2d 413, 425 (CCPA 1981).

Based on the above disclosures and contrary to Appellants’ argument, we agree with the Examiner’s conclusion that Hillman would have suggested providing a second coating subunit that “binds” to the first coating subunit. Specifically, Hillman discloses that the Figure 4 embodiment has two coatings in semi-chamber 136 (Hillman, col. 21, ll. 51-53). Hillman’s Figure 4 appears to show that two coatings (i.e., the slanted lines and crosses) at least touch one another in the upper portion of the semi-chamber 136 (i.e., the cross and slanted line are in contact). Accordingly, as the Examiner finds, there appears to be end-to-end contact between two reagent coatings and, thus, some amount of binding (i.e., some form of interaction, for example, van der Waals’ forces) (Ans. 6).

Furthermore, Hillman discloses that the first coating indicated by slanted lines in Figure 4 is “non-diffusively bound” to the surface of the semi-chamber 136 (Hillman, col. 21, ll. 53-56). Hillman discloses that the second coating indicated by the crosses is “reversibly bound” to the surface of the semi-chamber 136 (Hillman, col. 21, ll. 56-61). Accordingly, Hillman’s Figure 4 embodiment demonstrates that the coating indicated by slanted lines and the coating indicated by crosses are bound (i.e., interact) together end-to-end via the substrate (i.e., the wall of semi-chamber 136). Accordingly, we determine that Appellants’ argued claim feature is suggested by Hillman.

We add that Hillman discloses treating an ABS substrate used to make the microfluidic device with an albumin coating or argon-plasma to render the ABS substrate hydrophilic (Hillman, col. 14, ll. 60-68, col. 15, ll. 1-5). Hillman further provides Example 9, which indicates that a reagent is coated on an argon-plasma treated ABS substrate (Hillman, col. 30, ll. 55-68, col. 31, ll. 1-7). Hillman further discloses that the reagents are bound to the surface of the substrate (Hillman, col. 6, l. 68; col. 7, ll. 1-4).

We determine that such Hillman disclosures would have suggested applying a first subunit (i.e., the albumin coating) to a substrate to render it hydrophilic and applying a second subunit (i.e., the reagent coating) to the first subunit such that the first and second subunit are overlapped and bound together. For this additional reason, we find that Hillman discloses Appellants’ argued claim feature.

We are unpersuaded by Appellants’ arguments regarding the lack of reasonable expectation of success in using overlapping, bound reagents and that such a use would render Hillman’s device unsatisfactory for its intended

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purpose. Rather, as evinced by Hillman's Figure 4 embodiment, first and second subunits (i.e., coatings) are bound together and provide the necessary analysis and reaction. Accordingly, Hillman's disclosure provides a reasonable expectation that bound subunits (i.e., coatings) would be available for the necessary reactions and the two subunits bound together would not render Hillman's device unsatisfactory for its intended purpose.

For the above reasons, we determine that the preponderance of the evidence weighs in favor of Examiner's obviousness conclusion. Accordingly, we sustain the Examiner's § 103 rejection of claims 1-3, 7 and 10 over Hillman.

#### REMAINING § 103 REJECTIONS

Appellants do not advance any additional arguments regarding the following rejections: (1) the § 103 rejection of dependent claims 8 and 9 over Hillman in view of Kennedy and (2) the § 103 rejection of dependent claims 4-6 over Hillman in view of Fitzgerald. Rather, Appellants rely on the same arguments made regarding independent claim 1. We are unpersuaded by Appellants' arguments regarding claim 1 for the reasons previously provided.

Accordingly, we sustain the Examiner's § 103 rejection of claims 8 and 9 over Hillman in view Kennedy, and the § 103 rejection of claims 4-6 over Hillman in view of Fitzgerald.

#### DECISION

The Examiner's decision is affirmed.

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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**

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