UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DAN KIKINIS

Appeal 2007-2672
Application 10/166,322
Technology Center 1700

Decided: April 30, 2008

Before DONALD E. ADAMS, DEMETRA J. MILLS, and MELANIE L. McCOLLUM, *Administrative Patent Judges*.

McCOLLUM, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 involving claims to a micro-testing lab. The Examiner has rejected the claims as obvious. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

STATEMENT OF THE CASE

Claims 1-8, 11, 13, 15-25, and 27-29 stand rejected under 35 U.S.C. § 103(a) as obvious over Wilding (U.S. 5,587,128, Dec. 24, 1996) in view of York (US 6,154,226, Nov. 28, 2000).[1]

Claims 9, 14, and 26 stand rejected under 35 U.S.C. § 103(a) as obvious over Wilding in view of York and Bass (US 6,399,396 B1, Jun. 4, 2002).

Claims 1-8, 11, 13, 15-25, and 27-29 stand rejected under 35 U.S.C. § 103(a) as obvious over Wilding in view of Lee (US 6,146,103, Nov. 14, 2000).

Claims 9, 14, and 26 stand rejected under 35 U.S.C. § 103(a) as obvious over Wilding in view of Lee and Bass.

Appellant contends that the Examiner erred in concluding that the claims would have been obvious.

ISSUES

The issues are whether Appellant has shown that the Examiner erred in concluding that claims 1-8, 11, 13, 15-25, and 27-29 would have been obvious over Wilding in view of York and over Wilding in view of Lee and in concluding that claims 9, 14, and 26 would have been obvious over Wilding in view of York and Bass and over Wilding in view of Lee and Bass.

CLAIMS

Claims 1-9, 11, and 13-29 are pending and on appeal. With the possible exception of claim 15, the claims subject to each rejection have not

[1] Claim 12, which was also rejected on this basis, was previously cancelled.

been argued separately and therefore stand or fall together. 37 C.F.R. § 41.37(c)(1)(vii). We will focus on claim 1, which is representative. We will also discuss claim 15, which is specifically mentioned by Appellant. Claims 1 and 15 read as follows:

> 1. A micro-testing lab comprising:
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> a substrate;
>
> a layer of semiconducting material formed over the substrate;
>
> one or more grooves providing one or more flow paths for test material; and
>
> a plurality of individually controllable electrode pairs, each pair spanning one of the one or more grooves and strategically located at different points along the groove to selectively and variably impede or propel the test material along the flow path.
>
> 15. The micro-testing lab of claim 1 further comprising at least one separation switch for urging material from a primary groove having access to a secondary groove into the secondary groove, the switch comprising:
>
> a gatekeeper electrode for attracting charged particles into the secondary groove and,
>
> a set of propulsion electrode pairs in the primary groove combining function with the gatekeeper electrode to divert material from the primary path to the secondary path.

Thus, claim 1 is directed to a micro-testing lab comprising a substrate, a semiconducting material over the substrate, a groove providing a flow path for test material, and more than one individually controllable electrode pairs, each pair spanning a groove. With regard to the recitation that the electrode pairs are "strategically located," we find that an arrangement of more than one electrode pairs at different points along a groove that allows test material to be impeded or propelled along a flow path meets this recitation.

FINDINGS OF FACT

1. Wilding describes devices "for conducting a reaction to enable the rapid amplification of a polynucleotide in a sample" (Wilding, col. 4, ll. 11-14).

2. Specifically, Wilding describes a device comprising "a solid substrate that is fabricated to comprise a mesoscale polynucleotide amplification reaction chamber" (*id.* at col. 4, ll. 14-17). The term "mesoscale" is defined in Wilding as having "at least one cross-sectional dimension between about 0.1 µm and 1,000 µm" (*id.* at col. 4, ll. 37-40).

3. Wilding states that the "device further includes at least one port in fluid communication with the reaction chamber, for introducing a sample into the chamber," and "may include one or more flow channels extending from the ports to the reaction chamber, and/or connecting two or more reaction chambers" (*id.* at col. 4, ll. 19-26).

4. Wilding also states that "[o]ne or more ports and/or flow channels of the device may be fabricated . . . in the substrate" (*id.* at col. 4, ll. 28-31).

5. In addition, Wilding states that the substrate "may comprise a material such as silicon, polysilicon, silica, glass, gallium arsenide, polyimide, silicon nitride and silicon dioxide" (*id.* at col. 7, ll. 31-34).

6. In particular, Wilding describes fabricating "the reaction chamber(s) and/or the flow channel(s) . . . within a silicon substrate" (*id.* at col. 5, ll. 55-57).

7. Wilding also describes including "means for transferring the contents of the chamber between the sections to implement the reaction, e.g., a pump controlled by a computer" (*id.* at col. 7, ll. 10-13).

8. In addition, Wilding describes an appliance containing "a nesting site for holding the substrate of the device" (*id.* at col. 7, ll. 39-41).

9. York describes a print array incorporating "electrohydro-dynamic (EHD) micropumps, microchannels and reservoirs(s) to selectively dispense fluid from the reservoir(s) onto a receptor" (York, col. 1, ll. 6-9).

10. In particular, York describes "[m]icrochannels connected to . . . red, green, and blue ink reservoirs [that] distribute a single ink color to an entire row of dispensers" (*id.* at col. 5, ll. 59-61).

11. York states that each dispenser includes "an EHD micropump **434** that comprises a pair of electrodes **436**. The EHD micropumps **434** are disposed within channels of capillary dimension, where the EHD micropumps effect the movement of the fluids by applying an electric field to the fluids through the application of a difference of potential." (*Id.* at col. 5, l. 66, to col. 6, l. 5.)

12. In particular, York states that "the EHD micropump has a positive and a negative electrode. In the appropriate fluids, application of an AC or DC signal across a region of the fluid via the pump electrodes causes fluid to flow towards the dispenser. The AC/DC signal is applied via . . . drivers which are electrically connected to the EHD micropumps." (*Id.* at col. 7, ll. 47-53.)

13. York states that each dispenser may comprise a driver coupled to the electrodes of the EHD micropump (*id.* at col. 7, l. 67, to col. 8, l. 5).

14. York also states that the driver "is capable of receiving a control signal from [a] controller . . . and activates the micropump . . . to cause fluid to flow from the reservoir to the receptor surface" (*id.* at col. 9, ll. 25-29).

15. Lee describes "using magnetohydrodynamics (MHDs) for microfluid propulsion, and more particularly [relates] to micromachined MHD actuators, such as micropumps" (Lee, col. 1, ll. 12-16).

16. Specifically, Lee describes an MHD micropump comprising "a pair of electrodes . . . positioned adjacent the flow channel" (*id.* at col. 4, ll. 12-21).

17. Lee states that the MHD micropump "utilizes micromachining to integrate the electrodes with microchannels" (*id.* at col. 2, ll. 23-25).

18. Lee also states that the MHD micropumps "can generate continuous flow or reversible flow with readily controllable flow rates" (*id.* at col. 2, ll. 29-31).

19. In addition, Lee states that the micropump "can be placed at any position in the fluidic circuit as an element, and by using a combination of micropumps one can generate fluidic plugs and valves" (*id.* at col. 2, ll. 34-37).

20. Lee also states that the MHD actuators can be used for numerous applications "including biotech instrumentation, environmental sensing/monitoring devices, medical devices for analyzing and processing biological samples, pumps for drug delivery, etc." (*id.* at col. 2, ll. 39-44).

21. In Figure 8, Lee "illustrates a microfluidic system, incorporating a plurality of MHD micropumps" (*id.* at col. 5, ll. 43-44).

22. Lee states that each electrode pair is "connected to a power supply" (*id.* at col. 5, ll. 54-55). Thus, we find that these electrode pairs are individually controllable.

OBVIOUSNESS

The Examiner rejects claims 1-8, 11, 13, 15-25, and 27-29 under 35 U.S.C. § 103(a) as obvious over Wilding in view of York. The Examiner relies on Wilding for teachings "a microfluidic apparatus (a 'micro-testing lab') comprising: a substrate (appliance 50); a polysilicon layer (silicon substrate 14), which is a semiconductive material, positioned over the substrate . . . , wherein the polysilicon layer comprises a series of grooves (mesoscale flow channel 20)" (Ans. 3). The Examiner finds that Wilding teaches "that the microfluidic apparatus incorporates the use of a pump (52) within the device structure to facilitate sample transfer within the channel and compartment network contained within the device" (*id.* at 4).

The Examiner relies on York for teaching "a microfluidic apparatus comprising electrohydrodynamic (EHD) micropumps for facilitating fluid transfer, wherein an EHD micropump (434) comprises a plurality of electrode pairs (436), in which each pair of electrodes are disposed within and span the channel" (*id.*). The Examiner finds that it would have been obvious to "incorporate an electrode-based fluid flow system, as taught by York et al., with the microfluidic apparatus, as taught by Wilding et al., in order to facilitate effective sample fluid transfer within the microfluidic device of Wilding" (*id.* at 6). Based on our findings and those of the Examiner, we conclude that the Examiner has set forth a prima facie case that Wilding and York render claim 1 obvious.

Appellant argues, however, that "none of the references teach or suggest strategically locating electrode pairs along a flow path enabling selectively and variably propelling the material along the flow path, as is taught in applicant's invention. Therefore the reasonable expectation of success as espoused by the Examiner cannot hold." (App. Br. 9.)

We are not persuaded by this argument. York describes locating electrode pairs at different points along a flow path (Finding of Fact (FF) 10-11). In addition, York describes using these electrode pairs to propel fluid along the flow path (FF 11-12 & 14). York also states that the fluid is dispensed "selectively" (FF 9). Thus, we agree with the Examiner that York describes strategically locating electrode pairs along a flow path enabling selective and variable propelling of material along the flow path.

Appellant also argues that "York fails to teach the ability to individually control electrode pairs located at different points along the groove to selectively and variably impede or propel the test material along the flow path" (App. Br. 9). As discussed above, we agree with the Examiner that York describes locating electrode pairs along a flow path enabling selective and variable propelling of material along the flow path. In addition, York describes including a driver in each dispenser, the driver being coupled to the electrodes of the micropump (FF 13). York states that the driver is "capable of receiving a control signal from [a] controller . . . and activates the micropump . . . to cause fluid to flow from the reservoir to the receptor surface" (FF 14). Thus, we find that York's electrode pairs are individually controllable.

In addition, Appellant argues that York

> fails to teach at least one separation switch for urging material from a primary groove having access to a secondary groove into the secondary groove, wherein a gatekeeper electrode for attracting or repulsing charged particles urges matter into or away from the secondary groove and a set of propulsion electrode pairs in the primary groove combining function with the gatekeeper electrode divert material from the primary path to the secondary path.

(App. Br. 9-10.) Because claim 1 does not recite these features, we are not persuaded by this argument.[2]

Appellant also argues that "the Examiner is not applying the rule of equivalents properly as instructed in the MPEP and what the courts have held. The Examiner is making overly liberal use of the concept of equivalents in applying and relying on teachings in the references of York to suggest limitations in applicant's claims." (App. Br. 10.)

We are not persuaded by this argument. Wilding describes using a pump in its microdevice to transfer "the contents of the chamber between the sections to implement the reaction" (FF 2 & 7). York describes a type of

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[2] The Appeal Brief does not indicate that this argument was intended as a separate argument for the patentability of claim 15. However, even if it was, we do not agree that this argument is sufficient to overcome the Examiner's rejection of claim 15. In particular, although this argument states that certain features are not described by York, it does not point out why the features of claim 15 would not have been obvious over the combined teachings of Wilding and York. "Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references. . . . [The reference] must be read, not in isolation, but for what it fairly teaches in combination with the prior art as a whole." *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

pump, which can be used in a microdevice to "effect the movement of the fluids" (FF 11). We agree with the Examiner that it would have been obvious to include York's micropumps in Wilding's device to effect movement of the sample through the device. "The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l v. Teleflex Inc.*, 127 S. Ct. 1727, 1739 (2007).

In addition, Appellant argues that York's "micropumps are only used to form drops of liquid exiting the system" (App. Br. 12). As discussed above, we find that York's micropumps selectively and variably propel liquid along a flow path (FF 11-12 & 14). Therefore, we are not persuaded by this argument.

We conclude that the Examiner has set forth a prima facie case that claim 1 would have been obvious over Wilding in view of York, which Appellant has not rebutted. We therefore affirm the rejection of claim 1 under 35 U.S.C. § 103(a). Claims 2-8, 11, 13, 15-25, and 27-29 fall with claim 1.

The Examiner rejects claims 9, 14, and 26 under 35 U.S.C. § 103(a) as obvious over Wilding in view of York and Bass. Claims 9, 14, and 26 directly or indirectly depend from claims 1 or 17. The Examiner relies on Wilding and York as discussed above and relies on Bass for the limitations of claims 9, 14, and 26 (Ans. 7-8).

Appellant argues that claims 9, 14, and 26 are patentable "as depended from a patentable claim" (App. Br. 11). However, we have affirmed the rejection of claims 1-8, 11, 13, 15-25, and 27-29 under

35 U.S.C. § 103(a) over Wilding in view of York. Thus, we do not find Appellant's argument persuasive. We therefore affirm the rejection of claims 9, 14, and 26 under 35 U.S.C. § 103(a).

The Examiner rejects claims 1-8, 11, 13, 15-25, and 27-29 under 35 U.S.C. § 103(a) as obvious over Wilding in view of Lee. The Examiner relies on Wilding as discussed above (Ans. 8-9). The Examiner relies on Lee for teaching "the incorporation of a plurality of magnetohydrodynamic (MHD) micropumps within an analytical microfluidic apparatus" (*id.* at 9). The Examiner finds that Lee, in Figure 8, teaches "a microfluidic system comprising a plurality of MHD micropumps (79, 80, 81 & 82) comprising individual electrode pairs (83 & 84, 85 & 86, 87 & 88, and 89 & 90), respectively, wherein each electrode pair spans a channel segment at different points along the microfluidic channel flow system" (*id.*).

The Examiner concludes that it would have been obvious to "incorporate an electrode-based fluid flow system, as taught by Lee et al., with the microfluidic apparatus, as taught by Wilding et al., in order to facilitate effective sample fluid transfer within the microfluidic device of Wilding" (*id.* at 10). Based on our findings and those of the Examiner, we conclude that the Examiner has set forth a prima facie case that Wilding and Lee render claim 1 obvious.

Appellant argues, however, that, MPEP § 2144.06 states that, "[i]n order to rely on equivalence as a rationale supporting an obviousness rejection, the equivalency must be recognized in the prior art, and cannot be based on applicant's disclosure or the mere fact that the components at issue are functional or mechanical equivalents" (App. Br. 11). In particular, Appellant argues:

> The Examiner has applied a lot of art re: micropumps and the like for moving sample material in a testing apparatus. The doctrine of equivalence cannot be used relative to these teachings, simply because there is not, and fairly could not be, any recognition in the art to the multiple electrode arrangement and its function that the applicant claims. Applicant argues the equivalence of micropumps with an arrangement of multiple electrodes is specifically not stated in the references cited and applied, and of course could not be, because the use of an arrangement of multiple electrodes to effect the movement of sample material in a single channel, or to switch flow from one channel to another, is not taught anywhere in this art, either. The equivalence theory cannot be supported without incorporating teachings from applicant's disclosure.

(*Id.* at 11-12.)

We are not persuaded by this argument. We agree with the Examiner that Lee describes an arrangement of multiple electrodes to effect the movement of sample material in a channel (FF 15-21). Claim 1 does not recite that the arrangement of electrodes switches flow from one channel to another. In addition, we agree with the Examiner that it would have been obvious to include Lee's micropumps in Wilding's device to effect movement of the sample through the device. "The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l v. Teleflex Inc.*, 127 S. Ct. at 1739.

Appellant also argues that the "art fails to show individually controlled electrodes capable of selectively and variably impeding or propelling the test material along the flow path" (App. Br. 12). However, Lee describes individually controllable electrodes capable of selectively and variably impeding or propelling the test material along the flow path (FF 15-22). Therefore, we are not persuaded by this argument.

In addition, Appellant argues that, "in the case of the reverse direction teaching[,] the art of Lee would not be able to control the amount of liquid going into each channel" (App Br. 12). In particular, Appellant argues that, if the direction of the flow was reversed in the device depicted in Lee's Figure 8, "the liquid would primarily dump into basin 72" (*id.*).

We are not persuaded by this argument. Claim 1 does not recite that the device is able to control the amount of liquid going into more than one channel in the reverse direction.

Appellant also argues that "the Examiner's equivalency argument fails if one takes into consideration the strategic placement of the electrodes along with the switching and gatekeeper electrodes as recited in claim 15" (App. Br. 12).

We are not persuaded by this argument. First, Lee describes an arrangement of more than one electrode pairs at different points along a groove that allows test material to be impeded or propelled along a flow path (FF 15-20) and therefore describes "strategically located" electrode pairs. In addition, claim 1 does not require switching and gatekeeper electrodes.

With regard to claim 15, we agree with the Examiner that it would have been obvious to include Lee's micropumps in Wilding's device to effect movement of the sample through the device. In addition, Appellant has not pointed to any reason why the features of claim 15 would not have been obvious over the combined teachings of Wilding and Lee. "The test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art." *In re Young*, 927 F.2d 588, 591 (Fed. Cir. 1991).

We conclude that the Examiner has set forth a prima facie case that claims 1 and 15 would have been obvious over Wilding in view of Lee, which Appellant has not rebutted. We therefore affirm the rejection of claims 1 and 15 under 35 U.S.C. § 103(a). Claims 2-8, 11, 13, 16-25, and 27-29 fall with claims 1 and 15.

The Examiner rejects claims 9, 14, and 26 under 35 U.S.C. § 103(a) as obvious over Wilding in view of Lee and Bass. Claims 9, 14, and 26 directly or indirectly depend from claims 1 or 17. The Examiner relies on Wilding and Lee as discussed above and relies on Bass for the limitations of claims 9, 14, and 26 (Ans. 12-13).

Appellant argues that claims 9, 14, and 26 are patentable "as depended from a patentable claim" (App. Br. 13). However, we have affirmed the rejection of claims 1-8, 11, 13, 15-25, and 27-29 under 35 U.S.C. § 103(a) over Wilding in view of Lee. Thus, we do not find Appellant's argument persuasive. We therefore affirm the rejection of claims 9, 14, and 26 under 35 U.S.C. § 103(a).

CONCLUSION

The Examiner's position is supported by the preponderance of the evidence of record. We therefore affirm the rejections of claims 1-9, 11, and 13-29 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

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