UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte APRIL DAWN HIXSON-GOLDSMITH,
MATTHEW WALTER LAST,
MURALI RAMASUBRAMANIAN, and
ROLF SCHAEFER

Appeal 2007-2546
Application 10/218,011[1]
Technology Center 1700

Decided: May 22, 2008

Before ADRIENE LEPIANE HANLON, SALLY G. LANE, and MICHAEL P. TIERNEY, *Administrative Patent Judges*.

HANLON, *Administrative Patent Judge*.

DECISION ON APPEAL

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[1] Application for patent filed on August 12, 2002.

A. STATEMENT OF THE CASE

The Appellants appeal from the final rejection of claims 1-17.[2] 35 U.S.C. § 134. We have jurisdiction under 35 U.S.C. § 6(b). We AFFIRM.

The Examiner finally rejected claims 1-17 under 35 U.S.C. § 112, second paragraph, as being indefinite. Final 3.[3]

The Examiner finally rejected claims 1-17 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Final 2-3.

The Examiner finally rejected claims 1-17 under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of Asai et al.,[4] Nee et al.,[5] and Andricacos et al.[6] Final 4.

B. ISSUES

Whether the Appellants have shown that the Examiner erred in rejecting claims 1-17 under 35 U.S.C. § 112, second paragraph, as being indefinite.

Whether the Appellants have shown that the Examiner erred in rejecting claims 1-17 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement.

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[2] Claim 18 is also pending in the application but has been withdrawn from consideration. Final Office Action mailed May 12, 2006, at 1.
[3] Final Office Action mailed May 12, 2006.
[4] U.S. Patent 5,489,488 issued to Asai et al. on February 6, 1996 ("Asai").
[5] U.S. Patent 4,869,971 issued to Nee et al. on September 26, 1989 ("Nee").
[6] U.S. Patent 5,582,927 issued to Andricacos et al. on December 10, 1996 ("Andricacos").

Whether the Appellants have shown that the Examiner erred in rejecting claims 1-17 under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of Asai, Nee, and Andricacos.

C. FINDINGS OF FACT

The following findings of fact are believed to be supported by a preponderance of the evidence. Additional findings of fact as necessary appear in the Analysis portion of the opinion.

1. Appellants' invention

The Appellants' invention relates to electrodeposition, and more particularly, creating multiple layers of varying compositions from a single plating bath. 011 Specification 1:8-10.[7]

According to one embodiment of the invention, the composition of a first layer is determined by the following variables: current density, the high current value, the duration of the pulse, and the rate of agitation. Once the first layer is deposited, one or more of these variables can be changed to deposit materials of a second composition. 011 Specification 5:3-7.

For example, in one combination the first and second current densities are different, the first and second high current values are different, and the first and second rates of agitation are the same. 011 Specification 5:9-11.

In another combination, the first and second current densities are the same, the first and second high current values are different, and the first and second rates of agitation are different. 011 Specification 5:13-15.

The Appellants disclose that by changing combinations of the paddle speed (rate of agitation), average current density, and pulse duration, an operator can select the proper parameters to obtain a multi-level plating of

[7] Specification of Application 10/218,011.

desired compositions. Once the first layer is deposited, one or more of these variables can be changed to deposit materials of a second composition. 011 Specification 13:7-11.

Table 1 lists several possible combinations of the variables, where "same" represents the same setting during deposition of the first and second layers and "different" represents a different setting during deposition of the first and second layers. 011 Specification 13:13-16.

Table 1

Current Density	Pulse Duration	Paddle Speed
same	same	different
same	different	different
same	different	same
different	same	same
different	same	different
different	different	same
different	different	different

011 Specification 13:17-14:2.

2. Claimed invention

Claim 1 is representative of the subject matter on appeal and reads as follows:

> A method for multi-layer electrodeposition in a single bath, comprising:
>
> immersing a substrate in a bath;
>
> applying a first current of a first current density to the substrate for electrodepositing a first layer of material on the substrate;
>
> toggling the first current between first high and low values at least twice at first intervals;
>
> agitating the bath near the substrate at a first rate of agitation;

> applying a second current of a second current density to the substrate for electrodepositing a second layer of material on the substrate, the second layer being of a different composition than the first layer, wherein the second current density is at least one of a same current density as the first current density and different than the first current density;
>
> toggling the second current between second high and low values at least twice at second intervals; and
>
> agitating the bath near the substrate at a second rate of agitation different than the first rate of agitation.

2. Nee

Nee discloses a process that employs a single electrodeposition bath for electrodepositing multiple layers of at least two distinct materials on a substrate. Nee 1:9-12.

The process includes the step of immersing an electrically-conductive substrate in an electrodeposition bath. Nee 2:41-43.

Nee indicates that the bath may be stirred with a magnetic stirrer. Nee 7:31-32.

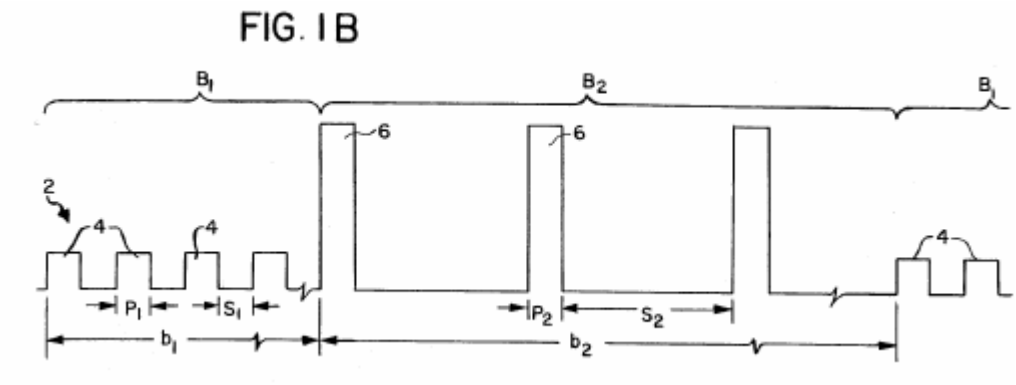
The process further includes the step of passing a charge burst of a first pulsed electric current through the electrodeposition bath to the substrate. The first pulsed electric current has a first pulsed-on/off waveform and a first peak current density effective to electrodeposit the first electrodeposited material. Nee 2:44-49.

The process further includes the step of passing a charge burst of a second electric current through the electrodeposition bath to the substrate. The second electric current has a second waveform and a second current

density effective to electrodeposit the second electrodeposited material. The second waveform may be a pulsed-on/off waveform. Nee 2:53-60.

A preferred pulse train for the process of the invention is said to be shown in Nee Figures 1A and 1B. Nee 4:37-38. Nee Figure 1B is reproduced below:

FIG. 1B



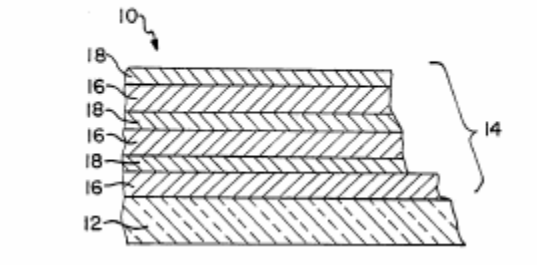
Nee Figure 1B depicts a pulse train.

The horizontal axis in Figure 1B corresponds to time in arbitrary units, and the vertical axis corresponds to current density in arbitrary units. Nee 4:38-41.

Figure 1B illustrates a first charge burst B_1 of pulses consisting of a series of current pulses **4** at one current density for burst time b_1 and a second charge burst B_2 of pulses consisting of a series of current pulses **6** at another current density for burst time b_2. Nee 4:43-53.

Nee Figure 2 illustrates a multilayered substrate produced according to the process of Figures 1A and 1B. Nee 4:67-5:2. Nee Figure 2 is reproduced below:

FIG. 2



Nee Figure 2 depicts a multilayered substrate.

According to Nee, the first material of layers **16** differs from the second material of layers **18** because the peak pulse current and pulse spacing of the pulses of charge burst B_1 differ from the peak pulse current and pulse spacing of the pulses of charge burst B_2. Nee 5:15-20.

The disclosed process may be used to plate brass alloys from a plating solution containing copper and zinc ions. Nee 5:23-25.

3. Andricacos

Andricacos discloses a plating process and plating bath for preparing certain alloys of cobalt, iron, and copper (CoFeCu) which, in thin film form, have a unique combination of electromagnetic properties that make them useful as magnetic thin films in magnetic recording heads, flux guides, and shields. Andricacos 1:10-16.

The CoFeCu alloys are prepared from a single aqueous plating solution using a DC or pulsed current electrodeposition process. The alloys are preferably prepared from such solutions in the form of thin films or thin film laminates. Andricacos 4:10-15.

According to Andricacos, the Cu deposition reaction at the cathode is favored, thermodynamically, to the Co and Fe deposition reactions. Thus, the Cu content of the resulting deposited alloy composition depends strongly on agitation of the bath as well as the Cu^{2+} concentration in the solution and

current density. The electrolyte baths of the invention disclosed in Andricacos are said to be best suited for use in plating processes carried out in paddle equipped electrolysis cells that provide uniform agitation over large area surfaces. Andricacos 4:60-5:3.

Andricacos discloses that increasing the strength of the agitation favors increasing the content of Cu in the alloy. Andricacos 5:37-38.

The plating solution may be used to make laminated films comprising alternating layers of magnetic film (CoFeCu) and non-magnetic film (Cu or CoCu). Andricacos 5:15-22.

These CoFeCu—Cu or CoFeCu—CoCu laminates can be made by pulsing the plating current between two values, i_{hi} and i_{lo}. These values represent, respectively, low Cu and high Cu alloy layers. Andricacos 5:22-25.

The magnitude of i_{hi} depends on the desired composition of the magnetic alloy, the composition of the bath, and the strength of the agitation employed. Andricacos 5:27-30.

According to Andricacos, the current pulsing method for alternately plating magnetic and non-magnetic ternary alloy layers out of the same electroplating bath may be used to plate other laminates such as 5% Cu–95% NiFe (magnetic)/95% Cu–5% NiFe (non-magnetic). Andricacos 6:12-16.

4. Asai

Asai discloses a method of manufacturing a magnetic multilayer film that may be used in the production of magnetic thin film heads. Asai 6:46-54.

The multilayer film is manufactured by an electroplating process. Asai 2:37-42.

Asai discloses an electroplating apparatus comprising a container for holding an electroplating bath. Asai 3:25-26.

The electroplating bath is a permalloy electroplating bath or an electrolyte containing nickel (Ni) ions and iron (Fe) ions. Asai 3:41-43.

A sample electrode (cathode) and a counter electrode (anode) extend into the electroplating bath. A current generator is electrically connected between the two electrodes, and an actuator serves to vibrate the sample electrode in the vertical direction at a frequency of 2 Hz. Asai 3:26-40.

The sample electrode includes a glass substrate. Asai 3:44-46.

According to the method disclosed in Asai, two Ni-Fe alloy layers differing in composition may be formed on the substrate by toggling between two different current densities (I1 and I2) at different time intervals (t1 and t2). Asai 5:12-29; Fig. 3.

One layer is said to have good soft-magnetic properties, and the other layer is said to have poor or deteriorated soft-magnetic properties. Asai 5:29-37.

D. PRINCIPLES OF LAW

A claimed invention is not patentable if the subject matter of the invention would have been obvious to a person having ordinary skill in the art at the time the invention was made. 35 U.S.C. § 103(a); *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727 (2007); *Graham v. John Deere Co.*, 383 U.S. 1 (1966).

Facts relevant to a determination of obviousness include (1) the scope and content of the prior art, (2) any differences between the claimed invention and the prior art, (3) the level of skill in the art, and (4) any

relevant objective evidence of obviousness or non-obviousness. *KSR*, 127 S. Ct. at 1734; *Graham*, 383 U.S. at 17-18.

One of ordinary skill in the art is presumed to have skills apart from what the prior art references expressly disclose. *See In re Sovish*, 769 F.2d 738, 743 (Fed. Cir. 1985). A person of ordinary skill is also a person of ordinary creativity, not an automaton. *KSR*, 127 S. Ct. at 1742.

A rejection premised upon a proper combination of references cannot be overcome by attacking the references individually. *In re Keller*, 642 F.2d 413, 426 (CCPA 1981).

For obviousness under 35 U.S.C § 103(a), all that is required is a reasonable expectation of success. *In re O'Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988).

E. ANALYSIS

1. Rejection based on 35 U.S.C. § 112, second paragraph

The Examiner rejected claims 1-17 under 35 U.S.C. § 112, second paragraph, as being indefinite. Final 3; Ans. 4-5.[8] Claims 2-15 depend, either directly or indirectly, from independent claim 1, and claim 17 depends directly from independent claim 16.

Prior to the Final Office Action, the Appellants amended claim 1 to include the following language, "wherein the second current density is *at least one of* a same current density as the first current density and different than the first current density" (italics added). Amendment dated March 3, 2006.

In the Final Office Action, the Examiner explained:

[8] Examiner's Answer mailed December 19, 2006.

> The expression "at least one of" is interpreted to include one of the recited elements and also more than one of the recited elements, i.e.[,] two of the recited elements. The recited elements are the same as the first current density and different than the first current density. It is not apparent how the second current [density] can be both the same as and different than the first current density. It appears that the expression "at least" should be deleted.

Final 3.

The Appellants had an opportunity to amend claim 1 after the Final Office Action, but they did not. The Appellants also did not discuss the rejection in the Appeal Brief. The Examiner maintained the rejection in the Answer, and the Appellants responded to the rejection for the first time on appeal in the Reply Brief.

In the Reply Brief, the Appellants argue that the words "average current density" on page 13, line 8 of the Specification imply that in some embodiments, the current density may vary or fluctuate during a given plating step. Therefore, the Appellants argue that it is possible that, in a single application of the second current, variation or fluctuation could cause the second current to have, at one point in time, the same current density as the first current density, and at another point in time, a different current density than the first current density. Reply 4-5.[9] To the extent that this possibility may exist, claim 1 does not recite a relationship between a second *average* current density and the first current density. *See In re Zletz*, 893 F.2d 319, 321 (Fed. Cir. 1989) (during prosecution, claims must be interpreted as broadly as their terms reasonably allow).

[9] Reply Brief dated January 24, 2007.

The Appellants have failed to demonstrate that the Examiner erred in rejecting claims 1-16 under 35 U.S.C. § 112, second paragraph.

In the Reply Brief, the Appellants also point out that the Examiner does not mention claims 16 and 17 in the rejection. Reply 5.

Claim 16 is an independent claim, and claim 17 depends from claim 16. Our review of claims 16 and 17 reveals that neither claim recites the language at issue in the §112, second paragraph, rejection before us. Therefore, the Examiner erred in rejecting claims 16 and 17 under 35 U.S.C. § 112, second paragraph.

2. Rejection based on 35 U.S.C. § 112, first paragraph

Claim 1 recites that "the second layer [is] of a different composition than the first layer." Claim 1 was amended to recite that "the second current density is at least one of a same current density as the first current density and different than the first current density." The Examiner maintains that this limitation introduces new matter because the original disclosure does not describe that a second layer having a different composition than the first layer may be formed when the first and second current densities are the same.[10] Final 2-3; Ans. 3-4.

Relying on page 5, lines 13-15 and page 13, line 7 to page 14, line 2 of the Specification, the Appellants argue that the Specification describes that a second layer having a different composition than the first layer may be

[10] The Examiner did not find that the original disclosure does not provide written description support for the following language, "wherein the second current density is at least one of a same current density as the first current density and different than the first current density." Therefore, it is not necessary to reach the issue on appeal.

deposited by applying a second current density that is the same as the first current density. Br. 9;[11] Reply 3-4.

We find that these portions of the original disclosure describe that a second layer having a different composition than the first layer may be deposited when the first and second current densities are the same and other variables, such as paddle speed or rate of agitation, are different.

The Appellants also point out that the Examiner does not mention claims 16 and 17 in the rejection. Reply 4.

Our review of claims 16 and 17 reveals that neither claim recites the language at issue in the §112, first paragraph, rejection before us.

For the reasons set forth above, the Examiner erred in rejecting claims 1-17 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement.

3. Rejection based on 35 U.S.C. § 103(a)

The Examiner found that the difference between the process of claim 1 and the process disclosed in Nee is that Nee does not vary the agitation rates in the electrodeposition bath as recited in claim 1. Nevertheless, the Examiner relies on the teachings of Andricacos to establish that it was known to vary the agitation in a plating bath to change the composition of a deposited layer.[12] Ans. 7.

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[11] Appeal Brief dated September 29, 2006.

[12] For the limited purpose of reviewing the rejection under 35 U.S.C. § 103(a), we interpret claim 1 as reciting that the second current density is either the same as or different than the first current density. *See* Reply 4. The Appellants do not dispute that Nee discloses electrodepositing different materials at different current densities. Rather, the Appellants argue that Andricacos does not teach or suggest electrodeposition at two different rates

The Examiner concluded:

> It would have been obvious at the time the invention was made to have utilized the process of Nee et al, which varies the applied current to produce a deposit of alloy layers which vary from one another in composition from a single bath, . . . to have varied the agitation of the bath to assist in varying the composition of the layers because Andricacos et al teach that changing the rate of agitation when electrodepositing an alloy coating results in a variation in the composition of the alloy.

Ans. 8.

The Appellants argue that Andricacos does not teach or suggest electrodeposition at two different rates of agitation as claimed. Rather, referring to column 5, lines 49 and 55 of Andricacos, the Appellants argue that Andricacos discloses examples where agitation is set at a constant rate of 1 Hz. Br. 11.

A disclosure is not limited to the examples. *In re Lamberti*, 545 F.2d 747, 750 (CCPA 1976) (all disclosures of the prior art must be considered). Andricacos discloses an electrodeposition process for making laminated films comprising alternating layers of magnetic film and non-magnetic film. The magnetic film layer consists of a CoFeCu alloy, and the non-magnetic film layer is either pure Cu or a CoCu alloy. Andricacos 5:15-22. Andricacos suggests that the element content of the alloy depends on several variables, i.e., magnitude of current, composition of the bath, and rate of agitation. *See* Andricacos 5:26-38. Moreover, Andricacos expressly discloses that "increasing the strength of the agitation favors increasing the content of Cu in the alloy." Andricacos 5:37-38.

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of agitation. Thus, we focus our attention on the disputed limitations of the claims on appeal.

Based on these disclosures, we find that one of ordinary skill in the art would have understood that the Cu content in the alloys disclosed in Andricacos, and thus the composition of the alloys, may be varied by adjusting the agitation rate. We further find that one of ordinary skill in the art would have understood that the Cu content in each layer of the laminated film in Nee could be varied by plating the layers at different agitation rates.

Relying on column 5, lines 7-10 of Andricacos, the Appellants also argue that Andricacos teaches away from varying the agitation when forming magnetic devices.[13] Br. 12.

We disagree. According to Andricacos:

> The electrolyte baths of the present invention are thus best suited for use in plating processes carried out in paddle equipped electrolysis cells which provide uniform agitation over large area surfaces . . . . Non-uniform agitation would result in films with non-uniform composition and while not desired for magnetic devices may be desirable for other purposes.

Andricacos 4:65-5:11.

We find that one of ordinary skill in the art would have reasonably understood this disclosure to mean that for a given rate of agitation, agitation should be uniform over the surface of a substrate.

Finally, the Appellants argue that the prior art does not disclose critical parameters or indicate choices likely to be successful to form, for example, first and second layers of differing magnetic moments (claims 2 and 3) or two layers having different iron contents (claim 5). Br. 13.

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[13] Claim 1 is not directed to a magnetic device. Claims 9, 14, and 17 recite that "a portion of the first and second layers is used to form at least a portion of a write pole of a magnetic write head."

To the contrary, Andricacos suggests that three parameters are critical in the disclosed plating process, i.e., magnitude of current, composition of the bath, and rate of agitation. Andricacos suggests that the Cu content in an alloy may be adjusted by varying the rate of agitation. *See* Andricacos 5:26-38. Further, by adjusting the Cu content, the magnetic properties as well as the iron content in the laminated films may be adjusted. *See* Andricacos 5:18-22 (magnetic layer consists of a CoFeCu alloy and non-magnetic layer is either pure Cu or a CoCu alloy having a Co amount less than about 5 weight percent); Andricacos 6:12-16 ("The novel current pulsing method described above for alternately plating magnetic and non-magnetic ternary alloy layers out of the same electroplating bath may be used to plate other laminates such as 5% Cu–95% NiFe (magnetic)/95% Cu–5% NiFe (non-magnetic).").

For the reasons set forth above, the Appellants have failed to show that the Examiner erred in rejecting claims 1-17 under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of Nee, Andricacos, and Asai.

F. DECISION

The rejection of claims 1-15 under 35 U.S.C. § 112, second paragraph, as being indefinite is affirmed.

The rejection of claims 16 and 17 under 35 U.S.C. § 112, second paragraph, as being indefinite is reversed.

The rejection of claims 1-17 under 35 U.S.C. § 112, first paragraph, based on the written description requirement is reversed.

The rejection of claims 1-17 under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of Asai, Nee, and Andricacos 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) (2006).

AFFIRMED

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