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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/419,234	03/13/2012	Kirby W. Beard	PNK1410US	1032

23413 7590 02/04/2020
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EXAMINER	
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ART UNIT	**PAPER NUMBER**
1744	
NOTIFICATION DATE	**DELIVERY MODE**
02/04/2020	ELECTRONIC

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte KIRBY W. BEARD and ANN M. EDWARDS

Appeal 2019–004036
Application 13/419,234
Technology Center 1700

BEFORE BEVERLY A. FRANKLIN, N. WHITNEY WILSON, and JEFFREY R. SNAY, *Administrative Patent Judges.*

FRANKLIN, *Administrative Patent Judge.*

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's decision to reject claims 1–5, 7–12, 14–16, and 18–23. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

[1] We use the word Appellant to refer to "applicant" as defined in 37 C.F.R. § 1.42(a). Appellant identifies the real party in interest as Samsung Electronics Co. Appeal Br. 2.

CLAIMED SUBJECT MATTER

Claim 1 is illustrative of Appellant's subject matter on appeal and is set forth below:

> 1. A method comprising:
>
> forming a microporous membrane by a liquid casting process using a solution comprising:
>
> a polymer binder comprising PVDF;
>
> a first filler material being a spherical filler material; and
>
> a solvent dissolving the polymer binder;
>
> said microporous membrane having a first manufactured state having:
>
> at least 50% porosity; and
>
> at least 10% by volume of said first filler material based on the total volume of the microporous membrane; and
>
> post processing said microporous membrane having said polymer binder and at least 10% by volume of said first filler material based on the total volume of the microporous membrane by bringing said polymer binder comprising PVDF into at least a partially molten state for a sufficient time for the polymer binder comprising PVDF to completely wet the first filler material such that said polymer binder reforms after said post processing such that said microporous membrane has a second manufactured state being at least 50% porous and having the first filler material dispersed within a pore wall of said microporous membrane.

REFERENCES

The prior art relied upon by the Examiner is:

Name	Reference	Date
Funaoka et al.	US 2005/0098913 Al	May 12, 2005
Yeager et al.	US 2008/0203012 Al	Aug. 28, 2008
Hauser et al.	US 2010/0178567 Al	July 15, 2010

THE REJECTION

Claims 1–5, 7–12, 14–16, and 18–23 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Hauser in view of Yeager and Funaoka.

OPINION

We can focus on the claim limitation involving the post processing step of claim 1 in making our determination herein.

We refer to the Examiner's statement of the rejection as set forth on pages 4–16 of the Answer. The Examiner relies upon Hauser for the teachings set forth on page 4 of the Answer. On page 5 of the Answer, the Examiner states that Hauser does not teach a post processing of the microporous membrane by bringing said polymer binder into at least a partially molten state for a sufficient time for the polymer binder to completely wet the first filler material such that said polymer binder reforms after said post processing such that said microporous membrane has a second manufactured state being at least 50% porous and having the first filler material disposed within a pore wall of said microporous membrane. The Examiner relies upon Funaoka for teaching this aspect of the claimed subject matter. Ans. 5–6. The Examiner concludes that it would have been obvious to have modified the microporous membrane forming process of Hauser to incorporate the post processing step of Funaoka motivated by controlling the pore size and porosity of the membrane only by changing the temperature and time of the hot solvent treatment step, without changing the overall process (Funaoka, ¶ [0056]) thereby simplifying the overall process while maintaining control over important parameters. Ans. 6. The Examiner also states that it would have been obvious to have modified the process of Hauser to at least partially melt the microporous membrane for a sufficient period of time as taught by Funaoka, motivated by improving permeability and strength of the microporous membrane (Funaoka, ¶ [0053]). Ans. 6–7.

Appellant argues that there is no motivation to modify Hauser with Funaoka because the pore size variation disclosed by Hauser is widely different from the pore size distribution disclosed in Funaoka. Appeal Br. 7–13.

On pages 17–18 of the Answer, the Examiner responds and states:

> Hauser discloses in [0094] that the membranes will function in a symmetric manner and be sufficiently uniform where the pores vary in diameter by a factor of about 5 or less. This teaching implies that any membranes having a pore diameter variation of a factor of 5 or less would not destroy the product desired by Hauser. Funaoka teaches average pore size in the exterior of the membrane is 0.05 to 50 microns, preferably 1 to 30 microns and the average pore size in the middle of the membrane is 0.01 to 30 microns, preferably 0.03 to 2 microns, where the pore size in exterior of the membrane is larger than the pore size in the middle of the membrane. Within the ranges described by Funaoka there are values in which the diameter of the pores vary by a factor of 5 or less. Additionally, Example 5 of Funaoka which is described in [0076] and Table 2, teaches a microporous membrane which has been treated by the hot solvent and has an average pore size in the front surface of 15 microns, an average

> pore size in the back surface of 14.8 microns, and an average pore size in the middle section of 14.8 microns. This distribution of pore size complies with the relative uniformity desired in Hauser, is treated with the hot solvent, and has a second state with at least 50% porosity. Thus, the combination of Hauser with Funaoka also does not destroy the product desired by Hauser.

Beginning on page 3 of the Reply Brief, Appellants dispute the Examiner's response. Appellant argues that Hauser stresses the paramount importance of uniformity in the membrane. Appellant refers to paragraph [0076] of Hauser, wherein Hauser teaches that liquid removal must be performed rapidly at a low temperature in order to produce a membrane withenhanced uniformity. In particular, this paragraph discloses:

> Rapid low temperature liquid removal, preferably using air flowing at a temperature of about 80° C. and below, most preferably at about 60° C. and below, without immersion of the membrane into another liquid has been found to produce a membrane with enhanced uniformity.

Appellant submits that this particular teaching also teaches avoiding immersion of the membrane into another liquid. Appellant submits that this statement would dissuade one of ordinary skill from performing a second solvent immersion step (from Funaoka) that the Examiner has proposed. Reply Br. 3.

Appellant also argues that in paragraphs [0081], [0084] and [0094] of Hauser, Hauser further stresses the thinness of the film with a view of obtaining uniform pore sizes. Reply Br. 3. These paragraphs are reproduced below:

> [0081] In view of the thinness of the films, the temperature throughout may be relatively uniform, though the outer surface may be slightly

> cooler than the bottom layer. Thermal uniformity may enable the subsequent polymer precipitation to occur in a more uniform manner.
>
> [0084] The interaction among the two liquids (with their different surface tension characteristics) and the polymer (with a surface energy intermediate the surface tensions of the liquids) may yield a membrane with high porosity and relatively uniform pore size throughout its thickness. The surface tension forces may act at the interface between the liquids and the polymer to give uniformity to the cell structure during the removal step. The resulting product may be a solid polymeric membrane with relatively high porosity and uniformity of pore size.
>
> [0094] Some embodiments may be generally uniform and symmetric, i.e. the substrate side pores may be substantially similar in size to the central and the air side pores. Pores varying in diameter by a factor of about 5 or less may be sufficiently uniform for the membranes to function in a symmetric manner.

Appellant submit that the aforementioned teachings show that uniform pore size is a very important feature for a membrane that is to be used as a dielectric spacer in a battery. Hauser, ¶ [0002]. Reply Br. 3. Appellant submits that the uniform distribution of pore sizes in the membrane permits a uniform distribution of spacer fillers in the membrane thereby preventing crushing of the membrane and preventing a fire. Hauser, ¶¶ [0002], [0011] and [0012]. Reply Br. 3.

Appellant states that the Examiner has refuted these arguments by stating that "within the ranges described by Funaoka, there are values in which the diameter of the pores vary by a factor of 5 or less." Ans. 17. Reply Br. 4. Appellants argue that even if some of the pores of Funaoka lie within the range prescribed by Hauser, the overall distribution of pore sizes lie far outside the range desired by Hauser. Appellant argues that the Examiner relies upon Example 5 of Funaoka in support of his contention, but this example does not include a partial melting of the polymer as is presently claimed. Reply Br. 4. Appellant states that the instant claims requires a partial melting of the polymeric binder. Appellant states that this would require the polymeric binder to be at least temporarily elevated to a temperature above its melting point so that some of the crystals would begin to melt. Appellant points out that while Funaoka in paragraph [0053] teaches that the solvent temperature is from the crystal dispersion temperature to melting point plus 10°C of the polyolefin or polyolefin composition, its examples are not conducted at above the melting point of the polymer as presently claimed. *Id.* Appellant states that Funaoka's Example 5 was conducted below the melting point of the ultrahigh molecular weight polyethylene. Appellant explains that Example 5 is similar to Example 3 except that it was treated with the hot solvent at 122°C for 10 seconds. Funaoka, ¶ [0076]. Appellant states that the polyethylene of Example 3 had a melting point of 135°C. Appellant state that Funaoka's examples therefore do not conform to the instantly claimed invention, which requires a partial melting of the membrane. Appellant states that even if this example is indicative of uniformity, Appellants argue that it does not meet the limitations of the instant claims. Appellant concludes that the Examiner appears to have inadvertently misconstrued the data. We agree and are thus persuaded by this line of argument.

Furthermore, Appellants point out that Table 1 of Funaoka displays four examples (Example 1, Example 2, Comparative Example 1 and Comparative Example 2). Reply Br. 4. Appellant states that it is worth noting that Examples 1 and 2 exemplify Funaoka's teachings, notably that of a second immersion into a hot solvent, while Comparative Examples 1 and 2 exemplify the procedure disclosed by Hauser, i.e., they are not subjected to the secondary hot solvent immersion. Appellant states that from Table 1, it is shown that the Comparative Examples 1 and 2 show cell uniformity, while Examples 1 and 2 both display wide variations in pore sizes. Appellant submits that in addition to not desiring this second immersion into a solvent because it produces non-uniform pore sizes (Hauser, ¶ [0076]), Hauser clearly does not desire this variation in pore sizes. Reply Br. 5.

In view of the above, we are persuaded by Appellant's arguments as discussed above, and reverse the rejection.

CONCLUSION

We reverse the Examiner's decision.

DECISION SUMMARY

In summary:

Claims Rejected	**35 U.S.C. §**	**Reference(s)/Basis**	**Reversed**	**Affirmed**
1–5, 7–12, 14–16, 18–23	103	Hauser, Yeager, Funaoka	1–5, 7–12, 14–16, 18–23	

REVERSED