

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 11

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte THOMAS D. KETCHAM, WAYNE B. SANDERSON, DECEASED,
BY STUART R. SANDERSON, ADMINISTRATOR, DELL J. ST. JULIEN
and KATHLEEN A. WEXELL

Appeal No. 95-1042
Application 07/964,002¹

ON BRIEF

Before KIMLIN, WARREN and OWENS, *Administrative Patent Judges*.
OWENS, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal from the examiner's rejection of claims 31-48 and 50-55, which are all of the claims remaining in the

¹ Application for patent filed October 21, 1992. According to the appellants, the application is a continuation of Application 07/664,295, filed March 4, 1991, abandoned; which is a continuation-in-part of Application 07/393,532, filed August 11, 1989, abandoned.

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application. Claims 31 and 46 are illustrative and read as follows:

31. A method for making a flexible inorganic sintered sheet or tape structure comprising the steps of:

a) mixing an inorganic powder with one or more vehicle constituents to form a fluid batch;

b) forming the fluid batch on a fugitive polymer sheet support into an elongated green sheet or tape preform of aspect ratio greater than 2:1; and

c) sintering said green preform and support to vaporize the support without damage to the preform and to sinter the inorganic powder, thus to provide a flat sintered inorganic sheet or tape structure of sufficient strength and flexibility to survive bending in at least one direction to a radius of curvature not exceeding about 20 centimeters without breakage.

46. A method in accordance with claim 31 wherein the step of sintering the elongated green preform comprises continuously transporting the elongated green preform through a hot zone maintained at a temperature above the sintering temperature of the inorganic powder.

THE REFERENCES

Park, Jr. (Park)	2,966,719	Jan. 3, 1961
Cleveland	4,025,462	May 24, 1977
Huang	4,997,812	Mar. 5, 1991
Ohtaki	5,176,772	Jan. 5, 1993

THE REJECTIONS

Claims 31-42, 46-48 and 50-52 stand rejected under 35 U.S.C. § 103 as being unpatentable over Park in view of Cleveland. Claims 43 and 44 stand rejected under 35 U.S.C. § 103 as being

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unpatentable over Park in view of Cleveland and Ohtaki. Claims
45 and 53-55 stand rejected under 35 U.S.C. § 103 as being
unpatentable over Park in view of Cleveland and Huang.

OPINION

We have carefully considered all of the arguments advanced by appellants and the examiner and agree with the examiner that the invention recited in appellants' claims 31-45, 48 and 50-55 would have been obvious to one of ordinary skill in the art at the time of appellants' invention over the applied references. Accordingly, the aforementioned rejections of these claims will be affirmed. However, we agree with appellants that the rejection of claims 46 and 47 is not well founded. We therefore will reverse this rejection.

At the outset, we note that appellants state that the claims stand or fall in two groups, wherein the first group is claims 31-45, 48 and 50-55, and the second group is claims 46 and 47. We therefore limit our discussion to one claim within each group, namely, claims 31 and 46. See 37 C.F.R. § 1.192(c)(5)(1993).²

Appellants' invention as recited in claim 31 is a method for making a flexible inorganic sintered sheet or tape. The method includes mixing a fluid batch of an inorganic powder and one or more vehicles, forming the batch on a fugitive polymer support into an elongated green sheet or tape preform having an aspect

² A discussion of Ohtaki and Huang is not necessary to our decision.

ratio greater than 2:1, and sintering the preform and support to vaporize the support without damaging the preform and to sinter the inorganic powder, thereby forming a flat sintered inorganic sheet or tape which can survive bending to a radius of curvature not exceeding about 20 centimeters.

Appellants' claim 46 recites that the preform is sintered by continuously transporting it through a hot zone at a temperature above the sintering temperature of the inorganic powder.

Park discloses a method for making ceramic-particulate films by mixing a ceramic powder, an organic volatile solvent, a wetting agent and an organic binder to form a slip, depositing the slip in the form of a film which is "as thin as on the order of 1 mil" on a flexible moving tape support, and then drying the slip (col. 1, lines 50-53; col. 2, lines 15-26). "The flexible supporting tape may be of any impervious, non-porous material, such as polytetrafluorethylene ('Teflon'), glycol terephthalic acid polyester ('Mylar'), cellulose acetate, cellophane (regenerated cellulose) and the like. A cellulose derivative is preferred" (col. 5, lines 33-38). Park discloses cutting through the ceramic-particulate film, but not the tape, such that small squares or rectangular ceramic-particulate units are supported on the tape, placing the tape units-side-down on a refractory plate,

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and stripping the tape from the units prior to firing the units (col. 7, lines 11-41).

Cleveland discloses a method for making ceramic cellular structures having high cell density per unit area which are useful as heat exchangers and supports for catalysts (col. 1, lines 16-21). The portion of the reference relied upon by the examiner (answer, page 5) is the discussion of the prior art, wherein Cleveland states (col. 1, lines 44-68):

A major disadvantage of ceramics is the difficulty inherent in forming them, due in large part to their low strength in the green, unfired state and to their brittleness in the fired state. The problem becomes more acute as surface area and size requirements for these structures increase, requiring decreased cell wall thicknesses and increased bulk weight.

One approach to solving such forming problems has been to cast a ceramic film from a slurry onto a fugitive support material to form a bilayered tape, mold the bilayered tape into a corrugated member, form the tape into the desired structure (for example, by rolling or stacking with interposing flat members) and fire to volatilize the support medium and sinter-weld the structure.

The technique of utilizing a fugitive support material to provide needed strength during forming imposes an upper limit on cell density due to the space occupied by the support layer in the structure prior to firing. In addition, where the wall thickness is small compared to the support thickness, substantial contact of the nodes of the corrugated layer may be prevented (particularly in a rolled structure) resulting in formation of few sinter welds during firing and consequent low mechanical strength of the finished structure.

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The examiner concludes that in view of the teaching by Cleveland, it would have been obvious to one of ordinary skill in the art to sinter the Parks preform while it is still attached to the support, in order to enhance the strength of the green preform (answer, page 5). Appellants do not specifically address this conclusion of obviousness.

Appellants argue that Park does not disclose forming a flexible ceramic sheet (brief, page 6). Park discloses use of green sheets which are as thin as "on the order of 1 mil" which, as pointed out by the examiner (answer, page 4), is about 25 microns. Since this thickness is within the range thickness of sintered films most preferred by appellants, i.e., no more than about 30 microns (specification, page 6, lines 14-18), it appears that thin sintered films formed by the Park process have the same flexibility as those formed by appellants' process.

Appellants argue that there is no proximate or remote connection between Cleveland's teaching and producing extremely thin ceramic sheets, and that the skilled artisan would not look to Cleveland for guidance regarding making thin flexible sintered ceramic sheets (brief, page 10).

We are not persuaded by this argument because although the ultimate product discussed in the prior art section of Cleveland

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is one which has been formed into a desired structure, the teaching in this portion of the reference regarding casting a ceramic preform film on a fugitive support and removing the support by vaporizing it would have indicated to one of ordinary skill in the art that vaporizing a fugitive support is an effective method for removing the support from a green ceramic preform which has been formed on it. Thus, this teaching would have indicated to such a person that peeling a support from a green ceramic preform prior to sintering, and vaporizing the support during sintering, are alternative ways for removing a support from a green ceramic preform which has been formed thereon.

Appellants argue that Parks teaches directly away from appellants' invention by teaching that the support should be removed prior to sintering the ceramic (brief, pages 6-7). Appellants argue that "while Cleveland references the use of fugitive sheet materials for honeycomb fabrication in the prior art, the clear teaching of the reference is to *avoid* such use in favor of a self-supporting green sheet" (brief, page 10; emphasis in original).

Cleveland teaches, in the prior art portion quoted above, that using a fugitive support has a disadvantage when cellular

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structures are produced because the fugitive support takes up space and therefore limits cell density (col. 1, lines 59-62). Thus, Cleveland avoids using fugitive supports for making his cellular structures. However, as discussed above, the teaching that vaporizing a fugitive support is an effective means for removing the support from a green ceramic film formed thereon would have indicated to one of ordinary skill in the art that this removal means is an alternative to removing the support before firing as taught by Park (col. 7, lines 45-49).

Appellants also argue that the reason why the support is removed before the ceramic is sintered is "that polymer supports of the kind utilized by Park are thermoplastics which tend to warp and curl when heated, distorting any green sheet or tape preforms disposed thereon" (brief, page 7). Appellants' support for this argument is column 6, lines 45-55 of Parks, wherein Parks states:

The drying chamber is preferably approximately 8 feet long and is fitted with a plurality of spindles 19 to support the flexible tape as it passes therethrough. These spindles 19 are spaced at different levels so as to form somewhat of an arc the length of the drying chamber. This is required when heating extremely thin films of ceramic-particulate on flexible tapes inasmuch as the tape itself undergoes some warping when subjected to heat.

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Thus, appellants argue, the thermoplastic sheet supports disclosed by Park do not qualify as fugitive polymer supports for appellants' method because "they tend to warp or curl on heating, distorting the green tape preforms supported thereon" (brief, page 9). We do not find this argument to be convincing for the following reasons.

First, Park does not teach that the supports in his process actually warp or curl. He states that "the tape itself undergoes some warping when subjected to heat" (col. 6, lines 51-53), but indicates that spindles 19 on which the tape is supported while being dried are used to prevent such warping (col. 6, lines 45-53).

Second, appellants have not established that the warping referred to by Park damages the preform, and that such damage would be present in the film after firing. Also, appellants have not established that support films made of the materials disclosed in their specification, i.e., acrylic polymers and copolymers and polyalkyl carbonate polymers, do not warp to some extent when heated.

Third, not all of the support film materials disclosed by Park are thermoplastic as argued by appellants (brief, pages 8-

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9). Park teaches use of cellophane (col. 5, lines 31-38) which does not melt.³

Fourth, in two examples in appellants' specification (Example 13, page 32 and Example 24, page 42) the slip is cast onto a Mylar® polyester sheet and fired. There is no disclosure that the sheet is removed from the film before firing. The films after firing are disclosed as being strong and flexible. These examples indicated that even if a thermoplastic fugitive support sheet is used, a product having strength and flexibility as recited in claim 31 can be formed.

For the above reasons, we conclude, based on the preponderance of the evidence and argument in the record, that the invention recited in appellants' claim 31 would have been obvious to one of ordinary skill in the art within the meaning of 35 U.S.C. § 103.

We now turn to the rejection of claim 46.

The examiner acknowledges that he has applied no prior art to claim 46, but argues that it would have been within the realm of routine experimentation for one of ordinary skill in the art

³ See The Condensed Chemical Dictionary, 9th ed., 174 (Van Nostrand Reinhold, 1977).

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to optimize the process conditions, such as process time and/or properties of the final product (answer, pages 10-11).

"The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. [citations omitted] Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure." *In re Dow Chemical Co.*, 837 F.2d 469, 473, 5 USPQ2d 1529, 1531 (Fed. Cir. 1988). The mere possibility that the prior art could be modified such that appellants' process is carried out is not a sufficient basis for a *prima facie* case of obviousness. See *In re Brouwer*, 77 F.3d 422, 425, 37 USPQ2d 1663, 1666 (Fed. Cir. 1995); *In re Ochiai*, 71 F.3d 1565, 1570, 37 USPQ2d 1127, 1131 (Fed. Cir. 1995).

The examiner has not explained why the applied prior art would have suggested sintering an elongated green ceramic preform formed on a fugitive support by passing it continuously through a hot zone, and explained why the prior art would have provided such a person with a reasonable expectation of success in doing so. Thus, the examiner has not established a *prima facie* case of obviousness of appellants' claim 46.

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The examiner argues that appellants have not contested his holding that the process of claim 46 would have been arrived at by routine optimization, but have only stated that the limitations of claim 46 are not taught in the references (answer, page 11).

This argument is not well taken because, as stated above, the examiner has the initial burden of explaining why the applied references would have provided one of ordinary skill in the art with both a suggestion to carry out the claimed process and a reasonable expectation of success in doing so. Furthermore, appellants argue that one of ordinary skill in the art would have expected "that vaporization of organics from the green material approaching the sintering zone would have left the powdered ceramic material with no binder phase, and thus with insufficient cohesiveness to draw trailing green material into the furnace" (brief, page 12). Thus, appellants have challenged the examiner's assertion that arriving at the process recited in appellants' claim 46 would have involved no more than routine optimization.

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DECISION

The rejections of claims 31-42, 48 and 50-52 under 35 U.S.C. § 103 as being unpatentable over Park in view of Cleveland, of claims 43 and 44 under 35 U.S.C. § 103 as being unpatentable over Park in view of Cleveland and Ohtaki, and of claims 45 and 53-55 under 35 U.S.C. § 103 as being unpatentable over Park in view of Cleveland and Huang, are affirmed. The rejection of claims 46 and 47 under 35 U.S.C. § 103 as being unpatentable over Park in view of Cleveland is reversed.

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-IN-PART

EDWARD C. KIMLIN)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
CHARLES F. WARREN)	
Administrative Patent Judge)	APPEALS AND
)	
)	INTERFERENCES
)	
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