UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte IAN FAYE, FRANK BRENNER,
HANS-RUEDIGER WEISS,
THANH-HUNG NGUYEN-SCHAEFER,
RAINER SALIGER, and THOMAS HEBNER

Appeal 2007-2553
Application 10/367,347
Technology Center 1700

Decided: July 31, 2007

Before EDWARD C. KIMLIN, THOMAS A. WALTZ, and
JEFFREY T. SMITH, *Administrative Patent Judges*.

WALTZ, *Administrative Patent Judge*

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the Primary Examiner's final rejection of claims 1-3 and 15. Claims 4-14 and 16 are the only other claims pending in this application and stand objected to

by the Examiner as allowable but depending on a rejected claim (Final Office Action dated Nov. 18, 2005, unnumbered pages 3-4). We have jurisdiction pursuant to 35 U.S.C. § 6(b).

According to Appellants, the invention is directed to a fuel cell device comprising a fuel cell, a conversion unit for converting material mixtures to a hydrogen-containing fluid stream, a separation device for separating the hydrogen-containing fluid stream into at least one hydrogen-enriched material stream and a residual gas stream, where the separation device is formed as a mass separation device (Br. 2-3). Independent claim 1 is illustrative of the invention and is reproduced below:

> 1. A fuel cell device, comprising a fuel cell unit; a conversion unit for converting material mixtures to a hydrogen-containing fluid stream provided to the fuel cell unit; a separation device for separating the hydrogen-containing fluid stream, into at least one hydrogen-enriched material stream and a gaseous residual stream, said separation device being formed as a mass separation device for separating different masses.

The Examiner has relied upon the following reference as evidence of unpatentability:

Muradov	US 6,670,058 B2	Dec. 30, 2003

ISSUES ON APPEAL

Claims 1-3 and 15 stand rejected under 35 U.S.C. § 102(e) as anticipated by Muradov (Answer 3).

Appellants contend that the Examiner's analysis overlooks that Muradov produces a hydrogen fluid stream free of CO/CO_2 which is transferred to the fuel cell via a cyclone used for separating catalytic carbon particles (Br. 4). Appellants further contend that Muradov fails to disclose

use of the cyclone for separating one hydrogen-enriched material stream from a gaseous residual stream (*id.*).

Appellants contend that separation device 2 disclosed by Muradov is constructed as a cyclone for separating particulate matter, as it is commonly known that particles are separated from a gaseous stream by mass separation, but it is not possible to separate a hydrogen-enriched material stream from a gaseous residual stream in a cyclone (Br. 4-5). Appellants thus contend that Muradov does not describe each and every limitation of the claims and fails to anticipate the claimed subject matter (Br. 5).

The Examiner contends that the cyclone 2 disclosed by Muradov is clearly a mass separation device, and according to claim 14 and Figure 2 of the reference, the hydrogen-containing gas from the reactor must be separated in the cyclone into pure hydrogen, for introduction into the anode of the fuel cell, and hydrogen depleted gas (HDG) (Answer 4-5). The Examiner further contends that cyclone separators are well known for separating gaseous streams of different density, and Muradov does not disclose or suggest that carbon particles are separated in the cyclone (Answer 5).

The Examiner also contends that the claims are directed to apparatus, therefore the type of gases separated are not given patentable weight, and the cyclone must merely be capable of separating a hydrogen containing fluid stream into a hydrogen enriched material stream and a gaseous residual stream (Answer 6).

Accordingly, the issues presented from the record in this appeal are as follows: (1) is the cyclone disclosed by Muradov capable of separating

gaseous streams? (2) does Muradov describe each and every limitation found in the claims on appeal?

We determine that the Examiner has established a prima facie case of anticipation in view of the reference evidence, which prima facie case has not been adequately rebutted by Appellants' arguments. Therefore we AFFIRM the sole rejection on appeal essentially for the reasons stated in the Answer, as well as those reasons set forth below.[1]

OPINION

We determine the following factual findings from the record in this appeal:

(1) Muradov discloses the carbon dioxide-free production of hydrogen and carbon by thermocatalytic decomposition of hydrocarbons over carbon-based catalysts by combining a catalytic reactor with a gas separation unit to produce high purity hydrogen that can be introduced to a fuel cell (Abstract; col. 1, ll. 5-10; and col. 3, ll. 54-57, 65-67);

(2) Muradov discloses a process of thermocatalytic decomposition of a hydrocarbon stream over a moving bed of carbon particulates , recovering a stream of hydrogen-containing gas (HCG), directing this stream to a gas-separation unit (GSU) where pure hydrogen is separated from said stream and hydrogen-depleted gas (HDG), recovering pure hydrogen for use in combination with a fuel cell (col. 4, ll. 1-17);

[1] Since Appellants do not contest the patentability of any specific claim, we limit our consideration in this appeal to independent claim 1.

(3) Muradov discloses that, in addition to pure hydrogen for the fuel cell, a very important byproduct is clean carbon (col. 4, ll. 65-67, and col. 11, ll. 64-67);

(4) Muradov describes the process and apparatus needed for two embodiments, one with a fuel cell (Figure 2) and one without a fuel cell (Figure 1); the Figure 1 embodiment uses a GSU to separate hydrogen with at least 99.0% purity, where the GSU may be a gas separation membrane, a PSA system, cryogenic absorption, or any other system capable of separating hydrogen from hydrocarbons (col. 5, ll. 1-22);

(5) In both embodiments, Muradov discloses that the carbon product is withdrawn from the bottom of the fluidized bed reactor 1 in the form of carbon particulates (col. 5, ll. 41-43, and claim 7 in col. 12);

(6) In the Figure 2 embodiment, Muradov discloses that the HCG, after reactor 1, a cyclone 2, and a heat exchanger 3, enters the anode compartment 9 of fuel cell 7, with hydrogen being absorbed by the fuel cell and unconverted hydrocarbons recycled to the reactor (col. 6, ll. 31-33 and 43-51); and

(7) Muradov claims a process of decomposing hydrocarbons, recovering a stream of HCG, directing this stream to a GSU where pure hydrogen is separated and recovered, and introducing this pure hydrogen into an anode of a fuel cell (col. 13-14, claim 14).

Under § 102, anticipation requires that the prior art reference discloses, either expressly or under the principles of inherency, every limitation of the claim. *See In re King,* 801 F.2d 1324, 1326, 231 USPQ

136, 138 (Fed. Cir. 1986). The absence of a disclosure relating to function does not defeat a finding of anticipation. A patent applicant is free to recite features of an apparatus either structurally or functionally. Yet, choosing to define an element functionally, i.e., by what it does, carries with it a risk. Where the Examiner has reason to believe that a functional limitation asserted to be critical for establishing novelty may, in fact, be an inherent characteristic of the prior art, the burden rests with applicant to prove that the subject matter shown to be in the prior art does not possess this characteristic. *See In re Schreiber,* 128 F.3d 1473, 1478-79, 44 USPQ2d 1429, 1432-33, *quoting In re Swinehart,* 439 F.2d 210, 213, 169 USPQ 226, 228 (CCPA 1971).

Applying the preceding legal principles to the factual findings in this record, we determine that the Examiner has established a prima facie case of anticipation which case has not been adequately rebutted by Appellants' arguments. As shown by factual findings (1) and (2) listed above, and not contested by Appellants, Muradov discloses a fuel cell unit (FC 7), a conversion unit capable of converting hydrocarbons to a hydrogen-containing fluid stream provided to the fuel cell unit (reactor 1), and a separation device (GSU 4). Appellants dispute the Examiner's contention that cyclone 2 also acts as a separation device (Br. 4-5). We determine that the Examiner has established a prima facie case of anticipation for several reasons. First, we determine that the embodiment of Figure 1 (*see* factual findings (4) and (7) listed above), includes a fuel cell unit with pure hydrogen introduced therein (i.e., 99 v.%), where the GSU acts to separate the HCG from the HDG. Accordingly, every limitation of claim 1 on appeal is disclosed by the reference if the GSU is a "mass separation device" as

required by the claim. We determine that this term is not defined by Appellants (Specification 5), and thus we give the broadest reasonable meaning to this term in its general usage as it would be understood by one of ordinary skill in the art. *See In re Morris,* 127 F.3d 1048, 1054, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997). We determine that the broadest reasonable interpretation of this term in its general usage would be any device that separates two streams based in some part on their different masses. However, the gas separation devices taught by Muradov all use the different masses of the gas streams, to some extent, to separate the gases even though pressure or temperature may also be a factor (*see* col. 5, ll. 19-22, and factual finding (4) listed above).

Second, we agree with the Examiner that the cyclone 2 disclosed by Muradov is *capable* of separating gaseous streams.[2] *See In re Schreiber, supra.* Contrary to Appellants' argument that the cyclone is used for separating carbon particles from a gaseous stream (Br. 4-5), Muradov specifically teaches that the carbon particulates are removed from the bottom of reactor 1 and thus do not appear to enter the cyclone 2 (*see* factual findings (3) and (5) listed above).[3] Furthermore, Muradov teaches that the gas entering the anode of the fuel cell unit should be "pure hydrogen" (i.e., 99 v.%), and the only apparatus between the reactor 1 and the fuel cell unit 7 is the cyclone 2 and heat exchanger (*see* Figure 2 and factual findings (6) and (7) listed above). Thus we determine that the Examiner has established

[2] We note that Appellants have not disputed that the cyclone 2 taught by Muradov is a "mass separation device" within the scope of this term in claim 1 on appeal.
[3] We note that Muradov does show a stream exiting the bottom of cyclone 2 into the heater 6 but does not identify this stream (*see* Figures 1 and 2).

a reasonable belief that the cyclone 2 must act as a gas separation device since the gas exiting the reactor 1 has a hydrogen concentration of only about 30-90% (col. 5, ll. 23-28). *See In re Schreiber, supra; and In re Best,* 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977).

For the foregoing reasons and those stated in the Answer, we affirm the rejection on appeal. The decision of the Examiner 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)(1)(iv).

AFFIRMED

tlc/ls

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