

# **Freedom-to-Operate Study: HDPE Fuel Tanks**

PIUG 2007 Northeast Conference

Thomas E. Wolff, Ph.D.  
Wolff Information Consulting LLC

# Outline

- What is “freedom-to-operate”?
- FTO analysis by attorneys
- Rules for successful FTO searches
- Case study: HDPE Fuel Tank

# Freedom-to-Operate

- Synonyms: freedom-to-operate (FTO), freedom-to-practice (FTP), clearance, infringement, noninfringement, right-to-use
- No identifiable patent barriers to the commercialization of products or processes
  - No *relevant unexpired* patents in the *locations* targeted for manufacture, sale or use
  - No relevant patent applications that could become barriers

# Freedom-to-Operate Analysis by Attorneys

- “The single most difficult issue for a patent practitioner to deal with on a day-to-day basis” – patent attorney
- Requires explicit and accurate definition at the beginning
- **Requires a comprehensive search**
- Claims analysis for literal infringement and under “doctrine of equivalents” if necessary – understand claims in context of whole specification and prosecution history
- Never 100% up-to-date – 18 months publication delay
- Ends with a risk assessment
- There is never any certainty of the end result, only a comfort level

# Rules for Successful FTO Searches

1. Verify and verify again the scope with the customer
2. Don't miss the obvious references
3. Carry out search in two independent parts
4. Be sure you know why you are rejecting each reference and think twice about it
5. Present the results in the fashion that your customer can best use
6. Expect to defend your search

# Rule 1: Verify and Verify Again the Scope with the Customer

- Customer interview with search professional and/or patent attorney
- Prepare cover letter with explicit and accurate definition of the matter
  - Subject definition
  - Geographic limitations
  - Expiry considerations
- Provide clear explanation of search scope
- Get feedback on cover letter and search scope
- Revise search scope and strategy throughout search process

# Subject: HDPE Fuel Tank

- Ethylene homopolymer or copolymer comprising ethylene and not more than 10% by weight of an alpha-olefin having from 3 to 20 carbon atoms
- Density of from 0.945 to 0.970 g/cm<sup>3</sup> [HDPE is defined by a density of greater or equal to 0.941 g/cc]
- Prepared by classic Ziegler-Natta catalysts, i.e. titanium chloride (TiCl<sub>3</sub>, TiCl<sub>4</sub>; group IVB, 4B, IUPAC 4) – alkylaluminum (AlEt<sub>3</sub>, Et<sub>2</sub>AlCl, EtAlCl<sub>2</sub>...; group IIIA, 3A, IUPAC 13) with or without supports or modifiers
- Intrinsic viscosity of from 2 to 6 dl/g
- Blow mold fuel tank
- US and Europe

# Search Scope: HDPE Fuel Tank

<b>Initial Definition</b>	<b>Search Scope</b>
Ethylene homopolymer or copolyolefin	C2 homopolymer, C2/C3+ olefin copolymer
Density 0.945-0.970 g/cc	“High density”; 0.94, 0.95, 0.96, 0.97, 0.98 g/cc
Ziegler-Natta catalysis	Post search evaluation only
Intrinsic viscosity 2-6 dl/g	Intrinsic viscosity but values in post search only
Fuel tank	Vehicle or fuel tanks, drums, reservoirs; blow molded or hollow articles
US and Europe	EP, US and WO patents and application – generally since 1985



## Rule 2: Don't Miss the Obvious References

- Carry out initial search with broadest acceptable search terms – MicroPatent, USPTO, Espacenet, QPat, PatBase
- Prepare search strategy for full search
- Prepare cost estimate if necessary

# Find Obvious References: HDPE Fuel Tank

- Espacenet (title and abstract):  
polyethylene and fuel and tank
- MicroPatent (claims, title, abstract; 1981-2007): ((fuel or gasoline or petrol or fluid or vehicle or car or automobile) near1 (tank or drum or reservoir) or (hollow near3 (body or mold\* or mould\* or article)) or (blow\* near2 (mold\* or mould\* or article) or parison)) and "intrinsic viscosity"

## Rule 3: Carry Out Search in Two Independent Parts

1. Full text of claims, title, abstract – requires extensive use of term variations and synonyms
    - Full-text databases (USPATFULL, EPFULL, PCTFULL)
    - MicroPatent
  2. Value-added databases – indexing and text search terms
    - Chemical Abstracts (CAPLUS) - CASRN®, indexing (old basic index)
    - Thomson Derwent World Patents Index (DWPI) – Derwent polymer indexing terms and text search terms
    - IFI CLAIMS US Patents (IFICDB) – IFI thesaurus terms and text search terms
- Combine patent numbers for claims/specification analysis

# Rule 4: Be Sure You Know Why You are Rejecting Each Reference and Then Think Twice About It

- Screen and review – judgment not opinion
- Check target patent and application claims, preferably in a patent viewer with term highlighting
- Examine specification for relevant term definitions using term highlighting
- Log relevant and rejected patent numbers – create notes to annotate final table, note patent expiration
- Do not reject “family members” as a class

# Evaluating References: HDPE Fuel Tank

- Transfer all patent document numbers to PatentViewer/STN Viewer/QPAT or equivalent
- Set up term highlighting
- View claims and then specification if necessary
- Log, annotate every reference with comments and relevant claims details
- Compare “family members”
- Note patent expiration

Minesoft Viewer - Internet Explorer provided by Dell  
 http://viewer.minesoft.com/default.asp

US5547722 - Ethylene polymer and fuel tank comprising the same

Work File: PE fuel tank (38/57)

Biblio | **Claims** | Description | Family | Notes | Print | List | Highlight | Delete | Abstract | Claims | Description

[View hit map](#)  
[Smart claims viewer](#)

**Claims of US5547722:**

What is claimed is:

1. A fuel tank obtained by blow molding of an ethylene homopolymer or copolymer comprising ethylene and not more than 10% by weight of an .alpha.-olefin having from 3 to 20 carbon atoms, said ethylene polymer having (1) an intrinsic viscosity of from 2 to 6 dl/g, (2) a density of from 0.945 to 0.970 g/cm<sup>3</sup>, (3) an R value of from 2.5 to 4, said R value being defined as a .sigma.2 / .sigma.1 ratio, wherein .sigma.1 and .sigma.2 mean stress in elongation with a strain at 2 sec and 4 sec, respectively, under a flow at an elongational strain rate .epsiloni. of 0.5 sec<sup>-1</sup>, and (4) a relationship between high-velocity impact strength (HRI-IZOD) measured at -30 DEG C. and a melt index under a load of 21.6 kg (HLMI) satisfying formula:  

$$\text{HRI-IZOD} \cdot \text{gtoreq} \cdot \log \text{HLMI} + 1.15$$
2. A fuel tank as claimed in claim 1, wherein said fuel tank has a laminate structure composed of a gas barrier layer and a polyethylene layer comprising said ethylene polymer.
3. A fuel tank as claimed in claim 2, wherein said fuel tank is composed of a gas barrier layer having laminated thereon at least one side thereof a polyethylene layer comprising said ethylene polymer via an adhesive layer.
4. A fuel tank as claimed in claim 2, wherein said gas barrier layer comprises a polyamide resin.
5. A fuel tank as claimed in claim 4, wherein said gas barrier layer is a composition comprising a polyamide resin and a maleic anhydride-modified ethylene-.alpha.-olefin copolymer having a degree of crystallization of from 1 to 35% and a melt index (HLMI) of from 0.01 to 50 g/10 min and being modified with maleic anhydride at a grafting ratio of from 0.05 to 1% by weight.
6. A fuel tank as claimed in claim 3, wherein said adhesive layer comprises high-density polyethylene modified with 0.01 to 1% by weight of an unsaturated carboxylic acid or an anhydride thereof.
7. The fuel tank as claimed in claim 1, wherein (1) the intrinsic viscosity is from 2.3 to 5.5 dl/g, (2) the density is from 0.955 to 0.970 g/cm<sup>3</sup>, (3) the R value is from 2.6 to 3.8, (4) the relationship between (HRI-IZOD) and (HLMI) satisfies the formula:

US005547722A

**United States Patent** [19]  
 Uehara et al.

[11] Patent Number: **5,547,722**  
 [45] Date of Patent: **Aug. 20, 1996**

[54] **ETHYLENE POLYMER AND FUEL TANK COMPRISING THE SAME** 5,384,172 1/1995 Takada et al. 426/516  
 5,441,781 8/1995 Uehara et al. 428/976.1

[75] Inventors: Yumio Uehara; Nobuo Enokido; Kiyotoshi Fujioka, all of Kanagawa; Nobuyuki Shimizu; Motonori Ueda, both of Okayama, all of Japan  
*Primary Examiner*—Tae Yoon  
*Attorney, Agent, or Firm*—Sughrue, Mison, Zimm, Macpeak & Seas

[73] Assignee: Mitsubishi Kasei Corporation, Tokyo, Japan

[21] Appl. No.: 414,231  
 [22] Filed: Mar. 31, 1995

Related U.S. Application Data

[62] Division of Ser. No. 311,674, Sep. 23, 1994.

Foreign Application Priority Data

Sep. 27, 1993	[JP]	Japan	5-239986
Sep. 29, 1993	[JP]	Japan	5-242926
Sep. 29, 1993	[JP]	Japan	5-242927

[51] Int. Cl.<sup>5</sup> B65D 88/12; B32B 27/32; B32B 27/34

[52] U.S. Cl. 428/35.7; 428/36.7; 428/476.1; 428/516; 428/520; 2204.13; 2204.14; 2204.15

[58] Field of Search 428/35.7, 36.7, 428/476.1, 516; 206/0.6; 2204.13, 4.14

[56] References Cited  
 U.S. PATENT DOCUMENTS  
 5,073,420 12/1991 Yano et al. 428/35.7

**18 Claims, No Drawings**

[57] **ABSTRACT**  
 An ethylene homopolymer or copolymer comprising ethylene and not more than 10% by weight of an .alpha.-olefin having from 3 to 20 carbon atoms and a fuel tank obtained therefrom are disclosed, said ethylene homopolymer or copolymer having (1) an intrinsic viscosity [eta] of from 2 to 6 dl/g, (2) a density of from 0.945 to 0.970 g/cm<sup>3</sup>, (3) an R value of from 2.5 to 4, said R value being defined as a .sigma.2/.sigma.1 ratio, wherein .sigma.1 and .sigma.2 mean stress in elongation with a strain at 2 sec and 4 sec, respectively, under a flow at an elongational strain rate .epsiloni. of 0.5 sec<sup>-1</sup>, and (4) a relationship between high-velocity impact strength (HRI-IZOD) measured at -30° C. and a melt index under a load of 21.6 kg (HLMI) satisfying formula:  

$$\text{HRI-IZOD} \cdot \text{gtoreq} \cdot \log \text{HLMI} + 1.15$$
  
 The ethylene polymer exhibits high melt tension and excellent molding properties such as uniform stretchability in blow molding to provide molded articles, such as a fuel tank, having excellent mechanical characteristics, such as high stiffness and high impact resistance, and excellent fire resistance.

7.72 x 11.36 in

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Minesoft Viewer - Internet Explorer provided by Dell  
 http://viewer.minesoft.com/default.asp

US5547722 US5547722 - Ethylene polymer and fuel tank comprising the same 0 % Rank Work File: PE fuel tank (38/57)

Biblio Claims Description Family Notes Print List Highlight Delete Abstract Claims Description

### Highlighting

Please enter the words you wish to highlight in the appropriate colour boxes separated by a space.

Yellow	high density
Cyan	intrinsic viscosity
Green	zeigler natta aluminum aluminium titanium ticl3 ticl4
Red	blow blown mold mould
Pink	tank hollow parison reservoir drum

Save Clear

US005547722A

**United States Patent** [19]  
**Uehara et al.**

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 [45] Date of Patent: **Aug. 20, 1996**

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[58] Field of Search **428/35.7, 36.7, 428/476.1, 516; 206/0.6; 2204.13, 4.14**

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**18 Claims, No Drawings**

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An ethylene homopolymer or copolymer comprising ethylene and not more than 10% by weight of an  $\alpha$ -olefin having from 3 to 20 carbon atoms and a fuel tank obtained therefrom are disclosed, said ethylene homopolymer or copolymer having (1) an intrinsic viscosity  $[\eta]$  of from 2 to 6 dl/g, (2) a density of from 0.945 to 0.970 g/cm<sup>3</sup>, (3) an R value of from 2.5 to 4, said R value being defined as a  $\sigma_1/\sigma_2$  ratio, wherein  $\sigma_1$  and  $\sigma_2$  mean stress in elongation with a strain at 2 sec and 4 sec, respectively, under a flow at an elongational strain rate  $\dot{\epsilon}$  of 0.5 sec<sup>-1</sup>, and (4) a relationship between high-velocity impact strength (HRI-IZOD) measured at -30° C. and a melt index under a load of 21.6 kg (HLM1) satisfying formula:

HRI-IZOD<sup>0.8</sup>-log HLM<sup>0.1</sup>-1.15

The ethylene polymer exhibits high melt tension and excellent molding properties such as uniform stretchability in blow molding to provide molded articles, such as a fuel tank, having excellent mechanical characteristics, such as high stiffness and high impact resistance, and excellent fire resistance.

7.72 x 11.36 in

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# Rule 5: Present the Results in the Fashion That Your Customer Can Best Use

- Tabulate relevant references (BizInt Smart Charts, STN Table Tool, MicroPatent/PatentOrder/QPAT... Export)

<b>Title</b>	<b>Assignee</b>	<b>Patent Number</b>	<b>Family Members</b>	<b>Key Claims &amp; Comments</b>

- List bibliographic information, abstracts, and/or claims – e.g., Derwent WPI records, PatentOrder output, full-text claims
- Include links to patent documents



# Rule 6: Expect to Defend Your Search

- Be very clear in explaining the scope of your search
- Tabulate rejected references
- Get independent feedback on report if possible
- Be interviewed by customer about search report
- Expect iteration or further searching

# Conclusions

- Use best search practices
- Follow the “rules”