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PATENT AND TRADEMARK OFFICE

Certainty in Search and Cooperative Patent Classification

Brett Feeney

Supervisory Patent Examiner, AU2822

Technology Center Lead for Classification, Semiconductor Workgroup

Kevin Parendo

Primary Patent Examiner

CPC Quality Nominee and TC 2800 Trainer

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An application is docketed to the examiner – now what?

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Layouts | SEARCH | OC | FEENEY,Brett (2822) | 14/981,120 - CHIP STACK COOLING STRUCTURE

Application Contents | Application Data

Create Bib Data Sheet | View IPF | Assignment Data

Application Number	14/981,120
Application Title	CHIP STACK COOLING STRUCTURE
Examiner Name	PARENDO, Kevin (2819)
AIA(FITF)	Yes
Application Status Date	10/25/2017
Application Status	Patented Case

- Contents
- Application History
- Disclosure
- Correspondence Information
- Fees — View All Fees (5)
- Petitions — View All Petitions (0)
- Classification

DRW.NONBW - 02/22/2016

OCR | 75% | Page 1 of 15

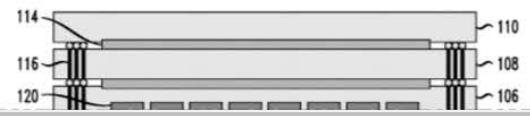
This document contains no annotations | View / Edit Annotations

Drawings-other than black and white line drawings - 02/22/2016 | Examiner: PARENDO, Kevin (2819) | Application Number: 14/981,120

Notes

FIG. 1

100



Claims - 04/14/2017 | Specification - 12/28/2015

OCR | 90% | Page 1 of 5

This document contains no annotations | View / Edit Annotations

Claims - 04/14/2017 | Examiner: PARENDO, Kevin (2819) | AIA(FITF): Yes | Application Number: 14/981,120

Notes

Attorney Docket No. YOR920151141US1

IN THE CLAIMS

1. (Currently amended) An apparatus comprising:

a first die;

a thermal cooler ~~formed~~ disposed over at least a portion of the first die;

a second die ~~formed~~ disposed over at least a portion of the thermal cooler; and

a plurality of through-silicon vias providing electrical connections between the first die and the second die;

wherein the thermal cooler comprises a plurality of fluid channels for fluid cooling of the first die and the second die, each of the plurality of fluid channels ~~being formed~~ disposed horizontally through the thermal cooler; ~~and~~

wherein the plurality of through-silicon vias are ~~formed~~ disposed vertically through the first die, the thermal cooler and the second die;

wherein the thermal cooler comprises a first silicon wafer die half and a second silicon wafer die half, each of the first silicon wafer die half and the second silicon wafer die half comprising a plurality of vias disposed in outer edge portions thereof and a plurality of trenches disposed in an inner portion thereof, the outer edge portions of the first silicon wafer die half and the second silicon wafer die half surrounding the inner portions of the first silicon wafer die half and the second silicon wafer die half, respectively; and

wherein the first silicon wafer die half and the second silicon wafer die half are thermo-compression copper bonded to connect the plurality of vias disposed in the outer edge portions thereof to one another forming connected pairs of vias and to connect the plurality of trenches disposed in the inner portions thereof to one another forming connected pairs of trenches, each connected pair of trenches providing one of the plurality of microchannel coolers and each connected pair of vias providing a portion of one of the plurality of through-silicon vias.

PE2E–Docket and App Viewer

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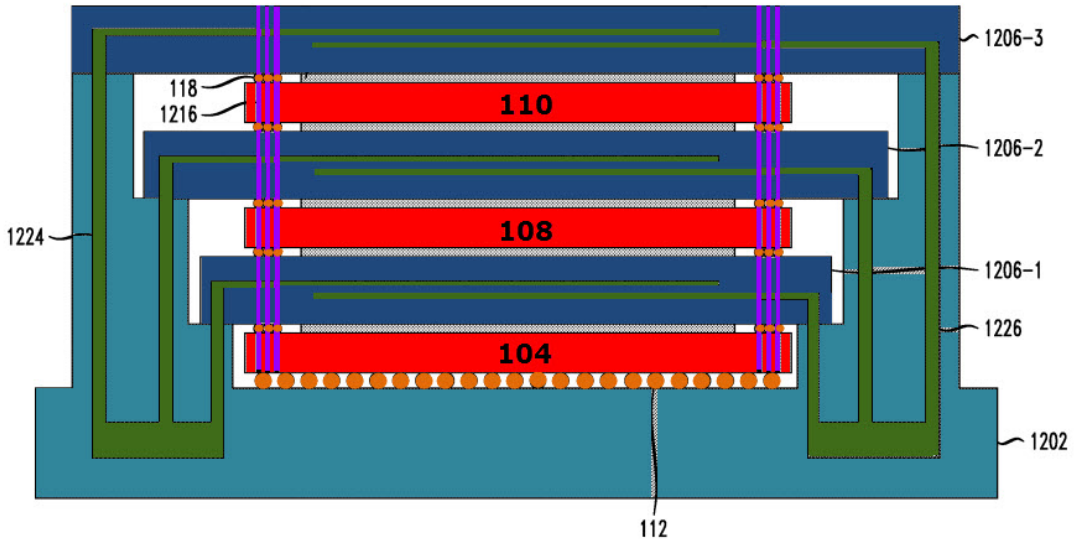
App Orientation

1. Read the Specification

2. Read/Interpret the Claims

1. An **apparatus** comprising:
a **first die**;
a **thermal cooler** formed over at least a portion of the first die;
a **second die** formed over at least a portion of the thermal cooler; and
a plurality of **through-silicon vias** providing electrical connections between the first and second dies;
wherein the thermal cooler comprises a plurality of **fluid channels *for fluid cooling*** of the first die and the second die, the plurality of fluid channels being ***formed horizontally through the thermal cooler***; and
wherein the plurality of **through-silicon vias** are formed ***vertically through the first die, the thermal cooler and the second die***.

3. Identify Representative Drawing(s)



1202 - silicon housing of heat sinks

1206-1 through 1206-3 - silicon wafers (heat sinks) having channels 1224 for fluid coolant therein

104, 108, 110 - silicon dies (IC chips)

1216 - TSV in all chips and heat sinks

118 - bumps connecting vertical TSVs (claimed in dependent claims)

Now the examiner starts to “search” – but what does that mean?

Why do Examiners search?

- Determine the state of the art
- Facilitate claim interpretation
  - e.g. what else could the claim cover under BRI?
- Identify relevant prior art
- Determine allowability of an application

How are search strategies developed?

- **Claim interpretation**
  - Read and understand the claimed invention
  - Determine the scope of the claimed invention
- **Review of the cited prior art**
  - Information disclosure statements, 3rd party submissions
- **Review of patent family documents (foreign or domestic)**
- **Review Classification Picture**
- **Review Non-Patent Literature**
- **Consultation with other examiners**

Where do Examiners search?

- **US and International Patent Literature databases, e.g. USPTO databases via EAST/WEST, WIPO, EPO, JPO, etc.**
- **Non-Patent Literature Searching**
  - Anywhere an examiner might find the information they need with evidence of the date of publication or availability. For example: publications, peer-reviewed journal articles, web sites, online libraries, etc.

Patent Office Sites

WIPO PATENTSCOPE

Search International and National Patent Collections

WORLD INTELLECTUAL PROPERTY ORGANIZATION

Search | Browse | Translate | Options | News | Login | Help

Home > IP Services > PATENTSCOPE

Results 1-10 of 953 for Criteria:pill dispenser reminder Office(s):all Language:EN Stemming: true

prev 1 2 3 4 5 6 7 8 9 10 next Page: 1 / 96 Go >

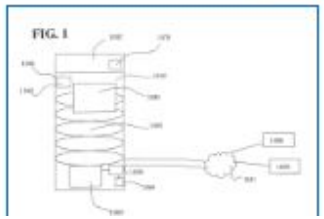
Refine Search pill dispenser reminder Search RSS

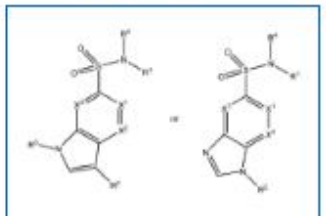
Analysis

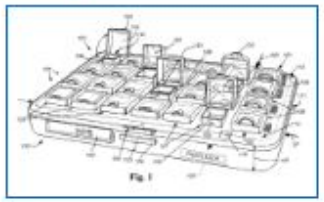
Options Table Graph Options bar pie

Countries		Main IPC		Main Applicant		Main Inventor		Pub Date	
Name	No	Name	No	Name	No	Name	No	Date	No
PCT	722	A61K	247	PFIZER PRODUCTS INC.	92	FENG, Jun	11	2003	57
European Patent Office	161	C07D	187	PFIZER PROD INC	48	CHANG, George	7	2004	62
South Africa	49	A61J	115	TAKEDA PHARMACEUTICAL COMPANY LIMITED	39	DONG, Qing	7	2005	89
Israel	15	G06F	69	DECODE GENETICS EHF.	34	LEE, Andrew, George	7	2006	81
ARIPO	6	A61B	31	TAKEDA SAN DIEGO, INC.	26	CAMERON, Kimberly, O'Keefe	6	2007	91
		G06Q	31	IRONWOOD PHARMACEUTICALS, INC.	22	CURRIE, Mark G.	6	2008	88
		C07C	30	TAKEDA PHARMACEUTICAL	15	MYLARI BANAVARA LAKSHMAN	6	2009	67
		A01N	26	PFIZER PRODUCTS INC	14	MYLARI, Banavara, Lakshman	6	2010	64
		B65D	25	MICROBIA, INC.	11	BRESSI, Jerome, C.	5	2011	63
		C12Q	23	ARIAD PHARMACEUTICALS, INC.	10	BROWN, Jason W.	5	2012	53
								2013	5

Sort by: App Date Desc View Image List Length 10







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Japanese | Top page | Help list | Site map | JPO | INPIT

National Center for Industrial Property Information and Training

Patent & Utility Model | Design | Trademark | Trial & Appeal

Top page > Patent & Utility Model > Patent & Utility Model Search

Patent & Utility Model Search ? Help

Search → List → Detail

The keyword and classification (FI and the F-term, IPC, etc.) which are included in bibliographic items, Claim, etc. are input, and a patent and a published examined utility model application can be searched.

Publication issued, and updates schedule, please refer to the NEWS.

Field Combination | Command line

Patent registration document search

○Yes ◉No

Kind(This choice can be omitted. When you have no check, all Kinds are chosen.)

☐Patent(A, A1, B) ☑Patent specification(C)

☐Utility model(U, U1, A1, Y) ☐Examined utility model specification(Z)

Theme code

You can specify the main theme code (one) and the sub-theme code (up to 9).

5F041 ← F-term

Publication Date(Japanese era or Western era)

e.g. 20150101 ~ e.g. 20150331

Retrieval keyword

Retrieval item selection		Retrieval keyword	Method
Abstract	Including	dicing	OR
AND			
Full text	Including	e.g. 感染を予防	OR

Add

Search

By clicking on "Convert to command line-based search", search keywords will be converted to command line-based search

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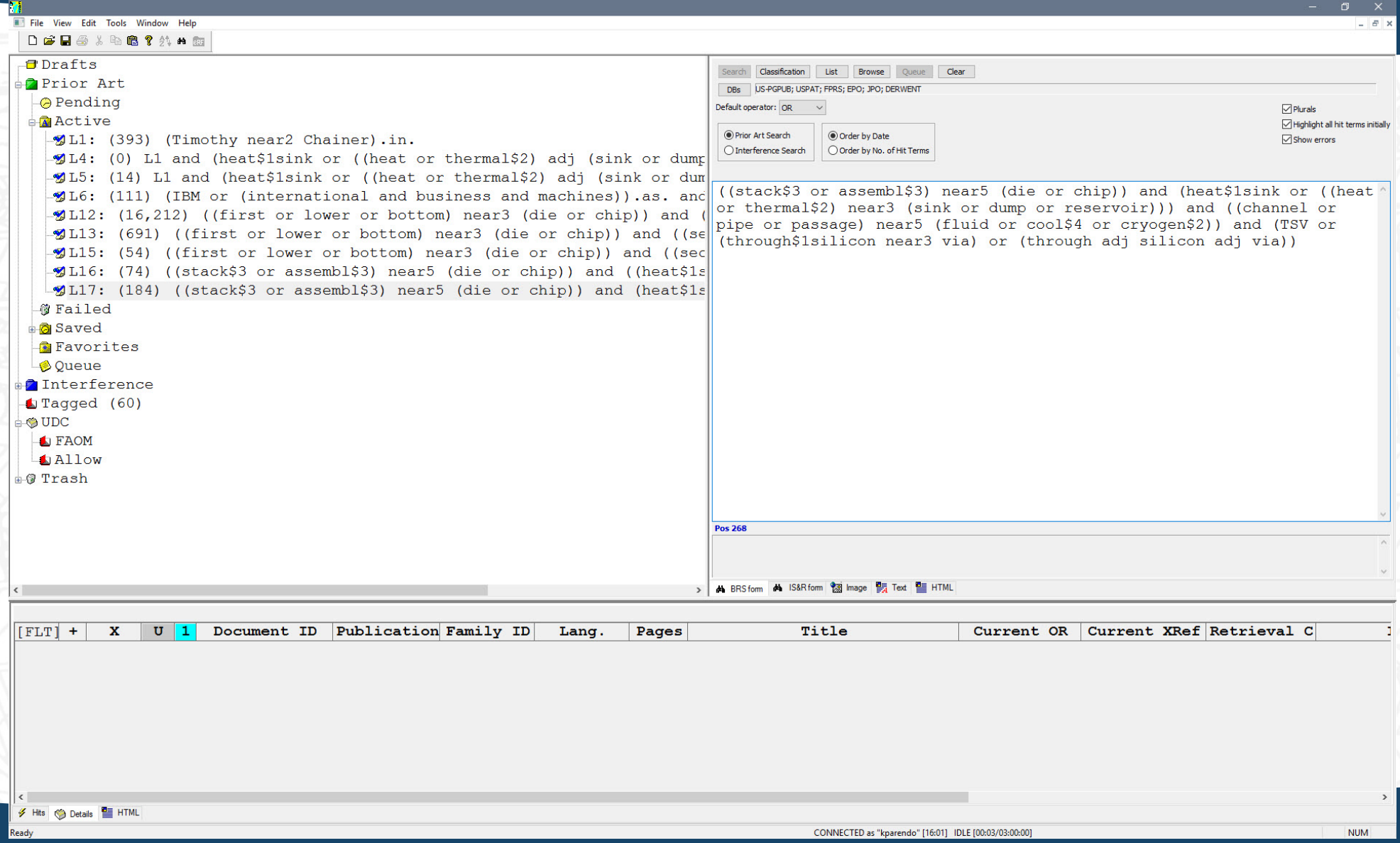

Examiner's Automated Search Tool (EAST)

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What do EAST searches look like?

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App Orientation

1. Read the Specification

2. Read/Interpret the Claims

1. An **apparatus** comprising:
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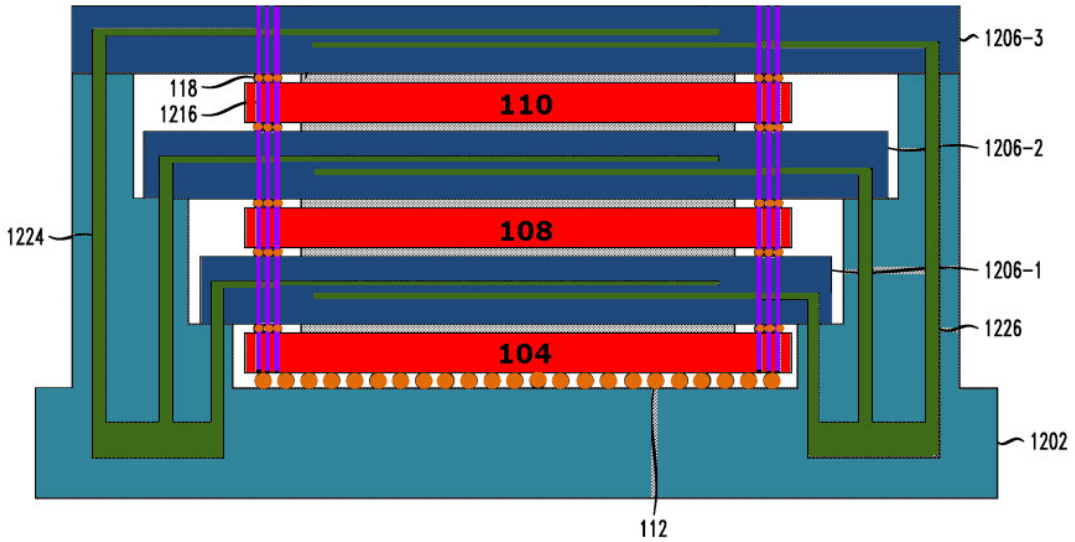

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104, 108, 110 - silicon dies (IC chips)

1216 - TSV in all chips and heat sinks

118 - bumps connecting vertical TSVs (claimed in dependent claims)

4. Devise search queries to find the claimed or disclosed invention)

5. Text Searching

1. An **apparatus** comprising:
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L1: (thermal near3 cooler)

4. Devise search queries to find the claimed or disclosed invention)

5. Text Searching

1. An **apparatus** comprising:
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L2: ((thermal near3 cooler) OR (cool$3 near3 (apparatus or device)) OR heat$1sink OR ((thermal or heat) near3 (sink$3 or dump$3)))

4. Devise search queries to find the claimed or disclosed invention)

5. Text Searching

1. An **apparatus** comprising:
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L3: L2 AND
((second or top or upper$4) near3 (die or chip)) AND
((first or bottom or lower$4) near3 (die or chip))

4. Devise search queries to find the claimed or disclosed invention)

5. Text Searching

1. An **apparatus** comprising:
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L4: L3 AND
((liquid or fluid) near3 (passage$4 or tube or channel))

4. Devise search queries to find the claimed or disclosed invention)

5. Text Searching

Text searching is a useful type of searching.

However, if the prior art uses terms the examiner does not include in the text search, the prior art can not be found.

This limitation of text searching can be remedied by including **CPC searching** as a part of a complete and quality search.

4. Devise search queries to find the claimed or disclosed invention)

5a. Text Searching

5b. CPC Searching

1. An **apparatus** comprising:
a **first die**;
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L5: H01L23/473.cpc.

L6: H01L23/473.cpc. AND H01L 23/481.cpc.

L7: H01L23/473.cpc. AND H01L2225/06589.cpc. AND H01L2225/06541.cpc.

What electronic tools does an examiner use for Search?

- **Docket and Application Viewer (DAV)**
  - View application's documents
- **Search Tools (EAST/WEST, other electronic databases)**

What electronic tools does an examiner use for Search?

- **Docket and Application Viewer (DAV)**
  - View application's documents
- **Search Tools (EAST/WEST, other electronic databases)**
- **Classification Allocation Tool (CAT)**
  - View application's classification information
- **CPC Scheme Navigator**
  - Review scope of classification information
- **Semiconductor Topical Index**

Nexus of Classification & Search

- Classification groups similar technologies for quick and efficient retrieval
- Crosses and connects different languages, semantics, spellings, etc. in a language neutral manner
- Links multiple national offices and publications
- USPTO used to use USPC but now uses CPC

How does CPC searching work?

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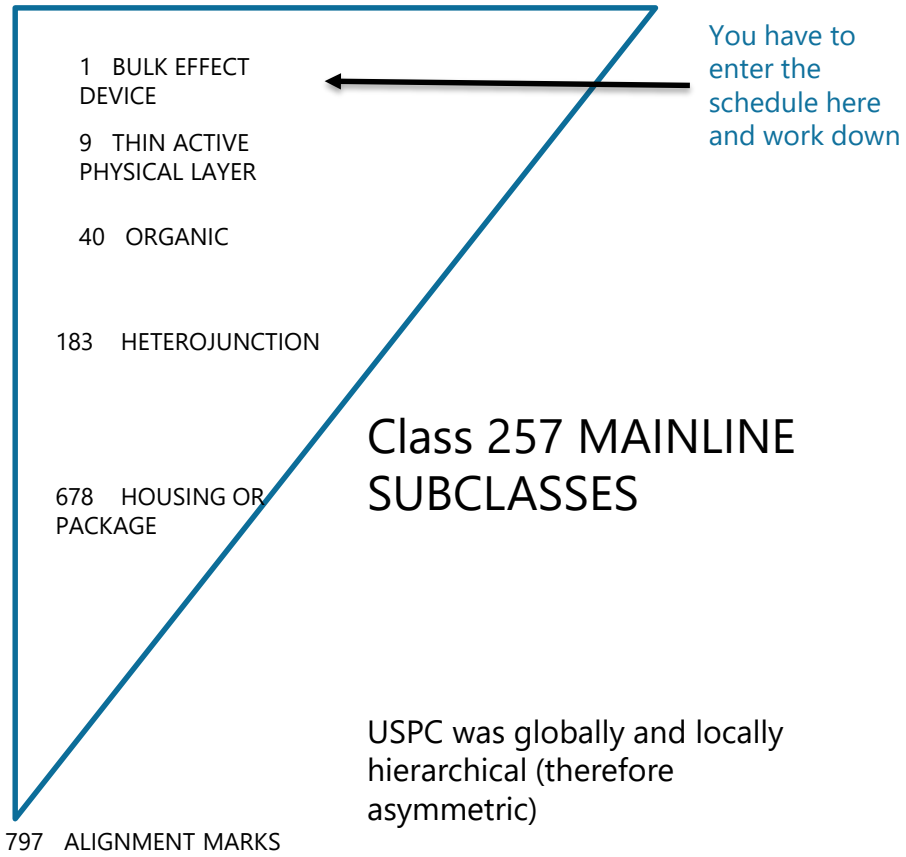
Transitioning from USPC to CPC

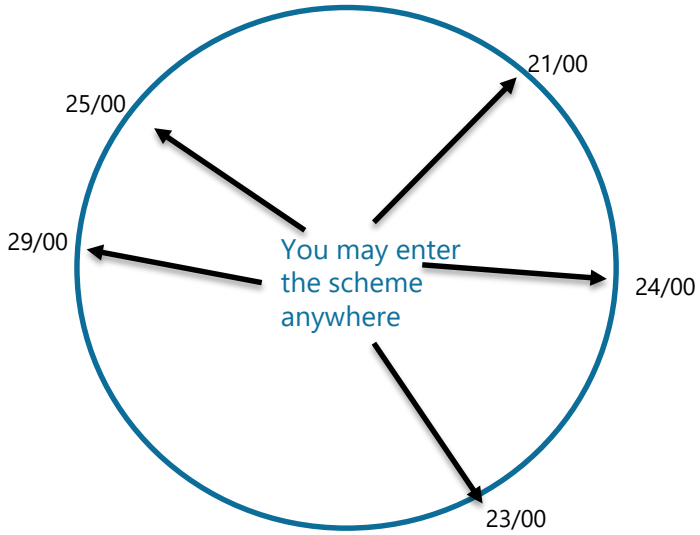
This structure of CPC allows use of classification picture as a tool, e.g. different approach for searching, understanding growth areas, defining related art communities……



Class 257 MAINLINE SUBCLASSES

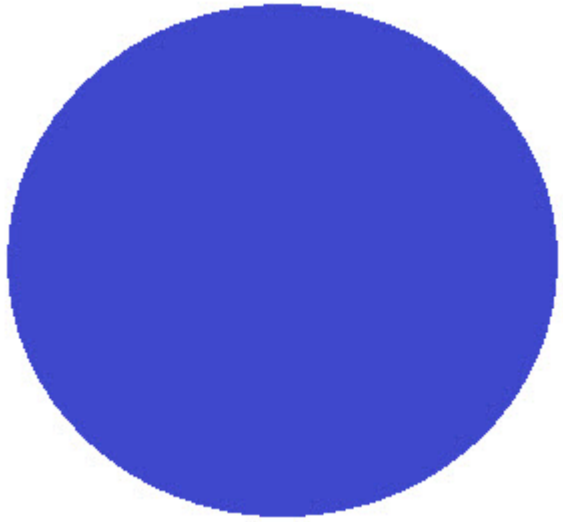
USPC was globally and locally hierarchical (therefore asymmetric)

H01L MAIN GROUPS



CPC is symmetric down to the main group level

CPC and Subgroups

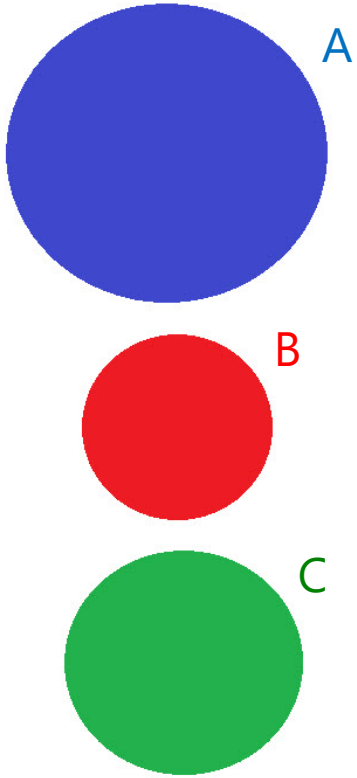


CPC is a "**language neutral**" system designed to collect all **useful** documents relating to a **concept** in a single place, regardless of the text **synonyms** the documents use to describe the concept, and regardless of the preferred synonyms of the classifier.

Simple Example

CPC subgroups describe features or groups of features

- A subgroup represents metadata – it tags the documents with a feature.
- All documents in each subgroup share that feature.



The area of A indicates all documents having the attributes of A – all hammers.

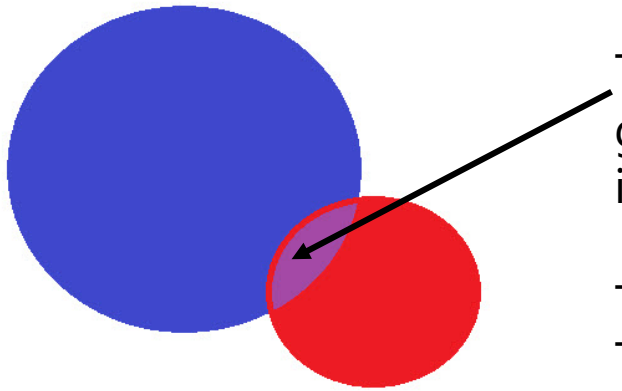
The area of B indicates all documents having the attributes of B – the handle attachment.

The area of C indicates all documents having the attributes of C – type of grip & types of tools included in subgroup.

Searching CPC

"Intersection" CPC subgroup search

An "intersection" CPC subgroup search is a search where you search the overlap between two or more subgroups

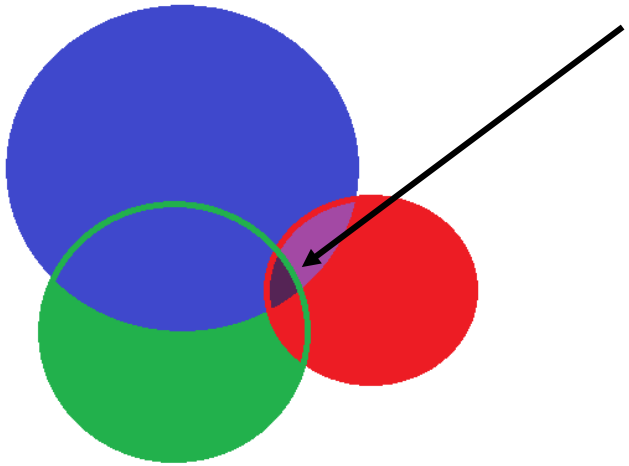


The intersection of A and B,
given by "A and B",
is the purple region of overlap.

The intersection is a subset of A and a subset of B.
The intersection requires all of the properties of both subgroups.

Intersection Searching

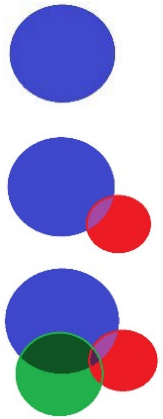
An “intersection” CPC subgroup search is a search where you search the overlap between two or more subgroups



The intersection of A, B, and C,
given by “A and B and C”,
is the darkest purple region of overlap.

The intersection is a subset of each of the three subgroups. The intersection requires all of the properties of all three subgroups.

What does a CPC search actually look like?



L5: H01L23/473.cpc.

L6: H01L23/473.cpc. AND H01L23/481.cpc.

L7: H01L23/473.cpc. AND H01L23/481.cpc. AND H01L2225/06589.cpc.

Benefits: these searches

1) *do not rely on text semantics,*
2) *do not rely on text language or spelling that Applicants used,*
3) *do not rely on text synonyms that prior art references used,*
4) *utilize classifiers' intellectual effort*

How do CPC symbols get applied to an application?

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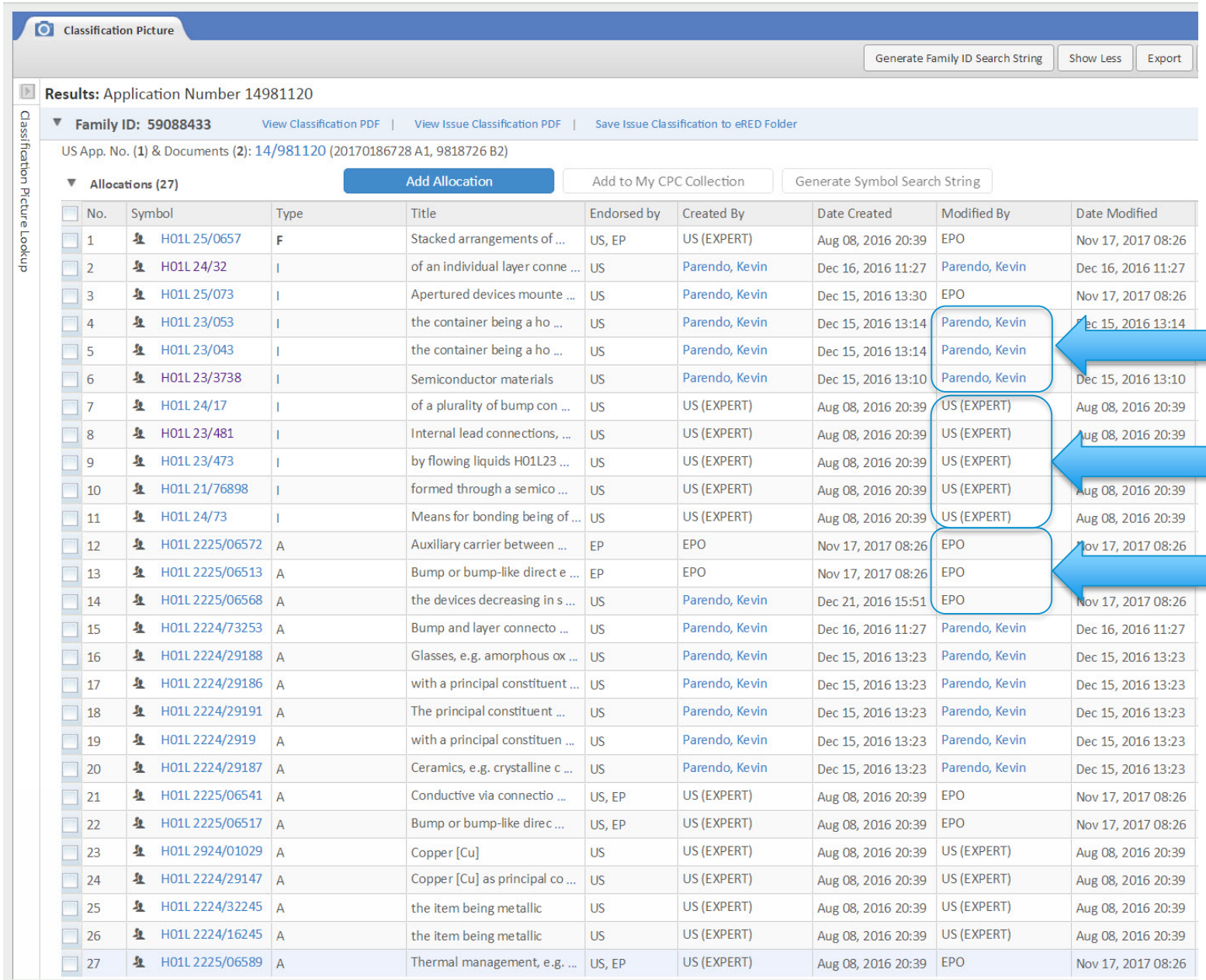
Classification Allocation Tool (CAT)



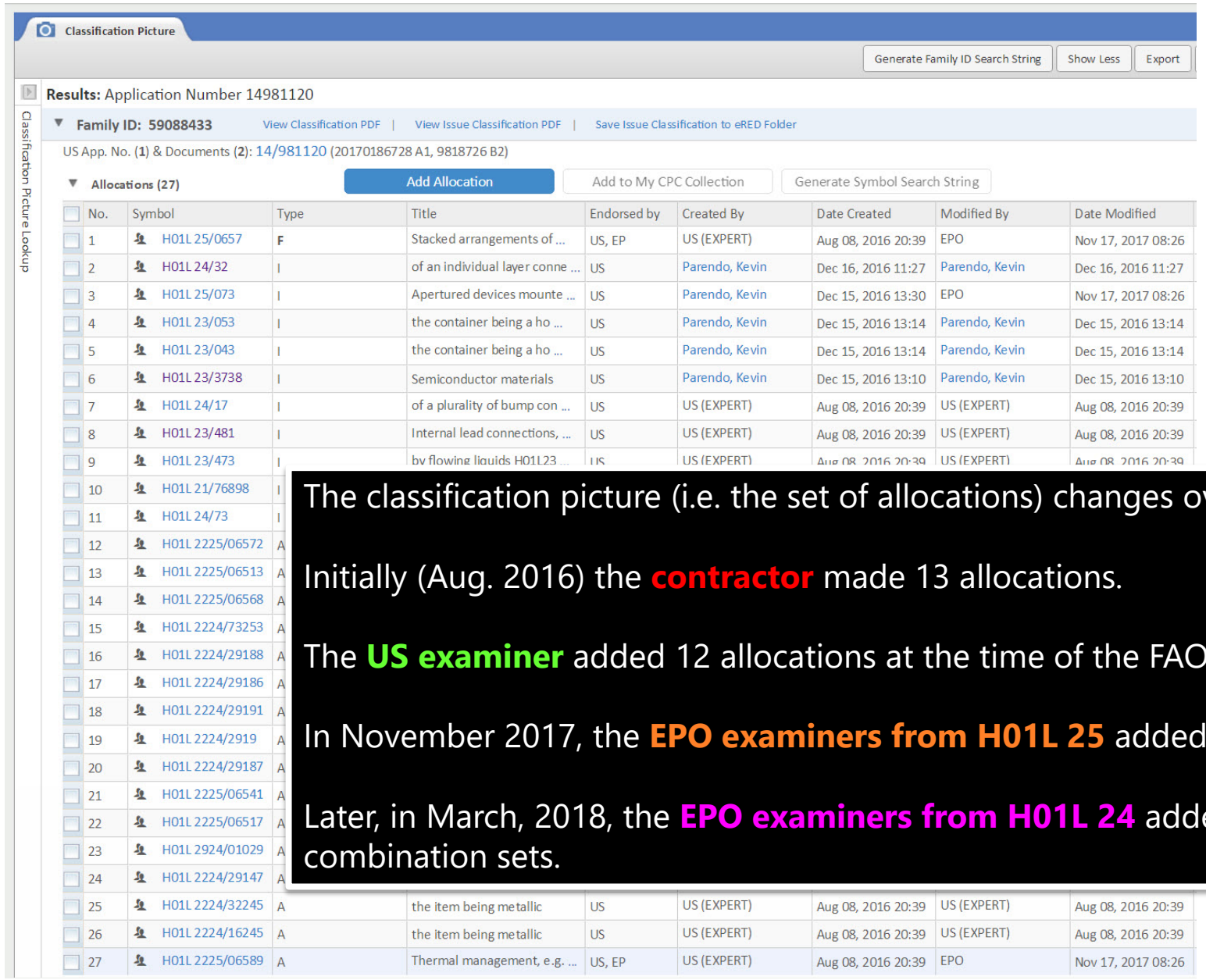
No.	Symbol	Type	Title	Endorsed by	Created By	Date Created	Modified By	Date Modified
1	H01L 25/0657	F	Stacked arrangements of ...	US, EP	US (EXPERT)	Aug 08, 2016 20:39	EPO	Nov 17, 2017 08:26
2	H01L 24/32	I	of an individual layer conne ...	US	Parendo, Kevin	Dec 16, 2016 11:27	Parendo, Kevin	Dec 16, 2016 11:27
3	H01L 25/073	I	Apertured devices mounte ...	US	Parendo, Kevin	Dec 15, 2016 13:30	EPO	Nov 17, 2017 08:26
4	H01L 23/053	I	the container being a ho ...	US	Parendo, Kevin	Dec 15, 2016 13:14	Parendo, Kevin	Dec 15, 2016 13:14
5	H01L 23/043	I	the container being a ho ...	US	Parendo, Kevin	Dec 15, 2016 13:14	Parendo, Kevin	
6	H01L 23/3738	I	Semiconductor materials	US	Parendo, Kevin	Dec 15, 2016 13:10	Parendo, Kevin	Dec 15, 2016 13:10
7	H01L 24/17	I	of a plurality of bump con ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
8	H01L 23/481	I	Internal lead connections, ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
9	H01L 23/473	I	by flowing liquids H01L23 ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	
10	H01L 21/76898	I	formed through a semico ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
11	H01L 24/73	I	Means for bonding being of ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
12	H01L 2225/06572	A	Auxiliary carrier between ...	EP	EPO	Nov 17, 2017 08:26	EPO	Nov 17, 2017 08:26
13	H01L 2225/06513	A	Bump or bump-like direct e ...	EP	EPO	Nov 17, 2017 08:26	EPO	
14	H01L 2225/06568	A	the devices decreasing in s ...	US	Parendo, Kevin	Dec 21, 2016 15:51	EPO	Nov 17, 2017 08:26
15	H01L 2224/73253	A	Bump and layer connecto ...	US	Parendo, Kevin	Dec 16, 2016 11:27	Parendo, Kevin	Dec 16, 2016 11:27
16	H01L 2224/29188	A	Glasses, e.g. amorphous ox ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
17	H01L 2224/29186	A	with a principal constituent ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
18	H01L 2224/29191	A	The principal constituent ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
19	H01L 2224/2919	A	with a principal constituen ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
20	H01L 2224/29187	A	Ceramics, e.g. crystalline c ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
21	H01L 2225/06541	A	Conductive via connectio ...	US, EP	US (EXPERT)	Aug 08, 2016 20:39	EPO	Nov 17, 2017 08:26
22	H01L 2225/06517	A	Bump or bump-like direc ...	US, EP	US (EXPERT)	Aug 08, 2016 20:39	EPO	Nov 17, 2017 08:26
23	H01L 2924/01029	A	Copper [Cu]	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
24	H01L 2224/29147	A	Copper [Cu] as principal co ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
25	H01L 2224/32245	A	the item being metallic	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
26	H01L 2224/16245	A	the item being metallic	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
27	H01L 2225/06589	A	Thermal management, e.g. ...	US, EP	US (EXPERT)	Aug 08, 2016 20:39	EPO	Nov 17, 2017 08:26

Examiner

Contractors

EPO

Classification Allocation Tool (CAT)



No.	Symbol	Type	Title	Endorsed by	Created By	Date Created	Modified By	Date Modified
1	H01L 25/0657	F	Stacked arrangements of ...	US, EP	US (EXPERT)	Aug 08, 2016 20:39	EPO	Nov 17, 2017 08:26
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3	H01L 25/073	I	Apertured devices mounte ...	US	Parendo, Kevin	Dec 15, 2016 13:30	EPO	Nov 17, 2017 08:26
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6	H01L 23/3738	I	Semiconductor materials	US	Parendo, Kevin	Dec 15, 2016 13:10	Parendo, Kevin	Dec 15, 2016 13:10
7	H01L 24/17	I	of a plurality of bump con ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
8	H01L 23/481	I	Internal lead connections, ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
9	H01L 23/473	I	by flowing liquids H01L23 ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
10	H01L 21/76898	I						
11	H01L 24/73	I						
12	H01L 2225/06572	A						
13	H01L 2225/06513	A						
14	H01L 2225/06568	A						
15	H01L 2224/73253	A						
16	H01L 2224/29188	A						
17	H01L 2224/29186	A						
18	H01L 2224/29191	A						
19	H01L 2224/2919	A						
20	H01L 2224/29187	A						
21	H01L 2225/06541	A						
22	H01L 2225/06517	A						
23	H01L 2924/01029	A						
24	H01L 2224/29147	A						
25	H01L 2224/32245	A	the item being metallic	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
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The classification picture (i.e. the set of allocations) changes over time.

Initially (Aug. 2016) the **contractor** made 13 allocations.

The **US examiner** added 12 allocations at the time of the FAOM (Dec. 2016).

In November 2017, the **EPO examiners from H01L 25** added 2 allocations.

Later, in March, 2018, the **EPO examiners from H01L 24** added 19 allocations and 5 combination sets.

How do examiners find symbols to apply?

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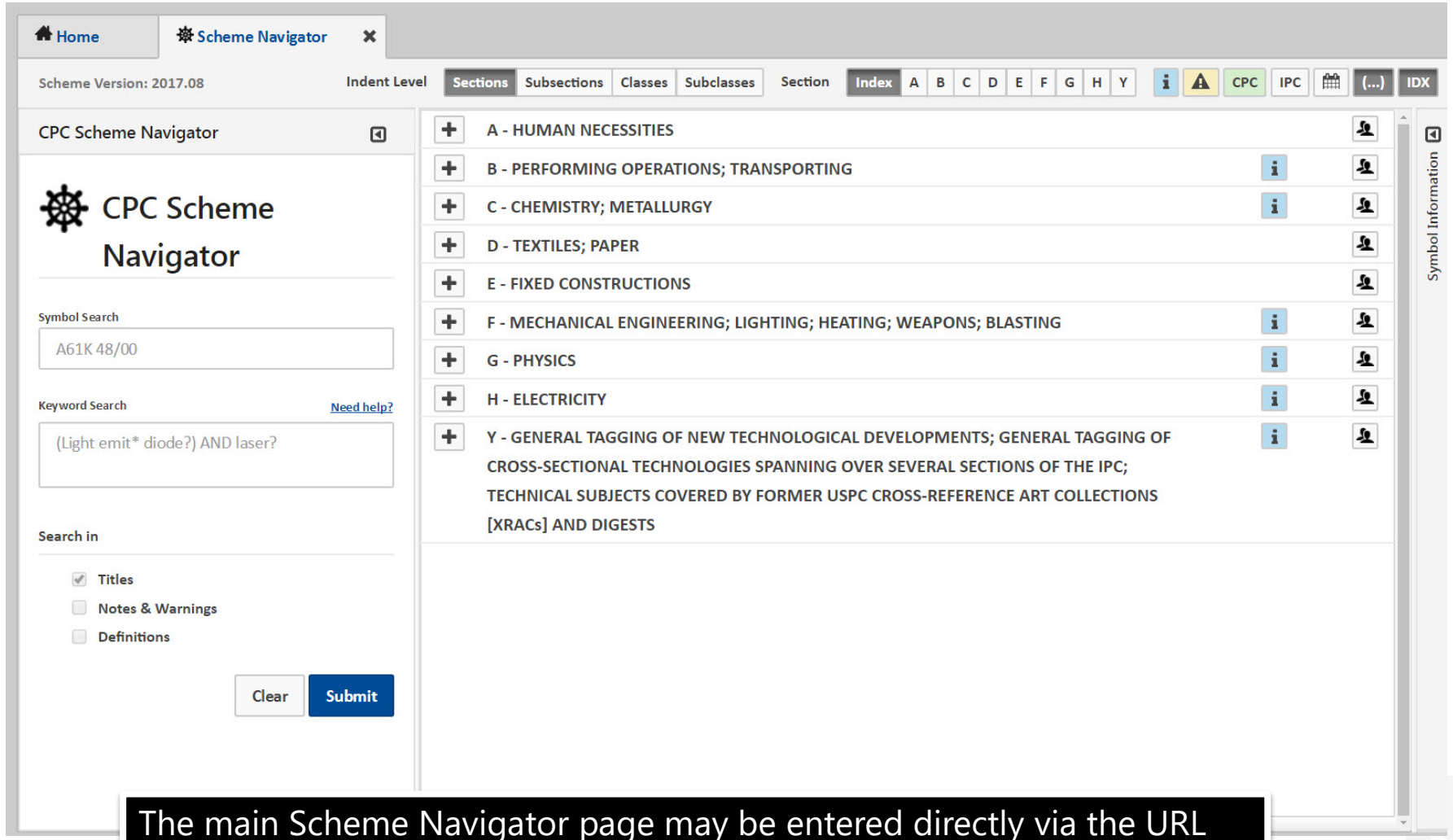
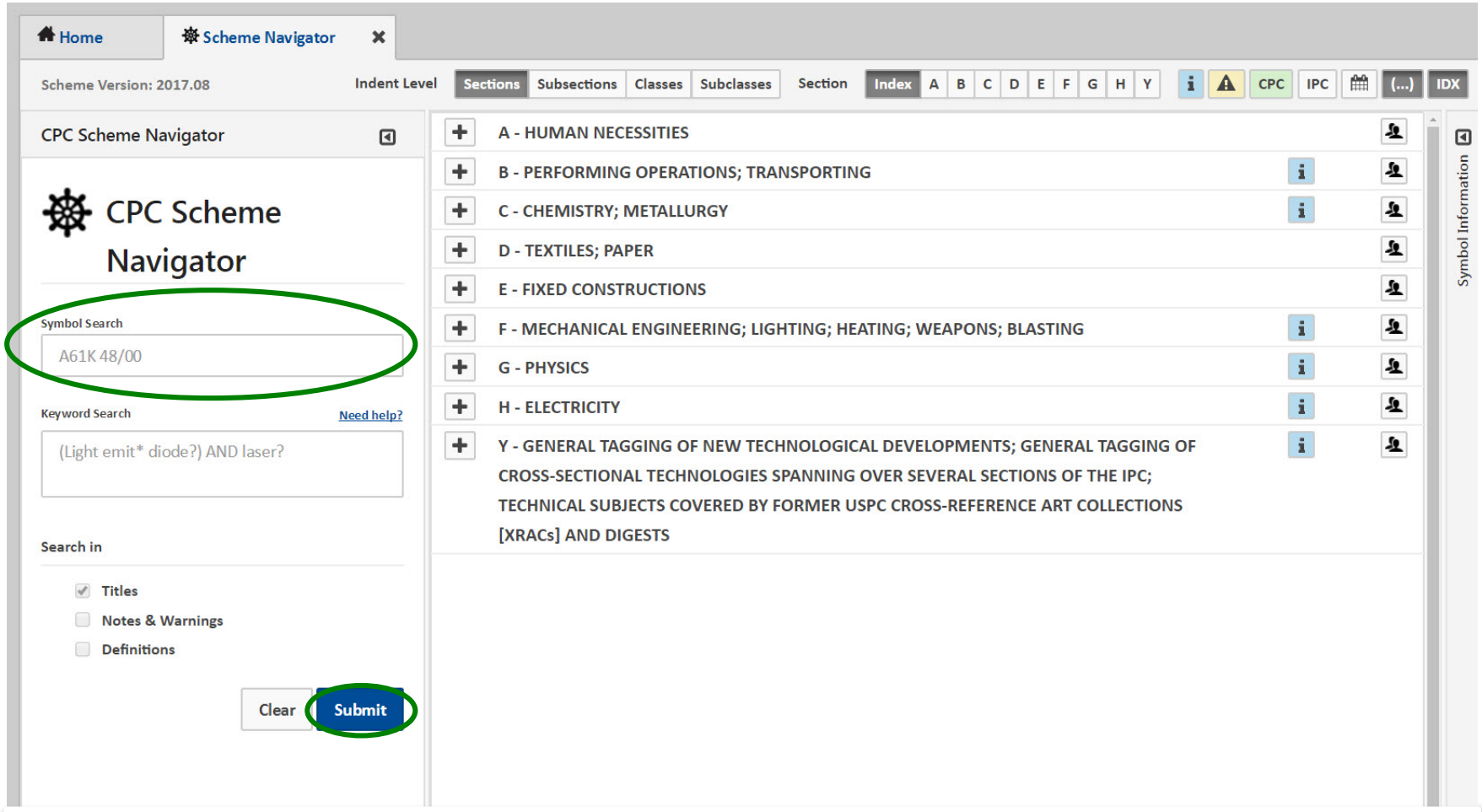
Scheme Navigator



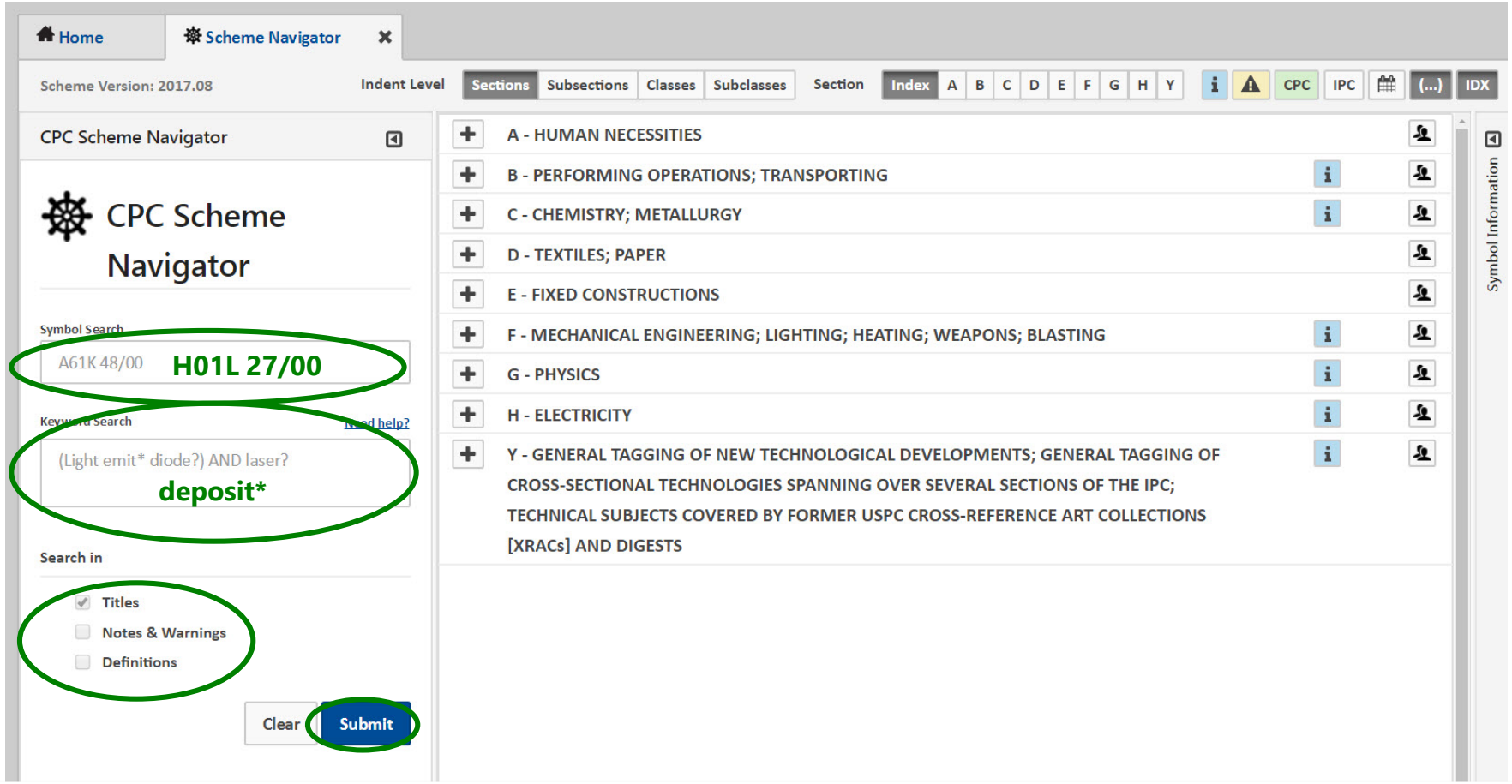
The main Scheme Navigator page may be entered directly via the URL https://www.cpc-ce.org/#/schemeNavigator.

Scheme Navigator



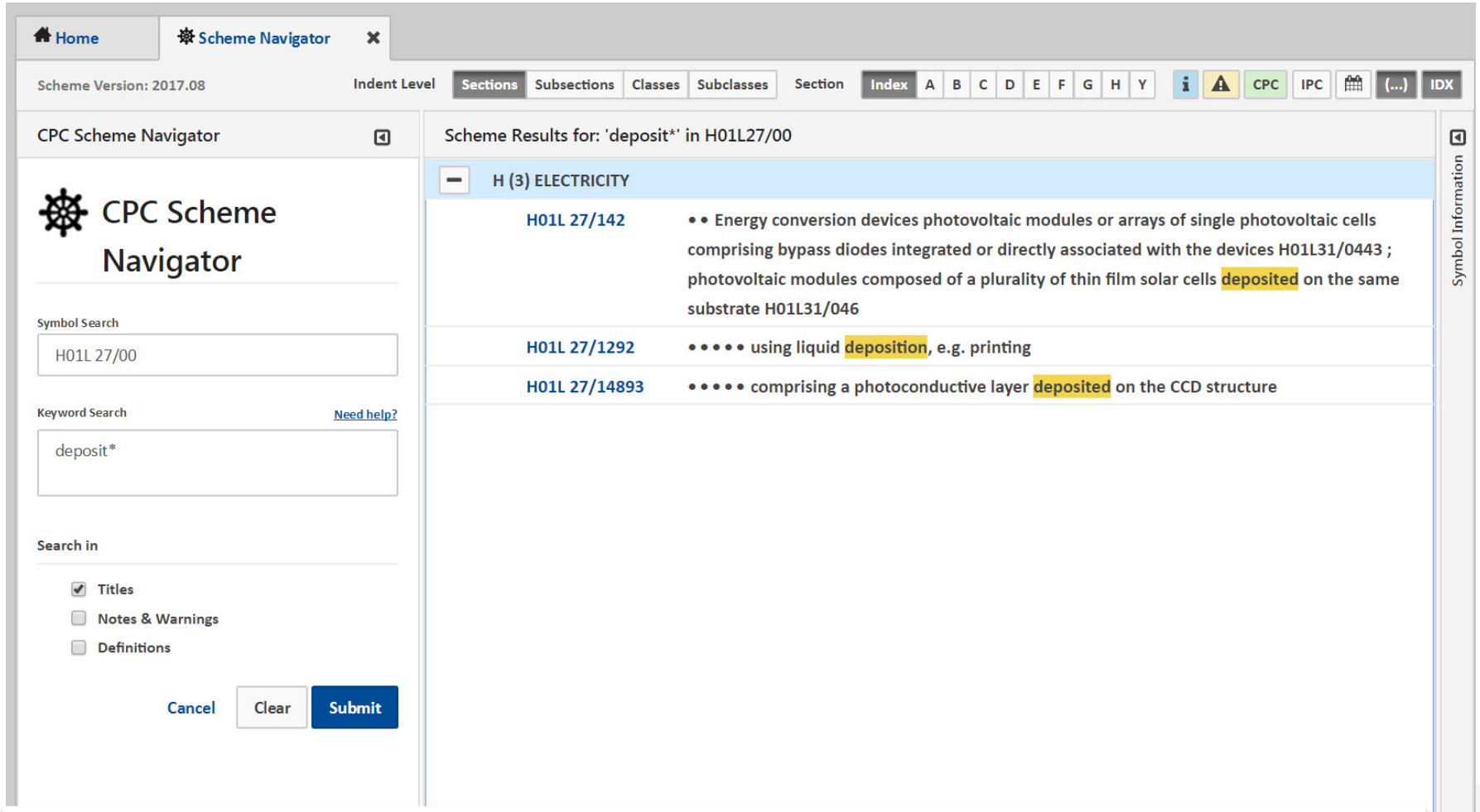
The scheme navigator is a good tool to view a symbol's hierarchy. We have seen that previously, as accessed by CAT. To do so from the main Scheme Navigator page, merely enter in the symbol information at the upper left corner and click "submit".

Scheme Navigator



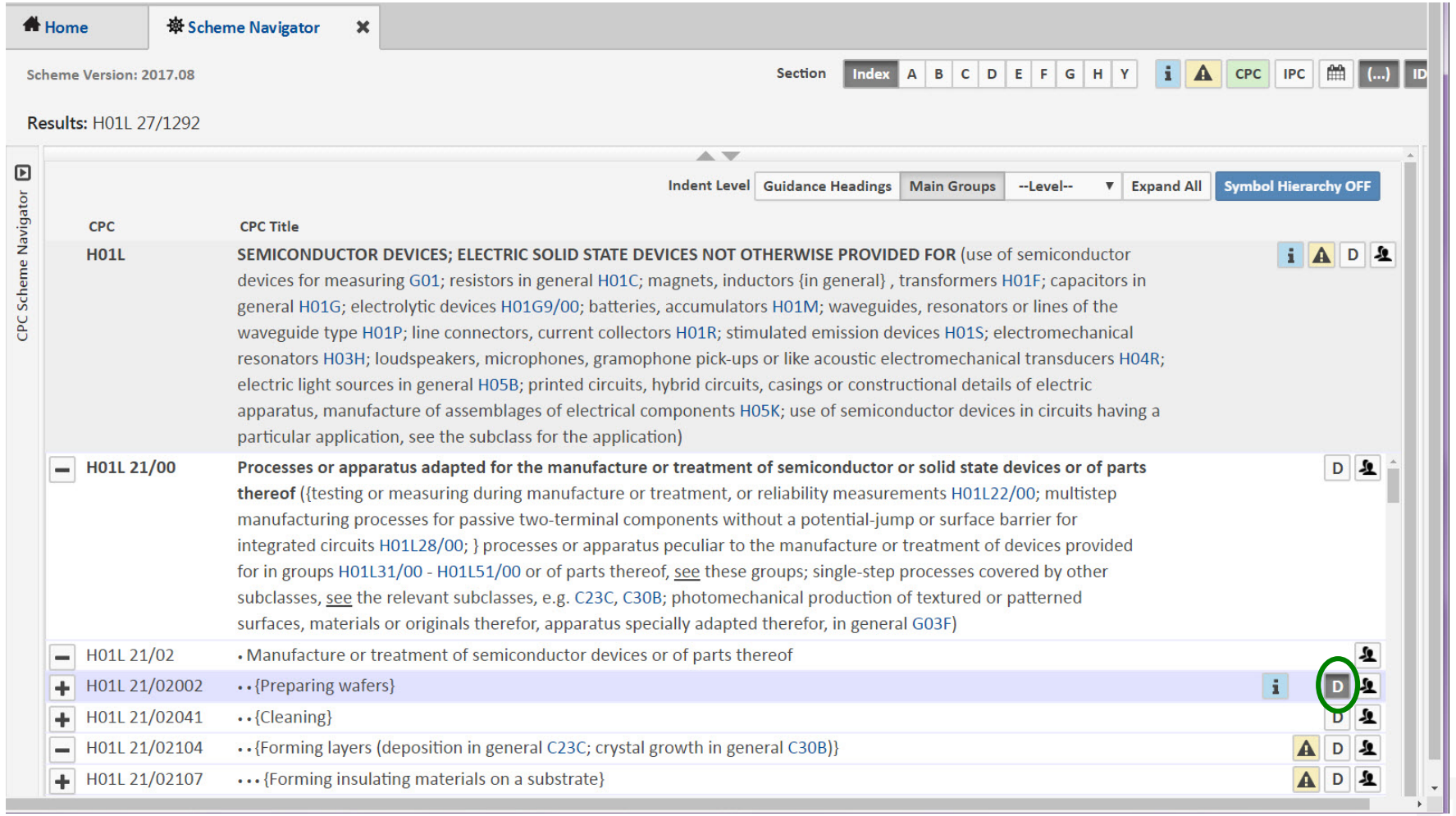
The scheme navigator allows for good searches. You may search the titles, notes/warnings, and/or definitions of the scheme. You may optionally limit the search to H01L, H01L 27/00, etc., by entering that information in the "symbol search" box. If you do not put an entry in "symbol search", the entire CPC scheme will be searched. You can use ? or * as a wildcard. The search utilizes the Boolean operators AND, OR, NOT.

Scheme Navigator



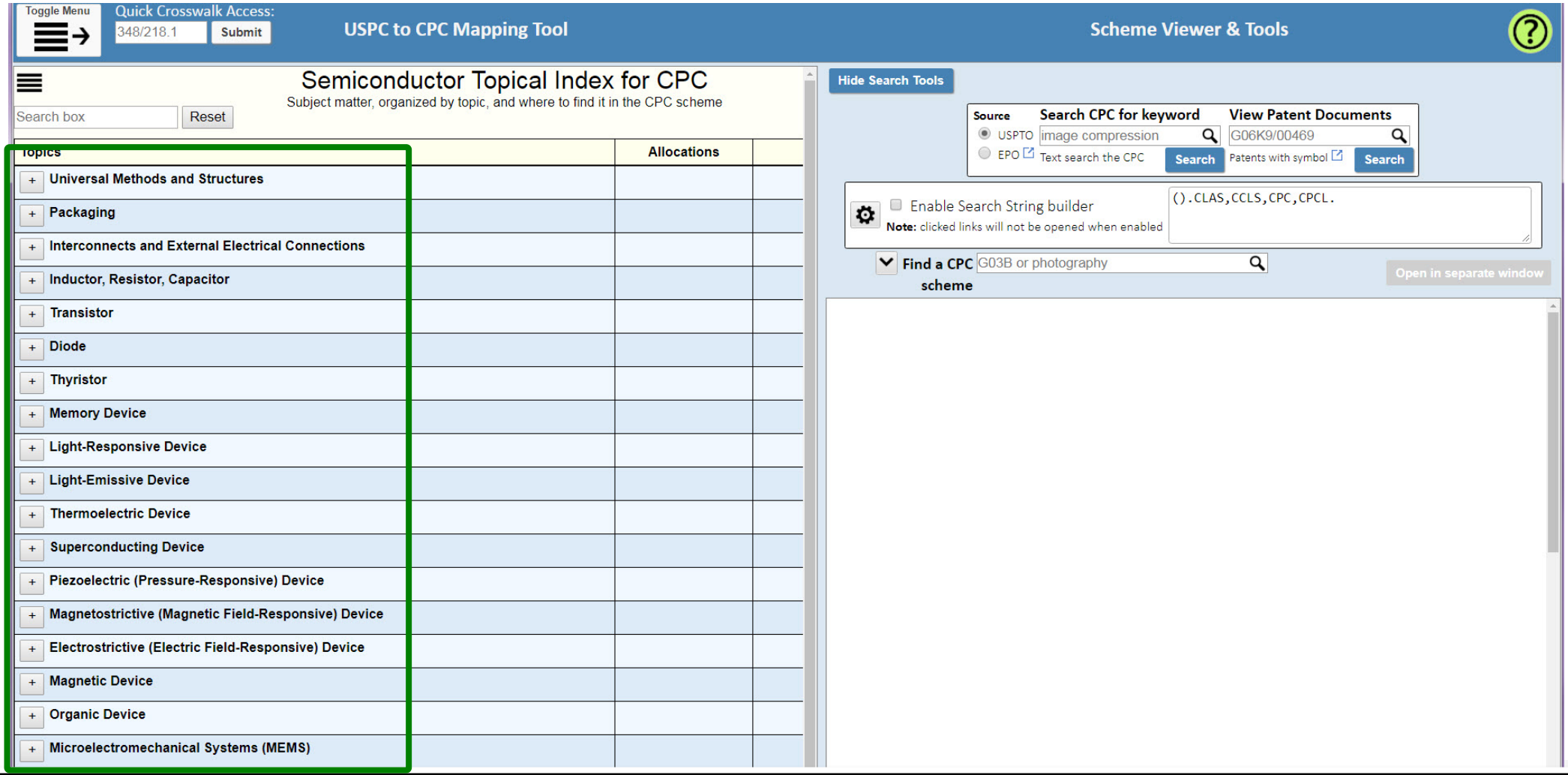
Once you have searched, key-word-in-context search results appear. You may click on one and show the hierarchy to see the full scope of the subgroup.

Scheme Navigator



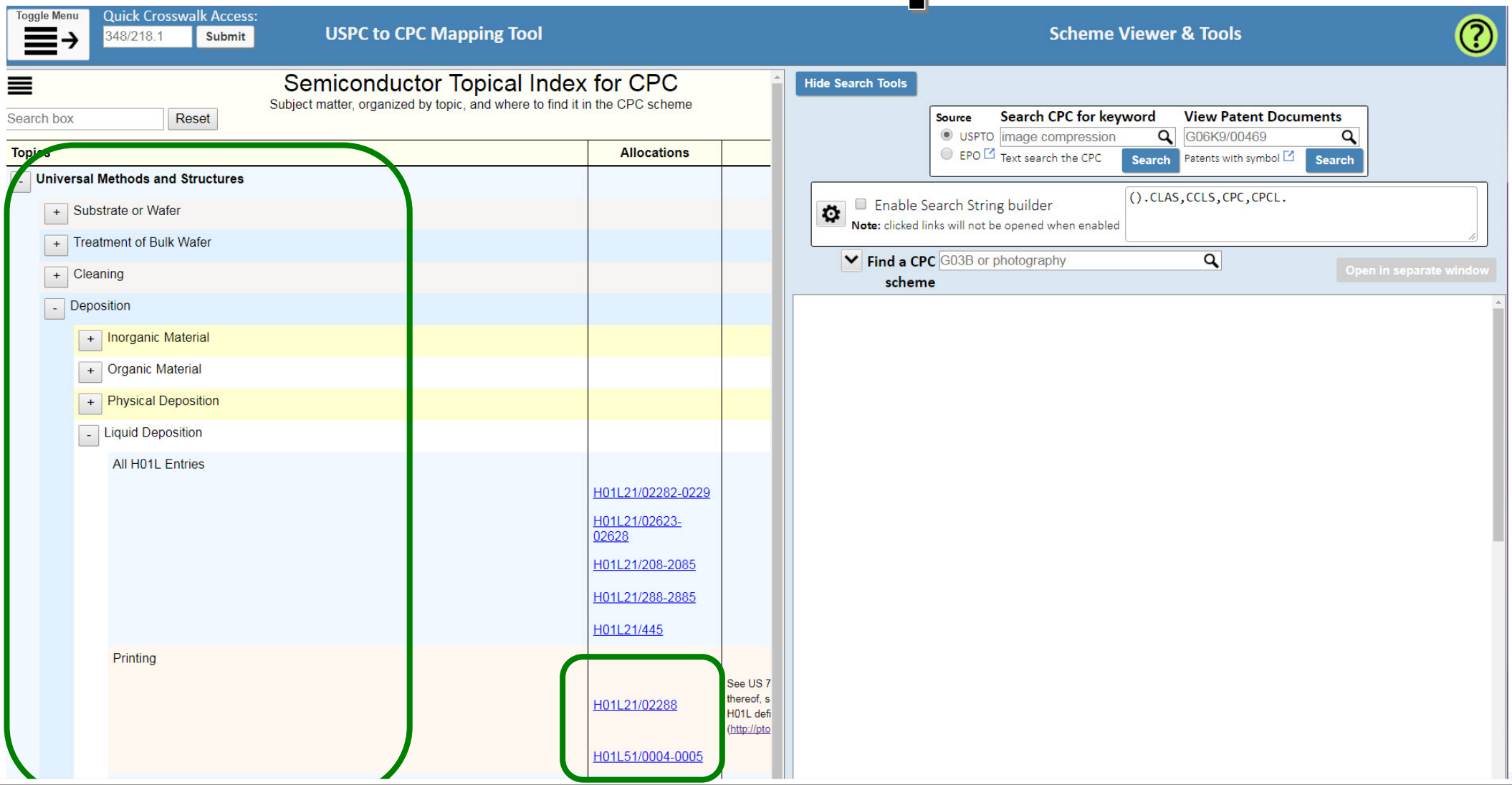
The scheme definitions may be viewed in the scheme navigator.

Semiconductor Topical Index



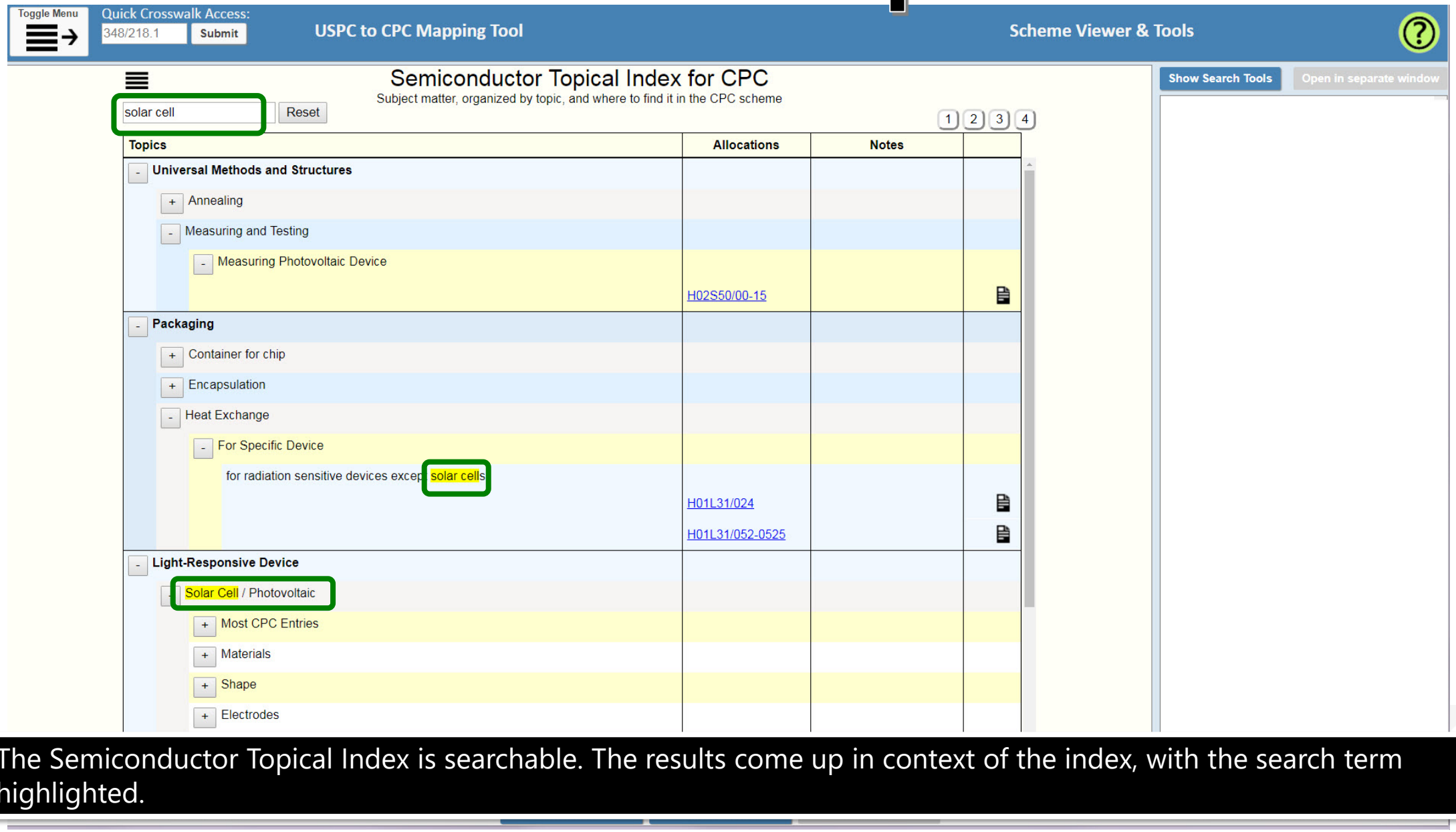
The Semiconductor Topical Index orders topics and subtopics in the general order of the H01L scheme. The language that is used is generally simpler than is used in the CPC scheme. Also, it is much easier and quicker to find the topics that you want to find than it is to find them in the scheme itself. The topics are generally ordered in the order of H01L.

Semiconductor Topical Index



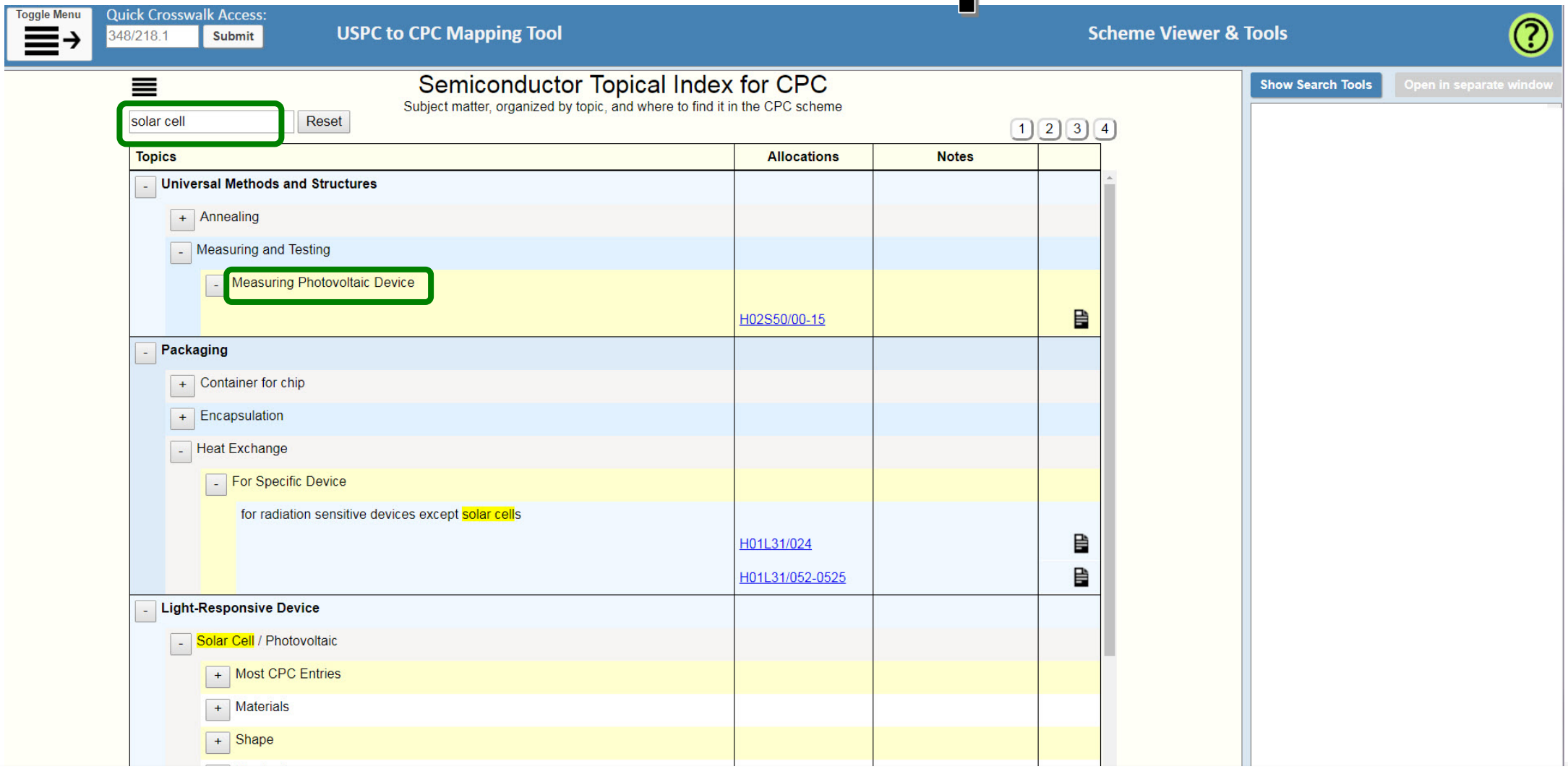
One can quickly expand through topics and subtopics in order to find a desired idea. For instance, one may find liquid deposition by choosing universal methods / Deposition. Clicking on liquid deposition gives the subtopics under it, such as printing, spraying, etc. The locations in CPC are listed in the “allocations” column.

Semiconductor Topical Index



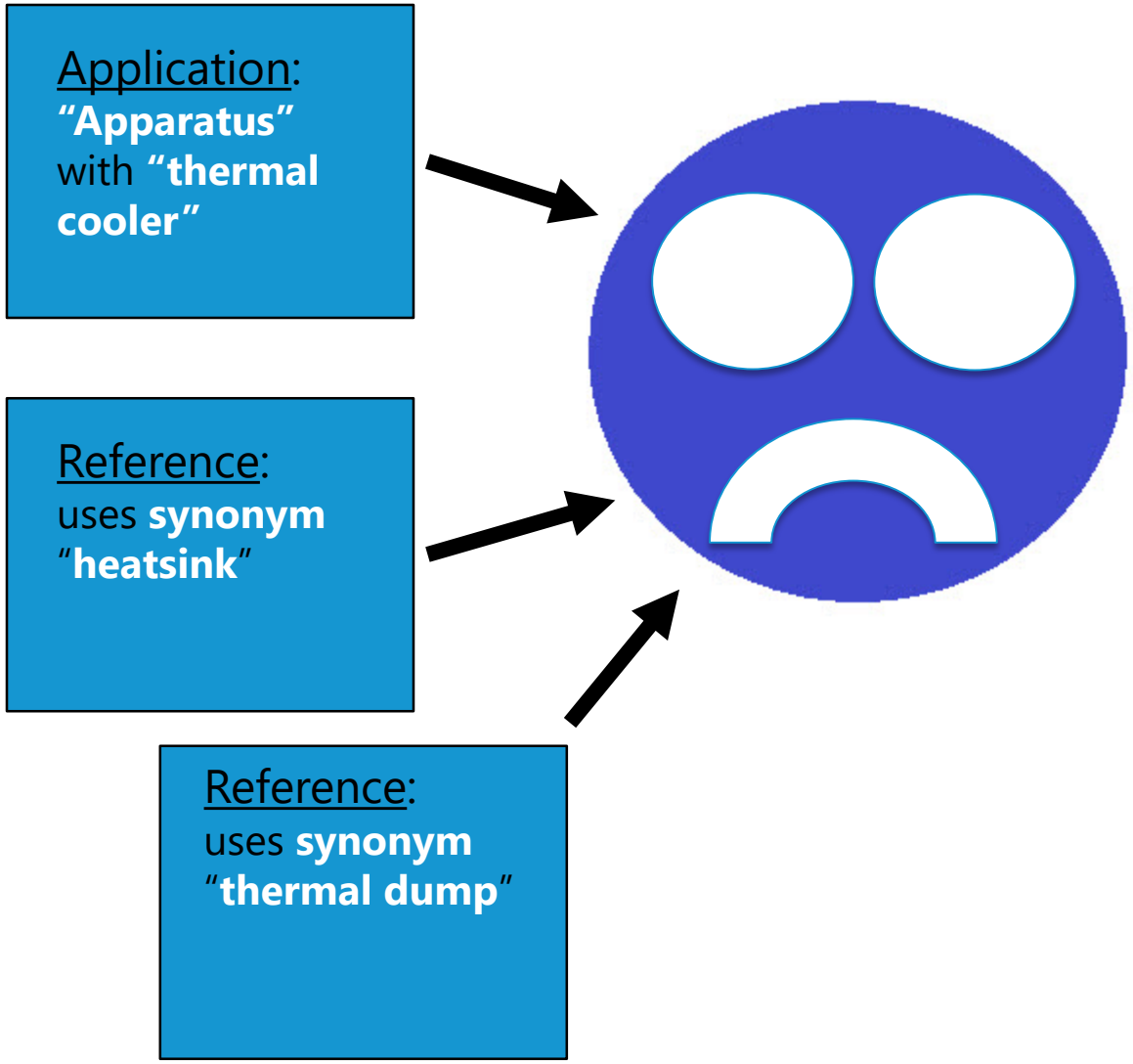
The Semiconductor Topical Index is searchable. The results come up in context of the index, with the search term highlighted.

Semiconductor Topical Index



Hidden synonyms enable relevant topics to be found, even if the searched term does not exactly match the topic's title. This ensures that relevant CPC subgroups may be found even if a user does not know the terminology used by the CPC scheme or by the Semiconductor Topical Index.

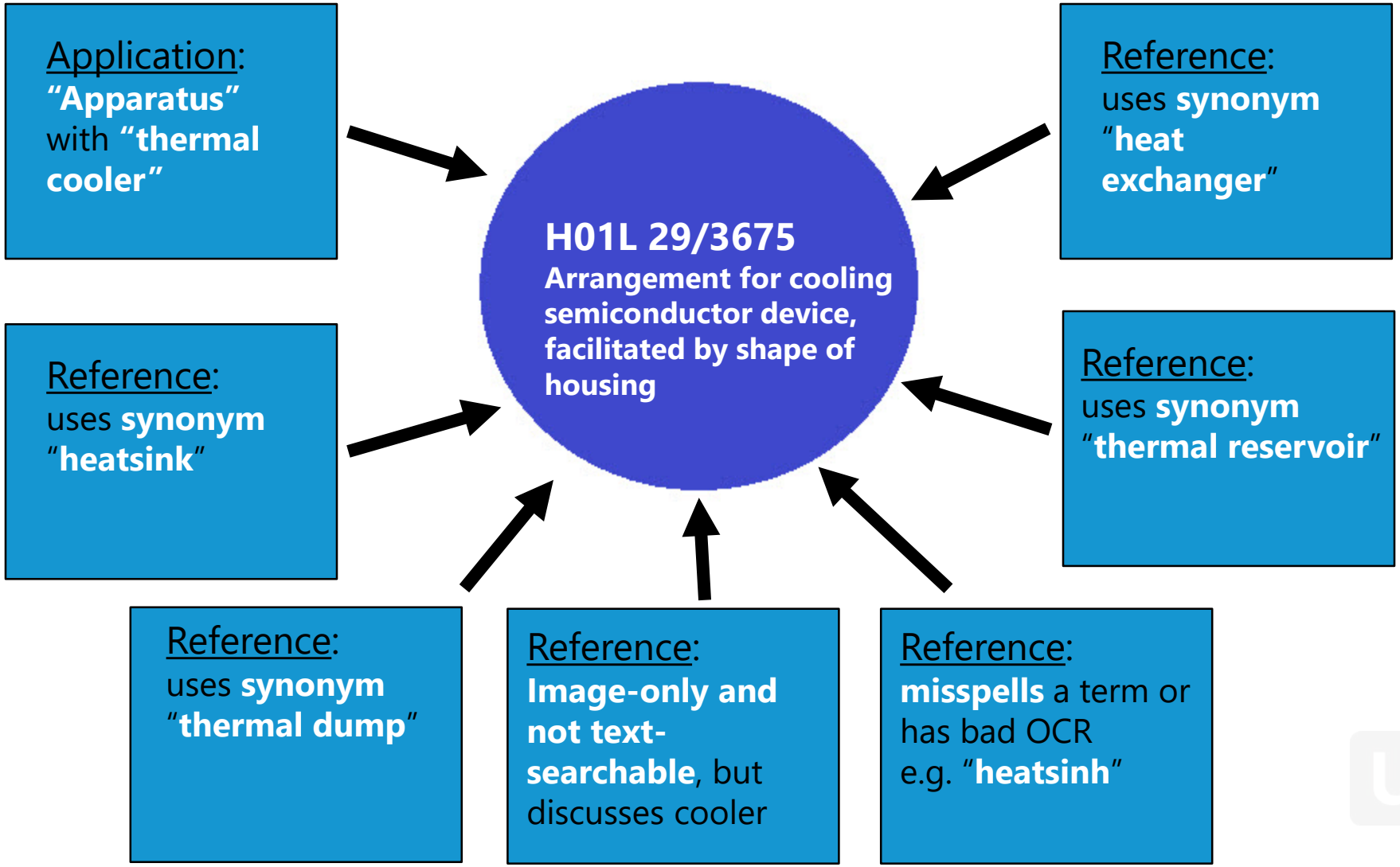
Finding prior art by text searching

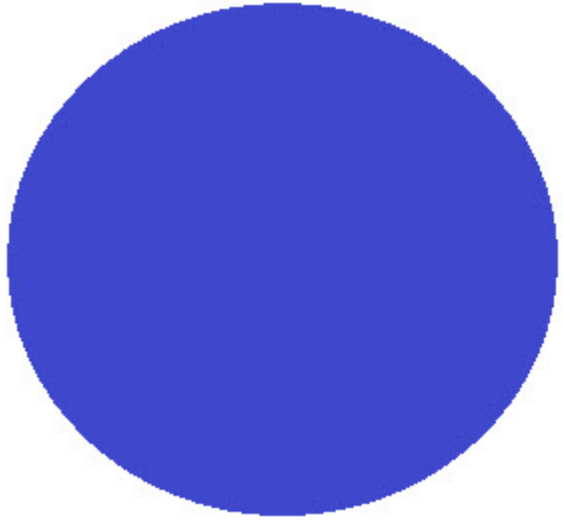


Imagine these are the synonyms you know, or that you gather from references in preliminary searches.

If these are the only synonyms you text search for, you will **miss** prior art that use **other terms**.

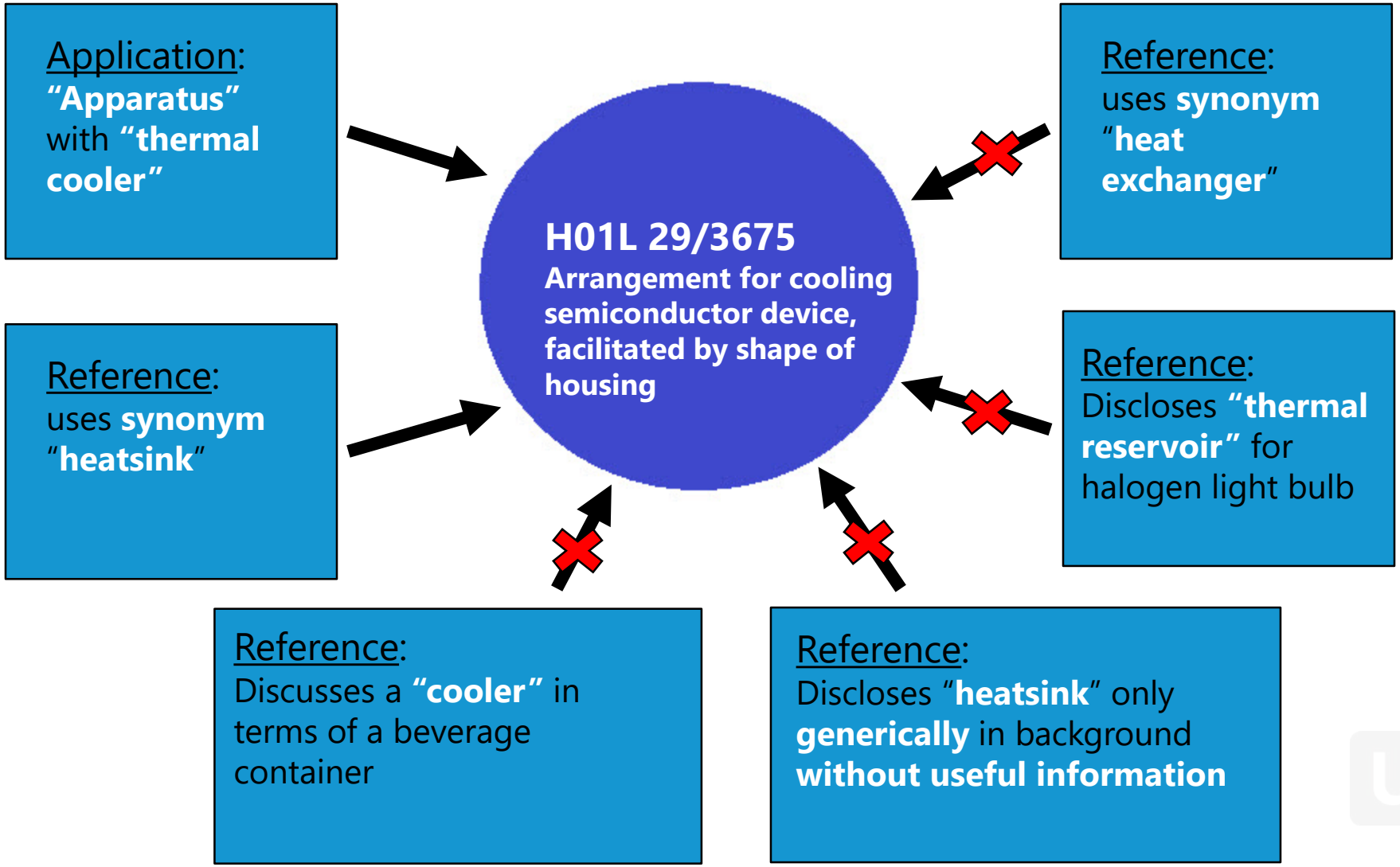
Searching CPC fills in the gaps





CPC is a “**language neutral**” system designed to collect all **useful** documents relating to a **concept** in a single place, regardless of the text **synonyms** the documents use to describe the concept, and regardless of the preferred synonyms of the classifier.

What CPC searches do not find



CPC harmonizes search strategies

The effective use of CPC provides the examiner and the Applicant more certainty and confidence that a complete, quality search of the prior art has been performed because it is **language neutral**.

Applying CPC to Search: Example Application

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1. An **apparatus** comprising:

a **first die**;

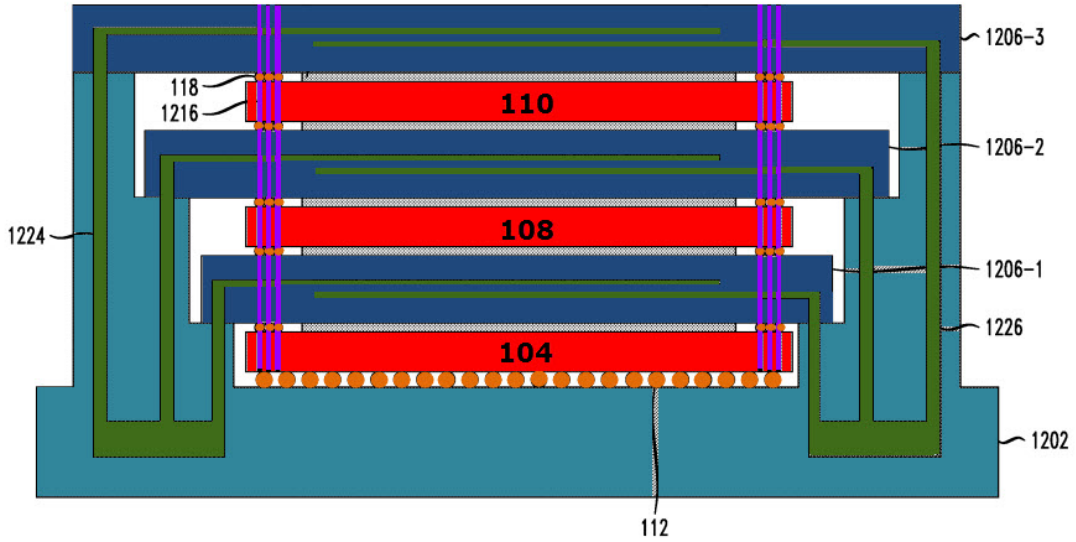
a **thermal cooler** formed over at least a portion of the first die;

a **second die** formed over at least a portion of the thermal cooler; and

a plurality of **through-silicon vias** providing electrical connections between the first and second dies;

wherein the thermal cooler comprises a plurality of **fluid channels *for fluid cooling*** of the first die and the second die, the plurality of fluid channels being ***formed horizontally through the thermal cooler***; and

wherein the plurality of **through-silicon vias** are formed ***vertically through the first die, the thermal cooler and the second die***.



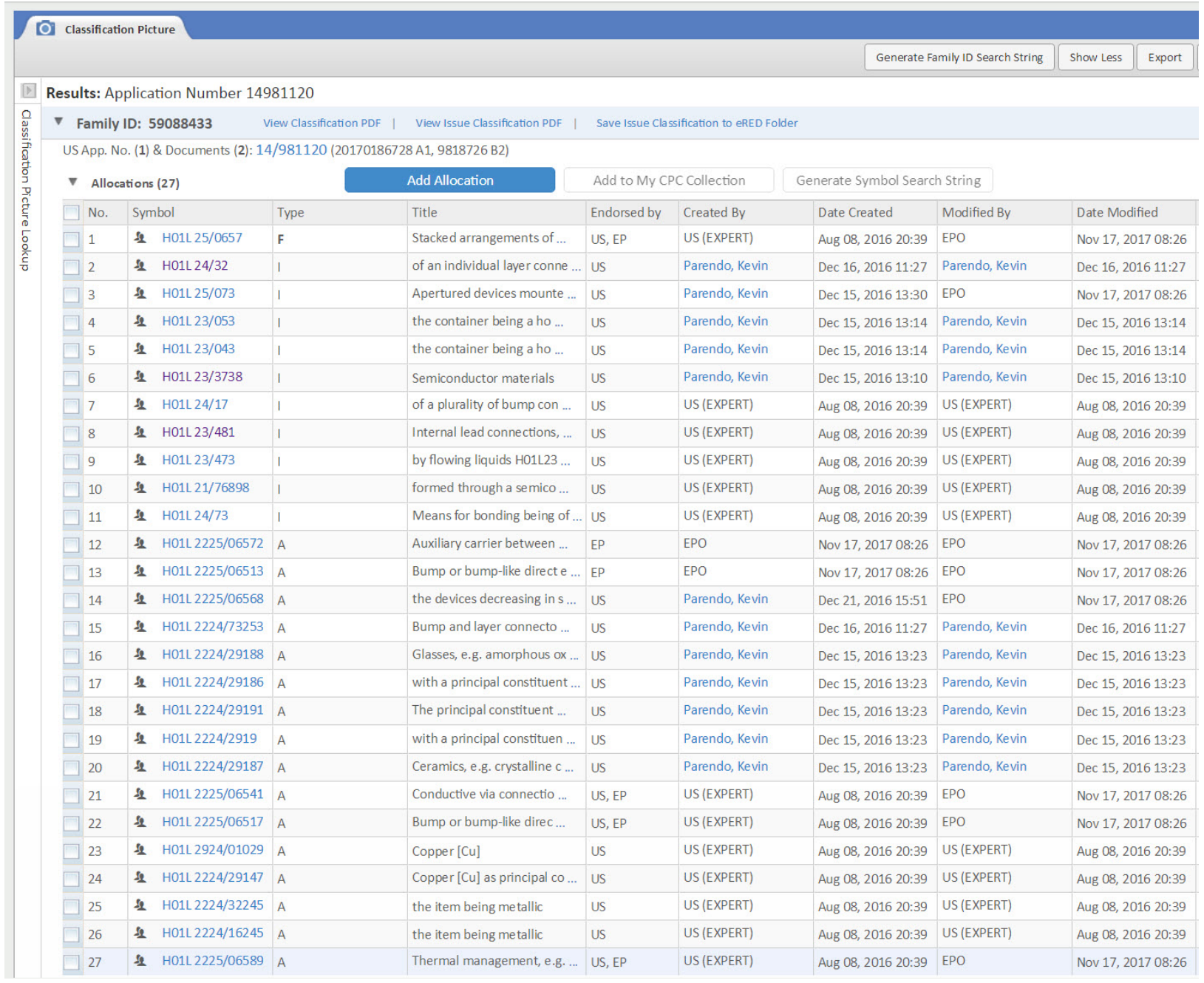
1202 - silicon housing of heat sinks

1206-1 through 1206-3 - silicon wafers (heat sinks) having channels 1224 for fluid coolant therein

104, 108, 110 - silicon dies (IC chips)

1216 - TSV in all chips and heat sinks

118 - bumps connecting vertical TSVs (claimed in dependent claims)



No.	Symbol	Type	Title	Endorsed by	Created By	Date Created	Modified By	Date Modified
1	H01L 25/0657	F	Stacked arrangements of ...	US, EP	US (EXPERT)	Aug 08, 2016 20:39	EPO	Nov 17, 2017 08:26
2	H01L 24/32	I	of an individual layer conne ...	US	Parendo, Kevin	Dec 16, 2016 11:27	Parendo, Kevin	Dec 16, 2016 11:27
3	H01L 25/073	I	Apertured devices mounte ...	US	Parendo, Kevin	Dec 15, 2016 13:30	EPO	Nov 17, 2017 08:26
4	H01L 23/053	I	the container being a ho ...	US	Parendo, Kevin	Dec 15, 2016 13:14	Parendo, Kevin	Dec 15, 2016 13:14
5	H01L 23/043	I	the container being a ho ...	US	Parendo, Kevin	Dec 15, 2016 13:14	Parendo, Kevin	Dec 15, 2016 13:14
6	H01L 23/3738	I	Semiconductor materials	US	Parendo, Kevin	Dec 15, 2016 13:10	Parendo, Kevin	Dec 15, 2016 13:10
7	H01L 24/17	I	of a plurality of bump con ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
8	H01L 23/481	I	Internal lead connections, ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
9	H01L 23/473	I	by flowing liquids H01L23 ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
10	H01L 21/76898	I	formed through a semico ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
11	H01L 24/73	I	Means for bonding being of ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
12	H01L 2225/06572	A	Auxiliary carrier between ...	EP	EPO	Nov 17, 2017 08:26	EPO	Nov 17, 2017 08:26
13	H01L 2225/06513	A	Bump or bump-like direct e ...	EP	EPO	Nov 17, 2017 08:26	EPO	Nov 17, 2017 08:26
14	H01L 2225/06568	A	the devices decreasing in s ...	US	Parendo, Kevin	Dec 21, 2016 15:51	EPO	Nov 17, 2017 08:26
15	H01L 2224/73253	A	Bump and layer connecto ...	US	Parendo, Kevin	Dec 16, 2016 11:27	Parendo, Kevin	Dec 16, 2016 11:27
16	H01L 2224/29188	A	Glasses, e.g. amorphous ox ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
17	H01L 2224/29186	A	with a principal constituent ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
18	H01L 2224/29191	A	The principal constituent ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
19	H01L 2224/2919	A	with a principal constituen ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
20	H01L 2224/29187	A	Ceramics, e.g. crystalline c ...	US	Parendo, Kevin	Dec 15, 2016 13:23	Parendo, Kevin	Dec 15, 2016 13:23
21	H01L 2225/06541	A	Conductive via connectio ...	US, EP	US (EXPERT)	Aug 08, 2016 20:39	EPO	Nov 17, 2017 08:26
22	H01L 2225/06517	A	Bump or bump-like direc ...	US, EP	US (EXPERT)	Aug 08, 2016 20:39	EPO	Nov 17, 2017 08:26
23	H01L 2924/01029	A	Copper [Cu]	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
24	H01L 2224/29147	A	Copper [Cu] as principal co ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
25	H01L 2224/32245	A	the item being metallic	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
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Step 1: View the classification picture in the Classification Allocation Tool

Step 2: Determine the scope of each allocated subgroup in a scheme viewer

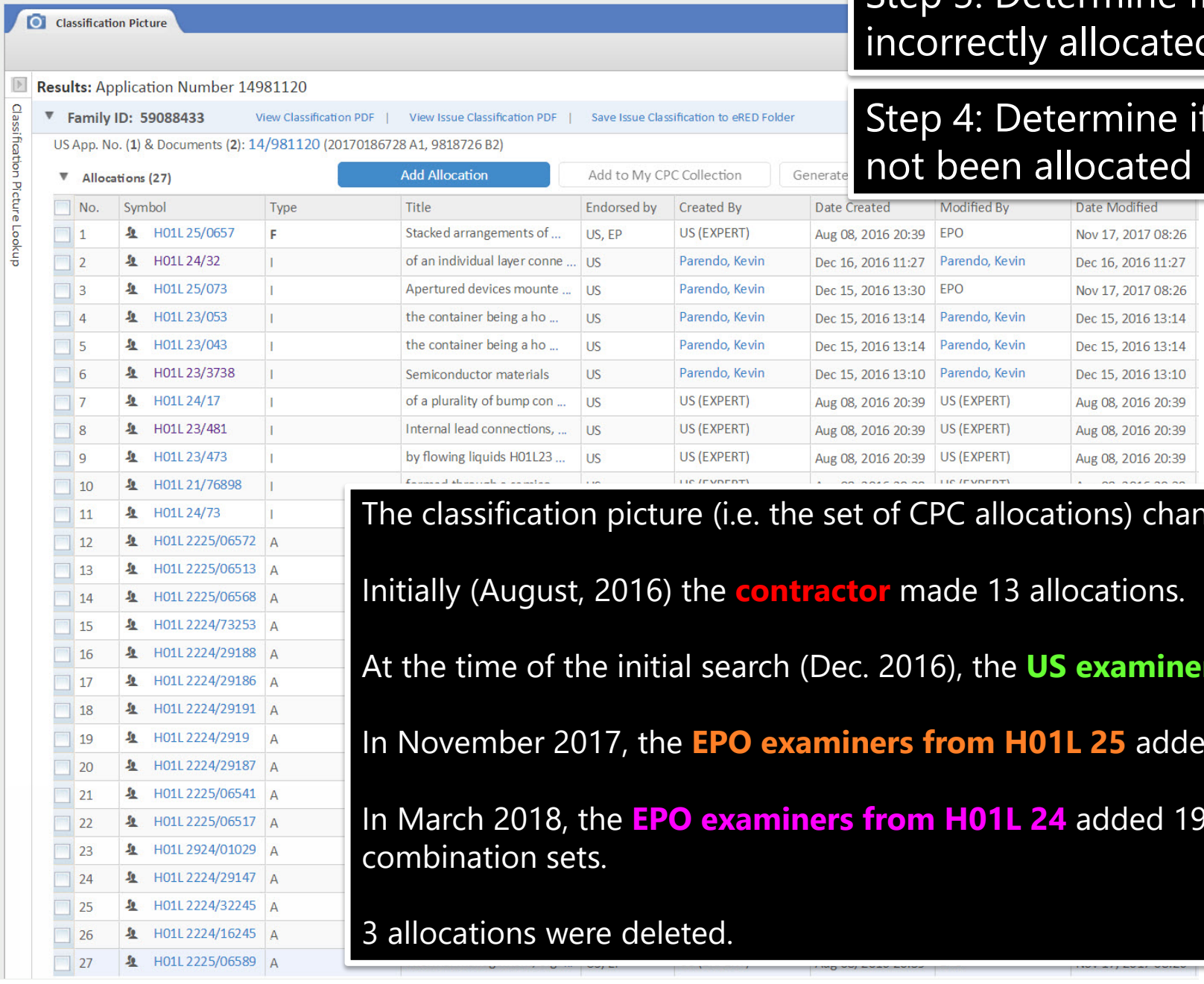
▲ ☐	**H01L 23/00**	**Details of semiconductor or other solid state devices** (H01L 25/00 takes precedence {; structural arrangements for testing or measuring during manufacture or treatment, or for reliability measurements H01L 22/00; arrangements for connecting or disconnecting semiconductor or solid-state bodies, or methods related thereto H01L 24/00; finger print sensors G06K 9/00006})
☐	**H01L 23/34**	• Arrangements for cooling, heating, ventilating or temperature compensation {; Temperature sensing arrangements (thermal treatment apparatus H01L 21/00)}
☐	**H01L 23/36**	•• Selection of materials, or shaping, to facilitate cooling or heating, e.g. heatsinks { (H01L 23/28, H01L 23/40, H01L 23/42, H01L 23/44, H01L 23/46 take precedence; heating H01L 23/345)}
☐	**H01L 23/373**	••• Cooling facilitated by selection of materials for the device {or materials for thermal expansion adaptation, e.g. carbon}
☐	**H01L 23/3738**	•••• {Semiconductor materials}

The scope of the subgroup **H01L 23/3738** is the sum of each subgroup it depends from in its hierarchy:

An arrangement for cooling a semiconductor or solid state device,
the cooling being facilitated by a semiconducting material in the arrangement

Step 3: Determine if any subgroups have been incorrectly allocated.

Step 4: Determine if pertinent subgroups have not been allocated yet.



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9	H01L 23/473	I	by flowing liquids H01L23 ...	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
10	H01L 21/76898	I						
11	H01L 24/73	I						
12	H01L 2225/06572	A						
13	H01L 2225/06513	A						
14	H01L 2225/06568	A						
15	H01L 2224/73253	A						
16	H01L 2224/29188	A						
17	H01L 2224/29186	A						
18	H01L 2224/29191	A						
19	H01L 2224/2919	A						
20	H01L 2224/29187	A						
21	H01L 2225/06541	A						
22	H01L 2225/06517	A						
23	H01L 2924/01029	A						
24	H01L 2224/29147	A						
25	H01L 2224/32245	A						
26	H01L 2224/16245	A						
27	H01L 2225/06589	A						

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At the time of the initial search (Dec. 2016), the **US examiner** added 12 allocations.

In November 2017, the **EPO examiners from H01L 25** added 2 allocations.

In March 2018, the **EPO examiners from H01L 24** added 19 allocations and 5 combination sets.

3 allocations were deleted.

What follows is a partial classification picture of the *disclosed* invention (i.e. subjectively the "best" subgroups) [the full scope of each subgroup is summarized]

H01L 23/473	**Arrangement for cooling or heating** using **flowing liquid**
H01L 23/3738	**Arrangement for cooling** made of **semiconductor material**
H01L 25/0657	**Stack of integrated circuit chips**
H01L 2225/06589	**Stacks of integrated circuit chips** having **thermal management**
H01L 23/481	**Through silicon via** in a semiconductor device
H01L 2225/06541	**Stacks of integrated circuit chips** having **TSV** connections therein
H01L 24/16	**Bump connector** electrically connecting **stacked semiconductor chips**
H01L 2225/06517	**Stacks of integrated circuit chips** having a **bump** direct electrical connection between a **device** and a **substrate**

Step 5: Devise CPC searches from the correct, pertinent subgroups

Step 6: Perform CPC search by combining subgroups to match a large portion of the invention's scope. Repeat by trying various promising combinations.

Sometimes the devising of the search strategy happens initially. It is often informed by trying combinations and seeing how many documents are yielded by the search.

H01L 23/473	**Arrangement for cooling or heating** using **flowing liquid**
H01L 23/3738	**Arrangement for cooling** made of **semiconductor material**
H01L 25/0657	**Stack of integrated circuit chips**
H01L 2225/06589	**Stacks of integrated circuit chips** having **thermal management**
H01L 23/481	**Through silicon via** in a semiconductor device
H01L 2225/06541	**Stacks of integrated circuit chips** having **TSV** connections therein
H01L 24/16	**Bump connector** electrically connecting **stacked semiconductor chips**
H01L 2225/06517	**Stacks of integrated circuit chips** having a **bump** direct electrical connection between a **device** and a **substrate**

1. An **apparatus** comprising:

a **first die**;

a **thermal cooler** formed over at least a portion of the first die;

a **second die** formed over at least a portion of the thermal cooler; and

a plurality of **through-silicon vias** providing electrical connections between the first and second dies;

wherein the thermal cooler comprises a plurality of **fluid channels *for fluid cooling*** of the first die and the second die, the plurality of fluid channels being ***formed horizontally through the thermal cooler***; and

wherein the plurality of **through-silicon vias** are formed ***vertically through the first die, the thermal cooler and the second die***.

H01L 23/473	**Arrangement for cooling or heating** using **flowing liquid**
H01L 23/3738	**Arrangement for cooling** made of **semiconductor material**
H01L 25/0657	**Stack of integrated circuit chips**
H01L 2225/06589	**Stacks of integrated circuit chips** having **thermal management**
H01L 23/481	**Through silicon via** in a semiconductor device
H01L 2225/06541	**Stacks of integrated circuit chips** having **TSV** connections therein
H01L 24/16	**Bump connector** electrically connecting **stacked semiconductor chips**
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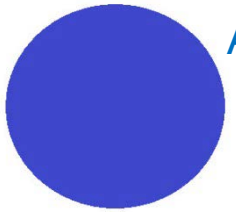
wherein the plurality of **through-silicon vias** are formed ***vertically through the first die, the thermal cooler and the second die***.

CPC search L5: H01L23/473.cpc.

searches for arrangement for cooling or heating, using flowing liquid, of a semiconductor or solid state device



A L1 could be searched individually in its entirety

1. An **apparatus** comprising:

a **first die**;

a **thermal cooler** formed over at least a portion of the first die;

a **second die** formed over at least a portion of the thermal cooler; and

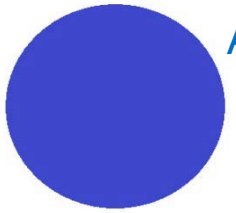
a plurality of **through-silicon vias** providing electrical connections between the first and second dies;

wherein the thermal cooler comprises a plurality of **fluid channels *for fluid cooling*** of the first die and the second die, the plurality of fluid channels being ***formed horizontally through the thermal cooler***; and

wherein the plurality of **through-silicon vias** are formed ***vertically through the first die, the thermal cooler and the second die***.

CPC search L5: H01L23/473.cpc.

searches for arrangement for cooling or heating, using flowing liquid, of a semiconductor or solid state device



A

L5 returns 14,272 documents, which is too many to search through.

L5 is not efficient to search, because it is too broad to capture the important elements of the claim.

For example, it does not require the TSVs, and only requires a single chip instead of a stack of plural chips.

1. An **apparatus** comprising:

a **first die**;

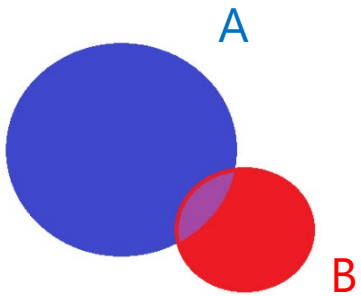
a **thermal cooler** formed over at least a portion of the first die;

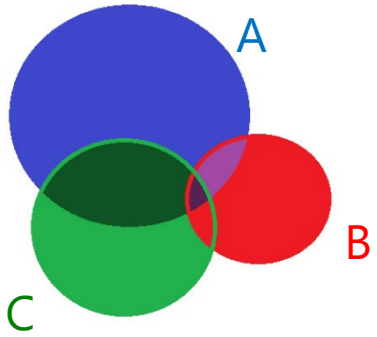
a **second die** formed over at least a portion of the thermal cooler; and

a plurality of **through-silicon vias** providing electrical connections between the first and second dies;

wherein the thermal cooler comprises a plurality of **fluid channels *for fluid cooling*** of the first die and the second die, the plurality of fluid channels being ***formed horizontally through the thermal cooler***; and

wherein the plurality of **through-silicon vias** are formed ***vertically through the first die, the thermal cooler and the second die***.





Thus, it would be better to do intersection searches that more completely match the scope of the claimed invention.

1. An **apparatus** comprising:

a **first die**;

a **thermal cooler** formed over at least a portion of the first die;

a **second die** formed over at least a portion of the thermal cooler; and

a plurality of **through-silicon vias** providing electrical connections between the first and second dies;

wherein the thermal cooler comprises a plurality of **fluid channels *for fluid cooling*** of the first die and the second die, the plurality of fluid channels being ***formed horizontally through the thermal cooler***; and

wherein the plurality of **through-silicon vias** are formed ***vertically through the first die, the thermal cooler and the second die***.

This claim is essentially described by four concepts:

- Stacked chips
- Heat sink
- Channels for fluid coolant in the heat sink
- TSVs connecting the chips to each other and to the heat sink

This claim has four different concepts:

- Stacked chips
- Heat sink
- Channels for fluid coolant in the heat sink
- TSVs connecting the chips to each other and to the heat sink

Which parts of this partial classification can cover these four concepts?

H01L 23/473	**Arrangement for cooling or heating** using **flowing liquid**
H01L 23/3738	**Arrangement for cooling** made of **semiconductor material**
H01L 25/0657	**Stack of integrated circuit chips**
H01L 2225/06589	**Stacks of integrated circuit chips** having **thermal management**
H01L 23/481	**Through silicon via** in a semiconductor device
H01L 2225/06541	**Stacks of integrated circuit chips** having **TSV** connections therein
H01L 24/16	**Bump connector** electrically connecting **stacked semiconductor chips**
H01L 2225/06517	**Stacks of integrated circuit chips** having a **bump** direct electrical connection between a **device** and a **substrate**

This claim has four different concepts:

- Stacked chips
- Heat sink
- Channels for fluid coolant in the heat sink
- TSVs connecting the chips to each other and to the heat sink

*Which parts of this partial classification picture **most specifically** cover these four concepts?*

H01L 23/473	**Arrangement for cooling or heating** using **flowing liquid**
H01L 23/3738	**Arrangement for cooling** made of **semiconductor material**
H01L 25/0657	**Stack of integrated circuit chips**
H01L 2225/06589	**Stacks of integrated circuit chips** having **thermal management**
H01L 23/481	**Through silicon via**
H01L 2225/06541	**Stacks of integrated circuit chips** having **TSV** connections therein
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This claim has four different concepts:

- Stacked chips
- Heat sink
- Channels for fluid coolant in the heat sink
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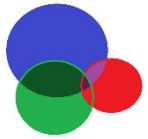
H01L 23/473	**Arrangement for cooling or heating** using **flowing liquid**
H01L 2225/06589	**Stacks of integrated circuit chips** having **thermal management**
H01L 2225/06541	**Stacks of integrated circuit chips** having **TSV** connections therein

Better CPC search (intersection search):

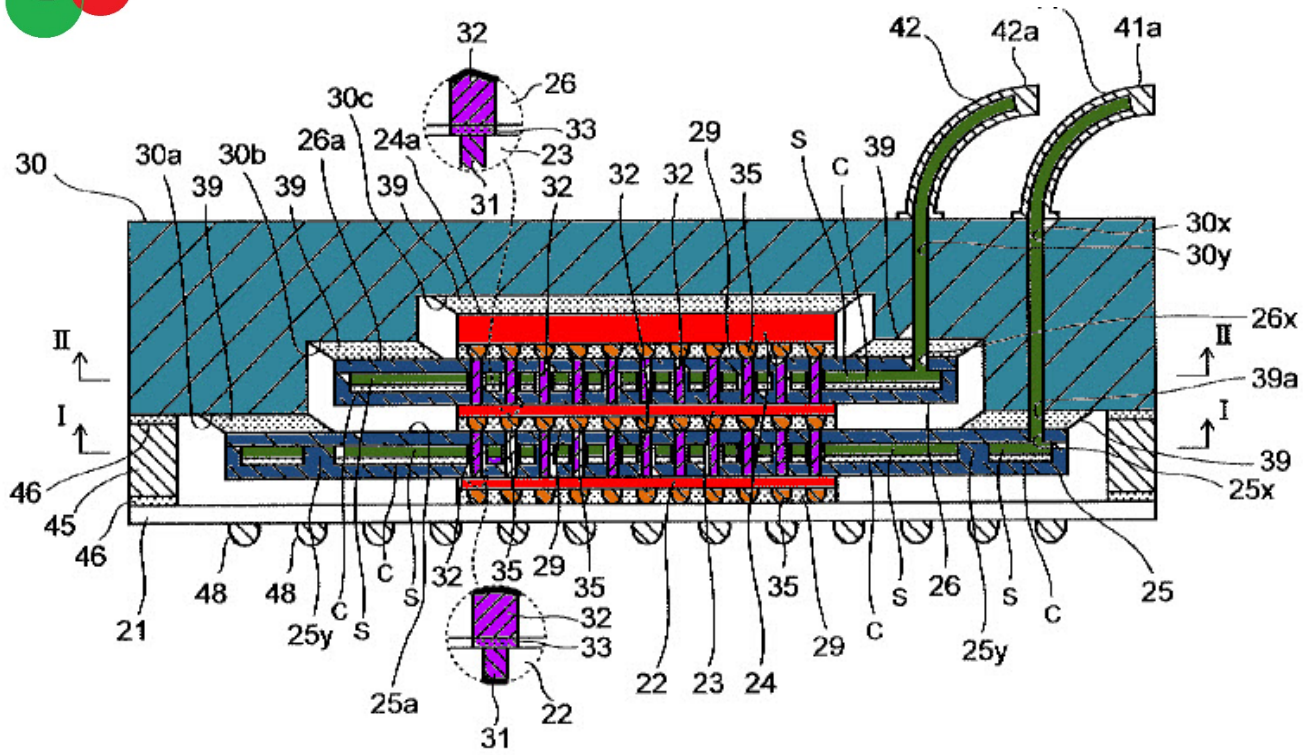


L7: H01L23/473.cpc. AND H01L2225/06589.cpc. AND H01L2225/06541.cpc.

L7 covers all four concepts using three CPC subgroups.

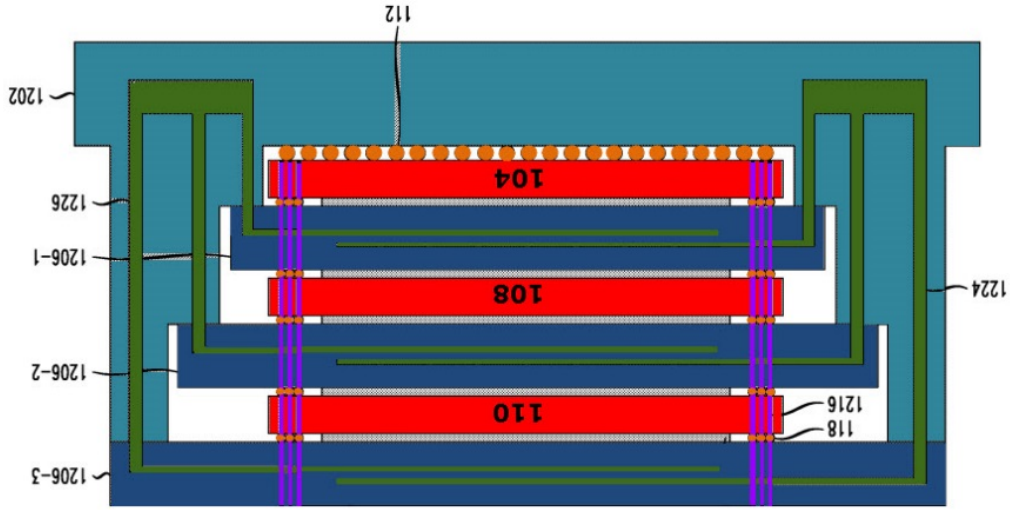
Step 6: Perform CPC search by combining subgroups to match a large portion of the invention's scope. Repeat by trying various promising combinations.

102 prior art reference found by search L7

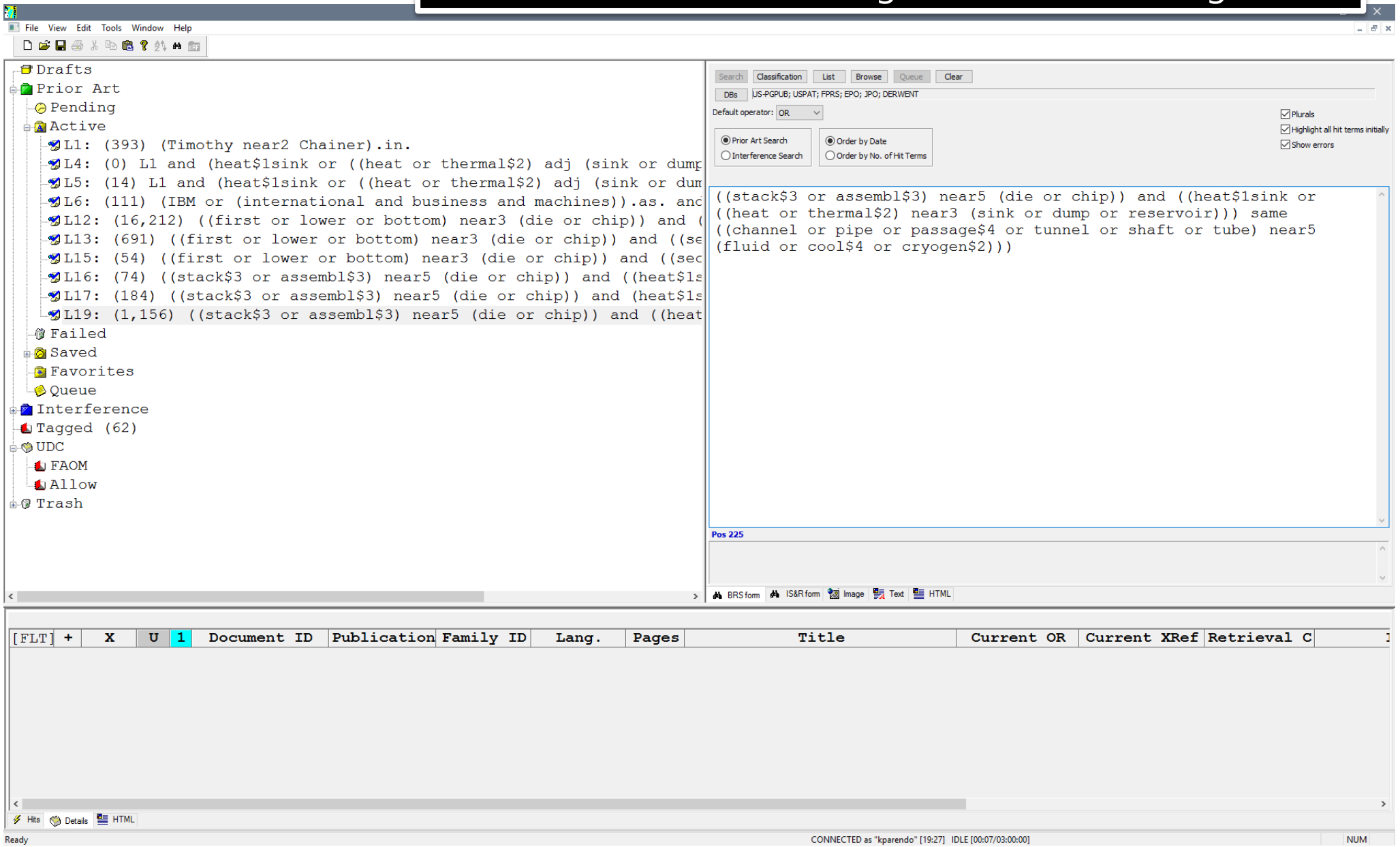


US 2016/0056089 A1 ("Taniguchi") has a **"heat spreading member" 30**, **stacked chips**, silicon **substrates 25** and **26** with **"cooling channels" S** therein, in a geometry that very closely matches the disclosed invention.

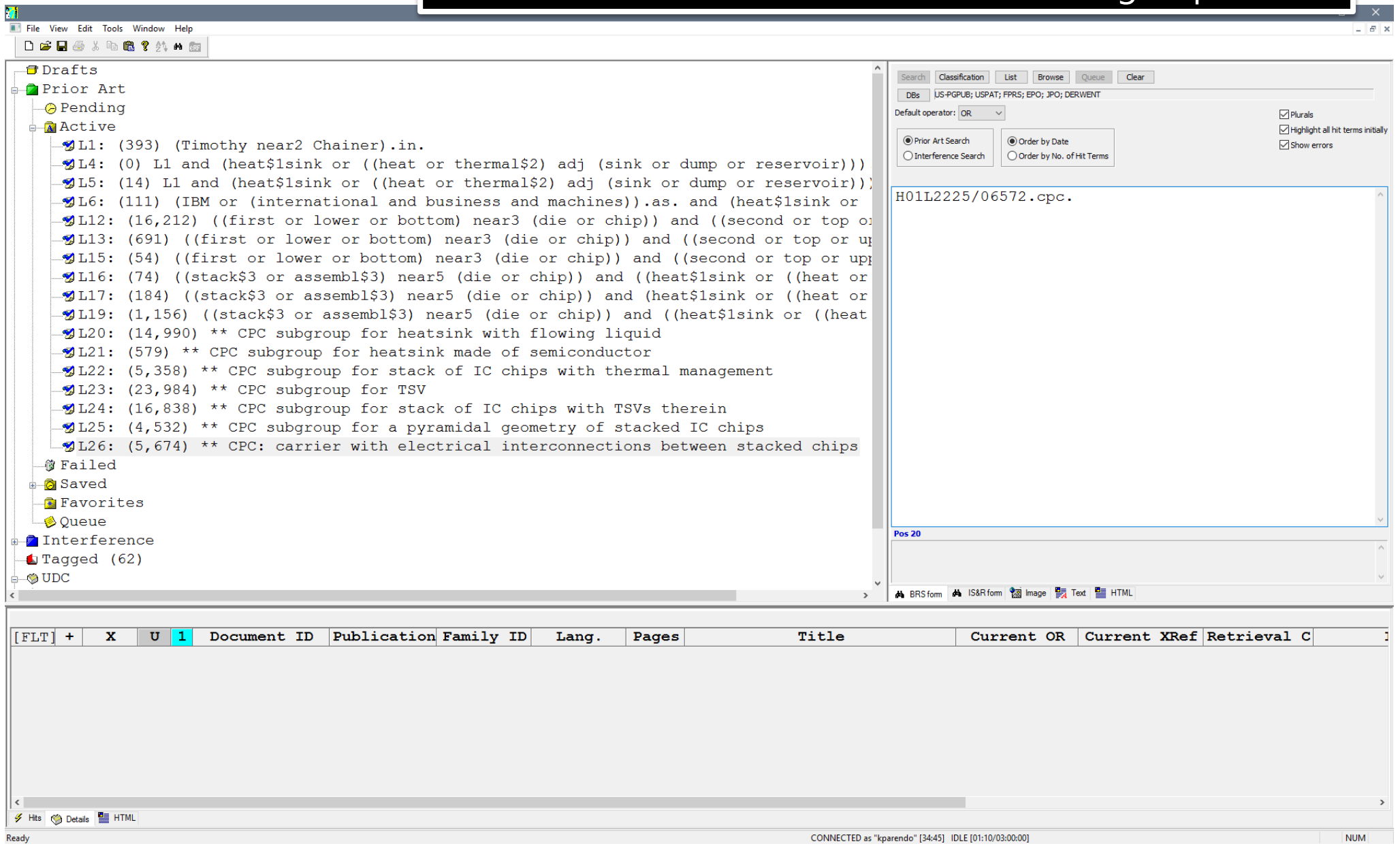
Application Device (rotated 180 degrees)



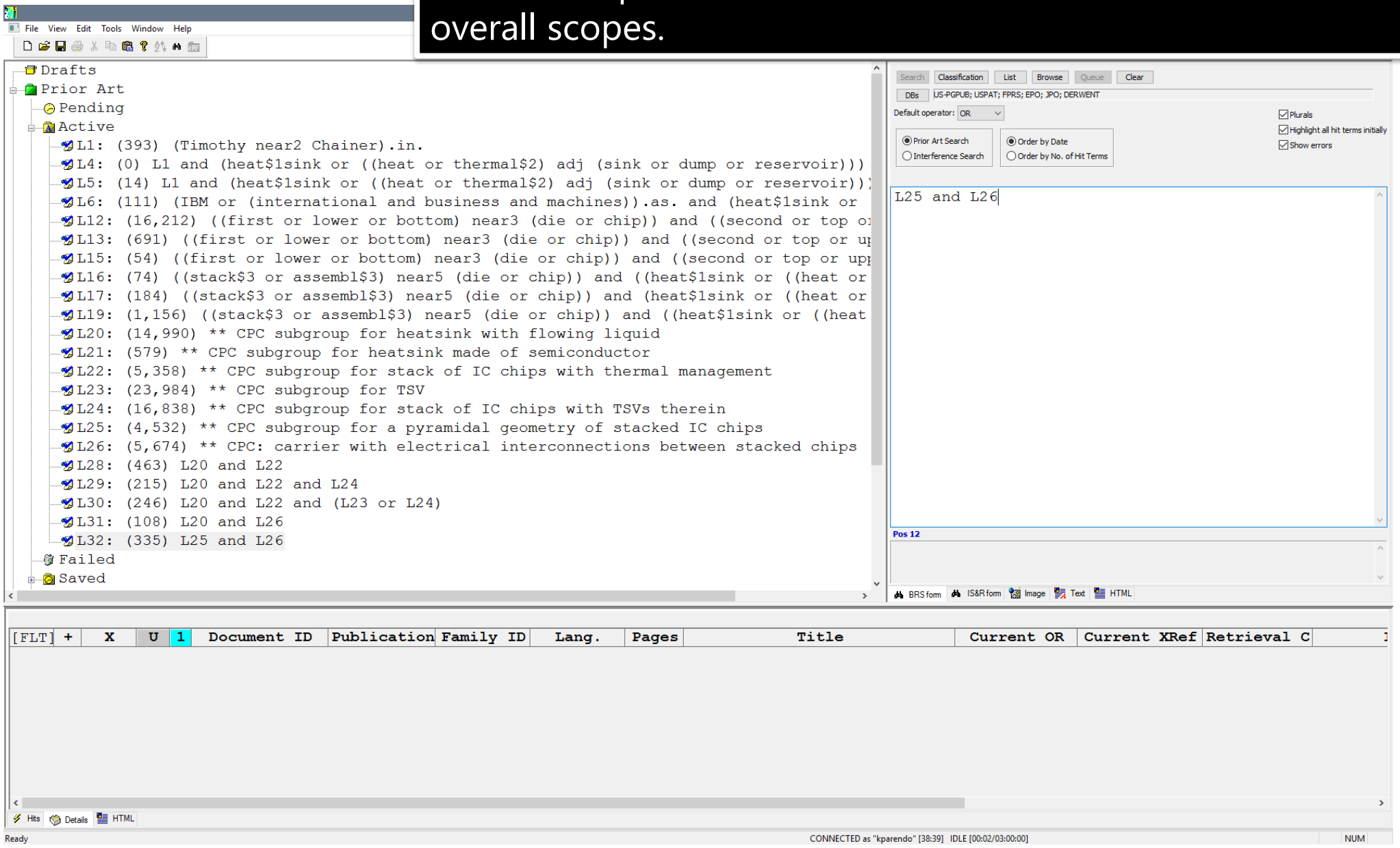
A condensed search showing some text searching



A condensed list of some relevant CPC subgroups



Some example CPC intersection searches. Various combinations cover different overall scopes.



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Thank You!


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