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# 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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A technical drawing of a mechanical assembly, possibly a piston or a similar component, is shown in a light gray, semi-transparent style. The drawing includes various parts with callout numbers such as 80, 86, 84, 82, 40, 36, 22, 26, 68, 34, 32, 52, 50, and 93. The drawing is set against a dark blue background that has a wavy, torn-paper-like edge at the top and bottom.

**An application is docketed to  
the examiner – now what?**

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FEENEY, Brett (2822) 14/981,120 - CHIP STACK COOLING STRUCTURE ?

Application Contents Application Data

Create Bib Data Sheet View IPF Assignment Data View IPF

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 Petitions Classification

DRW.NONBW - 02/22/2016

75%

This document contains no annotations

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

**FIG. 1**  
100

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

90%

This document contains no annotations

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

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~~ 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~~ each of the first silicon wafer die half and the second silicon wafer die half ~~comprising~~ 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.~~



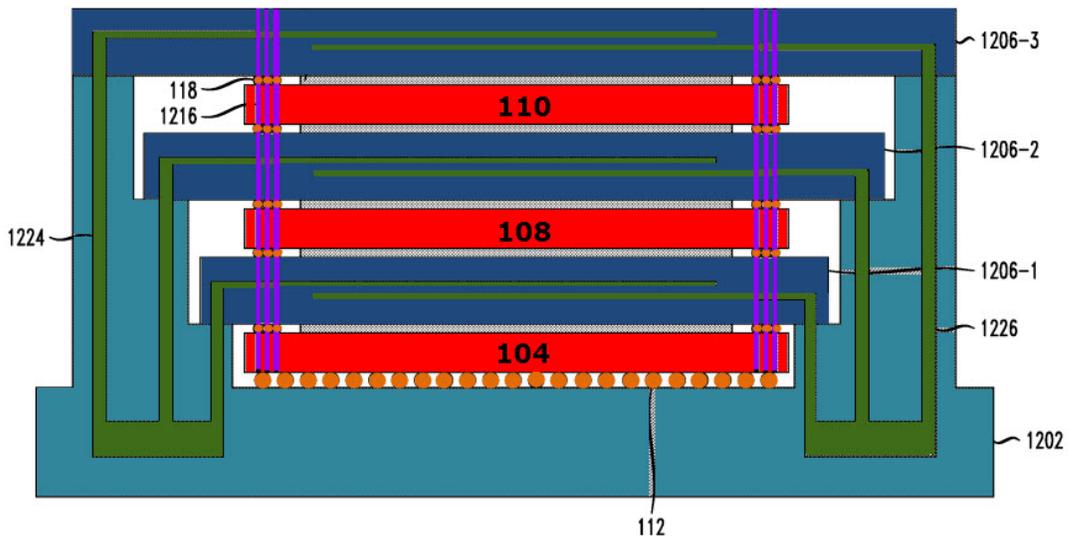
# PE2E-Docket and App Viewer



# App Orientation

## 1. Read the Specification

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)

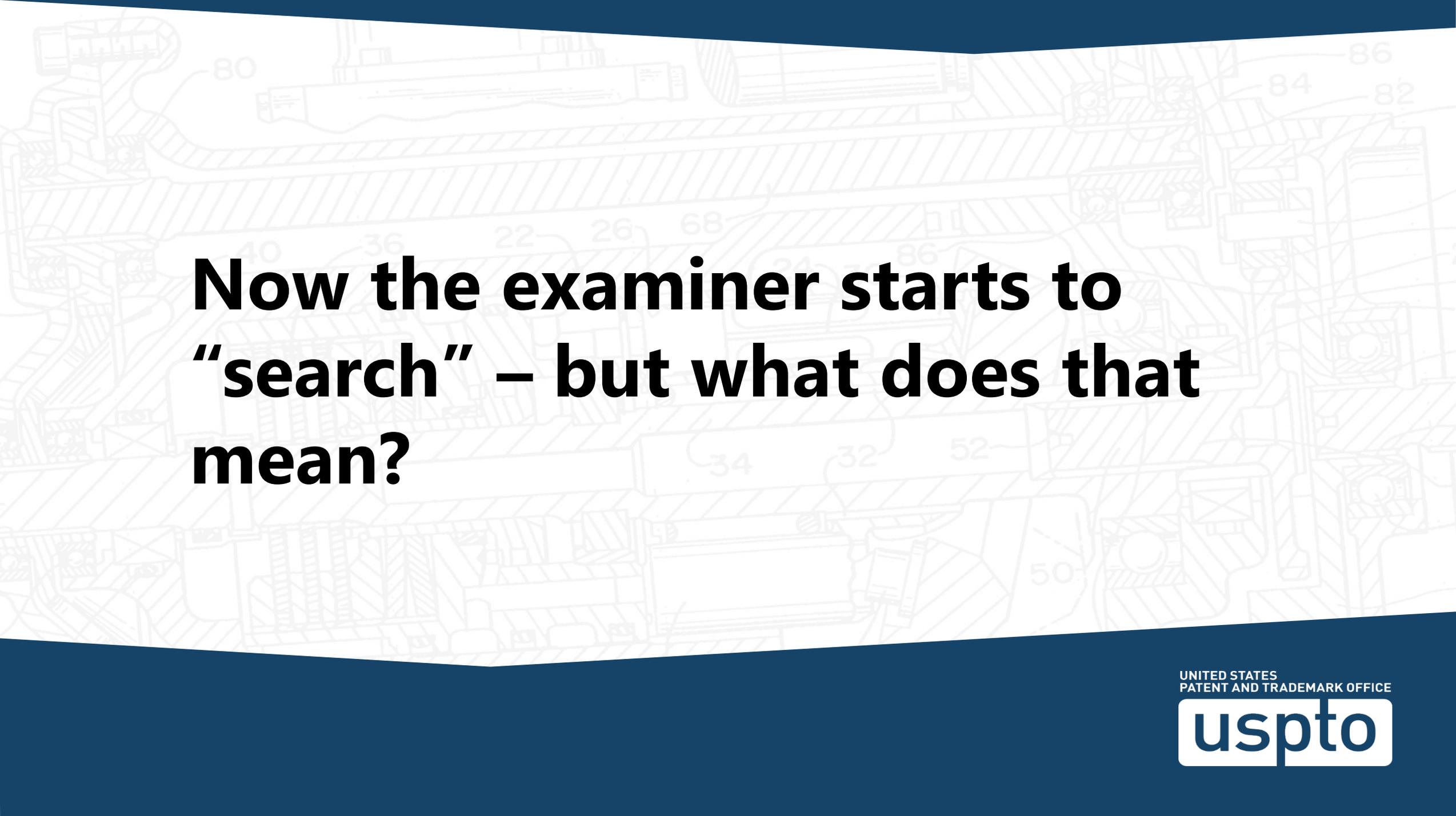
1216 - TSV in all chips and heat sinks

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

## 2. Read/Interpret the Claims

## 3. Identify Representative Drawing(s)

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A background of a technical drawing or patent illustration, showing various mechanical parts and components with numerical callouts (e.g., 80, 84, 86, 82, 22, 26, 68, 40, 36, 34, 32, 52, 50) and hatching lines. The drawing is rendered in a light gray color on a white background.

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

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# 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, 3<sup>rd</sup> 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.

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 >

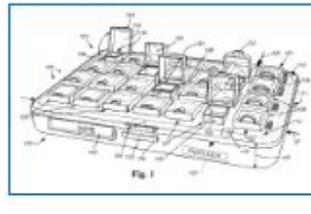
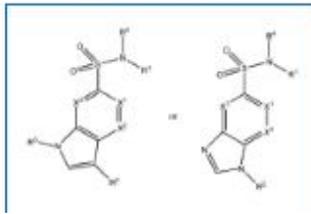
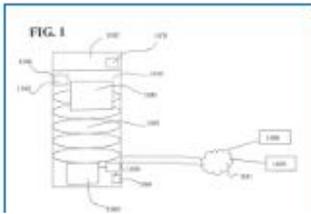
Refine Search pill dispenser reminder Search RSS

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	G08F	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
		G08Q	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, Isson, W.	5	2012	53
								2013	5

Sort by: App Date Desc View Image List Length 10



# Patent Office Sites

J-Plat Pat Japan Platform for Patent Information

Help desk (9:00-21:00) (+81)3-6666-8801 helpdesk@j-platpat.inpit.go.jp

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 Including 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



Search Classification List Browse Queue Clear

DBs US-PGPUB; USPAT; FRRS; EPO; IPO; DERWENT

Default operator: OR

Prior Art Search  
 Interference Search

Order by Date  
 Order by No. of Hit Terms

Plurals  
 Highlight all hit terms initially  
 Show errors

Pos 268

BRS form IS&R form Image Text HTML

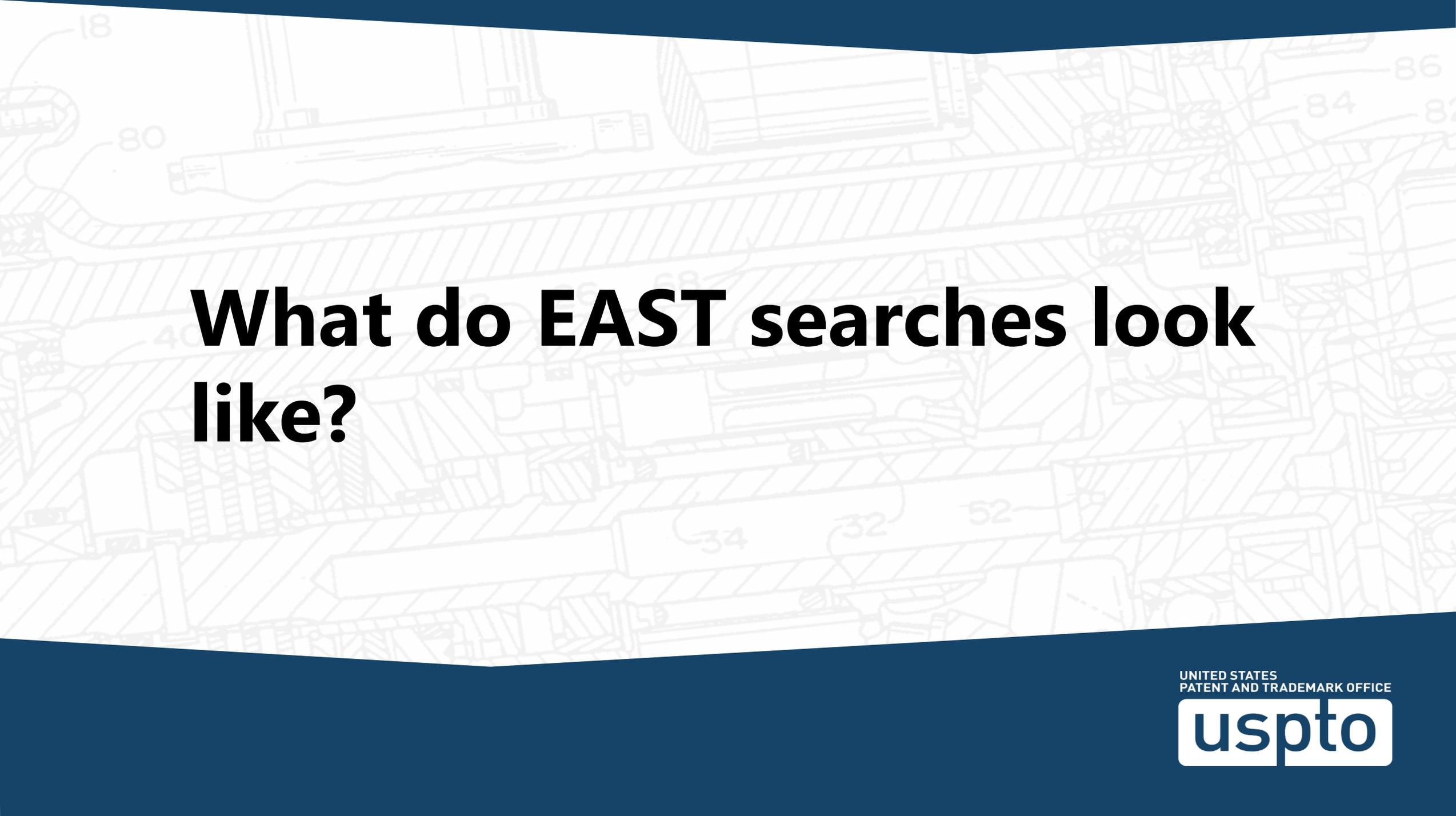
[FLT]	+	X	U	1	Document ID	Publication	Family ID	Lang.	Pages	Title	Current OR	Current XRef	Retrieval C

Ready CONNECTED as "kparendo" [16:01] IDLE [00:03/03:00:00] NUM

# Examiner's Automated Search Tool (EAST)

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The background of the slide is a light gray technical drawing of a mechanical assembly, showing various components, shafts, and gears with numerical callouts such as 18, 80, 40, 34, 32, 52, 84, 86, and 82. The drawing is rendered in a clean, line-art style.

# What do EAST searches look like?

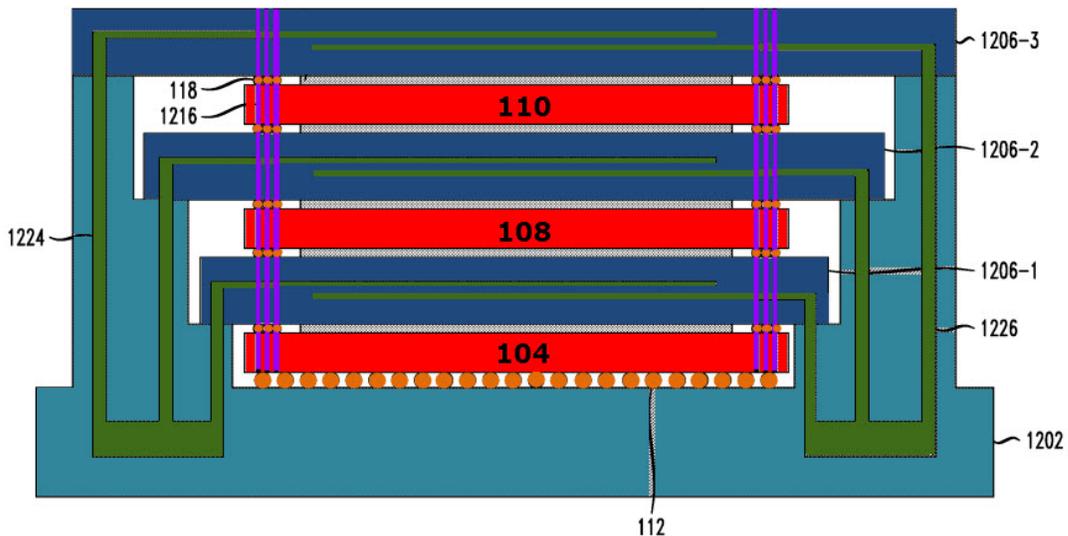
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# App Orientation

## 1. Read the Specification

1. An **apparatus** comprising:
  - a **first die**;
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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)

## 2. Read/Interpret the Claims

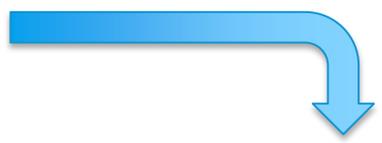
## 3. Identify Representative Drawing(s)

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

1. An **apparatus** comprising:
  - a **first die**;
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## 5. Text Searching

L1: (thermal near3 cooler)



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

1. An **apparatus** comprising:
  - a **first die**;
  - a **thermal cooler** formed over at least a portion of the first die;
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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**.



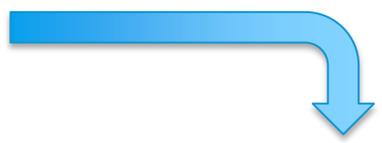
## 5. Text Searching

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)

1. An **apparatus** comprising:
  - a **first die**;
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  - a **second die** formed over at least a portion of the thermal cooler; and
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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.**



## 5. Text Searching

L3: L2 AND

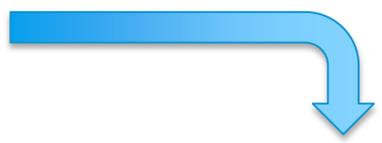
((second or top or upper\$4) near3 (die or chip)) AND

((first or bottom or lower\$4) near3 (die or chip))



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

1. An **apparatus** comprising:
  - a **first die**;
  - a **thermal cooler** formed over at least a portion of the first die;
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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.**



## 5. Text Searching

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)

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

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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**.

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.



### 5a. Text Searching



### 5b. CPC Searching



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# **What electronic tools does an examiner use for Search?**

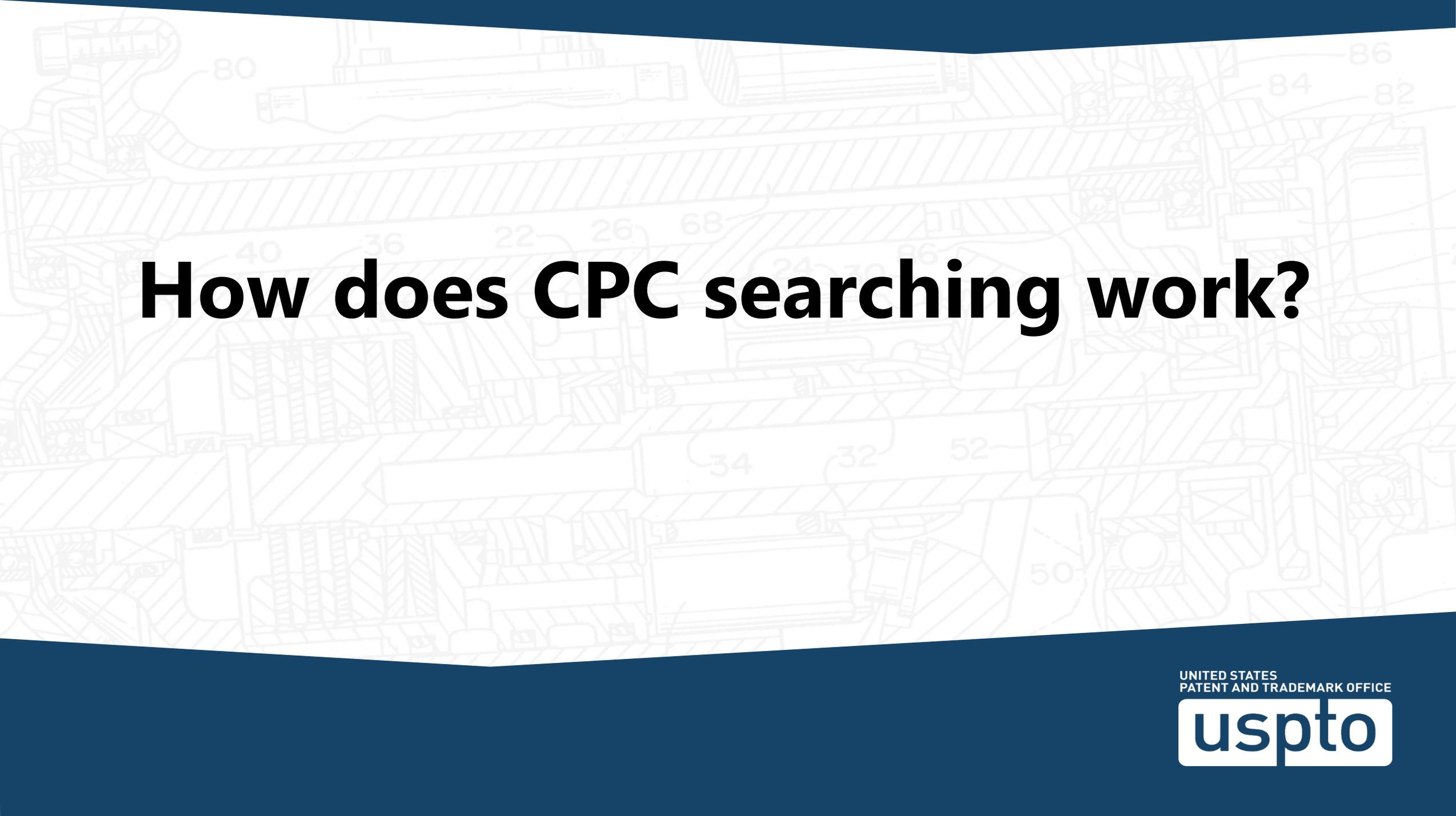
- **Docket and Application Viewer (DAV)**
  - View application's documents
- **Search Tools (EAST/WEST, other electronic databases)**

# 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

A background image of a technical drawing, likely a cross-section of a mechanical assembly, rendered in a light gray color. The drawing features various components, surfaces, and features, each labeled with a numerical callout. The callouts are scattered across the drawing, with some appearing in the upper left (e.g., 80, 40), upper right (e.g., 86, 84, 82), middle (e.g., 22, 26, 68, 24, 30, 26), lower middle (e.g., 34, 32, 52), and lower right (e.g., 50). The drawing uses standard technical drawing conventions, including hatching to indicate different materials or sections.

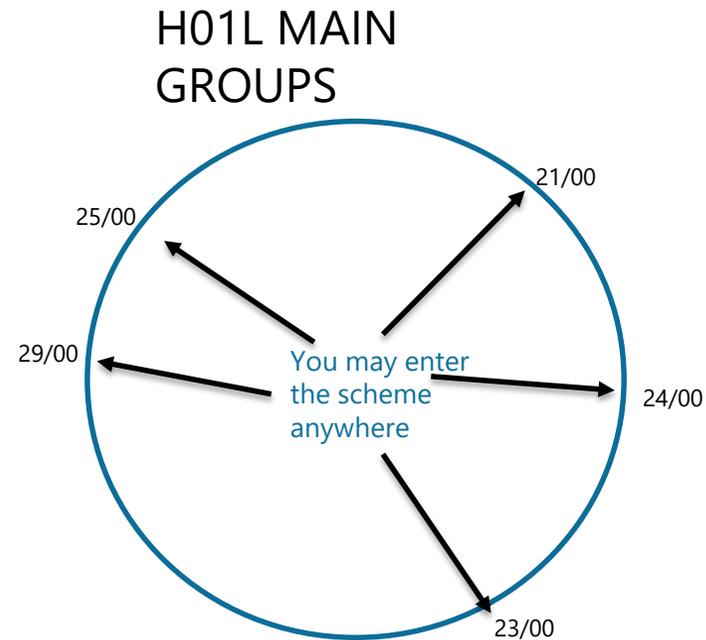
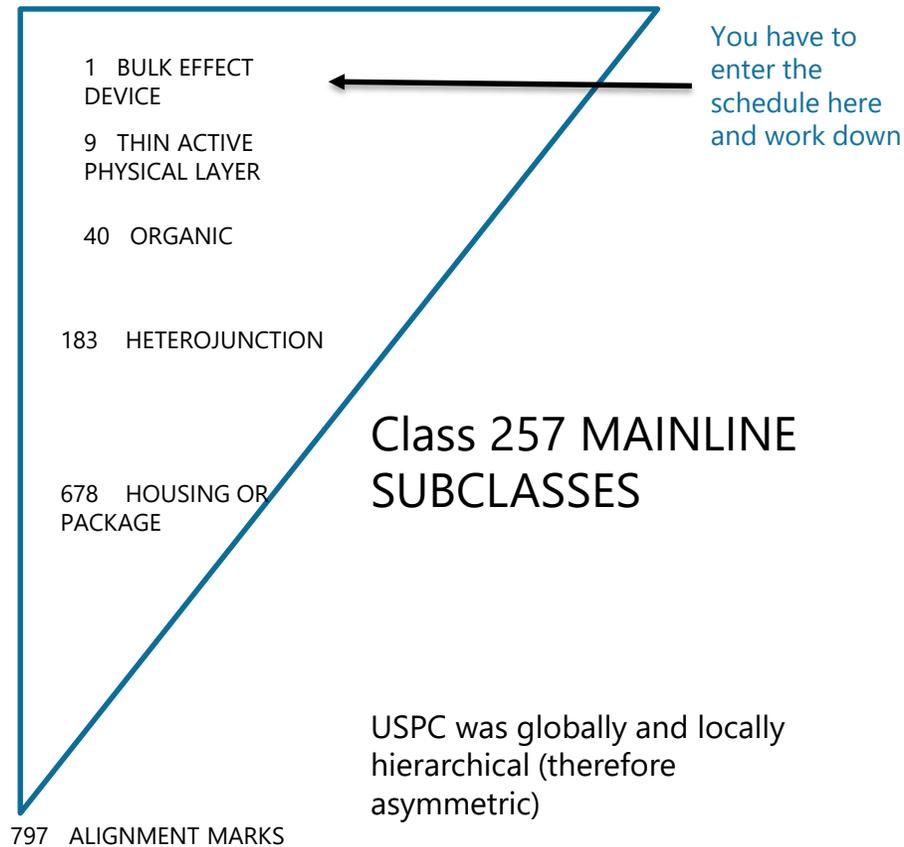
# How does CPC searching work?

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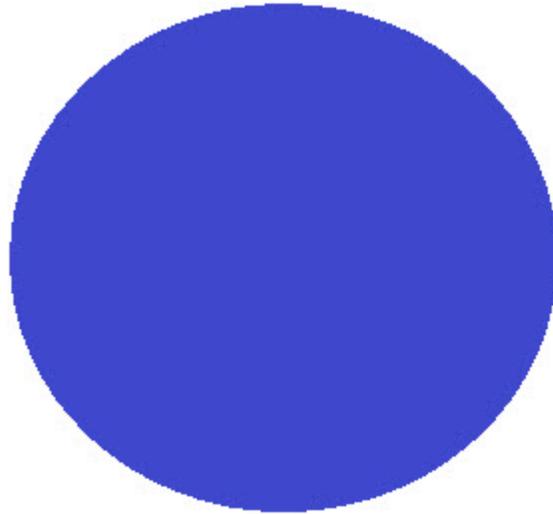
# Transitioning from USPC to CPC

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.....



CPC is symmetric down to the main group level

# CPC and Subgroups

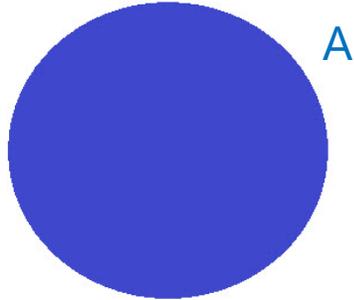


CPC is a “**language neutral**” system designed to collect all **useful** documents relating to a **concept** in a single place, regardless of the text **synonyms** the documents use to describe the concept, and regardless of the preferred synonyms of the classifier.

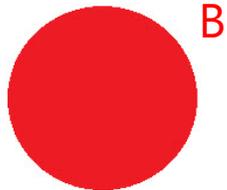
# Simple Example

## CPC subgroups describe features or groups of features

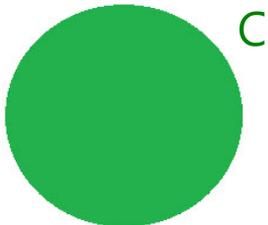
- A subgroup represents metadata – it tags the documents with a feature.
- All documents in each subgroup share that feature.



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.



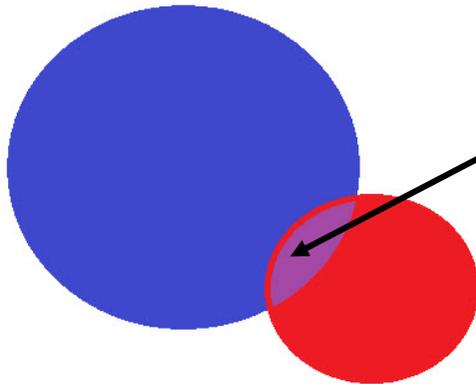
The area of C indicates all documents having the attributes of C – type of grip & types of tools included in subgroup.



# Searching CPC

## "Intersection" CPC subgroup search

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

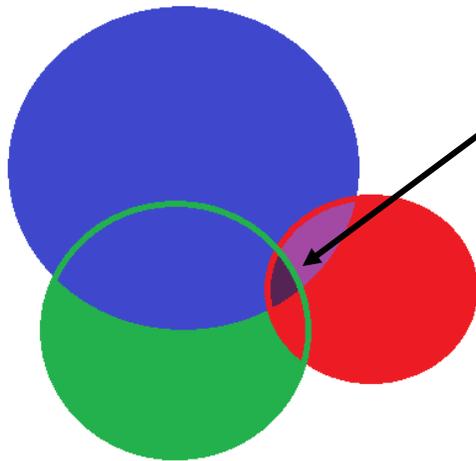


The **intersection** of A and B, given by "A and B", is the **purple region** of overlap.

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



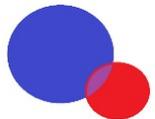
The intersection of A, B, and C, given by "A and B and C", is the darkest purple region of overlap.

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

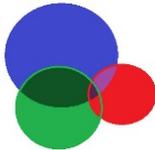
# What does a CPC search actually look like?



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)

Classification Picture

Generate Family ID Search String Show Less Export

Results: Application Number 14981120

Family ID: 59088433 View Classification PDF View Issue Classification PDF Save Issue Classification to eRED Folder

US App. No. (1) & Documents (2): 14/981120 (20170186728 A1, 9818726 B2)

Allocations (27) Add Allocation Add to My CPC Collection Generate Symbol Search String

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
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)

Classification Picture

Generate Family ID Search String Show Less Export

Results: Application Number 14981120

Family ID: 59088433 View Classification PDF View Issue Classification PDF Save Issue Classification to eRED Folder

US App. No. (1) & Documents (2): 14/981120 (20170186728 A1, 9818726 B2)

Allocations (27) Add Allocation Add to My CPC Collection Generate Symbol Search String

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						
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
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

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 screenshot shows the CPC Scheme Navigator web application. At the top, there are navigation tabs for 'Home' and 'Scheme Navigator'. Below this, the 'Scheme Version: 2017.08' is displayed. A horizontal menu contains 'Indent Level', 'Sections', 'Subsections', 'Classes', 'Subclasses', and 'Section'. The 'Section' menu is expanded to show 'Index', 'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'Y', and 'IDX'. The main content area is titled 'CPC Scheme Navigator' and features a search interface on the left with 'Symbol Search' (containing 'A61K 48/00') and 'Keyword Search' (containing '(Light emit\* diode?) AND laser?'). Below the search is a 'Search in' section with checkboxes for 'Titles' (checked), 'Notes & Warnings', and 'Definitions'. A 'Clear' button and a 'Submit' button are at the bottom of the search area. The main list displays sections A through Y, each with a plus sign, a title, an information icon, and a person icon. The 'Y' section title is truncated. A 'Symbol Information' sidebar is visible on the right.

Section	Title	Info Icon	Person Icon
A	HUMAN NECESSITIES		
B	PERFORMING OPERATIONS; TRANSPORTING	Info	Person
C	CHEMISTRY; METALLURGY	Info	Person
D	TEXTILES; PAPER		Person
E	FIXED CONSTRUCTIONS		Person
F	MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING	Info	Person
G	PHYSICS	Info	Person
H	ELECTRICITY	Info	Person
Y	GENERAL TAGGING OF NEW TECHNOLOGICAL DEVELOPMENTS; GENERAL TAGGING OF CROSS-SECTIONAL TECHNOLOGIES SPANNING OVER SEVERAL SECTIONS OF THE IPC; TECHNICAL SUBJECTS COVERED BY FORMER USPC CROSS-REFERENCE ART COLLECTIONS [XRACs] AND DIGESTS	Info	Person

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

# Scheme Navigator

The screenshot displays the CPC Scheme Navigator interface. At the top, there are tabs for 'Home' and 'Scheme Navigator'. Below the tabs, the 'Scheme Version: 2017.08' is indicated. A navigation bar includes 'Indent Level', 'Sections', 'Subsections', 'Classes', 'Subclasses', and 'Section'. The 'Section' dropdown is set to 'Index', with letters A through Y and icons for information, warning, CPC, IPC, and IDX. The main content area shows a list of sections: A - HUMAN NECESSITIES, B - PERFORMING OPERATIONS; TRANSPORTING, C - CHEMISTRY; METALLURGY, D - TEXTILES; PAPER, E - FIXED CONSTRUCTIONS, F - MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING, G - PHYSICS, H - ELECTRICITY, and Y - GENERAL TAGGING OF NEW TECHNOLOGICAL DEVELOPMENTS; GENERAL TAGGING OF CROSS-SECTIONAL TECHNOLOGIES SPANNING OVER SEVERAL SECTIONS OF THE IPC; TECHNICAL SUBJECTS COVERED BY FORMER USPC CROSS-REFERENCE ART COLLECTIONS [XRACs] AND DIGESTS. On the left side, there is a search section with 'Symbol Search' and 'Keyword Search' fields. The 'Symbol Search' field contains 'A61K 48/00' and is circled in green. Below it is a 'Submit' button, also circled in green. There are also 'Clear' and 'Need help?' options. A 'Search in' section has checkboxes for 'Titles' (checked), 'Notes & Warnings', and 'Definitions'. A vertical 'Symbol Information' sidebar is on the right.

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 screenshot displays the CPC Scheme Navigator interface. The top navigation bar includes 'Home' and 'Scheme Navigator' tabs. Below this, the 'Scheme Version: 2017.08' and 'Indent Level' are shown. The main navigation menu includes 'Sections', 'Subsections', 'Classes', 'Subclasses', and 'Section'. The 'Index' menu is expanded, showing letters A through Y, with 'A' through 'Y' being clickable. The main content area displays a list of sections, each with a plus sign icon on the left and an information icon on the right. The sections listed are: A - HUMAN NECESSITIES, B - PERFORMING OPERATIONS; TRANSPORTING, C - CHEMISTRY; METALLURGY, D - TEXTILES; PAPER, E - FIXED CONSTRUCTIONS, F - MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING, G - PHYSICS, H - ELECTRICITY, and Y - GENERAL TAGGING OF NEW TECHNOLOGICAL DEVELOPMENTS; GENERAL TAGGING OF CROSS-SECTIONAL TECHNOLOGIES SPANNING OVER SEVERAL SECTIONS OF THE IPC; TECHNICAL SUBJECTS COVERED BY FORMER USPC CROSS-REFERENCE ART COLLECTIONS [XRACs] AND DIGESTS. On the left side, there is a search panel titled 'CPC Scheme Navigator'. It contains a 'Symbol Search' box with the text 'A61K 48/00 H01L 27/00' and a 'Keyword search' box with the text '(Light emit\* diode?) AND laser? deposit\*'. Below the search boxes is a 'Search in' section with three checkboxes: 'Titles' (checked), 'Notes & Warnings', and 'Definitions'. At the bottom of the search panel are 'Clear' and 'Submit' buttons. The 'Submit' button is highlighted with a blue circle. The 'Symbol Search' and 'Keyword search' boxes are also highlighted with green circles. The 'Titles' checkbox is also highlighted with a green circle.

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

The screenshot displays the CPC Scheme Navigator web application. The interface includes a top navigation bar with tabs for 'Home' and 'Scheme Navigator'. Below this, there are filters for 'Scheme Version: 2017.08', 'Indent Level', and a list of sections (Sections, Subsections, Classes, Subclasses, Section). A search bar on the left contains 'H01L 27/00' and a keyword search bar contains 'deposit\*'. The search results are displayed in a table with columns for the symbol and its description. The results are as follows:

Symbol	Description
H (3) ELECTRICITY	
H01L 27/142	•• Energy conversion devices photovoltaic modules or arrays of single photovoltaic cells comprising bypass diodes integrated or directly associated with the devices H01L31/0443 ; photovoltaic modules composed of a plurality of thin film solar cells <b>deposited</b> on the same substrate H01L31/046
H01L 27/1292	••••• using liquid <b>deposition</b> , e.g. printing
H01L 27/14893	••••• comprising a photoconductive layer <b>deposited</b> on the CCD structure

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 screenshot shows the Scheme Navigator interface. At the top, there is a 'Home' button and a 'Scheme Navigator' tab. Below the tab, the 'Scheme Version' is 2017.08. A 'Section' menu is open, showing options: Index, A, B, C, D, E, F, G, H, Y, i, A, CPC, IPC, (...), ID. The 'Results' are H01L 27/1292. The main content area is titled 'CPC Scheme Navigator' and contains a table of CPC definitions. The table has columns for 'CPC' and 'CPC Title'. The first row is H01L, titled 'SEMICONDUCTOR DEVICES; ELECTRIC SOLID STATE DEVICES NOT OTHERWISE PROVIDED FOR'. Below it are several sub-rows, including H01L 21/00, H01L 21/02, H01L 21/02002, H01L 21/02041, H01L 21/02104, and H01L 21/02107. The row H01L 21/02002 is highlighted in blue, and its 'D' icon is circled in green. The interface also includes a search bar, a 'Symbol Hierarchy OFF' button, and various icons for information, warning, and document.

CPC	CPC Title
H01L	SEMICONDUCTOR DEVICES; ELECTRIC SOLID STATE DEVICES NOT OTHERWISE PROVIDED FOR (use of semiconductor devices for measuring G01; resistors in general H01C; magnets, inductors {in general} , transformers H01F; capacitors in general H01G; electrolytic devices H01G9/00; batteries, accumulators H01M; waveguides, resonators or lines of the waveguide type H01P; line connectors, current collectors H01R; stimulated emission devices H01S; electromechanical resonators H03H; loudspeakers, microphones, gramophone pick-ups or like acoustic electromechanical transducers H04R; electric light sources in general H05B; printed circuits, hybrid circuits, casings or constructional details of electric apparatus, manufacture of assemblages of electrical components H05K; use of semiconductor devices in circuits having a particular application, see the subclass for the application)
- H01L 21/00	Processes or apparatus adapted for the manufacture or treatment of semiconductor or solid state devices or of parts thereof ({testing or measuring during manufacture or treatment, or reliability measurements H01L22/00; multistep manufacturing processes for passive two-terminal components without a potential-jump or surface barrier for integrated circuits H01L28/00; } processes or apparatus peculiar to the manufacture or treatment of devices provided for in groups H01L31/00 - H01L51/00 or of parts thereof, <u>see</u> these groups; single-step processes covered by other subclasses, <u>see</u> the relevant subclasses, e.g. C23C, C30B; photomechanical production of textured or patterned surfaces, materials or originals therefor, apparatus specially adapted therefor, in general G03F)
- H01L 21/02	• Manufacture or treatment of semiconductor devices or of parts thereof
+ H01L 21/02002	••{Preparing wafers}
+ H01L 21/02041	••{Cleaning}
- H01L 21/02104	••{Forming layers (deposition in general C23C; crystal growth in general C30B)}
+ H01L 21/02107	••• {Forming insulating materials on a substrate}

The scheme definitions may be viewed in the scheme navigator.

# Semiconductor Topical Index

Toggle Menu Quick Crosswalk Access: 348/218.1 Submit USPC to CPC Mapping Tool Scheme Viewer & Tools

Semiconductor Topical Index for CPC  
Subject matter, organized by topic, and where to find it in the CPC scheme

Search box Reset

Topics	Allocations		
+ Universal Methods and Structures			
+ Packaging			
+ Interconnects and External Electrical Connections			
+ Inductor, Resistor, Capacitor			
+ Transistor			
+ Diode			
+ Thyristor			
+ Memory Device			
+ Light-Responsive Device			
+ Light-Emissive Device			
+ Thermoelectric Device			
+ Superconducting Device			
+ Piezoelectric (Pressure-Responsive) Device			
+ Magnetostrictive (Magnetic Field-Responsive) Device			
+ Electrostrictive (Electric Field-Responsive) Device			
+ Magnetic Device			
+ Organic Device			
+ Microelectromechanical Systems (MEMS)			

Hide Search Tools

Source Search CPC for keyword View Patent Documents

USPTO image compression  EPO Text search the CPC

G06K9/00469 Patents with symbol

Search Search

Enable Search String builder ( ) . CLAS, CCLS, CPC, CPCL .  
Note: clicked links will not be opened when enabled

Find a CPC G03B or photography scheme

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

USPC to CPC Mapping Tool

Quick Crosswalk Access: 348/218.1 Submit

Scheme Viewer & Tools

## Semiconductor Topical Index for CPC

Subject matter, organized by topic, and where to find it in the CPC scheme

Search box [ ] [Reset]

Topics	Allocations
<b>Universal Methods and Structures</b>	
+ Substrate or Wafer	
+ Treatment of Bulk Wafer	
+ Cleaning	
- Deposition	
+ Inorganic Material	<a href="#">H01L21/02282-0229</a>
+ Organic Material	<a href="#">H01L21/02623-02628</a>
+ Physical Deposition	<a href="#">H01L21/208-2085</a>
- Liquid Deposition	<a href="#">H01L21/288-2885</a>
All H01L Entries	<a href="#">H01L21/445</a>
Printing	<a href="#">H01L21/02288</a> <a href="#">H01L51/0004-0005</a>

See US 7 thereof, s H01L defi (<http://pto>)

Hide Search Tools

Source:  USPTO  EPO

Search CPC for keyword: image compression

View Patent Documents: G06K9/00469

Text search the CPC [Search] Patents with symbol [Search]

Enable Search String builder [ ]

Note: clicked links will not be opened when enabled

Find a CPC: G03B or photography

Open in separate window

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

Toggle Menu Quick Crosswalk Access: 348/218.1 Submit USPC to CPC Mapping Tool Scheme Viewer & Tools

Semiconductor Topical Index for CPC  
Subject matter, organized by topic, and where to find it in the CPC scheme

1 2 3 4

Search: solar cell [Reset]

Topics	Allocations	Notes
<b>Universal Methods and Structures</b>		
+ Annealing		
- Measuring and Testing		
- Measuring Photovoltaic Device	<a href="#">H02S50/00-15</a>	
<b>Packaging</b>		
+ Container for chip		
+ Encapsulation		
- Heat Exchange		
- For Specific Device		
for radiation sensitive devices except solar cells	<a href="#">H01L31/024</a> <a href="#">H01L31/052-0525</a>	
<b>Light-Responsive Device</b>		
Solar Cell / Photovoltaic		
+ Most CPC Entries		
+ Materials		
+ Shape		
+ Electrodes		

Show Search Tools Open in separate window

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

# Semiconductor Topical Index

Toggle Menu Quick Crosswalk Access: 348/218.1 Submit USPC to CPC Mapping Tool Scheme Viewer & Tools

Semiconductor Topical Index for CPC  
Subject matter, organized by topic, and where to find it in the CPC scheme

1 2 3 4

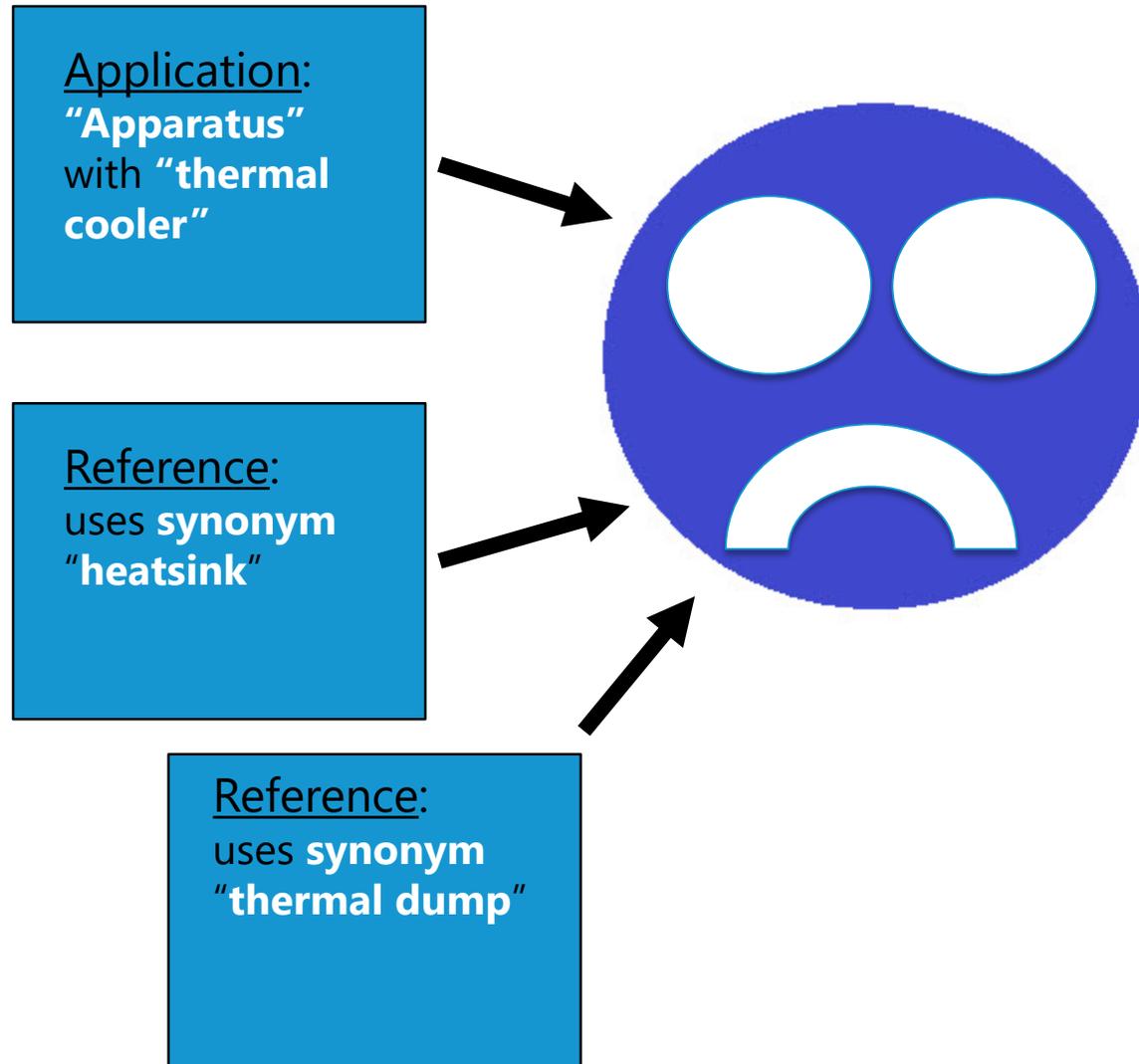
Search: solar cell Reset

Topics	Allocations	Notes	
<b>- Universal Methods and Structures</b>			
+ Annealing			
- Measuring and Testing			
- Measuring Photovoltaic Device	<a href="#">H02S50/00-15</a>		
<b>- Packaging</b>			
+ Container for chip			
+ Encapsulation			
- Heat Exchange			
- For Specific Device			
for radiation sensitive devices except solar cells	<a href="#">H01L31/024</a>		
	<a href="#">H01L31/052-0525</a>		
<b>- Light-Responsive Device</b>			
- Solar Cell / Photovoltaic			
+ Most CPC Entries			
+ Materials			
+ Shape			

Show Search Tools Open in separate window

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.

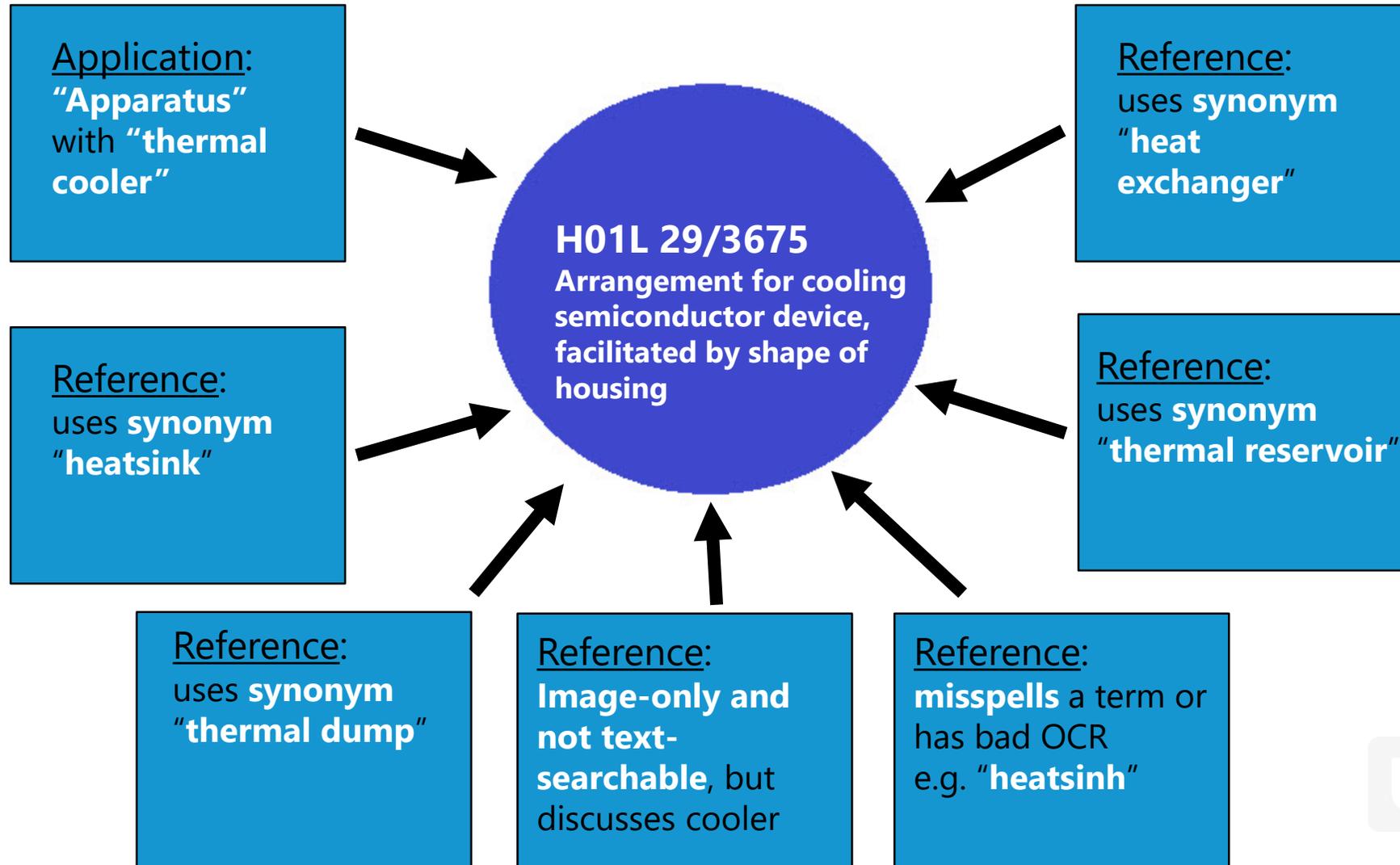
# Finding prior art by text searching

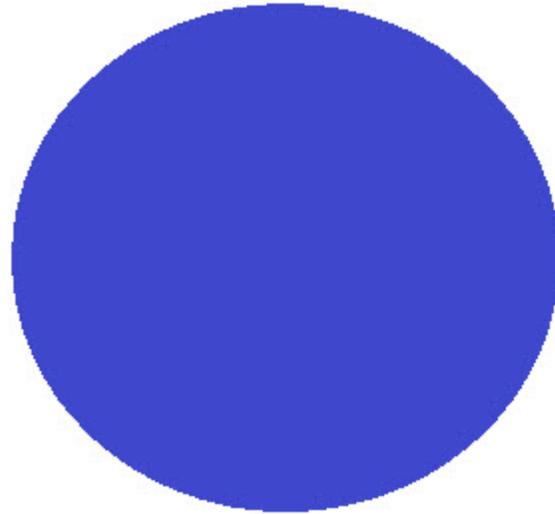


Imagine these are the synonyms you know, or that you gather from references in preliminary searches.

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

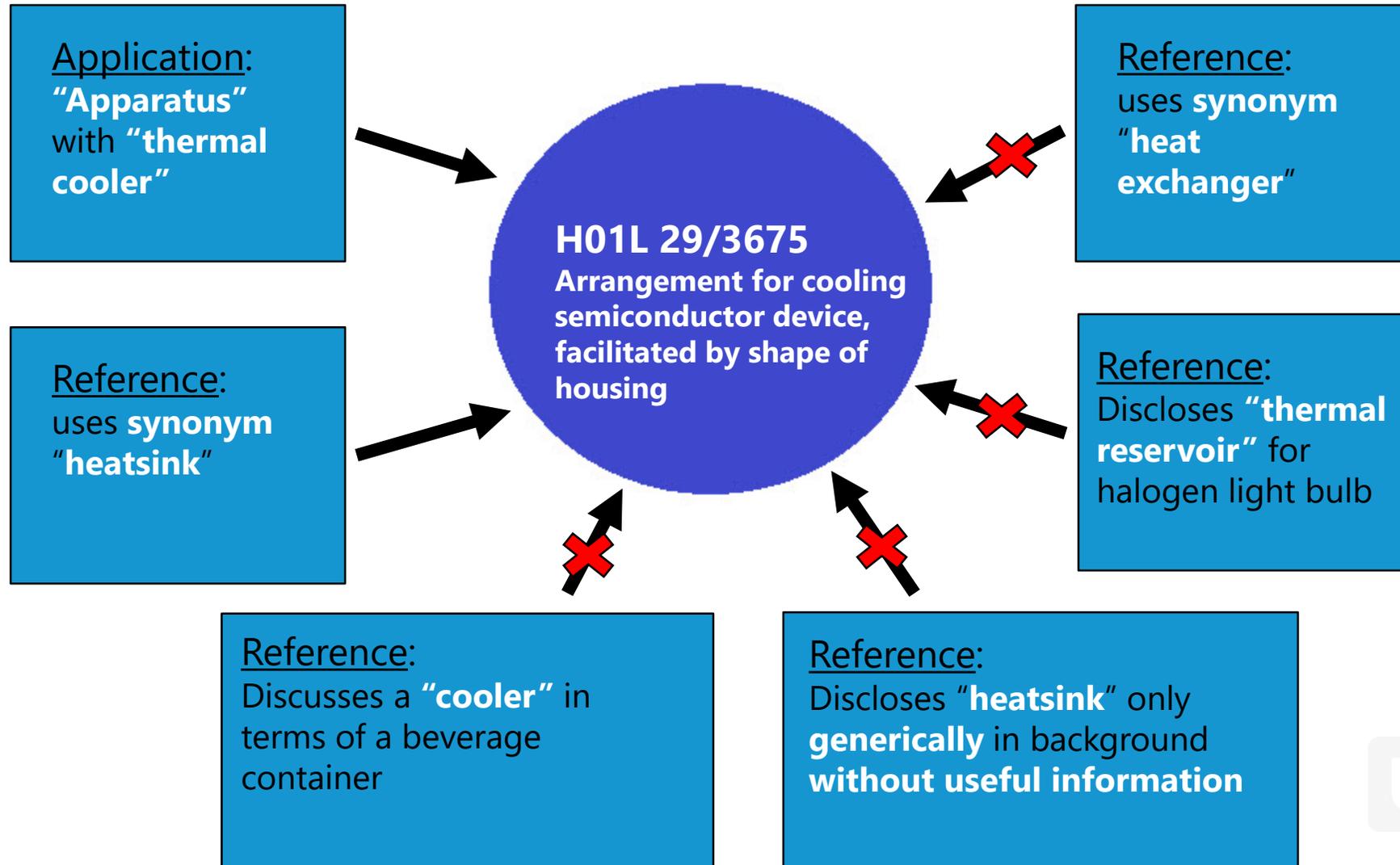
# Searching CPC fills in the gaps





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

**H01L 29/3675**

Arrangement for cooling  
semiconductor device,  
facilitated by shape of  
housing

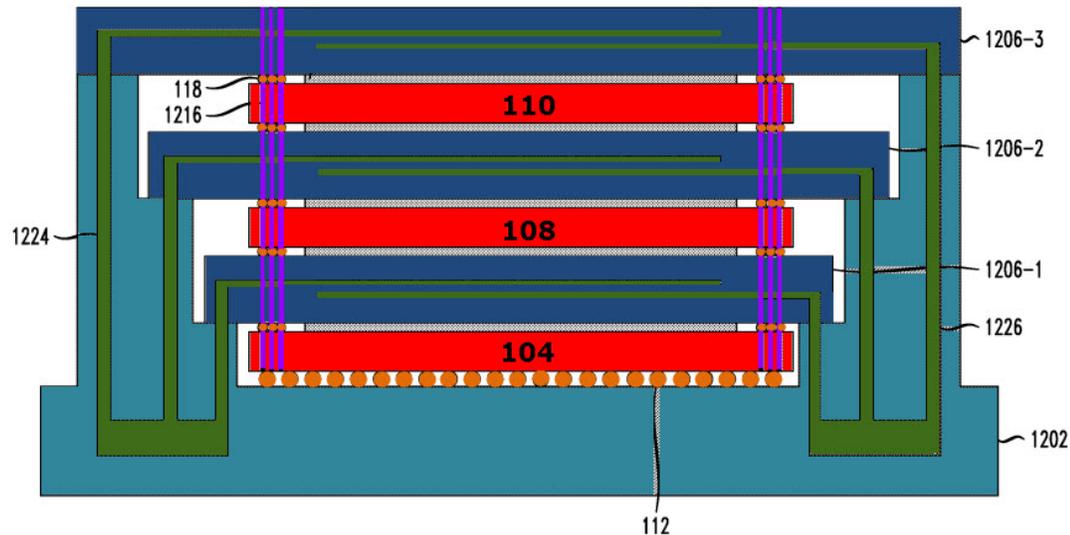
The effective use of CPC provides the examiner and the Applicant more **certainty** and **confidence** that a **complete, quality search** of the prior art has been performed because it is **language neutral**.

# Applying CPC to Search: Example Application

UNITED STATES  
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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)

Classification Picture

Generate Family ID Search String Show Less Export

Results: Application Number 14981120

Family ID: 59088433 View Classification PDF View Issue Classification PDF Save Issue Classification to eRED Folder

US App. No. (1) & Documents (2): 14/981120 (20170186728 A1, 9818726 B2)

Allocations (27) Add Allocation Add to My CPC Collection Generate Symbol Search String

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 constiuen ...	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

Step 1: View the classification picture in the Classification Allocation Tool



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

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

Classification Picture

Results: Application Number 14981120

Family ID: 59088433 [View Classification PDF](#) | [View Issue Classification PDF](#) | [Save Issue Classification to eRED Folder](#)

US App. No. (1) & Documents (2): 14/981120 (20170186728 A1, 9818726 B2)

Allocations (27) [Add Allocation](#) [Add to My CPC Collection](#) [Generate](#)

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 series	US	US (EXPERT)	Aug 08, 2016 20:39	US (EXPERT)	Aug 08, 2016 20:39
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						

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

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

The classification picture (i.e. the set of CPC allocations) changes over time.

Initially (August, 2016) the **contractor** made 13 allocations.

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

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

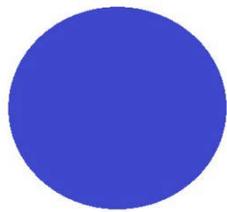
1. An **apparatus** comprising:
  - a **first die**;
  - a **thermal cooler** formed over at least a portion of the first die;
  - a **second die** formed over at least a portion of the thermal cooler; and
  - a plurality of **through-silicon vias** providing electrical connections between the first 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	<b>Arrangement for cooling or heating</b> using <b>flowing liquid</b>
H01L 23/3738	<b>Arrangement for cooling</b> made of <b>semiconductor material</b>
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H01L 2225/06517	<b>Stacks of integrated circuit chips</b> having a <b>bump</b> direct electrical connection between a <b>device</b> and a <b>substrate</b>

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**

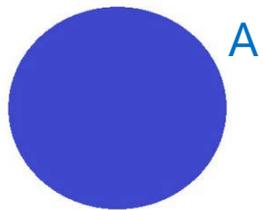


A L1 could be searched individually in its entirety

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**

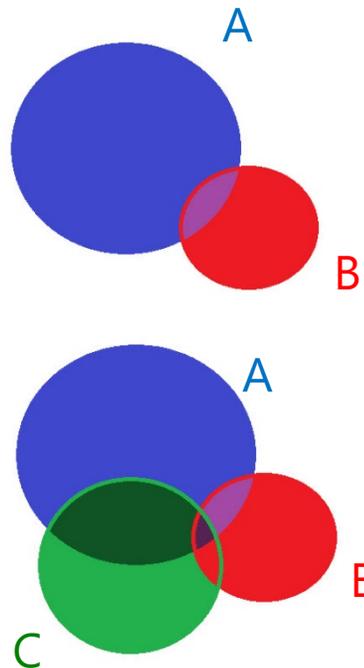


L5 returns 14,272 documents, which is too many to search through.

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

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?

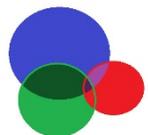
H01L 23/473	<b>Arrangement for cooling or heating</b> using <b>flowing liquid</b>
H01L 23/3738	Arrangement for cooling made of semiconductor material
H01L 25/0657	Stack of integrated circuit chips
H01L 2225/06589	<b>Stacks of integrated circuit chips</b> having <b>thermal management</b>
H01L 23/481	Through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

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

H01L 23/473	Arrangement for cooling or heating using <b>flowing liquid</b>
H01L 2225/06589	<b>Stacks of integrated circuit chips</b> having <b>thermal management</b>
H01L 2225/06541	<b>Stacks of integrated circuit chips</b> having <b>TSV</b> connections therein

### Better CPC search (intersection search):

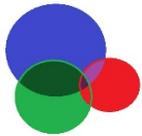


L7: H01L23/473.cpc. AND H01L2225/06589.cpc. AND H01L2225/06541.cpc.

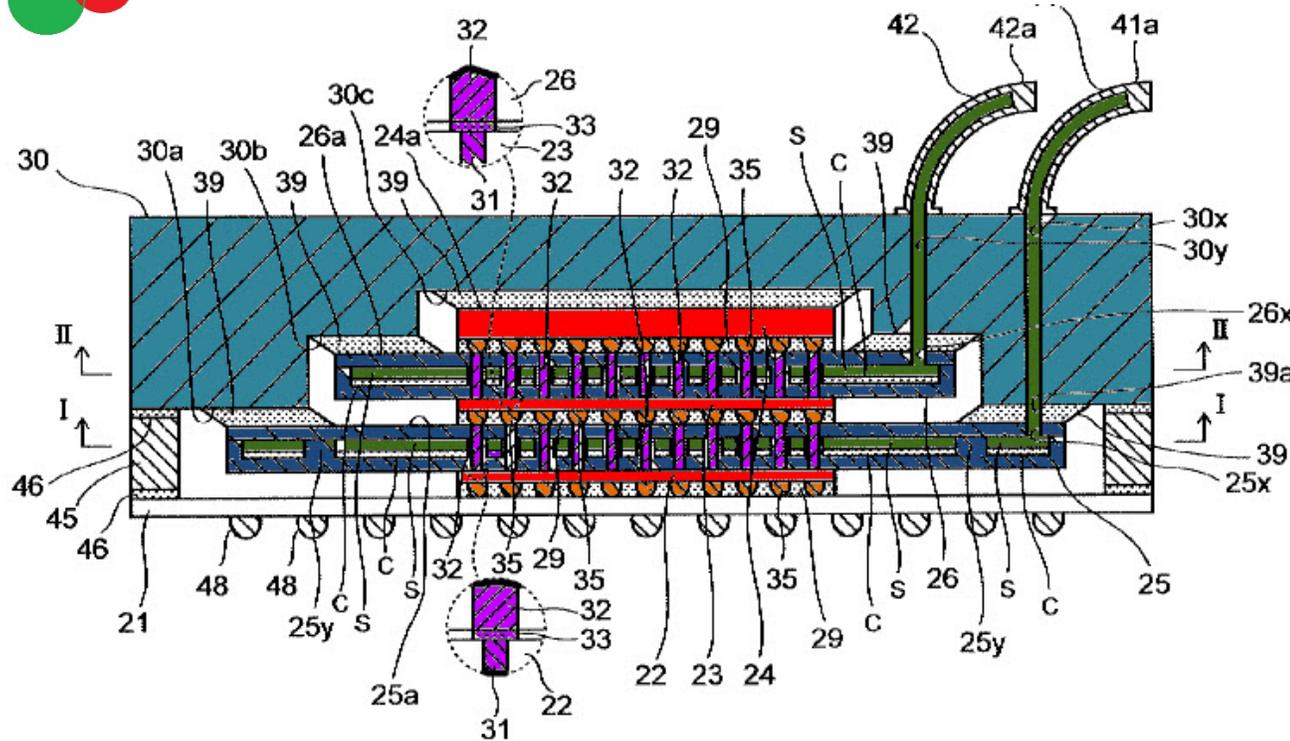
L7 covers all four concepts using three CPC subgroups.



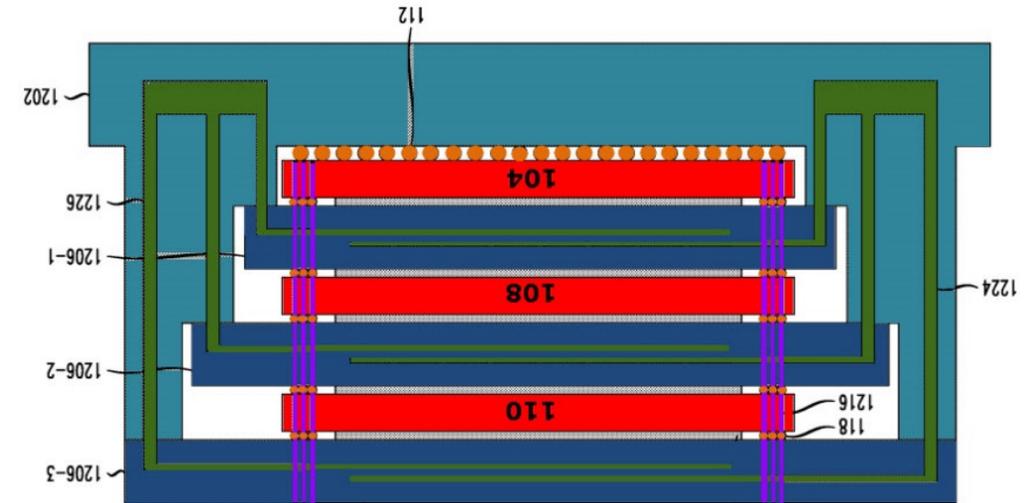
Step 6: Perform CPC search by combining subgroups to match a large portion of the invention's scope. Repeat by trying various promising combinations.



102 prior art reference found by search L7



Application Device (rotated 180 degrees)



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.

# A condensed search showing some text searching

The screenshot shows a patent search interface with a search query and a list of results. The search query is:

```
((stack$3 or assembl$3) near5 (die or chip)) and ((heat$1sink or ((heat or thermal$2) near3 (sink or dump or reservoir))) same ((channel or pipe or passage$4 or tunnel or shaft or tube) near5 (fluid or cool$4 or cryogen$2)))
```

The search results are listed in a table with the following columns: Document ID, Publication, Family ID, Lang., Pages, Title, Current OR, Current XRef, and Retrieval C.

Document ID	Publication	Family ID	Lang.	Pages	Title	Current OR	Current XRef	Retrieval C
L1: (393)	(Timothy near2 Chainer).	in.						
L4: (0)	L1 and (heat\$1sink or ((heat or thermal\$2) adj (sink or dump							
L5: (14)	L1 and (heat\$1sink or ((heat or thermal\$2) adj (sink or dum							
L6: (111)	(IBM or (international and business and machines)).as. and							
L12: (16,212)	((first or lower or bottom) near3 (die or chip)) and (							
L13: (691)	((first or lower or bottom) near3 (die or chip)) and ((se							
L15: (54)	((first or lower or bottom) near3 (die or chip)) and ((sec							
L16: (74)	((stack\$3 or assembl\$3) near5 (die or chip)) and ((heat\$1s							
L17: (184)	((stack\$3 or assembl\$3) near5 (die or chip)) and (heat\$1s							
L19: (1,156)	((stack\$3 or assembl\$3) near5 (die or chip)) and ((heat							

The interface also includes a search bar with the following options:

- Search: US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT
- Default operator: OR
- Buttons: Search, Classification, List, Browse, Queue, Clear
- Options:  Plurals,  Highlight all hit terms initially,  Show errors
- Ordering:  Prior Art Search,  Interference Search,  Order by Date,  Order by No. of Hit Terms

At the bottom of the interface, there are buttons for BRS form, IS&R form, Image, Text, and HTML. The status bar shows "Ready" and "CONNECTED as 'kparendo' [19:27] IDLE [00:07/03:00:00] NUM".



# A condensed list of some relevant CPC subgroups

The screenshot shows a patent search interface with a left sidebar containing folders like Drafts, Prior Art, Pending, Active, Failed, Saved, Favorites, Queue, Interference, Tagged (62), and UDC. The main area displays a list of CPC subgroups under the 'Active' folder:

- L1: (393) (Timothy near2 Chainer).in.
- L4: (0) L1 and (heat\$1sink or ((heat or thermal\$2) adj (sink or dump or reservoir)))
- L5: (14) L1 and (heat\$1sink or ((heat or thermal\$2) adj (sink or dump or reservoir)))
- L6: (111) (IBM or (international and business and machines)).as. and (heat\$1sink or
- L12: (16,212) ((first or lower or bottom) near3 (die or chip)) and ((second or top or up
- L13: (691) ((first or lower or bottom) near3 (die or chip)) and ((second or top or up
- L15: (54) ((first or lower or bottom) near3 (die or chip)) and ((second or top or up
- L16: (74) ((stack\$3 or assembl\$3) near5 (die or chip)) and ((heat\$1sink or ((heat or
- L17: (184) ((stack\$3 or assembl\$3) near5 (die or chip)) and (heat\$1sink or ((heat or
- L19: (1,156) ((stack\$3 or assembl\$3) near5 (die or chip)) and ((heat\$1sink or ((heat
- L20: (14,990) \*\* CPC subgroup for heatsink with flowing liquid
- L21: (579) \*\* CPC subgroup for heatsink made of semiconductor
- L22: (5,358) \*\* CPC subgroup for stack of IC chips with thermal management
- L23: (23,984) \*\* CPC subgroup for TSV
- L24: (16,838) \*\* CPC subgroup for stack of IC chips with TSVs therein
- L25: (4,532) \*\* CPC subgroup for a pyramidal geometry of stacked IC chips
- L26: (5,674) \*\* CPC: carrier with electrical interconnections between stacked chips

On the right, a search results window is open, showing a search for 'H01L2225/06572.cpc.' with various filters and options. Below the search window, a table header is visible:

[FLT]	+	X	U	1	Document ID	Publication	Family ID	Lang.	Pages	Title	Current OR	Current XRef	Retrieval C
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At the bottom of the interface, there are tabs for 'Hits', 'Details', and 'HTML', and a status bar showing 'Ready' and 'CONNECTED as "kparendo" [34:45] IDLE [01:10/03:00:00]'.



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

The screenshot displays a patent search interface with a list of CPC intersection searches on the left and a search results window on the right.

**Search Results Window:**

- Search: L25 and L26
- DBs: US-PG Pub; US PAT; FPRS; EPO; JPO; DERWENT
- Default operator: OR
- Options:  Plurals,  Highlight all hit terms initially,  Show errors
- Ordering:  Prior Art Search,  Interference Search,  Order by Date,  Order by No. of Hit Terms
- Result: Pos 12

**Search List (Left Panel):**

- L1: (393) (Timothy near2 Chainer).in.
- L4: (0) L1 and (heat\$1sink or ((heat or thermal\$2) adj (sink or dump or reservoir)))
- L5: (14) L1 and (heat\$1sink or ((heat or thermal\$2) adj (sink or dump or reservoir)))
- L6: (111) (IBM or (international and business and machines)).as. and (heat\$1sink or
- L12: (16,212) ((first or lower or bottom) near3 (die or chip)) and ((second or top or up
- L13: (691) ((first or lower or bottom) near3 (die or chip)) and ((second or top or up
- L15: (54) ((first or lower or bottom) near3 (die or chip)) and ((second or top or up
- L16: (74) ((stack\$3 or assembl\$3) near5 (die or chip)) and ((heat\$1sink or ((heat or
- L17: (184) ((stack\$3 or assembl\$3) near5 (die or chip)) and (heat\$1sink or ((heat or
- L19: (1,156) ((stack\$3 or assembl\$3) near5 (die or chip)) and ((heat\$1sink or ((heat
- L20: (14,990) \*\* CPC subgroup for heatsink with flowing liquid
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- L24: (16,838) \*\* CPC subgroup for stack of IC chips with TSVs therein
- L25: (4,532) \*\* CPC subgroup for a pyramidal geometry of stacked IC chips
- L26: (5,674) \*\* CPC: carrier with electrical interconnections between stacked chips
- L28: (463) L20 and L22
- L29: (215) L20 and L22 and L24
- L30: (246) L20 and L22 and (L23 or L24)
- L31: (108) L20 and L26
- L32: (335) L25 and L26

**Table Header:**

[FLT]	+	X	U	1	Document ID	Publication	Family ID	Lang.	Pages	Title	Current OR	Current XRef	Retrieval C
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UNITED STATES  
PATENT AND TRADEMARK OFFICE

# Thank You!



