The TLS211_PAT_PUBLN Table

Welcome to a comprehensive exploration of one of the key tables in the PATSTAT database: the Publication Table (TLS211_PAT_PUBLN). The TLS211_PAT_PUBLN table is a critical component of the EPO's PATSTAT database, containing key bibliographic information related to patent publications. This table stores data from over 90 countries, including patent documents and utility model documents, reflecting the various stages of patent processing. These publications are snapshots of a patent application's progress, from initial filing through to grant, providing comprehensive insights into the lifecycle of patent applications.

Each record in the TLS211_PAT_PUBLN table represents a unique patent publication and contains essential information such as the publication authority, publication number, kind code, language and publication date. These elements are typically found on the first page of a printed patent document, helping to identify the publication. The table also includes two supplementary data points:

1. PUBLN_FIRST_GRANT : Indicates whether the publication is the first granted version of the patent.
2. PUBLN_CLAIMS : Stores the number of claims associated with the publication (available for select patent authorities).

This table is directly linked to the TLS201_APPLN table through the APPLN_ID , ensuring that the bibliographic data can be connected back to the patent application. Furthermore, it supports a detailed understanding of the publication process, including identifying amendments and tracking different kinds of publication events, such as applications, grants, and search reports.

In addition, TLS211_PAT_PUBLN includes a mechanism for handling artificial publications—cases where a cited document is missing from the DOCDB but is assumed to exist due to its citation. These artificial entries are given unique PUBLN_IDs in a reserved range and are assigned a default publication date of '**9999-12-31**', allowing them to be identified and analysed separately. In fact, PATSTAT data does not contain any NULL values and in fact all attributes may be defined as NOT NULL. Depending on the data type / domain, PATSTAT represents missing values like this:

- Missing values in attributes of type date are represented as '**9999-12-31**'.

In [1]:
```
from epo.tipdata.patstat import PatstatClient
from epo.tipdata.patstat.database.models import (
    TLS201_APPLN,
    TLS206_PERSON,
    TLS211_PAT_PUBLN,
    TLS227_PERS_PUBLN
)
from sqlalchemy import and_, case, func, select

# Initialise the PATSTAT client
patstat = PatstatClient(env="TEST")

# Access ORM
db = patstat.orm()
```

Key Fields in the TLS211_PAT_PUBLN Table

PAT_PUBLN_ID and APPLN_ID

In the `TLS211_PAT_PUBLN` table, the primary key is `PAT_PUBLN_ID`, and the foreign key is `APPLN_ID`.

1. Primary Key: `PAT_PUBLN_ID`
    - `PAT_PUBLN_ID` serves as the primary key for this table, uniquely identifying each patent publication. Each record in the `TLS211_PAT_PUBLN` table corresponds to a specific patent publication, and the `PAT_PUBLN_ID` ensures that there is no duplication of records. This field is a unique identifier for every publication event (whether application publication, grant, or other types), providing a direct reference point for accessing the bibliographic details of each document.
2. Foreign Key: `APPLN_ID`
    - The `APPLN_ID` is the foreign key that links the `TLS211_PAT_PUBLN` table to the `TLS201_APPLN` table, which contains the details of the corresponding patent application. This relationship is crucial because a patent publication is directly tied to the patent application it originates from. The `APPLN_ID` in `TLS211_PAT_PUBLN` refers back to the `APPLN_ID` in `TLS201_APPLN`, enabling users to trace all publications related to a single patent application.
    - Since one patent application can result in multiple publications (such as publication of the application itself, subsequent amendments, and the grant publication), the APPLN_ID allows for these relationships to be tracked, facilitating the analysis of a patent's publication history over time.

The `PAT_PUBLN_ID` field in `TLS211_PAT_PUBLN` is also crucial in its connection to `TLS227_PERS_PUBLN`, which records the many-to-many relationships between persons (applicants or inventors) and patent publications.

`TLS227_PERS_PUBLN` uses `PAT_PUBLN_ID` as a foreign key to link persons to specific publications. In this table, a combination of `PERSON_ID`, `PAT_PUBLN_ID`, `APPLT_SEQ_NR`, and `INVT_SEQ_NR` uniquely identifies each relationship between a person and a publication. This structure reflects the reality that:

- One person (e.g., an inventor or applicant) can be associated with many patent publications.
- One publication can involve multiple persons (both inventors and applicants).
- One application can have multiple publications, each associated with different inventors or applicants at different stages.

In [2]:
```
query_publications_applications = (
    db.query(
        TLS211_PAT_PUBLN.pat_publn_id,
        TLS201_APPLN.appln_id,
        TLS201_APPLN.appln_nr,
        TLS201_APPLN.appln_auth,
    )
    .join(TLS201_APPLN, TLS211_PAT_PUBLN.appln_id == TLS201_APPL
N.appln_id)
    .order_by(TLS211_PAT_PUBLN.appln_id.desc())
)

publications_applications_res = patstat.df(query_publications_app
lications)
publications_applications_res
```

Out[2]:

	pat_publn_id	appln_id	appln_nr	appln_auth
0	900929942	931908724	D84904	US
1	901714509	931905962	DM097305	XH
2	900449650	931904822	2012040534	WO
3	901183346	931901715	2004001224	WO
4	900742887	931900638	D33386	US
...	...	...	...	...
461898	472824978	186	08009051	EP
461899	278556884	146	07015148	EP
461900	335943971	146	07015148	EP
461901	278426008	145	07015055	EP
461902	278426009	145	07015055	EP

461903 rows × 4 columns

Count Publications per Application

I could be interesting to look at the relationship between table `TLS211_PAT_PUBLN` and `TLS201_APPLN`. What could be relevant is the **count of publications per application**, which can analyse how many publications are connected to each application. This can provide insights into the activity and innovation dynamics related to specific patent applications.

In [3]:
```
query_publications_per_application = (
    db.query(
        TLS201_APPLN.appln_id,
        TLS201_APPLN.appln_nr,
        func.count(TLS211_PAT_PUBLN.pat_publn_id).label("num_publ
ications"),
    )
    .join(TLS211_PAT_PUBLN, TLS201_APPLN.appln_id == TLS211_PAT_P
UBLN.appln_id)
    .group_by(TLS201_APPLN.appln_id, TLS201_APPLN.appln_nr)
    .order_by(func.count(TLS211_PAT_PUBLN.pat_publn_id).desc())
)

publications_per_application_res = patstat.df(query_publications_
per_application)
publications_per_application_res
```

Out[3]:

	appln_id	appln_nr	num_publications
0	930486365	261253	5
1	15806316	01105573	5
2	21513231	0623079	5
3	334317987	201113015219	5
4	55344647	0818216	5
...	...	...	...
323573	604951821	20230126010	1
323574	605752605	20230143873	1
323575	605759471	20230150878	1
323576	602886417	20230156479	1
323577	604330031	2023111206	1

323578 rows × 3 columns

In [4]:
```
# Define the query to join TLS211_PAT_PUBLN and TLS227_PERS_PUBLN
based on pat_publn_id
query = (
    db.query(
        TLS211_PAT_PUBLN.pat_publn_id,
        TLS211_PAT_PUBLN.appln_id,
        TLS211_PAT_PUBLN.publn_auth,
        TLS211_PAT_PUBLN.publn_nr,
        TLS227_PERS_PUBLN.person_id,
        TLS227_PERS_PUBLN.applt_seq_nr,
        TLS227_PERS_PUBLN.invt_seq_nr
    )
    .join(TLS227_PERS_PUBLN, TLS211_PAT_PUBLN.pat_publn_id == TLS
227_PERS_PUBLN.pat_publn_id)
)

# Execute the query and convert the results to a DataFrame
data_frame = patstat.df(query)

# Display the DataFrame
data_frame
```

Out[4]:

	pat_publn_id	appln_id	publn_auth	publn_nr	person_id	applt_seq_nr	invt
0	57032409	57025341	WO	2009046095	40585895	13	
1	57032409	57025341	WO	2009046095	40585896	14	
2	277518485	275544314	US	2010080683	5764262	13	
3	277518485	275544314	US	2010080683	11335060	12	
4	275128005	275053264	WO	2010028340	13008376	13	
...	...	...	...	...	...	...	
1906243	602999132	602999131	CN	117189501	66570468	4	
1906244	339023446	338961690	KR	20110079794	32937894	4	
1906245	548650527	548650526	CN	112628093	73773228	4	
1906246	560193704	560193703	CN	214533388	73773228	4	
1906247	328351834	323114641	CN	101826726	18745393	4	

1906248 rows × 7 columns

PUBLN_AUTH

This field indicates the **authority responsible** for publishing the patent document. It typically refers to the national or regional patent office that has jurisdiction over the publication. The publication authority is crucial for understanding the legal context of the patent. Different jurisdictions may have varying patent laws, examination procedures, and enforcement mechanisms. Knowing the publication authority helps researchers and analysts assess the patent's validity and its implications in different regions.

In [5]:
```
authority_match_query = (
    db.query(
        TLS211_PAT_PUBLN.pat_publn_id,
        TLS211_PAT_PUBLN.publn_auth.label("publication_authority"),
        TLS201_APPLN.appln_auth.label("application_authority"),
        TLS211_PAT_PUBLN.appln_id,
    )
    .join(
        TLS201_APPLN,
        TLS211_PAT_PUBLN.appln_id
        == TLS201_APPLN.appln_id,
    )
    .filter(
        TLS211_PAT_PUBLN.publn_auth
        != TLS201_APPLN.appln_auth  # filter to identify the discrepances
    )
    .order_by(TLS201_APPLN.appln_id)
)

authority_match_res = patstat.df(authority_match_query)

authority_match_res
```

Out[5]:

	pat_publn_id	publication_authority	application_authority	appln_id
0	300967052	CZ	CS	8862623
1	300967053	CZ	CS	8862623
2	298746790	RU	SU	44109172
3	301308855	RU	SU	44584466
4	299588059	RU	SU	44678807
5	298945679	RU	SU	44778908
6	300934103	RU	SU	44811768
7	300598502	RU	SU	44825314
8	300168070	RU	SU	44827521
9	301096737	RU	SU	44828844
10	301234124	RU	SU	44838334

11	301107580	RU	SU	44839357
12	304837924	RU	SU	44845018
13	300147277	RU	SU	44847155
14	300557213	RU	SU	44864746
15	298422628	RU	SU	44865511
16	299444637	RU	SU	44865532
17	301114030	RU	SU	44876180
18	299258636	RU	SU	44876812
19	299588053	RU	SU	44877425
20	300085167	RU	SU	44886576
21	299981691	RU	SU	44896994
22	301333661	RU	SU	44897081
23	300934107	RU	SU	44898229
24	300268225	RU	SU	44903192
25	301290611	RU	SU	44903842
26	300976270	RU	SU	44905157
27	300996825	RU	SU	44907059
28	299225769	RU	SU	44907502
29	299588058	RU	SU	44908553
30	299588055	RU	SU	44908554
31	300110071	RU	SU	44908854
32	300976259	RU	SU	44911883
33	300996826	RU	SU	44914903
34	298747189	RU	SU	44915773
35	298772810	RU	SU	44916295
36	301290610	RU	SU	44916363
37	299101072	RU	SU	44916468
38	297226786	RU	SU	44916899
39	296623775	RU	SU	44917739
40	299711246	RU	SU	44917927
41	299797072	RU	SU	44918606
42	303007733	RU	SU	44920483
43	297425851	RU	SU	44922932
44	300109379	RU	SU	44922943

45	299489908	RU	SU	44924014
46	300615998	RU	SU	44924911
47	299151396	RU	SU	44928902
48	297102096	RU	SU	44931033
49	297425870	RU	SU	44931257
50	300221793	RU	SU	44931293
51	296691475	RU	SU	44933417
52	295962730	RU	SU	44934171
53	300268191	RU	SU	44936623
54	300244692	RU	SU	44937558
55	299443574	RU	SU	44941697
56	298366547	RU	SU	44944489
57	297017712	RU	SU	44947040
58	406402053	RU	SU	406293936

`APPLN_AUTH` should be identical to the `PUBLN_AUTH` but from the resutl we can see that application authority and publication authority are not always identical. Namely, **Czechoslovakia (CS)** dissolved in 1993, and **Czech Republic (CZ)** became its successor state. Therefore, patents that were filed under Czechoslovakia are now published under the Czech Republic. Similarly, the **Soviet Union (SU)** dissolved in 1991, and **Russia (RU)** took over the handling of applications and publications.

PUBLN_NR

The publication number is a unique identifier assigned to each patent publication. It serves as the primary reference for locating a specific document within the patent system. The publication number is essential for legal citations, enforcement actions, and academic research.

PUBLN_NR_ORIGINAL

The `PUBLN_NR_ORIGINAL` is the original publication number assigned to a patent publication. This number is often assigned at the time of filing and serves as a unique identifier for the patent document in its initial form before any potential changes or re-publications occur.

In [6]:
```
publication_comparison_query = (
    db.query(
        TLS211_PAT_PUBLN.pat_publn_id,
        TLS211_PAT_PUBLN.publn_auth,
        TLS211_PAT_PUBLN.publn_nr,
        TLS211_PAT_PUBLN.publn_nr_original,
        TLS211_PAT_PUBLN.publn_date,
    )
    .filter(
        TLS211_PAT_PUBLN.publn_nr
        != TLS211_PAT_PUBLN.publn_nr_original  # Check for differences
    )
    .order_by(TLS211_PAT_PUBLN.publn_nr)
)

publication_comparison_res = patstat.df(publication_comparison_query)

publication_comparison_res
```

Out[6]:

	pat_publn_id	publn_auth	publn_nr	publn_nr_original	publn_date
0	401234868	KR	0122540	2001225400000	1998-07-15
1	401246293	KR	0134720	2001347200000	1999-01-15
2	401399921	KR	0138059	2001380590000	1999-05-15
3	401250767	KR	0140595	2001405950000	1999-04-01
4	306010102	KR	0147364	1001473640000	1998-08-01
...	...	...	...	...	...
93807	491700391	IT	UB20155875	UB2015A005875	2017-05-25
93808	494746109	IT	UB20159172	UB2015A009172	2016-03-24
93809	495066500	IT	UB20159212	UB2015A009212	2017-06-29
93810	514644034	IT	UB20161185	UB2016A001185	2017-09-01
93811	495065267	IT	UB20169983	UB2016A009983	2017-07-14

93812 rows × 5 columns

It could be interesting to analyse which publication authority has the most changes in the `PUBLN_NR_ORIGINAL` (Original Publication Number) compared to the `PUBLN_NR` (Publication Number). This would help identify which authorities show the most frequent discrepancies or changes between the original and actual publication numbers, potentially offering insights into the consistency or changes in their patent publication processes.

In [7]:
```
import matplotlib.pyplot as plt
import pandas as pd

trend_analysis = (
    publication_comparison_res.groupby("publn_auth")
    .size()
    .reset_index(name="discrepancy_count")
)

trend_analysis = trend_analysis.sort_values(
    by="discrepancy_count", ascending=False
).head(10)

trend_analysis
```

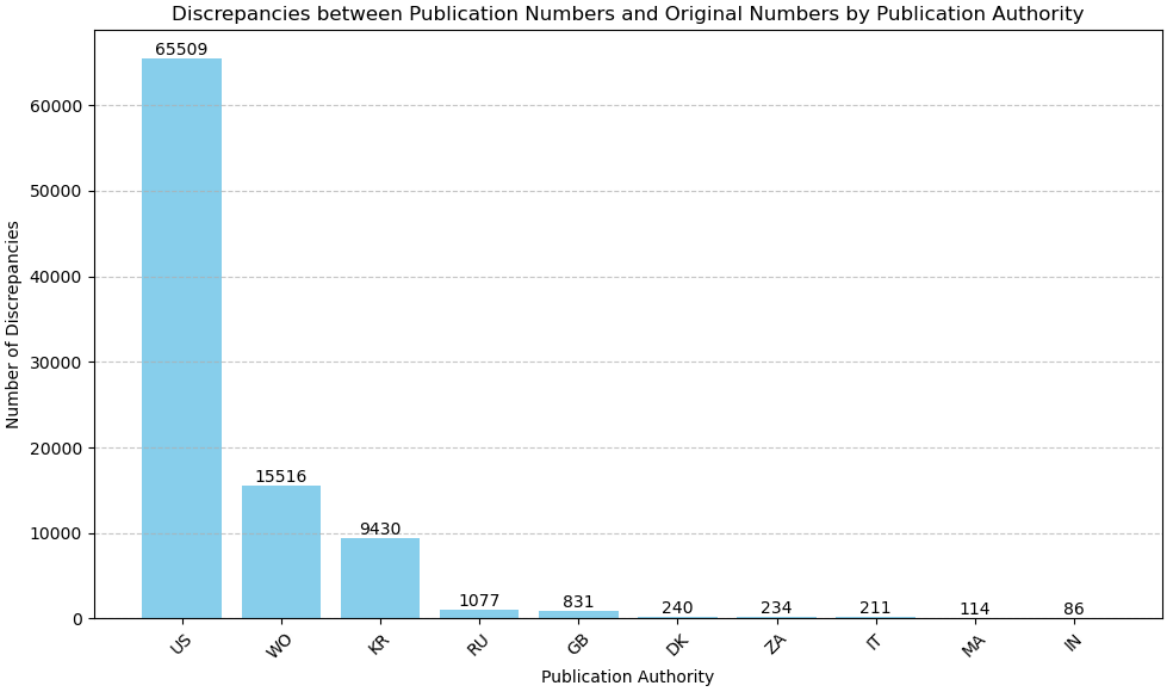
Out[7]:

	publn_auth	discrepancy_count
35	US	65509
37	WO	15516
21	KR	9430
28	RU	1077
13	GB	831
8	DK	240
38	ZA	234
18	IT	211
23	MA	114
17	IN	86

In [8]:
```
plt.figure(figsize=(10, 6))
bars = plt.bar(
    trend_analysis["publn_auth"], trend_analysis["discrepancy_count"], color="skyblue"
)

for bar in bars:
    height = bar.get_height()
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f'{int(height)}',  # Display the height as an integer
        ha="center",
        va="bottom",
    )

plt.title(
    "Discrepancies between Publication Numbers and Original Numbers by Publication Authority"
)
plt.xlabel("Publication Authority")
plt.ylabel("Number of Discrepancies")
plt.xticks(rotation=45)
plt.grid(axis="y", linestyle="--", alpha=0.7)
plt.tight_layout()
plt.show()
```



In [9]:
```
publication_matched_query = (
    db.query(
        TLS211_PAT_PUBLN.pat_publn_id,
        TLS211_PAT_PUBLN.publn_auth,
        TLS211_PAT_PUBLN.publn_nr,
        TLS211_PAT_PUBLN.publn_nr_original,
        TLS211_PAT_PUBLN.publn_date,
    )
    .filter(
        TLS211_PAT_PUBLN.publn_nr
        == TLS211_PAT_PUBLN.publn_nr_original  # Check for the on
es that have the same
    )
    .order_by(TLS211_PAT_PUBLN.publn_nr)
)

publication_matched_res = patstat.df(publication_matched_query)

publication_matched_res
```

Out[9]:

	pat_publn_id	publn_auth	publn_nr	publn_nr_original	publn_date
0	387314222	EA	000588	000588	1999-12-29
1	310875510	EP	0008173	0008173	1980-02-20
2	310729854	EP	0013870	0013870	1980-08-06
3	387317837	EA	004201	004201	2004-02-26
4	387318789	EA	005152	005152	2004-12-30
...	...	...	...	...	...
272913	597958912	JP	WO2023053847	WO2023053847	2023-04-06
272914	601132860	JP	WO2023105551	WO2023105551	2023-06-15
272915	603445212	JP	WO2023139714	WO2023139714	2023-07-27
272916	604697250	JP	WO2023152862	WO2023152862	2023-08-17
272917	593552557	JP	WO2023276004	WO2023276004	2023-01-05

272918 rows × 5 columns

In [10]:
```
matched_trend_analysis = (
    publication_matched_res.groupby("publn_auth")
    .size()
    .reset_index(name="matching_count")
)

matched_trend_analysis = matched_trend_analysis.sort_values(
    by="matching_count", ascending=False
).head(10)

matched_trend_analysis
```

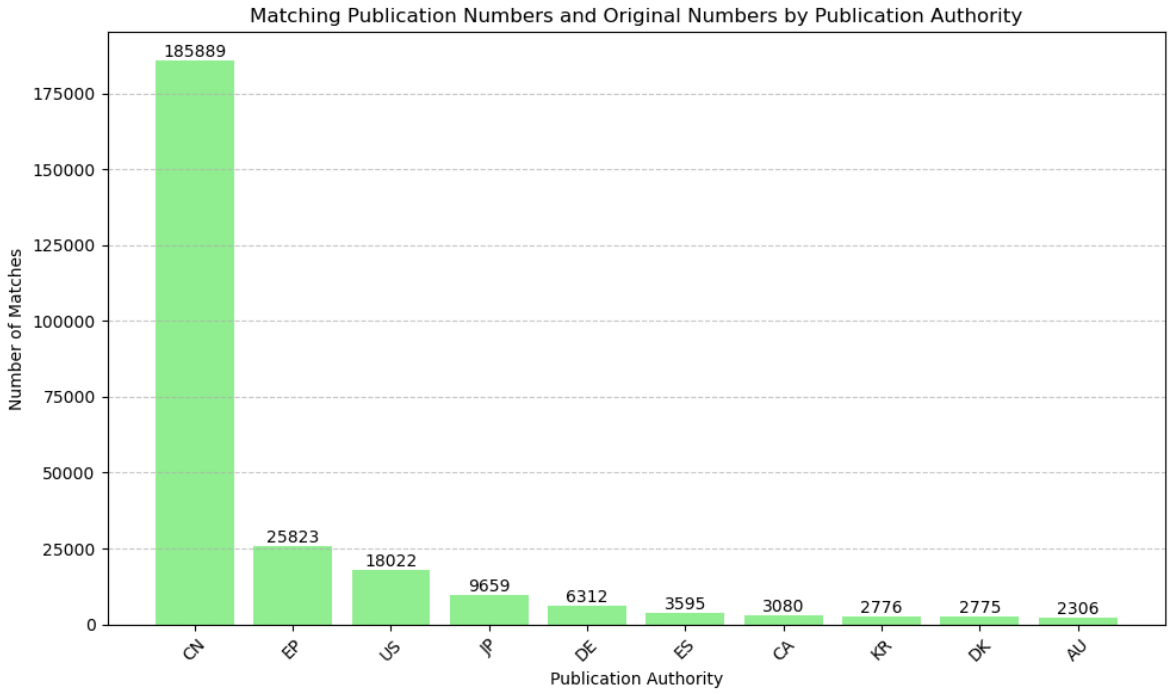
Out[10]:

	publn_auth	matching_count
9	CN	185889
19	EP	25823
59	US	18022
33	JP	9659
14	DE	6312
20	ES	3595
6	CA	3080
34	KR	2776
15	DK	2775
2	AU	2306

In [11]:
```
plt.figure(figsize=(10, 6))
bars = plt.bar(
    matched_trend_analysis["publn_auth"], matched_trend_analysis["matching_count"], color="lightgreen"
)

for bar in bars:
    height = bar.get_height()
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f'{int(height)}',  # Display the height as an integer
        ha="center",
        va="bottom",
    )

plt.title(
    "Matching Publication Numbers and Original Numbers by Publication Authority"
)
plt.xlabel("Publication Authority")
plt.ylabel("Number of Matches")
plt.xticks(rotation=45)
plt.grid(axis="y", linestyle="--", alpha=0.7)
plt.tight_layout()
plt.show()
```



PUBLN_KIND

The publication kind indicates the **type** or **format** of the published patent document. It is represented by a specific code that signifies whether the document is an application, a granted patent, or another type of publication (e.g., a search report). Understanding the publication kind is critical for interpreting the content and implications of the patent document. For example, in EPO publications, an application publication (A1, A2) provides different information compared to a granted patent (B1, B2). The publication kind code helps researchers and legal professionals quickly determine the document's relevance and legal status within the patent landscape.

In [12]:
```
kind_codes_query = (
    db.query(
        TLS211_PAT_PUBLN.publn_kind,
        func.count(TLS211_PAT_PUBLN.pat_publn_id).label("count"),
    )
    .group_by(TLS211_PAT_PUBLN.publn_kind)
    .order_by(func.count(TLS211_PAT_PUBLN.pat_publn_id).desc())
)

kind_codes_res = patstat.df(kind_codes_query)

kind_codes_res
```

Out[12]:

	publn_kind	count
0	A	141371
1	A1	106522
2	B	54250
3	B2	51918
4	U	46431
...	...	...
67	P2	1
68	P4	1
69	T9	1
70	X2	1
71	b	1

72 rows × 2 columns

STANDARD ST.16 - WIPO

Here the **RECOMMENDED STANDARD CODE FOR THE IDENTIFICATION OF DIFFERENT KINDS OF PATENT DOCUMENTS** is insert, so that people can orient themselves thorugh the different `PUBLN_KIND` that exist. The Standard ST.16 outlines the recommended letter codes used to identify

different kinds of patent documents published by industrial property offices. This classification is essential for the systematic organization and retrieval of patent-related documents.

The letter codes are designed to distinguish various patent documents, including those derived from patent applications and non-patent literature.

First Group

Includes primary patent documents (e.g., A, B, C). Use for documents resulting from a patent application and being identified as the primary or major series (excluding the utility model documents of Group 2 and the special series of patent documents as specified in Group 3, below).

- A - First publication level:
  - This code indicates that the document represents the first publication of a patent application. This is the initial public disclosure of the application, which typically occurs 18 months after the priority date or filing date, depending on the jurisdiction.
- B - Second publication level:
  - This code signifies a subsequent publication of a patent application. This may occur if the application undergoes significant changes or amendments after its initial filing and is re-published to reflect those changes.
- C - Third publication level:
  - This code indicates yet another level of publication, typically related to further amendments or additional disclosures regarding the patent application.

Second Group

Focuses on utility model documents, distinguishing between first, second, and third publication levels (U, Y, Z). Use for utility model documents having a numbering series other than the documents of Group:

- U - First publication level
- Y - Second publication level
- Z - Third publication level.

Third Group

Indicates another level of publication, typically related to further amendments or additional disclosures regarding the patent application:

- M - Medicament patent documents (e.g., documents previously published by FR)
- P - Plant patent documents (e.g., published by US)
- S - Design patent documents (e.g., published by US).

Fourth Group

Used for special types of patent documents or documents derived from/relating to patent applications and not covered by Groups 1 to 3:

- L - Documents, not covered by the letter code W, relating to patent documents and containing

bibliographic information and only the text of an abstract and/or claim(s) and, where appropriate, a drawing
- R - Separately published search reports
- T - Publication, for information or other purposes, of the translation of the whole or part of a patent document already published by another office or organisation
- W - Documents relating to utility model documents falling in Group 2 and containing bibliographic information and only the text of an abstract and/or claim(s) and, where appropriate, a drawing.

Fifth Group

Covers a series of patent documents not covered by Groups 1 to 4:

- E - First publication level
- F - Second publication level
- G - Third publication level.

Sixth Group

Documents derived from/relating to patent applications and not covered by Groups 1 to 5, above, according to the special requirements of each industrial property office (H and I)

Seventh Group

Others:

- N Non-patent literature documents
- X Documents restricted to the internal use of industrial property offices

Weekly updated coverage, codes and statistics - Publication, application, priority numbers concordance table

The different kind codes used by various states are updated weekly and can be freely consulted on the following site: Kind Codes Updates (https://publication-bdds.apps.epo.org/raw-data/products/public/product/31).

PUBLN_DATE

The publication date is the date on which the patent document is **officially published** and made available to the public. This date is critical in the patent lifecycle as it marks the moment when the patent application enters the public domain.

Retrieve Publications for a Specific Application

Here it can be seen how to query the publications for a specific application, for example, with APPLN_ID : **15806316**

In [13]:
```
query_publications_for_application = (
    db.query(
        TLS201_APPLN.appln_nr,
        TLS211_PAT_PUBLN.publn_nr,
        TLS211_PAT_PUBLN.publn_auth,
        TLS211_PAT_PUBLN.pat_publn_id,
        TLS211_PAT_PUBLN.publn_kind,
        TLS211_PAT_PUBLN.publn_date,
    )
    .join(TLS201_APPLN, TLS211_PAT_PUBLN.appln_id == TLS201_APPLN.appln_id)
    .filter(TLS201_APPLN.appln_id == 15806316)  # Filter for the specific application ID
    .order_by(TLS211_PAT_PUBLN.publn_date)  # Order publications by publication date
)

publications_for_application_res = patstat.df(query_publications_for_application)
publications_for_application_res
```

Out[13]:

	appln_nr	publn_nr	publn_auth	pat_publn_id	publn_kind	publn_date
0	01105573	1150039	EP	290717146	A2	2001-10-31
1	01105573	1150039	EP	387566930	A3	2003-03-12
2	01105573	1150039	EP	290717149	B1	2003-11-12
3	01105573	1150039	EP	290717156	B2	2007-11-14
4	01105573	1150039	EP	331998793	B3	2011-02-09

The dataframe displays information regarding European patent publications (`publn_auth` = EP) for a specific application, identified by the application number (`appln_nr`) and linked to various publications through the publication number (`publn_nr`). Each publication has associated attributes, including the publication authority (`publn_auth`), the unique patent publication ID (`pat_publn_id`), the publication kind (`publn_kind`), and the publication date (`publn_date`).

The European Patent Office (EPO) categorises its documents into two main types: **EP-A documents** and **EP-B documents**, each with distinct identifiers that indicate the nature of the publication.

EP-A Documents:

These are the initial publications of patent applications that provide information about the filing and associated search reports.

- **A1**: European patent application published with the European search report. This indicates that a search report has been made available alongside the publication.
- **A2**: European patent application published without the European search report. This indicates that at the time of publication, the search report was not available.
- **A3**: This refers to a separate publication of the European search report itself, allowing access to the search findings without the full application details.
- **A4**: Represents a supplementary search report, which provides additional insights following the initial search.
- **A8**: Indicates a corrected title page of a document, such as A1 or A2, which rectifies any inaccuracies.
- **A9**: Represents a complete reprint of a previously published document (A1, A2, or A3), ensuring that all details are accurately presented.

EP-B Documents:

These publications detail the specifications of granted patents and any changes following the opposition procedures.

- **B1**: This is a European patent specification that has been granted, indicating that the application has successfully completed the examination process.
- **B2**: This refers to a new European patent specification that has been amended following an opposition procedure, reflecting changes made to the initial granted patent.
- **B3**: Represents a European patent specification that has been amended following a limitation procedure, indicating a reduction in the scope of the patent claims.
- **B8**: Indicates a corrected title page of a B document (B1 or B2), ensuring all information is accurate and up-to-date.
- **B9**: This is a complete reprint of a B document (B1 or B2), which ensures that all details are correctly represented.

In this notebook, we will focus on analysing the kind codes that have the European Patent Office as their publication authority. By doing so, we aim to elucidate the underlying dynamics associated with these kind codes. This approach can subsequently be applied to other jurisdictions and their respective kind codes, enabling a comparative understanding of patent publication practices across different regions.

PUBLN_LG

This attribute indicates the **language** in which the patent publication is made. It is important for understanding the accessibility of the publication to different linguistic demographics and for determining the audience that can engage with the document.

To gather insights about the different languages used in patent publications, we can create a query that counts the number of publications by each language:

In [14]:
```
publication_language_query = (
    db.query(
        TLS211_PAT_PUBLN.publn_lg.label("publication_language"),
        func.count(TLS211_PAT_PUBLN.pat_publn_id).label("number_of_publications"),
    )
    .group_by(TLS211_PAT_PUBLN.publn_lg)  # Group by publication language
    .order_by(func.count(TLS211_PAT_PUBLN.pat_publn_id).desc())
    .limit(10)
)

publication_language_res = patstat.df(publication_language_query)

publication_language_res
```

Out[14]:

	publication_language	number_of_publications
0	ZH	190847
1	EN	157169
2		52703
3	DE	17735
4	KO	13148
5	JA	11151
6	ES	5311
7	FR	3670
8	RU	2819
9	DA	2806

PUBLN_FIRST_GRANT

This attribute indicates whether the publication marks the **first indication of a patent grant**. It essentially flags the publication as a significant milestone in the patent's lifecycle. This field can have two possible values:

- **Y** (Yes): This indicates that the publication represents the first indication of a patent grant for that application. It signifies that the application has successfully transitioned to a granted patent status for the first time.
- **N** (No): This signifies that the publication does not represent the first grant. In this case, the patent may have undergone modifications, amendments, or subsequent grants, and this publication is not the initial grant of the patent application.

The first grant publication is crucial because it represents the point at which the patent's rights are officially recognised. Analysing these publications can help track the effectiveness of patent applications and the timeliness of granting processes. It may also provide insights into the applicant's strategic decisions regarding when to file for patent protection. The **Y** and **N** values allow analysts to trace the lifecycle of patent applications. Recognising which publications are first grants can help assess the timing of patent grants in relation to application submissions.

In [15]:
```
query_first_grant = db.query(
    TLS211_PAT_PUBLN.pat_publn_id,
    TLS211_PAT_PUBLN.publn_auth,
    TLS211_PAT_PUBLN.publn_nr,
    TLS211_PAT_PUBLN.publn_date,
    TLS211_PAT_PUBLN.publn_first_grant,
).order_by(TLS211_PAT_PUBLN.publn_first_grant)

first_grant_res = patstat.df(query_first_grant)

first_grant_res
```

Out[15]:

	pat_publn_id	publn_auth	publn_nr	publn_date	publn_first_grant
0	277463601	JP	2007335157	2007-12-27	N
1	277470751	CN	101257214	2008-09-03	N
2	278075478	JP	2008101363	2008-05-01	N
3	278095305	JP	2008090548	2008-04-17	N
4	282661042	JP	2005023613	2005-01-27	N
...	...	...	...	...	...
461900	529676661	DK	201900085	2020-04-14	Y
461901	542048852	DK	202000105	2020-11-27	Y
461902	542436114	DK	202000107	2020-12-04	Y
461903	595358053	DK	202200058	2023-07-03	Y
461904	488188357	DK	201700026	2017-12-22	Y

461905 rows × 5 columns

It is interesting to analyse the average number of days that each authority takes from the application filing date to the first grant. Understanding the time taken by different patent authorities to grant patents provides valuable insights into the efficiency and responsiveness of their respective patent systems.

In [16]:
```
first_grant_time_query = (
    db.query(
        TLS201_APPLN.appln_nr,
        TLS211_PAT_PUBLN.pat_publn_id,
        TLS211_PAT_PUBLN.publn_auth,
        TLS211_PAT_PUBLN.publn_nr,
        TLS211_PAT_PUBLN.publn_nr_original,
        TLS211_PAT_PUBLN.publn_date,
        TLS201_APPLN.appln_filing_date,
        (TLS211_PAT_PUBLN.publn_date - TLS201_APPLN.appln_filing_
date).label(
            "days_to_first_grant"
        ),  # Subtract dates directly
    )
    .join(TLS201_APPLN, TLS211_PAT_PUBLN.appln_id == TLS201_APPL
N.appln_id)
    .filter(
        TLS211_PAT_PUBLN.publn_first_grant == "Y",
        TLS201_APPLN.appln_filing_date != "9999-12-31",
    )
    .order_by((TLS211_PAT_PUBLN.publn_date - TLS201_APPLN.appln_f
iling_date).asc())
)

first_grant_time_res = patstat.df(first_grant_time_query)

first_grant_time_res
```

Out[16]:

	appln_nr	pat_publn_id	publn_auth	publn_nr	publn_nr_original	publn_d
0	2026718	552081796	NL	2026718	None	2020-06
1	202022103411	576265066	DE	202022103411	202022103411	2022-06
2	202018101002	492134986	DE	202018101002	202018101002	2018-02
3	202021102426	551429718	DE	202021102426	202021102426	2021-05
4	202022103398	576264962	DE	202022103398	202022103398	2022-06
...	...	...	...	...	...	
208073	9104319	339782164	GB	2476787	2476787	2011-12
208074	27971052	327932689	US	3784983	None	1974-01
208075	41319073	294270975	US	5926128	None	1999-07
208076	22569981	421617606	US	8830112	08830112	2014-09
208077	17131862	286261376	US	6707871	None	2004-03

208078 rows × 8 columns

In [17]:
```
first_grant_time_res['days_to_first_grant'] = first_grant_time_res['days_to_first_grant'].apply(lambda x: x[1])    # Extract the number of days from the 'days_to_first_grant' tuple

average_days_to_first_grant = (
    first_grant_time_res.groupby("publn_auth")["days_to_first_grant"]
    .mean()
    .reset_index()
)

average_days_to_first_grant.columns = ["publn_auth", "avg_days_to_first_grant"]    # Rename the columns for clarity

average_days_to_first_grant['avg_days_to_first_grant'] = average_days_to_first_grant['avg_days_to_first_grant'].round(2)    # Rounded the average days to two decimal places

top_10_average_days_to_first_grant = average_days_to_first_grant.sort_values(
    by="avg_days_to_first_grant"
).head(10)

top_10_average_days_to_first_grant = top_10_average_days_to_first_grant.reset_index(drop=True)

top_10_average_days_to_first_grant
```

Out[17]:

	publn_auth	avg_days_to_first_grant
0	SM	37.00
1	NI	140.00
2	PH	150.13
3	SI	277.00
4	LU	311.98
5	AR	401.00
6	GR	407.33
7	BE	454.06
8	ZA	481.98
9	BG	568.22

The query demonstrates that when a patent is granted under the EPO, B1 is the kind code used to denote this status, as indicated by the `PUBLN_FIRST_GRANT = 'Y'` condition. This kind of check helps confirm the standard codes associated with patent grants.

In [18]:
```
distinct_kindcode_query = (
    db.query(TLS211_PAT_PUBLN.publn_kind)
    .filter(
        TLS211_PAT_PUBLN.publn_first_grant == "Y", TLS211_PAT_PUB
LN.publn_auth == "EP"
    )
    .distinct()
)

distinct_kindcode_res = patstat.df(distinct_kindcode_query)

distinct_kindcode_res
```

Out[18]:

	publn_kind
0	B1

PUBLN_CLAIMS

`PUBLN_CLAIMS` in the `TLS211_PAT_PUBLN` table refers to the number of claims listed in a specific patent publication. Claims are a crucial part of a patent document because they define the **scope of the patent's protection**, detailing the boundaries of the intellectual property that the patent covers. By looking at the number of claims, one can understand how broad or narrow the protection of the invention is. More claims might indicate a more comprehensive protection of various aspects of the invention.

The number of claims can indicate the **complexity** and **breadth** of the patent. A higher number of claims may suggest a more comprehensive coverage of the invention, which can be strategically beneficial for the applicant. Analysing claim counts across different patents can also highlight trends in innovation within certain industries or technology fields.

In [19]:
```
claims_changes_query = (
    db.query(
        TLS201_APPLN.appln_nr,
        TLS211_PAT_PUBLN.publn_auth,
        TLS211_PAT_PUBLN.publn_nr,
        TLS211_PAT_PUBLN.publn_kind,
        TLS211_PAT_PUBLN.publn_date,
        TLS211_PAT_PUBLN.publn_claims,
    )
    .filter(
        TLS201_APPLN.appln_id == 15806316  # Filter for the speci
fic application number
    )
    .join(TLS211_PAT_PUBLN, TLS201_APPLN.appln_id == TLS211_PAT_P
UBLN.appln_id)
    .order_by(TLS211_PAT_PUBLN.publn_date)
)

claims_changes_res = patstat.df(claims_changes_query)
claims_changes_res
```

Out[19]:

	appln_nr	publn_auth	publn_nr	publn_kind	publn_date	publn_claims
0	01105573	EP	1150039	A2	2001-10-31	10
1	01105573	EP	1150039	A3	2003-03-12	0
2	01105573	EP	1150039	B1	2003-11-12	10
3	01105573	EP	1150039	B2	2007-11-14	10
4	01105573	EP	1150039	B3	2011-02-09	10

Throughout the lifecycle of a publication, the number of claims associated with a patent can vary significantly. This variability may result in certain publications, such as those designated with kind code A3, having zero claims at certain points.

For example, publications categorised under A3 typically refer to separate publications of the European search report. These documents may not include any claims, reflecting their specific purpose of disclosing search results rather than outlining patent rights. Consequently, the claims for these publications can appear as zero, particularly if they are standalone documents that do not represent the complete patent application.

It is valuable to examine the **average number of claims** across different stages of European patent publications. By focusing on publications with kind codes A1 and A2, which represent the initial stages of a patent application, and comparing these to the B1 publications, which signify granted patents, we gain insights into the evolution of patent scope over the patenting process.

In [20]:
```
average_claims_A1_A2_query = db.query(
    func.avg(TLS211_PAT_PUBLN.publn_claims).label('avg_claims_A1_
A2')
).filter(
    TLS211_PAT_PUBLN.publn_auth == 'EP',
    TLS211_PAT_PUBLN.publn_kind.in_(['A1', 'A2'])
)

average_claims_A1_A2_res = patstat.df(average_claims_A1_A2_query)

average_claims_A1_A2_res
```

Out[20]:

	avg_claims_A1_A2
0	8.429957

These represent **initial patent applications** published by the European Patent Office, with **A1** including the European search report and A2 without it. Analysing the average number of claims in these stages helps identify how inventors define the scope of their inventions early in the process.

In [21]:
```
average_claims_B1_query = db.query(
    func.avg(TLS211_PAT_PUBLN.publn_claims).label('avg_claims_B
1')
).filter(
    TLS211_PAT_PUBLN.publn_auth == 'EP',
    TLS211_PAT_PUBLN.publn_kind == 'B1'
)

average_claims_B1_res = patstat.df(average_claims_B1_query)

average_claims_B1_res
```

Out[21]:

	avg_claims_B1
0	12.020827

The **B1** publication reflects the **granted patent**, often following examination and potential modifications. By comparing the average number of claims at this stage with the initial A1/A2 stages, we can see how the scope of the patent evolves. It's common for the number of claims to be reduced during the examination process due to legal and technical objections.