



# LEAPS IPR-WEBINAR

## INVENTION AND PATENT

Stephanie Maier & Lan Fimmen

01.10.2021

—  
INNOVATION &  
TECHNOLOGIE  
TRANSFER —



# Agenda

LEAPS IP-Workshop, October 1th,2021

1. Introducing the Innovation & Technology Transfer Department (ITT)- Lan Fimmen
2. What is IP? (Overview of IP types such as Know How, Copyright, Industrial property rights,..)
3. How can I get a patent? (from idea to patent, overview of procedures)
4. What is a patent ? (Novelty, inventive step)-Stephanie Maier
5. How do I read a patent?
6. Outlook



# Innovation & Technology Transfer Department (ITT)

# DESY Basics.

Founded in 1959 as  
Germany's national  
accelerator lab

HH

ZEU

2.700 employees

more than 3.000 users per year  
from >40 countries

+ 100 Mio. € third  
party funding

ca. 260 Mio. € base  
budget



Innovation Park

INNOVATION

DESY Innovation Village

Start-up Labs

Innovation Centre II

Technology Centre

CFEL

EMBL

MPI

Water Institution

CSSB 2.0

UHH EDUCATION

Wolfgang-Pauli-Center

DESY RESEARCH

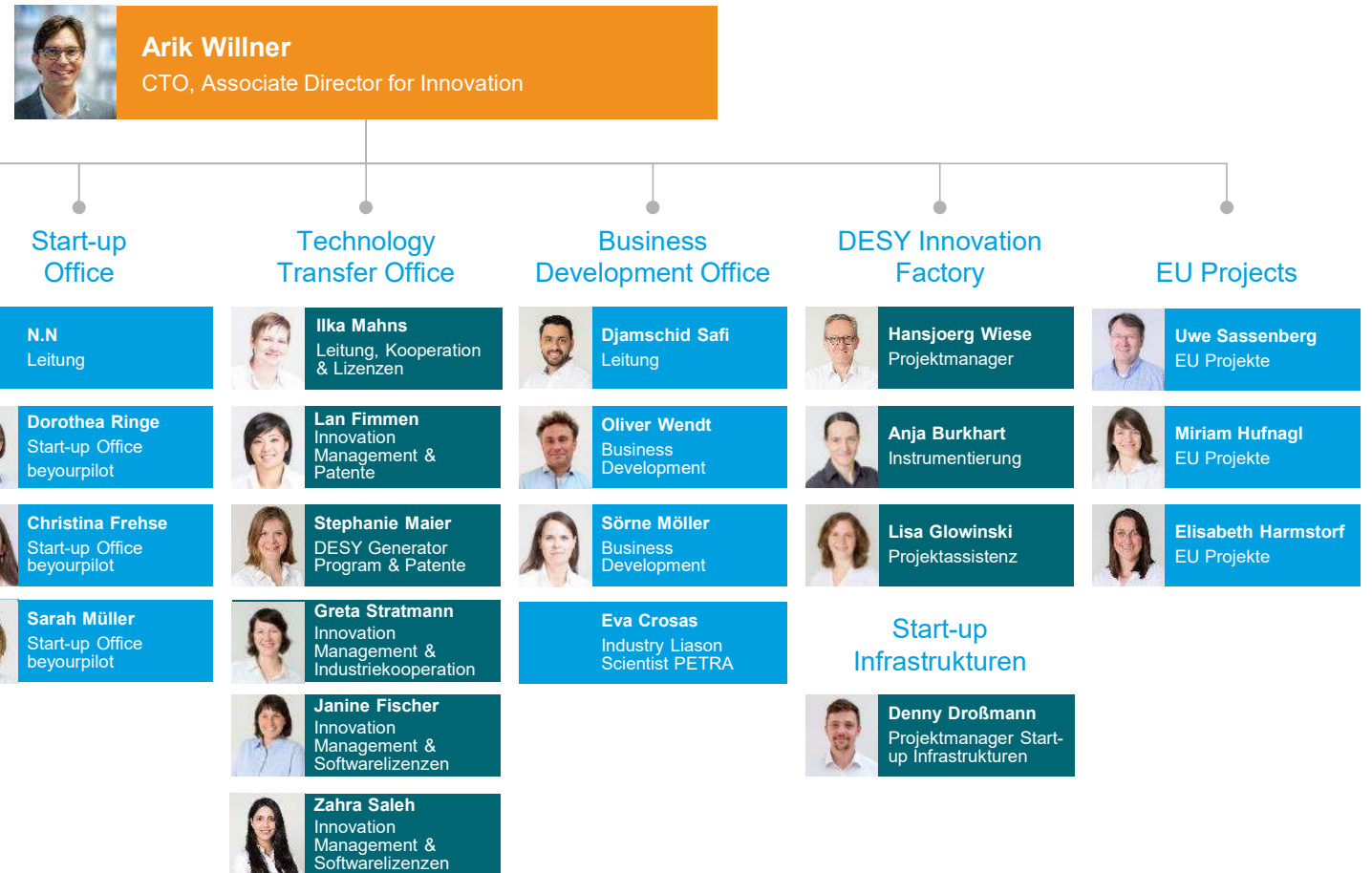
CHyn

PETRA IV

PETRA – Industry Hall

Vision: Innovation Ecosystem „Science City Bahrenfeld“

# Team for Innovation and Technology Transfer at DESY



# Technology Transfer Office (TTO)

## Team

— INNOVATION &  
TECHNOLOGIE  
TRANSFER —



**Ilka Mahns**  
(Physicist)  
Head of TTO  
Exploitation strategy  
Industry cooperation  
Licenses



**Lan Fimmen**  
(Chemist)  
Inventions  
Patents  
DESY Generator Program  
Industry cooperation



**Janine Fischer**  
(Biomedical engineer)  
Exploitation of Software  
Software licenses  
Digitalization  
*SoftWert* (BMBF)



**Stephanie Maier**  
(Physicist, Engineer)  
DESY Generator Program  
Inventions  
Patents



**Greta Stratmann**  
(Environmental scientist)  
Technology screening  
Industry cooperation  
3rd party funding



**Zahra Saleh**  
(Innovation manager)  
Exploitation of Software  
Project coordination  
*SoftWert* (BMBF)

# Technology Transfer Office (TTO)


## Activities


INNOVATION &  
TECHNOLOGIE  
TRANSFER

### Main Activities: IP protection and Exploitation of DESY technologies

- > Protection of the Intellectual Properties (IP) **generated at DESY**
- > **Technology Screenings** for early identification of innovations with exploitation potential
- > **Inventions & patents**
- > Identification of **confidential know-how**
- > Development of **exploitation strategies**
- > **Cooperation and validation projects with industrial partners**
- > **Licensing** of technologies including DESY know-how as well as patent applications
- > Networking in various working groups (different topics/sectors)
- > **Internal training** to raise awareness of IP protection and exploitation opportunities



(19)  Europäisches Patentamt  
European Patent Office  
Office européen des brevets

(11)  **EP 2 846 334 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent: **08.11.2017 Bulletin 2017/45**

(51) Int. Cl.: **H01F 10/32 (2006.01) H01F 41/30 (2006.01)**  
**G11B 5/39 (2006.01) G11B 5/85 (2006.01)**  
**H01L 43/12 (2006.01)**

(21) Application number: **13183166.1**

(22) Date of filing: **05.09.2013**

(54) **Method of producing a multilayer magnetoelectronic device and magnetoelectronic device**  
Verfahren zur Herstellung einer mehrschichtigen magnetoelektronischen Vorrichtung sowie magnetoelektronische Vorrichtung  
Procédé de production d'un dispositif magnétoélectronique multicouche et dispositif magnétoélectronique







# What is Intellectual Property (IP)?

# Intellectual Properties (IP): Definition

- > **Intellectual Properties (IP)** covers all property rights in creations of the human intellect  
→ for example: inventions, know-how, software, experimental results ...
- > **Intellectual Properties rights (IPR)** refers to all the rights that protect these individual intellectual achievements  
→ patent and utility model rights in respect of inventions  
or copyright in respect of works of science, literature and art (incl. software)  
or design rights or trademarks
- > **Background IP\***: any data, know-how or information is held by one party before the project started and is needed to proceed the project or exploit the results from the project  
→ Determination of Background IP **before** development starts!
- > **Foreground IP\***: any (tangible or intangible) output including results of the project such as data, knowledge or information that is generated in the project  
→ Documentation of Foreground IP **during** development!

\* from the Grant Agreement of LEAPS-INNOV

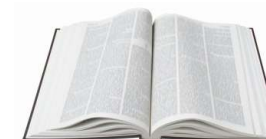
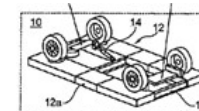
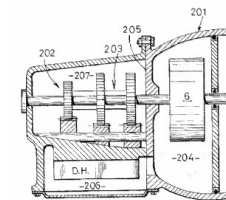
# Protection of Results and Exploitation – Regulation from the Grant Agreement

- > **Obligation to protect the results** (art. 27\*): Each party must examine the possibility of protecting its results and must adequately protect them, if
  - a) the results can reasonably be expected to be commercially or industrially exploited and
  - b) protecting them is possible, reasonable and justified (given the circumstances).
  
- > **Obligation to exploit the results** up to 4 years after project end (art. 28\*)
  - a) using them in further research activities (outside the action);
  - b) developing, creating or marketing a product or process;
  - c) creating and providing a service, or
  - d) using them in standardization activities.

\* from the Grant Agreement of LEAPS-INNOV

# The different types of IP-Protection (I)

Legal rights	What for?	How?
Patents	New inventions	Application and examination
Utility models	New inventions	Application and registration
Copyright	Original creative or artistic forms	Exists automatically



# The different types of IP-Protection (II)

Legal right	What for?	How?
Trade marks	Distinctive identification of products or services	Use and/or registration
Registered designs	External appearance	Registration
Trade secrets	Valuable information not known to the public	Reasonable efforts to keep secret



# Copyright

- When you create **an original literary, scientific and artistic work, such as poems, articles, films, songs or sculptures but also computer programs**, you are protected by copyright. Nobody apart from you has the right to make the work public or reproduce it.
- In EU countries, copyright protects your intellectual property **until 70 years after your death or 70 years** after the death of the last surviving author in the case of a work of joint authorship.

Copyright does not need to be registered. **It automatically exists when a work is created.**

- Copyright protection grants you the following exclusive rights:
  - economic rights – guaranteeing you have control over your work and remuneration for its use through selling or licensing
  - moral rights – usually protecting your rights to claim authorship (right of attribution) and to refuse a modification of your work (right of integrity)

# One product - many IP rights

## Trade marks

- NOKIA
- Product "208"
- Start-up tone

## Copyright

- Software
- User manuals
- Ringtones
- Start-up tone
- Images



## Patents and utility models

- Data-processing methods
- Operating system
- Operation of user interface

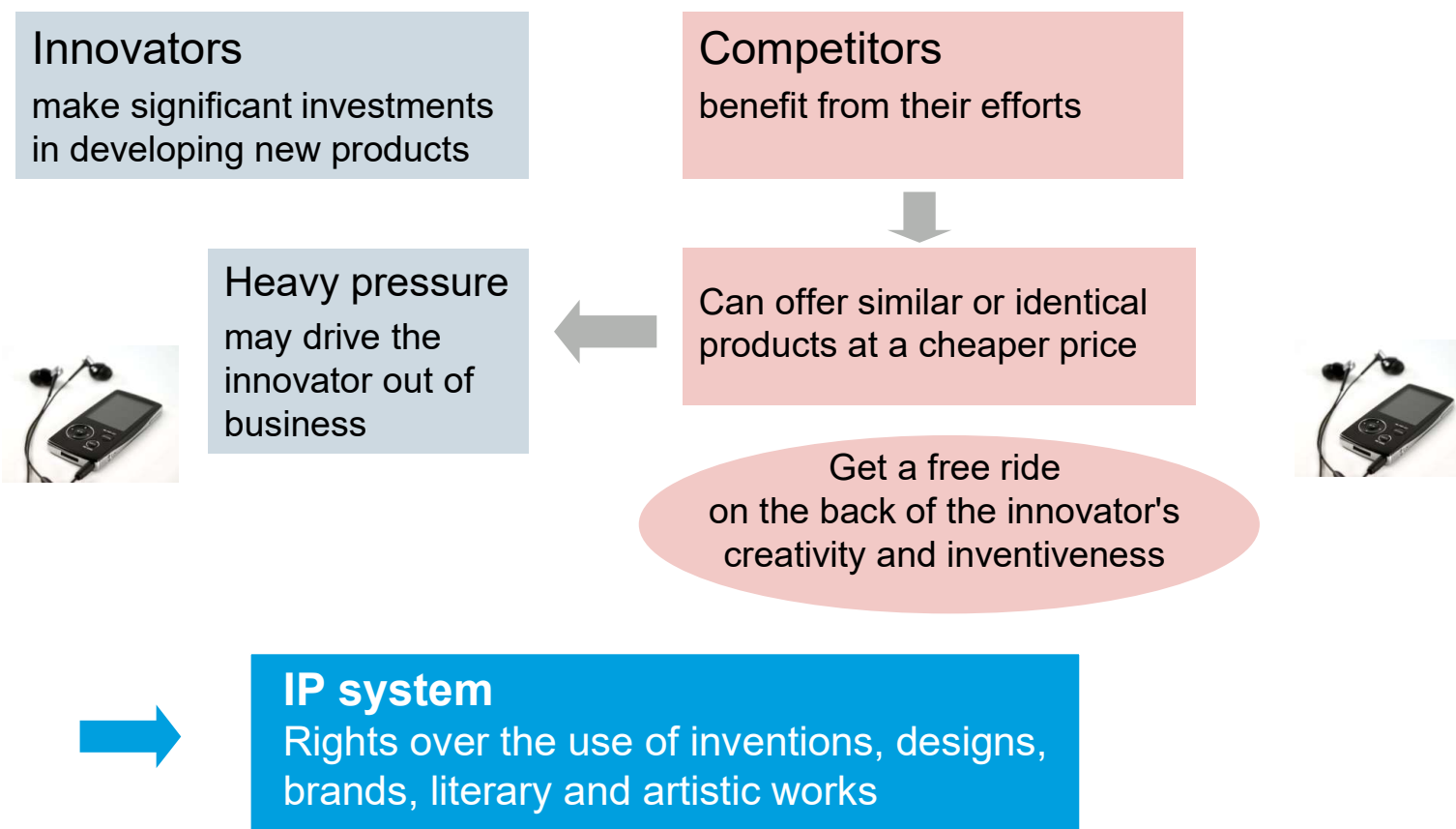
## Designs

- Form of overall phone
- Arrangement and shape of buttons
- Position and shape of screen

## Trade secrets

- Some technical know-how kept "in-house" and not published

# Importance of IP Protection





The background of the slide is a dense field of 3D question marks. Most are light gray, but one in the center is a vibrant red. A semi-transparent white rectangular box is overlaid on the scene, containing the text "Questions?".

**Questions?**



# How can I get a patent?

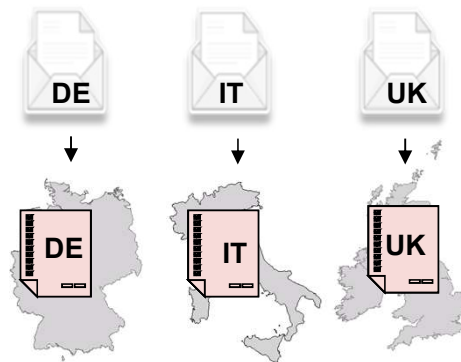
# How to obtain patent protection in Europe

(options 1 and 2)



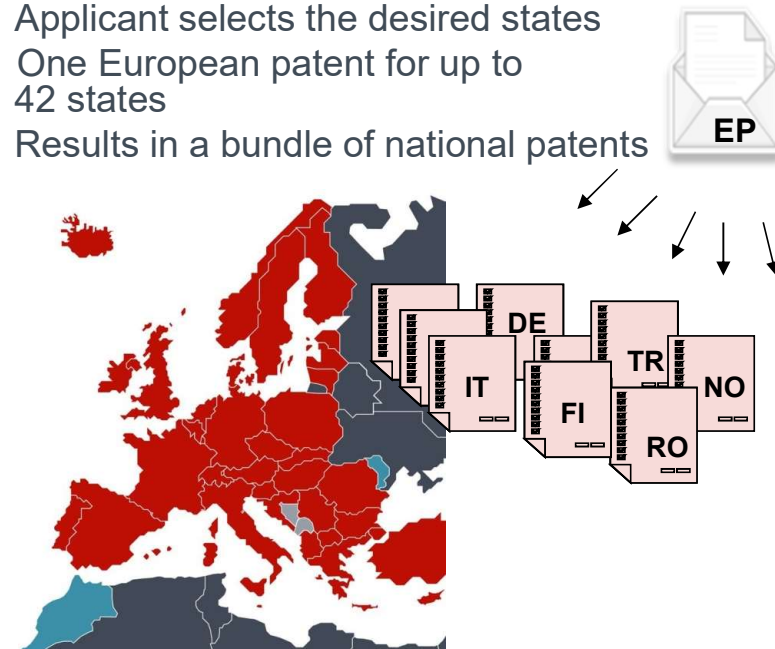
## The national route

- Separate procedures for each state
- Procedures differ according to national law



## The regional route: European Patent Convention

- One application filed at one office for up to 42 states
- One procedure
- Applicant selects the desired states
- One European patent for up to 42 states
- Results in a bundle of national patents

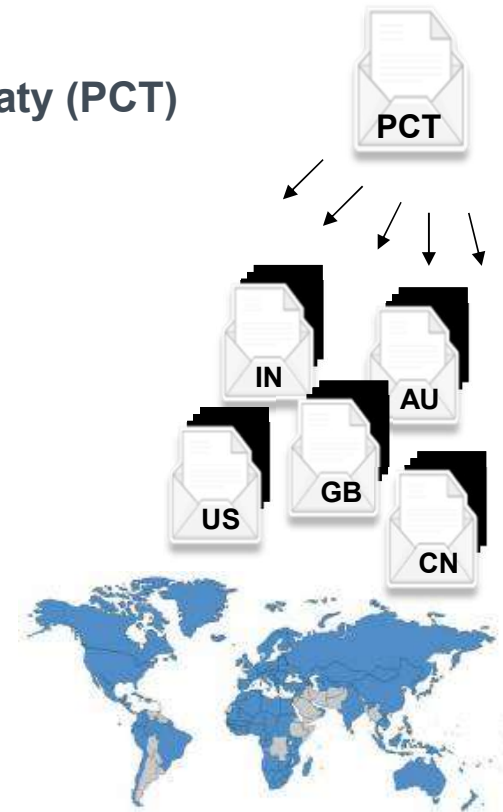


# How to obtain patent protection in Europe

(options 3)

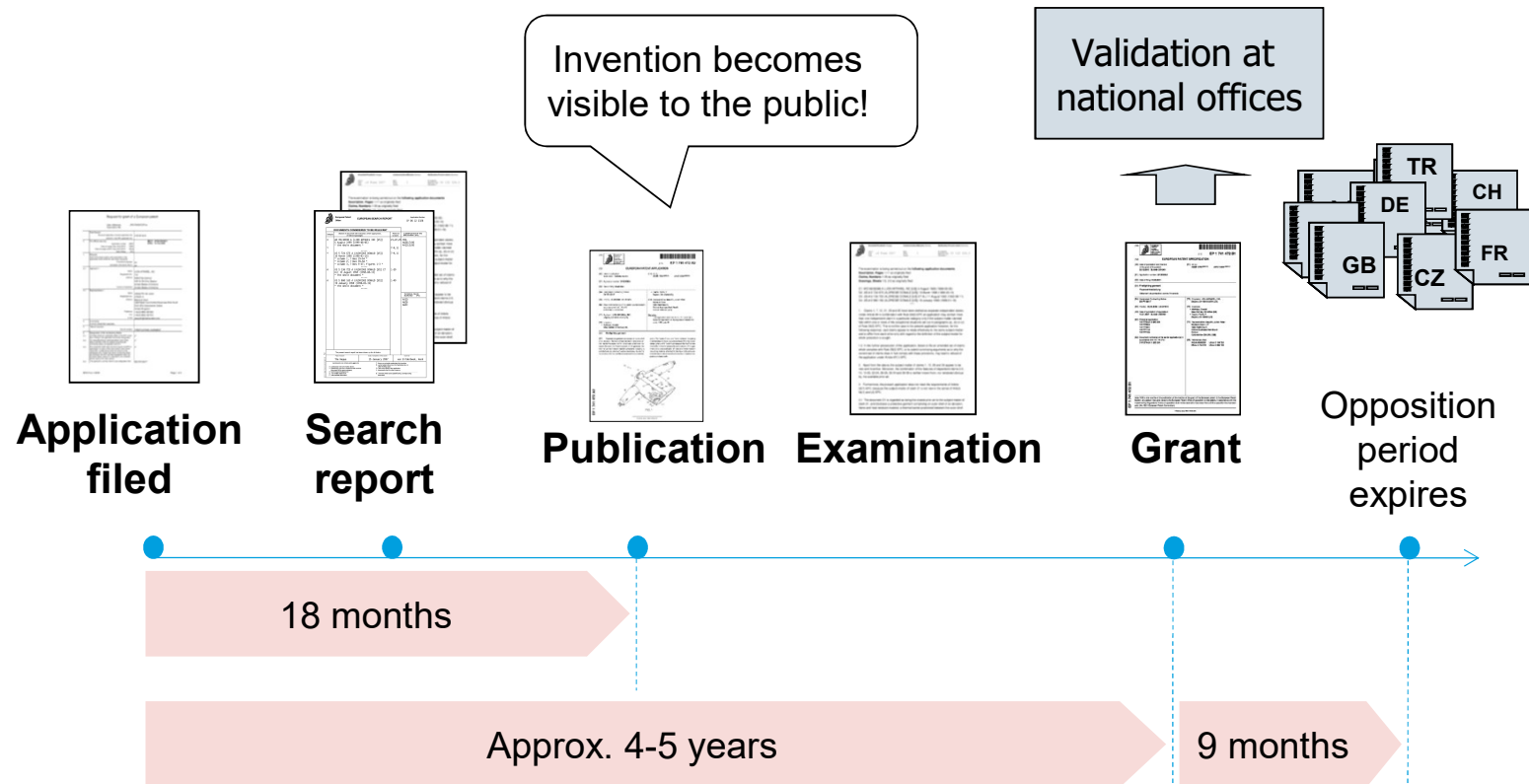
## The international route: Patent Cooperation Treaty (PCT)

- One single application for up to 148 countries\*
- Harmonisation of formal standards (language, patent agent, fees)
- Search report and opinion on patentability
- After 30-31 months, decision by applicant on which countries to proceed in.




\*December 2013

# The grant procedure before the EPO



The background of the slide is a dense field of 3D question marks. Most are light gray, but one in the center is a vibrant red. A semi-transparent white rectangular box is overlaid on the scene, containing the text "Questions?".

**Questions?**




**Break (10 min)**

The background features a dark brown gradient with a cluster of golden, faceted pyramids on the right side. A semi-transparent white rectangular box is centered horizontally, containing the text "What is a patent?".

# What is a patent?



# What is a patent?

(19)  (11) EP 1 535 121 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent: 25.08.2010 Bulletin 2010/34

(51) Int. Cl.: G06P 1/00 (2006.01)

(86) International application number: PCT/US2003/015459

(21) Application number: 03728962.6

(87) International publication number: WO 2003/10553 (04.12.2003 Gazette 2003/49)

(22) Date of filing: 16.05.2003

(54) SYSTEM AND METHOD FOR AUTOMATICALLY SETTING UP A UNIVERSAL REMOTE CONTROL  
SYSTEM UND VERFAHREN ZUM AUTOMATISCHEN EINRICHTEN EINER UNIVERSALLEN FERNBEDIENUNG  
SYSTEME ET PROCÉDÉ PERMETTANT DE RÉGLER AUTOMATIQUEMENT UNE TELECOMMANDE UNIVERSELLE

(84) Designated Contracting States: AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HE IE IT LI LU MC NL PT RO SE SI SK TR

(85) Priority: 20.05.2002 US 151835

(73) Proprietor: UNIVERSAL ELECTRONICS, INC. Cypress, CA 95050-4841 (US)

(72) Inventor: HANSEN, Patrick, H. Mission Viejo, CA 92691 (US)  
CONWAY, JR., James, N. Laguna Beach, CA 92651 (US)

(74) Representative: Stephens, Robert John Olswang LLP 90 High Holborn London WC1V 6XX (GB)

(56) References cited: EP-A: 1 788 089 EP-A2: 0 780 590  
WO-A: 001 7728 WO-A: 019 9150  
WO-A: 018 9967 US-A: 5 410 526  
US-A: 5 646 608 US-A: 5 742 730  
US-A: 6 104 234

EP 1 535 121 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Printed by Jouve, 35001 PARIS (FR)

- > A **legal title** which grants the holder
  - the exclusive right to prevent others from making, using or offering for sale, selling or importing a product that infringes his patent without his authorisation
  - in countries for which the patent was granted
  - for a limited time (up to 20 years).
- > In return for this protection, the holder has to disclose the invention to the public.



Patent applicant

Reveal invention (disclosure)



Get exclusivity (patent)



Public

Patents are granted in nearly every country in the world!

# What is a patent?

- > Does a patent give you the right to exploit an invention?

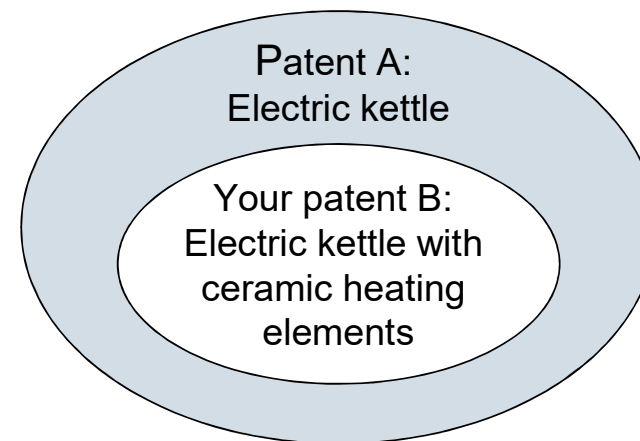
**- NO!**



- > A patent is a negative right. It gives you the right to prevent others from exploiting the invention. It is not an enabling right.
- > Patents owned by others may overlap or encompass your own patent.

-> Seek a licence before commercialising

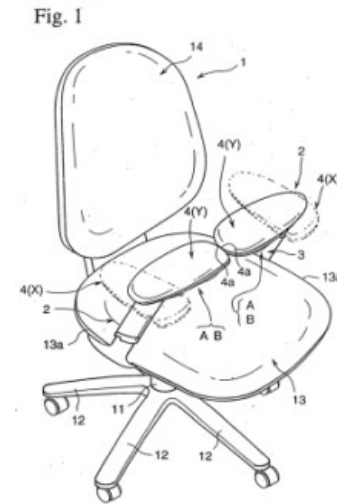
For example:



# What exactly can be patented?

Patents protect inventions which solve technical problems:

- chemical substances, pharmaceuticals
- processes, methods, uses
- products, devices, systems



In most countries, patents are not granted for business methods or rules of games as such, or for methods of treatment, diagnostics and surgery on the human or animal body.



# What are the requirements to get a patent?

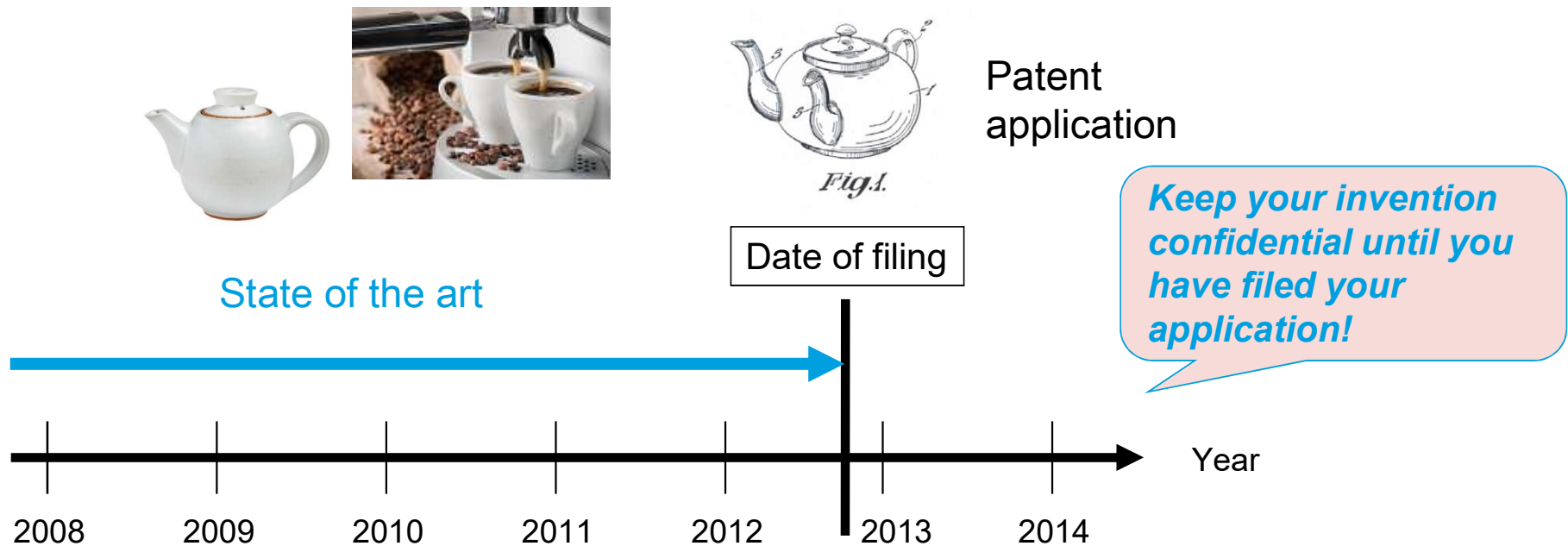
For an invention to be patented, it must usually be

- ✓ **new** to the world (i.e. not available to the public anywhere in the world)
- ✓ **inventive** (i.e. not an "obvious" solution), and
- ✓ susceptible of industrial application



# When is an invention "new"?

- > When it is not part of the state of the art
- > State of the art = everything made available to the public before the date of filing



# Do's and don'ts for safeguarding novelty



## Don'ts

- > Do not publish any articles, press releases, conference presentations/ posters/ proceedings, lectures or blog posts, etc. before you file



- > Do not sell any products incorporating the invention before you file



## Do's

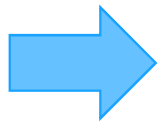
- > Sign a non-disclosure agreement (NDA)
- ⇒ contact the responsible person at the Technology Transfer department
- > Seek professional advice at an early stage
- > File before anyone else does!



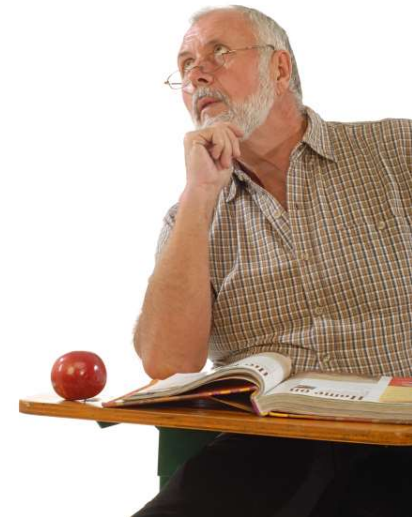
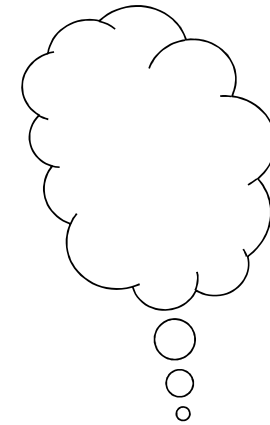
Once you have filed your application, you are free to present, publish or sell your invention as you wish.

# When is an invention "inventive"?

- > When it is not obvious to the person skilled in the art in view of the state of the art
- > The person skilled in the art
  - is a skilled practitioner in the relevant technical field
  - has access to the entire state of the art
  - is aware of general technical knowledge



**He knows EVERYTHING,  
but he does not have any imagination!**



# Assessing novelty

Claim: A pouring vessel comprising  
(a) a compartment for liquids (1),  
(b) a handle (2),  
(c) a lid, and  
(d) two spouts (5) extending from the compartment (1),  
(e) whereby the tops of the two spouts are arranged at the same height.



Stage 1: Prior art

The prior art search revealed the following documents:

**Document D1:**  
A teapot with one spout.



**Document D2:**  
A filter handle with two spouts to be used with a coffee-maker.



**Document D3:**  
An oil and vinegar bottle which reveals a second bottle inside. The two spouts are cleverly arranged to ensure the second bottle never drips while the first one is in use.



The invention as expressed in the claim is new.



# Assessing inventive step (I)

## Stage 1

- Determine the closest prior art and common features:
  - (a) a compartment for liquids
  - (b) a handle
  - (c) a lid
  - (d) one spout



## Stage 2: Problem

- Differences over D1:
  - two spouts instead of one
  - particular arrangement of the spouts
- Drawback of prior art:
  - time-consuming
- Advantage/effect of the invention:
  - reduced time needed to fill multiple cups
- Objective problem to solve:
  - how to modify the teapot of D1 to reduce the time needed to fill multiple cups



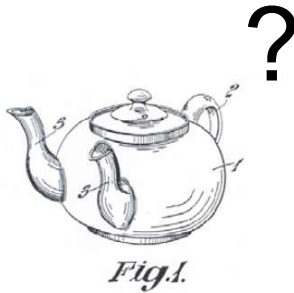
*Fig. 1.*



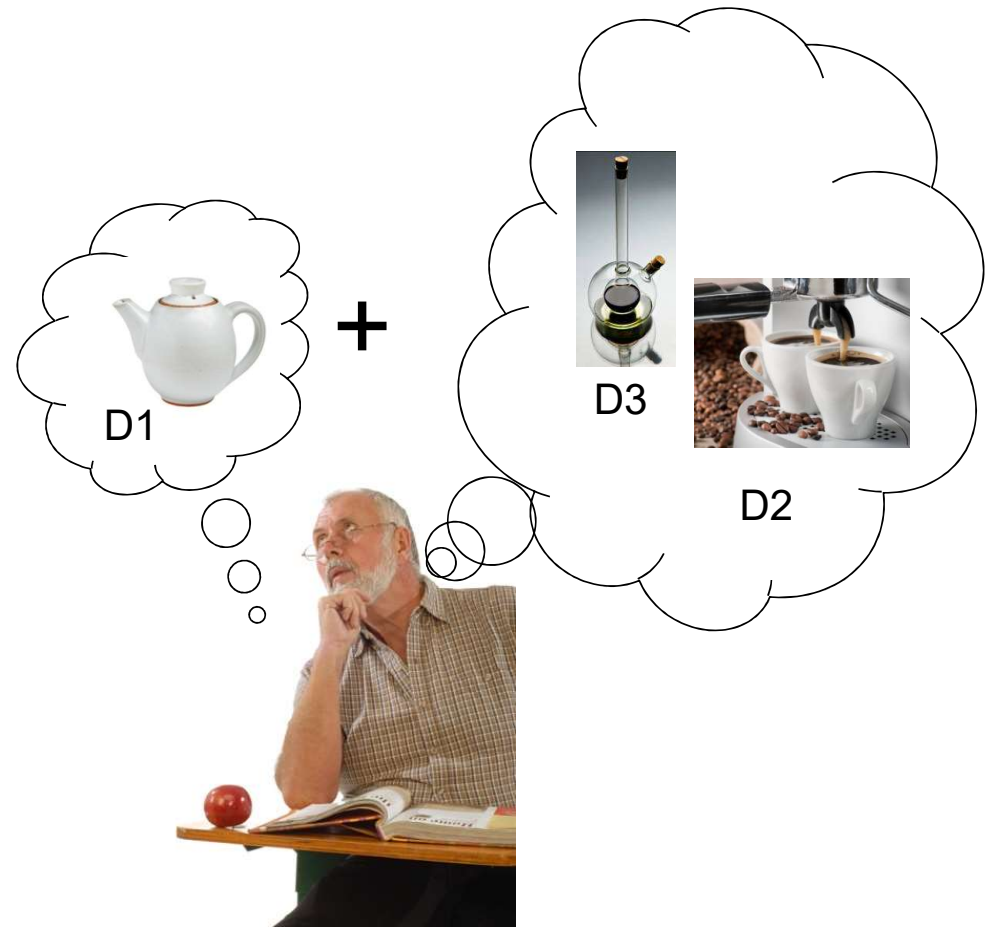
# Assessing inventive step (II)

Stage 3: Solution

Is the claimed solution obvious in view of the prior art?



Objective problem for the skilled person: **How to modify the teapot of D1 in order to reduce the time needed to fill multiple cups**



The claim is inventive, since the two documents in combination would not arrive at the claimed invention.

# Where to search for patents ?

- > [www.espacenet.com](http://www.espacenet.com)  
(Free worldwide patent information )

Europäisches Patentamt  
European Patent Office  
Office européen des brevets

**Espacenet**  
Patent search

Smart search  
**Advanced search**  
Classification search

Quick help  
→ How many search terms can I enter per field?  
→ How do I enter words from the title or abstract?  
→ How do I enter words from the description or claims?  
→ Can I use truncation/wildcards?  
→ How do I enter publication, application, priority and NPL reference numbers?  
→ How do I enter the names of

**Advanced search**

Select the collection you want to search in [i]  
Worldwide - collection of published applications from 90+ countries

Enter your search terms - CTRL-ENTER expands the field you are in

Enter keywords in English

Title: [i] plastic and bicycle

Title or abstract: [i] hair

- > Google patents
- > many more....



The background of the slide is a dense field of 3D question marks. Most are light gray, but one in the center is a vibrant red. A semi-transparent white rectangular box is overlaid on the scene, containing the text "Questions?".



**Questions?**

A glowing lightbulb sits on a wooden surface. A semi-transparent white rectangular box is overlaid on the image, containing the text 'How do I read a patent?'.

## How do I read a patent?

# Please read the patent application shared in the chat for 5 minutes and try to answer the following questions:

- > When was the patent application filed ?
- > When was the patent application published?
- > Who is the applicant?
- > What is the scope of protection of the patent application?

(19)  (11)  EP 3 540 743 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication: 18.09.2019 Bulletin 2019/38 (51) Int. Cl.: G21K 1/06 (2006.01) G03F 7/00 (2006.01)  
G21K 7/00 (2006.01)

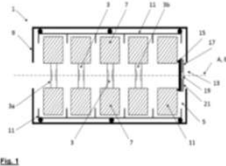
(21) Application number: 18162404.0 (22) Date of filing: 16.03.2018

(84) Designated Contracting States: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR Designated Extension States: BA ME Designated Validation States: KH MA MD TN	(72) Inventors: • Lyubomirsky, Mikhail 22549 Hamburg (DE) • Doehrmann, Ralph 21160 Völgelsen (DE) • Seiboth, Frank 01257 Dresden (DE)
(71) Applicant: Deutsches Elektronen-Synchrotron DESY 22607 Hamburg (DE)	(74) Representative: Bird & Bird LLP Großer Grasbrook 9 20457 Hamburg (DE)

(54) METHOD FOR MANUFACTURING OF A PRE-ALIGNED X-RAY OPTICAL CORRECTION PLATE

(57) It is described a method for manufacturing of an optical correction plate arrangement (13) comprising the steps of arranging a set of lenses (3) comprising at least a first lens (3a) and an optical correction plate arrangement holder (5) with respect to an optical axis (A) which coincides with a path of light. The set of lenses (3) is then aligned so that light impinging the set of lenses (3) on the first lens (3a) and leaving the set of lenses (3) is focused at a focal distance or an imaging distance. Afterwards, the aberrations of the set of lenses (3) are measured. An optical correction plate arrangement blank is positioned into the optical correction plate arrangement holder (5) in a default support position, wherein the optical correction plate arrangement blank comprises a substrate (15), wherein the substrate (15) comprises a photoactive coating (17). A region of the photoactive coating (17) which is aligned to the optical axis (A) is exposed by the light before impinging the set of lenses (3) by the first lens (3a), by the light while travelling within the set of lenses (3) or by the light after leaving the set of lenses (3). After the exposure, the optical correction plate arrangement blank is transformed into an optical correction plate arrangement (13) based on the measured aberration, wherein a part of the optical correction plate arrangement (13) is adapted to at least partially compensate the aberrations of the set of lenses (3), wherein said part is aligned to the exposed region (19) of the substrate (15). In addition, a lens box assembly (11) comprises a set of lenses (3) and an optical correction plate arrangement holder (5). Optical correction plate arrangement blanks and optical correction plate arrangement (13) may be re-inserted into the holder (5) with a high reproducible accuracy regarding their position.

EP 3 540 743 A1



# What do patent documents look like?

## Cover Page

(19)

(11) EP 3 540 743 A1

**EUROPEAN PATENT APPLICATION**

(43) Date of publication: 18.09.2019 Bulletin 2019/38  
 (21) Application number: 18162404.0  
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(51) Int. Cl.: G21K 1/06 (2006.01) G03F 7/00 (2006.01)  
 G21K 7/00 (2006.01)

(84) Designated Contracting States: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK NL NO PL PT RO RS SE SI SK SM TR  
 Designated Extension States: BA ME  
 Designated Validation States: KH MA MD TN

(72) Inventors:  
 • Lyubomirsky, Mikhail  
 22549 Hamburg (DE)  
 • Dosehmann, Ralph  
 21300 Vögelzen (DE)  
 • Seiboth, Frank  
 01257 Dresden (DE)

(74) Representative: Bird & Bird LLP  
 Großgrasbrook 9  
 20457 Hamburg (DE)

(54) **METHOD FOR MANUFACTURING OF A PRE-ALIGNED X-RAY OPTICAL CORRECTION PLATE**

(57) It is described a method for manufacturing of an optical correction plate arrangement (13) comprising the steps of arranging a set of lenses (3) comprising at least a first lens (3a) and an optical correction plate arrangement holder (5) with respect to an optical axis (A) which coincides with a path of light. The set of lenses (3) is then aligned so that light impinging the set of lenses (3) on the first lens (3a) and leaving the set of lenses (3) is focused at a focal distance or an imaging distance. Afterwards, the aberrations of the set of lenses (3) are measured. An optical correction plate arrangement blank is positioned into the optical correction plate arrangement holder (5) in a default support position, wherein the optical correction plate arrangement blank comprises a substrate (15), wherein the substrate (15) comprises a photoactive coating (17). A region of the photoactive coating (17) which is aligned to the optical axis (A) is exposed by the light before impinging the set of lenses (3) by the first lens (3a), by the light while travelling within the set of lenses (3) or by the light after leaving the set of lenses (3). After the exposure, the optical correction plate arrangement blank is transformed into an optical correction plate arrangement (13) based on the measured aberration, wherein a part of the optical correction plate arrangement (13) is adapted to at least partially compensate the aberrations of the set of lenses (3), wherein said part is aligned to the exposed region (19) of the substrate (15). In addition, a lens box assembly (1) comprises a set of lenses (3) and an optical correction plate arrangement holder (5). Optical correction plate arrangement blanks and optical correction plate arrangement (13) may be re-inserted into the holder (5) with a high reproducible accuracy regarding their position.

Fig. 1

Filed by Inventor, 150211 19003 (EP)

EP 3 540 743 A1

## Description

**Description**

EP 3 540 743 A1

It is described a method for manufacturing of an optical correction plate arrangement (13) comprising the steps of arranging a set of lenses (3) comprising at least a first lens (3a) and an optical correction plate arrangement holder (5) with respect to an optical axis (A) which coincides with a path of light. The set of lenses (3) is then aligned so that light impinging the set of lenses (3) on the first lens (3a) and leaving the set of lenses (3) is focused at a focal distance or an imaging distance. Afterwards, the aberrations of the set of lenses (3) are measured. An optical correction plate arrangement blank is positioned into the optical correction plate arrangement holder (5) in a default support position, wherein the optical correction plate arrangement blank comprises a substrate (15), wherein the substrate (15) comprises a photoactive coating (17). A region of the photoactive coating (17) which is aligned to the optical axis (A) is exposed by the light before impinging the set of lenses (3) by the first lens (3a), by the light while travelling within the set of lenses (3) or by the light after leaving the set of lenses (3). After the exposure, the optical correction plate arrangement blank is transformed into an optical correction plate arrangement (13) based on the measured aberration, wherein a part of the optical correction plate arrangement (13) is adapted to at least partially compensate the aberrations of the set of lenses (3), wherein said part is aligned to the exposed region (19) of the substrate (15). In addition, a lens box assembly (1) comprises a set of lenses (3) and an optical correction plate arrangement holder (5). Optical correction plate arrangement blanks and optical correction plate arrangement (13) may be re-inserted into the holder (5) with a high reproducible accuracy regarding their position.

## Drawing(s)

Fig. 1

## Claim(s)

**Claims**

1. Method for manufacturing of an optical correction plate arrangement (13) comprising the steps of:

- arranging a set of lenses (3) comprising at least a first lens (3a) and an optical correction plate arrangement holder (5) with respect to an optical axis (A) which coincides with a path of light,
- aligning the set of lenses (3) so that light impinging the set of lenses (3) on the first lens (3a) and leaving the set of lenses (3) is focused at a focal distance or an imaging distance,
- measuring aberrations of the set of lenses (3),
- positioning an optical correction plate arrangement blank into the optical correction plate arrangement holder (5) in a default support position, wherein the optical correction plate arrangement blank comprises a substrate (15), wherein the substrate (15) comprises a photoactive coating (17),
- exposing a region of the photoactive coating (17) aligned to the optical axis (A) by the light before impinging the set of lenses (3) by the first lens (3a), by the light while travelling within the set of lenses (3) or by the light after leaving the set of lenses (3), and
- transforming the optical correction plate arrangement blank into an optical correction plate arrangement (13) based on the measured aberration, wherein a part of the optical correction plate arrangement (13) is adapted to at least partially compensate the aberrations of the set of lenses (3), wherein said part is aligned to the exposed region (19) of the substrate (15).

# The parts of a patent document (I)

## Cover Page

The cover page of a patent application is structured as follows:

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- (71)** Applicant: Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg (DE).
- (72)** Inventors: Lyubomirskiy, Mikhail (22549 Hamburg (DE)), Doehrmann, Ralph (21360 Vögelzen (DE)), Seiboth, Frank (01257 Dresden (DE)).
- (74)** Representative: Bird & Bird LLP, Großer Grasbrook 9, 20457 Hamburg (DE).
- (54)** Title: METHOD FOR MANUFACTURING OF A PRE-ALIGNED X-RAY OPTICAL CORRECTION PLATE.
- (57)** Abstract (Short summary of the invention): It is described a method for manufacturing of an optical correction plate arrangement (13) comprising the steps of arranging a set of lenses (3) comprising at least a first lens (3a) and an optical correction plate arrangement holder (5) with respect to an optical axis (A) which coincides with a path of light. The set of lenses (3) is then aligned so that light impinging the set of lenses (3) on the first lens (3a) and leaving the set of lenses (3) is focused at a focal distance or an imaging distance. Afterwards, the aberrations of the set of lenses (3) are measured. An optical correction plate arrangement blank is positioned into the optical correction plate arrangement holder (5) in a default support position, wherein the optical correction plate arrangement blank comprises a substrate (15), wherein the substrate (15) comprises a photoactive coating (17). A region of the photoactive coating by the light before impinging the set of lenses (3) by the first lens (3a), by the light while travelling within the set of lenses (3) or by the light after leaving the set of lenses (3). After the exposure, the optical correction plate arrangement blank is transformed into an optical correction plate arrangement (13) based on the measured aberration, wherein a part of the optical correction plate arrangement (13) is adapted to at least partially compensate the aberrations of the set of lenses (3), wherein said part is aligned to the exposed region (19) of the substrate (15). In addition, a lens box assembly (1) comprises a set of lenses (3) and an optical correction plate arrangement holder (5). Optical correction plate arrangement blanks and optical correction plate arrangement (13) may be re-inserted into the holder (5) with a high reproducible accuracy regarding their position.



# The parts of a patent document (II)

## Description

1 EP 3 540 743 A1 2

**Description**

[0001] The present invention relates to a method for manufacturing an optical correction plate arrangement and a lens box assembly.

[0002] When using x-ray beams, e.g. from a synchrotron light source, focusing is a crucial but difficult task and requires special refractive lenses. Unfortunately, these refractive lenses typically have a large focal distance due to a limited refractive power of available materials, such as Be, Al, Si, Diamond, Si<sub>3</sub>N<sub>4</sub>, PMMA. Hence, a single refractive x-ray lens is inconvenient for technical application. To still focus x-ray beams, a plurality of refractive lenses is arranged in a stacking arrangement, i.e. stacked behind each other while being aligned to a common optical axis. These stacks of lenses are so-called compound refractive lenses (CRL).

[0003] Many different materials and manufacturing techniques are known for the manufacturing of the components of CRLs. Examples of these techniques are Be and Al printing techniques or Si and diamond structuring techniques. All of these techniques, however, only allow the fabrication of imperfect refractive lenses due to imperfections of the manufacturing procedures themselves and limited material quality. As a consequence of these imperfections, the fabricated lenses show aberrations and lead to undesired blurring and broadening of the focal spot.

[0004] The aberrations of the CRLs can be characterized using ptychographic characterization of the focal spot as was demonstrated A. Schropp et al. "Full spatial characterization of a nanofocused x-ray free-electron laser beam by ptychographic imaging", Scientific Reports 3, 1033 (2013). This characterization data is the starting point for computations which eventually lead to a phase shift pattern for aberration compensation and a corresponding structural pattern for a so-called phase plate which is manufactured according to the corresponding structural pattern.

[0005] A phase plate is typically the optical active part of an optical correction plate arrangement (OCPA). The phase plate is capable of correcting the aberration of the CRL. The phase plate may be positioned somewhere in the beam path going through the CRL, i.e. before the beam enters the CRL, while the beam travels through the CRL or after the beam leaves the CRL. A phase plate may be manufactured from amorphous SiO<sub>2</sub> or diamond or another suitable material using laser ablation technique, micro-milling or even 3D-printing techniques. For example, in case of laser ablation the laser removes material following a prior calculated pattern based on the ptychographic characterization. The surface pattern on the phase plate then leads to a phase shift of the outgoing x-ray beam leaving the CRL, thereby compensating the aberration of the CRL and improving the focal spot.

[0006] However, a disadvantage of these phase plates as used in the prior art arises from the requirement of accurate alignment. The phase plate can only compensate the aberration of the CRL, if it is properly aligned to the optical axis of the CRL. Such an alignment is highly time-consuming and costs precious beam time when used at commercial x-ray light sources.

[0007] It is therefore an object of the present invention to provide a method for manufacturing an optical correction plate arrangement and a lens box arrangement which overcome the problem of time-consuming alignment after the fabrication of the phase plate and prior to its use at the beamline.

[0008] This object is achieved in a first aspect of the invention by a method for manufacturing an optical correction plate arrangement (OCPA) according to claim 1. This method comprises the steps of

- arranging a set of lenses comprising at least a first lens and an optical correction plate arrangement holder with respect to an optical axis which coincides with a path of light,
- aligning the set of lenses so that light impinging the set of lenses on the first lens and leaving the set of lenses is focused at a focal distance or an imaging distance,
- measuring aberrations of the set of lenses,
- positioning an optical correction plate arrangement blank into the optical correction plate arrangement holder in a default support position, wherein the optical correction plate arrangement blank comprises a substrate, wherein the substrate comprises a photoactive coating,
- exposing a region of the photoactive coating aligned to the optical axis by the light before impinging the set of lenses by the first lens, by the light while travelling within the set of lenses or by the light after leaving the set of lenses, and
- transforming the optical correction plate arrangement blank into an optical correction plate arrangement based on the measured aberration, wherein a part of the optical correction plate arrangement is adapted to at least partially compensate the aberrations of the set of lenses, wherein said part is aligned to the exposed region of the substrate.

[0009] In other words, the method involves the following steps. At first, a set of lenses comprising at least a first lens and an OCPA holder are arranged with respect to an optical axis which coincides with a path of light. It may also be possible that the set of lenses comprises an aperture element. The purpose of the aperture element may be to clean the beam from undesired scattering. The cleaning may be achieved by choosing a suitable aperture of the aperture element by which the beam is manipulated. By this manipulation, the undesired scattering

- > Field of the invention (the technical area to which the invention relates)
- > Background of the invention (details of the prior art)
- > Detailed description of the invention: how does the invention provide a technical solution to the technical problem?
- > Brief description of the drawings
- > Detailed description of at least one way of carrying out the invention (embodiment of the invention)

# The parts of a patent document (III)

## Claims

### Claims

1. Method for manufacturing of an optical correction plate arrangement (13) comprising the steps of:

- arranging a set of lenses (3) comprising at least a first lens (3a) and an optical correction plate arrangement holder (5) with respect to an optical axis (A) which coincides with a path of light,
- aligning the set of lenses (3) so that light impinging the set of lenses (3) on the first lens (3a) and leaving the set of lenses (3) is focused at a focal distance or an imaging distance,
- measuring aberrations of the set of lenses (3),
- positioning an optical correction plate arrangement blank into the optical correction plate arrangement holder (5) in a default support position, wherein the optical correction plate arrangement blank comprises a substrate (15), wherein the substrate (15) comprises a photoactive coating (17),
- exposing a region of the photoactive coating (17) aligned to the optical axis (A) by the light before impinging the set of lenses (3) by the first lens (3a), by the light while travelling within the set of lenses (3) or by the light after leaving the set of lenses (3), and
- transforming the optical correction plate arrangement blank into an optical correction plate arrangement (13) based on the measured aberration, wherein a part of the optical correction plate arrangement (13) is adapted to at least partially compensate the aberrations of the set of lenses (3), wherein said part is aligned to the exposed region (19) of the substrate (15).

> What is the scope of the invention/the protection sought?

> Two types of claims

- Independent claims: the invention in its broadest scope
- Dependent claims

2. Method for manufacturing of an optical correction plate arrangement (13) according to claim 1, wherein the set of lenses (3) comprises a final lens (3b), wherein light leaves the set of lenses (3) through the final lens (3b).

# The parts of a patent document (IV)

## Claims

### Claims

1. Method for manufacturing of an optical correction plate arrangement (13) comprising the steps of:

- arranging a set of lenses (3) comprising at least a first lens (3a) and an optical correction plate arrangement holder (5) with respect to an optical axis (A) which coincides with a path of light,
- aligning the set of lenses (3) so that light impinging the set of lenses (3) on the first lens (3a) and leaving the set of lenses (3) is focused at a focal distance or an imaging distance,
- measuring aberrations of the set of lenses (3),
- positioning an optical correction plate arrangement blank into the optical correction plate arrangement holder (5) in a default support position, wherein the optical correction plate arrangement blank comprises a substrate (15), wherein the substrate (15) comprises a photoactive coating (17),
- exposing a region of the photoactive coating (17) aligned to the optical axis (A) by the light before impinging the set of lenses (3) by the first lens (3a), by the light while travelling within the set of lenses (3) or by the light after leaving the set of lenses (3), and
- transforming the optical correction plate arrangement blank into an optical correction plate arrangement (13) based on the measured aberration, wherein a part of the optical correction plate arrangement (13) is adapted to at least partially compensate the aberrations of the set of lenses (3), wherein said part is aligned to the exposed region (19) of the substrate (15).

11. Lens box assembly (1),

comprising a set of lenses (3) having at least a first lens (3a), arranged on an optical axis (A), and an optical correction plate arrangement holder (5), wherein the set of lenses (3) and the optical correction plate arrangement holder (5) are arranged with respect to the same optical axis (A), wherein the first lens (3a) is adapted to be impinged by light, wherein the lens box assembly (1) comprises fastening means (7) for fastening the set of lenses (3) and the optical correction plate arrangement holder (5) in the lens box assembly (1), wherein the optical correction plate arrangement holder (5) is configured to receive and support either an optical correction plate arrangement blank or an optical correction plate arrangement (13) in a default support position, and wherein a position of an optical correction plate arrangement blank and/or optical correction plate arrangement (13) in the optical correction plate arrangement holder (5) after the optical correction plate arrangement blank and/or optical correction plate arrangement (13) is inserted, removed and inserted back into the optical correction plate arrangement holder (5) corresponds in both directions perpendicular to the optical axis (A) to the default support position.

- Independent claim

Claim 1

An A (product/process/apparatus/use) comprising

B  
C  
D



Technical features of the claimed invention

The background of the slide is a dense field of 3D question marks. Most are light gray and slightly out of focus, creating a sense of depth. In the center, a single question mark is rendered in a vibrant red color and is in sharp focus, standing out from the rest. A semi-transparent white rectangular box is overlaid on the lower-left portion of the image, containing the text "Questions?".

**Questions?**

# Outlook

What are possible next workshop topics in this framework ?

- > Copyright in software
- > How to do a patent search
- > Exploitation of IP at accelerator centers





**Thank you for your  
attention!  
Any further questions ?**