

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 9,046,688 B2  
APPLICATION NO. : 14/272866  
DATED : June 2, 2015  
INVENTOR(S) : Artur Hoegele

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page, item (72) Inventors: delete “(US)” and insert --(DE)--, therefor.

In the claims,

In Column 10, line 59, delete “3” and insert --3°--, therefor.

In Column 10, line 60, delete “14” and insert --14°--, therefor.

Signed and Sealed this  
Twenty-fourth Day of November, 2015

A handwritten signature in black ink, reading "Michelle K. Lee". The signature is fluid and cursive, with the first letters of each name being capitalized and prominent.

Michelle K. Lee  
*Director of the United States Patent and Trademark Office*

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of	)	
	)	Confirmation No. 8559
Artur HOEGELE	)	
	)	Examiner: Hee-Yong Kim
Application No.: 14/272,866	)	
U.S. Patent No. 9,046,688 B2	)	Art Unit: 2482
	)	
Filed: May 8, 2014	)	
	)	
For: SURGICAL MICROSCOPE	)	
WITH ENLARGED WORKING	)	
DISTANCE	)	

**REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 C.F.R. § 1.323**

Commissioner for Patents  
Alexandria, VA 22313-1450

Sir:

Applicants request correction of U.S. Patent No. 9,046,688 B2, as noted in the proposed Certificate of Correction submitted herewith in order to correct minor discrepancies. The requisite fee for this request pursuant to 37 C.F.R. § 1.20(a) is submitted herewith. However, if necessary, the Commissioner is hereby authorized in this reply, to charge any additional required payment or credit any overpayment to our Deposit Account No. 50-5835.

Should there be any questions regarding this Request for Certificate of Correction, kindly contact the undersigned at (540) 361-1863, Ext. 125.

Respectfully submitted,

POTOMAC PATENT GROUP PLLC

By: /stevenmdubois/

Steven M. duBois

Registration No. 35,023

Date: July 31, 2014

Customer No. 113648

Patent Portfolio Builders PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404  
(540) 361-1863 Ext. 125

## UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page 1 of 1

PATENT NO. : 9,046,688 B2

APPLICATION NO.: 14/272,866

ISSUE DATE : June 2, 2015

INVENTOR(S) : Artur HOEGELE

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page, (72) Inventors: delete "(US)" and insert --(DE)--, therefor.

In Column 10, line 59, delete "3" and insert --3°--, therefor.

In Column 10, line 60, delete "14" and insert --14°--, therefor.

### MAILING ADDRESS OF SENDER (Please do not use customer number below):

Patent Portfolio Builders LLC  
P.O. Box 7999, Fredericksburg, VA 22404-7999

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*



## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	14272866			
<b>Filing Date:</b>	08-May-2014			
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance			
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE			
<b>Filer:</b>	Steven Maurice Dubois/Andrea Terry			
<b>Attorney Docket Number:</b>	0902-046			
Filed as Large Entity				
<b>Filing Fees for   Utility under 35 USC 111(a)</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
Certificate of Correction	1811	1	100	100

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				100

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	23084457
<b>Application Number:</b>	14272866
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8559
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE
<b>Customer Number:</b>	113648
<b>Filer:</b>	Steven Maurice Dubois/Andrea Terry
<b>Filer Authorized By:</b>	Steven Maurice Dubois
<b>Attorney Docket Number:</b>	0902-046
<b>Receipt Date:</b>	31-JUL-2015
<b>Filing Date:</b>	08-MAY-2014
<b>Time Stamp:</b>	15:29:52
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 100
RAM confirmation Number	1937
Deposit Account	505835
Authorized User	DUBOIS, STEVEN M

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	2015-07-31_Request_COC_0902-046.pdf	62844	no	2
			e9b9a6ca5cbc0d8f2f79166717156dbd5138334e		
Warnings:					
Information:					
2	Request for Certificate of Correction	2015-07-31_COC_0902-046.pdf	164398	no	2
			e15b275e522be04dbabbe304408f777ee763e904		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30138	no	2
			458ea3c3f1e76015f02ce85543c3e8553bc44550		
Warnings:					
Information:					
Total Files Size (in bytes):			257380		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

#### New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

#### National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

#### New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/272,866	06/02/2015	9046688	0902-046	8559

113648 7590 05/13/2015

Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

## ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

### **Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)** (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Artur HOEGELE, Oberkochen, GERMANY;  
Carl Zeiss Meditec AG, Jena, GERMANY;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit [SelectUSA.gov](http://SelectUSA.gov).

## PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE  
**Commissioner for Patents**  
**P.O. Box 1450**  
**Alexandria, Virginia 22313-1450**  
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

113648 7590 02/04/2015  
**Patent Portfolio Builders, PLLC**  
**P.O. Box 7999**  
**Fredericksburg, VA 22404-7999**

## Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/272,866	05/08/2014	Artur HOEGELE	0902-046	8559

TITLE OF INVENTION: Surgical Microscope with Enlarged Working Distance

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	05/04/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
KIM, HEE-YONG	2482	348-079000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a **Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 **PATENT PORTFOLIO BUILDERS PLLC**

2 \_\_\_\_\_

3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

**CARL ZEISS MEDITEC AG**

**JENA, GERMANY**

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☒ Payment by credit card.
- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number **50-5835** (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Steven M. duBois/

Date April 29, 2015

Typed or printed name Steven M. duBois

Registration No. 35,023

## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	14272866			
<b>Filing Date:</b>	08-May-2014			
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance			
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE			
<b>Filer:</b>	Steven Maurice Dubois/Tina Jenkins			
<b>Attorney Docket Number:</b>	0902-046			
Filed as Large Entity				
<b>Filing Fees for   Utility under 35 USC 111(a)</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
Utility Appl Issue Fee	1501	1	960	960



Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				960

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	22199469
<b>Application Number:</b>	14272866
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8559
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE
<b>Customer Number:</b>	113648
<b>Filer:</b>	Steven Maurice Dubois/Tina Jenkins
<b>Filer Authorized By:</b>	Steven Maurice Dubois
<b>Attorney Docket Number:</b>	0902-046
<b>Receipt Date:</b>	29-APR-2015
<b>Filing Date:</b>	08-MAY-2014
<b>Time Stamp:</b>	10:48:31
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$960
RAM confirmation Number	10195
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

--

**File Listing:**

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	2015-04-29_IF_Transmittal_0902-046.pdf	1597770	no	1
			29910c77dc8eeda5531450a3a768869fd39dc4bc		

**Warnings:**

**Information:**

2	Fee Worksheet (SB06)	fee-info.pdf	30448	no	2
			4a55c819b4f1205ddb899164ebb98fd45003e1ce		

**Warnings:**

**Information:**

Total Files Size (in bytes):			1628218
------------------------------	--	--	---------

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

## NOTICE OF ALLOWANCE AND FEE(S) DUE

113648 7590 02/04/2015  
Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

EXAMINER

KIM, HEE-YONG

ART UNIT

PAPER NUMBER

2482

DATE MAILED: 02/04/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

14/272,866

05/08/2014

Artur HOEGELE

0902-046

8559

TITLE OF INVENTION: Surgical Microscope with Enlarged Working Distance

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	05/04/2015

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

### HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**

# **PART B - FEE(S) TRANSMITTAL**

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
or Fax (571)-273-2885**

**INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

113648 7590 02/04/2015  
Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

## **Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/272,866	05/08/2014	Artur HOEGELE	0902-046	8559

TITLE OF INVENTION: Surgical Microscope with Enlarged Working Distance

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	05/04/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
KIM, HEE-YONG	2482	348-079000

<b>1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).</b> <input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. <input type="checkbox"/> "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. <b>Use of a Customer Number is required.</b>	<b>2. For printing on the patent front page, list</b> (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____ (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____ 3 _____
---	---

## **3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)**

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

## **4a. The following fee(s) are submitted:**

- ☐ Issue Fee  
☐ Publication Fee (No small entity discount permitted)  
☐ Advance Order - # of Copies \_\_\_\_\_

## **4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)**

- ☐ A check is enclosed.  
☐ Payment by credit card. Form PTO-2038 is attached.  
☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

## **5. Change in Entity Status (from status indicated above)**

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29  
☐ Applicant asserting small entity status. See 37 CFR 1.27  
☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

**NOTE:** This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature \_\_\_\_\_ Date \_\_\_\_\_  
Typed or printed name \_\_\_\_\_ Registration No. \_\_\_\_\_



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/272,866	05/08/2014	Artur HOEGELE	0902-046	8559

113648 7590 02/04/2015  
Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

EXAMINER
----------

KIM, HEE-YONG

ART UNIT	PAPER NUMBER
----------	--------------

2482

DATE MAILED: 02/04/2015

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

### Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

<b>Notice of Allowability</b>	<b>Application No.</b> 14/272,866	<b>Applicant(s)</b> HOEGELE, ARTUR	
	<b>Examiner</b> HEE-YONG KIM	<b>Art Unit</b> 2482	<b>AIA (First Inventor to File) Status</b> Yes

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 12/23/2014.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-21. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a) ☒ All    b) ☐ Some    \*c) ☐ None of the:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.  
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_.  
**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |  |  |
|--|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)   | 5. <input type="checkbox"/> Examiner's Amendment/Comment                             |
| 2. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date ____     | 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material | 7. <input type="checkbox"/> Other ____.  |
| 4. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date ____.                      |  |

/HEE-YONG KIM/  
Primary Examiner, Art Unit 2482



## **DETAILED ACTION**

1. The present application is being examined under AIA first to invent provisions.

### ***Allowable Subject Matter***

2. **Claims 1-21** are allowed.
3. The following is an examiner's statement of reasons for allowance.

In the previous Quayle action, it was noticed that all the claims are allowed, if formal matters of claims 1 and 4 and 18 are corrected. The amendment overcomes the formal matters. Therefore, all the pending claims are allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### ***Conclusion***

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to HEE-YONG KIM whose telephone number is (571)270-3669. The examiner can normally be reached on Monday-Thursday, 8:00am-5pm EST.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christopher Kelley can be reached on 571-272-7331. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2482

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HEE-YONG KIM/

Primary Examiner, Art Unit 2482

<b>Search Notes</b>  	<b>Application/Control No.</b>  14272866	<b>Applicant(s)/Patent Under Reexamination</b>  HOEGELE, ARTUR
	<b>Examiner</b>  HEE-YONG KIM	<b>Art Unit</b>  2482

CPC- SEARCHED		
Symbol	Date	Examiner
G02B21/02	11/24/2014	HK
G02B21/0012	11/24/2014	HK
G02B21/22	11/24/2014	HK


CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
348	79	11/24/2014	HK

SEARCH NOTES		
Search Notes	Date	Examiner
East Search	11/24/2014	HK

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
348	79	11/24/2014	HK
348	79	1/28/2015	HK

--	--

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  14272866	<b>Applicant(s)/Patent Under Reexamination</b>  HOEGELE, ARTUR
	<b>Examiner</b>  HEE-YONG KIM	<b>Art Unit</b>  2482


✓	<b>Rejected</b>
=	<b>Allowed</b>































-	<b>Cancelled</b>
÷	<b>Restricted</b>





N	<b>Non-Elected</b>
I	<b>Interference</b>

A	<b>Appeal</b>
O	<b>Objected</b>

<input type="checkbox"/> <b>Claims renumbered in the same order as presented by applicant</b>				<input type="checkbox"/> <b>CPA</b>		<input type="checkbox"/> <b>T.D.</b>		<input type="checkbox"/> <b>R.1.47</b>	
CLAIM		DATE							
Final	Original	11/25/2014	01/28/2015						
1	1	✓	=						
2	2	✓	=						
3	3	✓	=						
13	4	✓	=						
4	5	✓	=						
5	6	✓	=						
6	7	✓	=						
7	8	✓	=						
8	9	✓	=						
9	10	✓	=						
10	11	✓	=						
11	12	✓	=						
12	13	✓	=						
14	14	✓	=						
15	15	✓	=						
16	16	✓	=						
17	17	✓	=						
18	18	✓	=						
19	19	✓	=						
20	20	✓	=						
21	21	✓	=						


<b>Issue Classification</b> 	<b>Application/Control No.</b> 14272866	<b>Applicant(s)/Patent Under Reexamination</b> HOEGELE, ARTUR	
	<b>Examiner</b> HEE-YONG KIM	<b>Art Unit</b> 2482	

CPC						
Symbol					Type	Version
G02B		21		02	F	2013-01-01
G02B		21		22	I	2013-01-01
G02B		21		0012	I	2013-01-01
A61B		19		5223	I	2013-01-01
						
						
						
						
						
						
						
						
						
						
						

CPC Combination Sets					
Symbol		Type	Set	Ranking	Version
					
					

NONE		<b>Total Claims Allowed:</b>	
(Assistant Examiner)		21	
(Date)			
/HEE-YONG KIM/			
Primary Examiner.Art Unit 2482		O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)		1	2
(Date)			



<b>Issue Classification</b> 	<b>Application/Control No.</b> 14272866	<b>Applicant(s)/Patent Under Reexamination</b> HOEGELE, ARTUR
	<b>Examiner</b> HEE-YONG KIM	<b>Art Unit</b> 2482

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant															
<input type="checkbox"/> CPA															
<input type="checkbox"/> T.D.															
<input type="checkbox"/> R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	17	17												
2	2	18	18												
3	3	19	19												
13	4	20	20												
4	5	21	21												
5	6														
6	7														
7	8														
8	9														
9	10														
10	11														
11	12														
12	13														
14	14														
15	15														
16	16														

NONE	<b>Total Claims Allowed:</b> 21	
(Assistant Examiner)	(Date)	
/HEE-YONG KIM/ Primary Examiner.Art Unit 2482	1/28/2015	O.G. Print Claim(s) 1
(Primary Examiner)	(Date)	O.G. Print Figure 2

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of	)	
	)	
Artur HOEGELE	)	Group Art Unit: 2482
	)	
Application No.: 14/272,866	)	Examiner: HEE-YONG KIM
	)	
Filed: May 8, 2014	)	Confirmation No.: 8559
	)	
For: SURGICAL MICROSCOPE	)	
WITH ENLARGED WORKING	)	
DISTANCE	)	

**AMENDMENT IN RESPONSE TO QUAYLE ACTION**

Commissioner for Patents  
Alexandria, VA 22313-1450

Sir:

In complete response to the Office Action dated December 3, 2014, please  
consider the enclosed remarks and enter the following amendments:



**AMENDMENTS TO THE CLAIMS:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**LISTING OF CLAIMS:**

1. (Currently Amended) A surgical microscope, comprising:  
an imaging system that provides a magnified multidimensional image of an object disposable in a focal plane of the imaging system along at least one optical imaging path, the imaging system comprising an objective, the objective comprising at least two lens groups through which the at least one optical imaging path passes one after another, and which define the focal plane of the imaging system,  
wherein at least one lens group of the objective is moveable along its optical axis relative to the at least one other lens group of the objective,  
wherein the objective's first lens group which is located directly adjacent to the focal plane along the at least one optical imaging path consists of at least three optical lenses and has altogether a negative optical power, and  
wherein the absolute value of the focal length of the first lens group of the objective does altogether not exceed 35 % of the absolute value of ~~the~~ a minimum focal length of the objective.
2. (Previously Presented) The surgical microscope according to claim 1, wherein the absolute value of the focal length of the first lens group of the objective does altogether not exceed 25 % or 20 % of the absolute value of the minimum focal length of the objective.
3. (Previously Presented) The surgical microscope according to claim 1, wherein the absolute value of the focal length of each single optical lens of the first lens group of

the objective is between 80 % and 300 % or between 95 % and 200 % of the absolute value of the focal length of the first lens group of the objective.

4. (Currently Amended) A surgical microscope comprising:

an imaging system that provides a magnified multidimensional image of an object disposable in a focal plane of the imaging system along at least one optical imaging path, the imaging system comprising an objective, the objective comprising exactly two lens groups through which the at least one optical imaging path passes, and which define the focal plane of the imaging system,

wherein at least one lens group of the objective is moveable along its optical axis relative to the at least one other lens group of the objective,

wherein the objective's first lens group which is located directly adjacent to the focal plane along the at least one optical imaging path consists of at least three optical lenses and has altogether a negative optical power,

wherein the absolute value of the focal length of the first lens group of the objective does altogether not exceed 35 % of the absolute value of ~~the~~ a minimum focal length of the objective, and

wherein a ratio of the absolute value of the focal length of the first lens group of the objective to the absolute value of the focal length of the second lens group of the objective is between 0.75 and 1.00 or between 0.80 and 0.90 or between 0.82 and 0.88.

5. (Previously Presented) The surgical microscope according to claim 1, wherein the first lens group of the objective consists of just three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element.

6. (Previously Presented) The surgical microscope according to claim 1, wherein the objective's second lens group which is located along the at least one optical imaging path directly adjacent to the first lens group has altogether a positive optical power; and wherein the second lens group of the objective consists of exactly three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element.
7. (Previously Presented) The surgical microscope according to claim 1, wherein the optical lenses of each lens group are consecutively passed through by the same at least one optical imaging path, and are stationary relative to each other.
8. (Previously Presented) The surgical microscope according to claim 1, wherein no imaging of the focal plane to infinity takes place within each lens group.
9. (Previously Presented) The surgical microscope according to claim 1, wherein the objective as a whole effects an imaging of the object disposable in the focal plane of the imaging system to infinity.
10. (Previously Presented) The surgical microscope according to claim 1, wherein no imaging of the object disposable in the focal plane of the imaging system to infinity takes place within the objective.
11. (Previously Presented) The surgical microscope according to claim 1, wherein the imaging system provides at least one pair of optical imaging paths intersecting at the focal plane of the imaging system at a stereoscopic angle of between

3 and 14, and provides a magnified multidimensional image of the object disposable in the focal plane of the imaging system; and

wherein the optical lenses of the objective are collectively passed through by the at least one pair of optical imaging paths.

12. (Original) The surgical microscope according to claim 11, wherein the imaging system, further comprises a zoom system having several optical lenses, with the optical lenses of the zoom system being consecutively passed through by just one optical imaging path of the at least one pair of optical imaging paths.

13. (Previously Presented) The surgical microscope according to claim 1, further comprising at least one image sensor disposed in an image plane of the imaging system and outputting image data representing the image of the object generated by the imaging system.

14. (Previously Presented) The surgical microscope according to claim 4, wherein the absolute value of the focal length of each single optical lens of the first lens group of the objective is between 80% and 300% or between 95% and 200% of the absolute value of the focal length of the first lens group of the objective.

15. (Previously Presented) The surgical microscope according to claim 4, wherein the first lens group of the objective consists of just three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element;

wherein the objective's second lens group which is located along the at least one optical imaging path directly adjacent to the first lens group has altogether a positive optical power; and

wherein the second lens group of the objective consists of exactly three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element.

16. (Previously Presented) The surgical microscope according to claim 4,  
wherein the optical lenses of each lens group are consecutively passed through by the same at least one optical imaging path, and are stationary relative to each other;  
and

wherein no imaging of the focal plane to infinity takes place within each lens group.

17. (Previously Presented) The surgical microscope according to claim 4,  
wherein the objective as a whole effects an imaging of the object disposable in the focal plane of the imaging system to infinity; and

wherein no imaging of the object disposable in the focal plane of the imaging system to infinity takes place within the objective.

18. (Currently Amended) A surgical microscope, comprising:  
an imaging system that provides a magnified multidimensional image of an object disposable in a focal plane of the imaging system along at least one optical imaging path, the imaging system comprising an objective, the objective comprising at least two lens groups through which the at least one optical imaging path passes, and which define the focal plane of the imaging system,

wherein at least one lens group of the objective is moveable along its optical axis relative to the at least one other lens group of the objective,

wherein the objective's first lens group which is located directly adjacent to the focal plane along the at least one optical imaging path consists of at least three optical lenses and has altogether a negative optical power,

wherein the absolute value of the focal length of the first lens group of the objective does altogether not exceed 35% of the absolute value of ~~the~~ a minimum focal length of the objective,

wherein the optical lenses of each lens group are consecutively passed through by the same at least one optical imaging path, and are stationary relative to each other; and

wherein no imaging of the focal plane to infinity takes place within each lens group.

19. (Currently Amended) The surgical microscope according to claim 18, wherein the absolute value of the focal length of each single optical lens of the first lens group of the objective is between 80% and 300% of the absolute value of the focal length of the first lens group of the objective[.].

20. (Previously Presented) The surgical microscope according to claim 18, wherein the first lens group of the objective consists of just three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element;

wherein the objective's second lens group which is located along the at least one optical imaging path directly adjacent to the first lens group has altogether a positive optical power; and

wherein the second lens group of the objective consists of exactly three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element.

21. (Previously Presented) The surgical microscope according to claim 18,  
wherein the objective as a whole effects an imaging of the object disposable in the focal plane of the imaging system to infinity; and  
wherein no imaging of the object disposable in the focal plane of the imaging system to infinity takes place within the objective.

**REMARKS**

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-21 are pending in the present application. Claim 19 has been amended to correct a typographical error.

Applicant notes with appreciation the Examiner's indication that the filed drawings are accepted and that the Examiner has considered and made of record the documents submitted with the Information Disclosure Statements filed on June 23, 2014.

In regards to the claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f), applicant would like to point out that the priority document, German Patent Application No. 10 2013 008 090.8, was submitted to the USPTO as evidenced by the attached dated stamped submission letter (stamped July 3, 2014). Upon review of the file wrapper, the priority document is of record. Applicant respectfully requests a notice to that effect.

Applicant thanks the Examiner for the indication of allowable subject matter. Claims 1-21 are indicated as allowed if the formal matters discussed below are corrected.

Claims 1-21 stand rejected under 35 U.S.C. § 112(b) or 112, (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA, the applicant regards as the invention. Specifically, the Office Action rejects claims 1, 4, and 18 for reciting "the minimum focal length" without proper antecedent basis. Claims 1, 4, and 18 are hereby amended to recite "a minimum focal length" as kindly suggested by the Examiner. Withdrawal of the rejection is respectfully requested.



**CONCLUSION**

Accordingly, it is respectfully submitted that this application is in condition for allowance and a notice to that effect is earnestly solicited. Should the Examiner have any questions regarding this response or the application in general, he is invited to contact the undersigned at (540) 361-1863 Ext. 125.

Respectfully submitted,

PATENT PORTFOLIO BUILDERS PLLC

By: /Steven M. duBois/  
Steven M. duBois  
Registration No. 35,023

Date: December 23, 2014

Customer No. 113648  
Patent Portfolio Builders PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404  
(540) 361-1863 Ext. 125



IFJ

Attorney's Docket No. 0902-046

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
Artur HOEGELE	)	Group Art Unit: 3738
Application No.: 14/272,866	)	Examiner: Unassigned
Filed: May 8, 2014	)	
For: SURGICAL MICROSCOPE WITH	)	
ENLARGED WORKING DISTANCE	)	

SUBMISSION OF CERTIFIED PRIORITY DOCUMENT

Commissioner for Patents  
Alexandria, VA 22313-1450

Sir:

Applicants claim priority of German Patent Application No. 10 2013 008 090.8, filed on May 10, 2013 and submit herewith a certified copy of the priority document.

Respectfully submitted,  
PATENT PORTFOLIO BUILDERS PLLC

By: /Steven M. duBois/  
Steven M. duBois  
Registration No. 35,023

Date: June 26, 2014

Customer No. 113648  
Patent Portfolio Builders PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404  
(540) 361-1863, ext. 125

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	21046736
<b>Application Number:</b>	14272866
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8559
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE
<b>Customer Number:</b>	113648
<b>Filer:</b>	Steven Maurice Dubois/Tina Jenkins
<b>Filer Authorized By:</b>	Steven Maurice Dubois
<b>Attorney Docket Number:</b>	0902-046
<b>Receipt Date:</b>	23-DEC-2014
<b>Filing Date:</b>	08-MAY-2014
<b>Time Stamp:</b>	11:55:46
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
------------------------	----

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Z12033- US_2014-12-23_Amendment_0 902-046.pdf	170785  cef69bbce204e53d835b1800a069eb53abb b453e	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	11

**Warnings:**

**Information:**

<b>Total Files Size (in bytes):</b>	170785
-------------------------------------	--------

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

<b>PATENT APPLICATION FEE DETERMINATION RECORD</b> Substitute for Form PTO-875				Application or Docket Number <b>14/272,866</b>		Filing Date <b>05/08/2014</b>		<input type="checkbox"/> To be Mailed	
---	--	--	--	---	--	----------------------------------	--	---------------------------------------	--

ENTITY: <input checked="" type="checkbox"/> LARGE <input type="checkbox"/> SMALL <input type="checkbox"/> MICRO									
<b>APPLICATION AS FILED – PART I</b>									
(Column 1)			(Column 2)						
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)	
<input type="checkbox"/> BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A			
<input type="checkbox"/> SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A		N/A		N/A			
<input type="checkbox"/> EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A			
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =		*		X \$ =			
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =		*		X \$ =			
<input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))									
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL			

<b>APPLICATION AS AMENDED – PART II</b>														
(Column 1)			(Column 2)			(Column 3)								
<b>AMENDMENT</b>	<b>12/23/2014</b>		CLAIMS REMAINING AFTER AMENDMENT			HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))		* 21		Minus	** 21		= 0		x \$80 =		0		
	Independent (37 CFR 1.16(h))		* 3		Minus	***3		= 0		x \$420 =		0		
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))													
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))													
	TOTAL ADD'L FEE										<b>0</b>			
(Column 1)			(Column 2)			(Column 3)								
<b>AMENDMENT</b>			CLAIMS REMAINING AFTER AMENDMENT			HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))		*		Minus	**		=		X \$ =				
	Independent (37 CFR 1.16(h))		*		Minus	***		=		X \$ =				
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))													
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))													
	TOTAL ADD'L FEE													

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.  
 \*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".  
 \*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".  
 The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE  
/LAVINIA JOHNSON/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

<b>PATENT APPLICATION FEE DETERMINATION RECORD</b> Substitute for Form PTO-875	Application or Docket Number <b>14/272,866</b>	Filing Date <b>05/08/2014</b>	<input type="checkbox"/> To be Mailed
---	---	----------------------------------	---------------------------------------

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

**APPLICATION AS FILED – PART I**

(Column 1)

(Column 2)

FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)
<input type="checkbox"/> BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
<input type="checkbox"/> SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	
<input type="checkbox"/> EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =	
<input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

**APPLICATION AS AMENDED – PART II**

(Column 1)

(Column 2)

(Column 3)

AMENDMENT	12/23/2014	CLAIMS REMAINING AFTER AMENDMENT	MINUS	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	* 21	Minus	** 21	= 0	X \$80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X \$420 =	0
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))						
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
TOTAL ADD'L FEE							<b>0</b>

(Column 1)

(Column 2)

(Column 3)

AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT	MINUS	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))					
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					
TOTAL ADD'L FEE						

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

\*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE  
/LAVINIA JOHNSON/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/272,866	05/08/2014	Artur HOEGELE	0902-046	8559

113648 7590 12/03/2014  
Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

EXAMINER
----------

KIM, HEE-YONG

ART UNIT	PAPER NUMBER
----------	--------------

2482

NOTIFICATION DATE	DELIVERY MODE
-------------------	---------------

12/03/2014

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Emily@ppblaw.com  
Tina@ppblaw.com

<b>Office Action Summary</b>	<b>Application No.</b> 14/272,866	<b>Applicant(s)</b> HOEGELE, ARTUR	
	<b>Examiner</b> HEE-YONG KIM	<b>Art Unit</b> 2482	<b>AIA (First Inventor to File) Status</b> Yes

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 5/8/2014.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims\*

- 5) ☒ Claim(s) 1-21 is/are pending in the application.  
5a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 6) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 7) ☒ Claim(s) 1-21 is/are rejected.
- 8) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 9) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

\* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

### Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 5/8/2014 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

#### Certified copies:

- a) ☐ All    b) ☐ Some\*\*    c) ☒ None of the:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)  
Paper No(s)/Mail Date 6/23/2014.
- 3) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 4) ☐ Other: \_\_\_\_\_.



## DETAILED ACTION

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.
2. This application is in condition for allowance except for the following formal matters.

**Claims 1 and 4** recite the limitation "the minimum focal length" in line 14. There is insufficient antecedent basis for this limitation in the claim.

**Claim 18** recites the limitation "the minimum focal length" in line 14. There is insufficient antecedent basis for this limitation in the claim.

The above formal matters are corrected by replacing "the minimum focal length" with "a minimum focal length".

Prosecution on the merits is closed in accordance with the practice under *Ex parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935).

Since this application has been granted special status under the accelerated examination program, a shortened statutory period for reply to this action is set to expire **TWO (2) MONTHS** from the mailing date of this letter. Extensions of this time period may be granted under 37 CFR 1.136(a). However, filing a petition for extension of time will result in the application being taken out of the accelerated examination program.

3. The objective of the accelerated examination program is to complete the examination of an application within twelve months from the filing date of the application. Any reply must be filed electronically via EFS-Web so that the papers will be expeditiously processed and considered. If the reply is not filed electronically via

EFS-Web, the final disposition of the application may occur later than twelve months from the filing of the application.

***Claim Rejections - 35 USC § 112***

4. **Claims 1-21** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

5. **Claims 1 and 4** recite the limitation "the minimum focal length" in line 14. There is insufficient antecedent basis for this limitation in the claim.

6. **Claim 18** recites the limitation "the minimum focal length" in line 14. There is insufficient antecedent basis for this limitation in the claim.

***Allowable Subject Matter***

7. **Claims 1-21** are allowed if the above formal matters are corrected by replacing "the minimum focal length" with "a minimum focal length".

8. The following is an examiner's statement of reasons for allowance.

**Claims 1 and 4 and 18** recite "... at least one lens group of the objective is moveable along its optical axis relative to the at least one other lens group of the objective, wherein the objective's first lens group which is located directly adjacent to the focal plane along the at least one optical imaging path consists of at least three optical lenses and has altogether a negative optical power, and wherein the absolute

Art Unit: 2482

value of the focal length of the first lens group of the objective does altogether not exceed 35% of the absolute value of a minimum focal length of the objective..." which is neither anticipated nor obvious over the prior art over the record. All other remaining claims are dependent on any of the above independent claims. Therefore all the pending claims are allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### ***Conclusion***

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to HEE-YONG KIM whose telephone number is (571)270-3669. The examiner can normally be reached on Monday-Thursday, 8:00am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christopher Kelley can be reached on 571-272-7331. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2482

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HEE-YONG KIM/

Primary Examiner, Art Unit 2482

<b>Notice of References Cited</b>	Application/Control No. 14/272,866	Applicant(s)/Patent Under Reexamination HOEGELE, ARTUR	
	Examiner HEE-YONG KIM	Art Unit 2482	Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,110,005 A	08-1978	Bohm et al.	359/673
*	B	US-5,424,838 A	06-1995	Siu, Bernard	356/394
*	C	US-2006/0114554 A1	06-2006	Suzuki et al.	359/380
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			


**FOREIGN PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

**NON-PATENT DOCUMENTS**

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  14272866	<b>Applicant(s)/Patent Under Reexamination</b>  HOEGELE, ARTUR
	<b>Examiner</b>  HEE-YONG KIM	<b>Art Unit</b>  2482

✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

<input type="checkbox"/> <b>Claims renumbered in the same order as presented by applicant</b>		<input type="checkbox"/> <b>CPA</b>		<input type="checkbox"/> <b>T.D.</b>		<input type="checkbox"/> <b>R.1.47</b>			
CLAIM		DATE							
Final	Original	11/25/2014							
	1	✓							
	2	✓							
	3	✓							
	4	✓							
	5	✓							
	6	✓							
	7	✓							
	8	✓							
	9	✓							
	10	✓							
	11	✓							
	12	✓							
	13	✓							
	14	✓							
	15	✓							
	16	✓							
	17	✓							
	18	✓							
	19	✓							
	20	✓							
	21	✓							

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	14/272866.app.	US-PGPUB; USPAT	ADJ	ON	2014/11/24 15:31
S2	1	14/272866.app. and absolute	US-PGPUB; USPAT	ADJ	ON	2014/11/24 15:32
S3	1	14/272866.app. and absolute with minimum	US-PGPUB; USPAT	ADJ	ON	2014/11/24 15:32
S4	2	microscope and lens group and minimum adj2 (focal length objective)	US-PGPUB; USPAT	ADJ	ON	2014/11/24 15:37
S5	21	microscope and lens group and minimum adj2 (focal length)	US-PGPUB; USPAT	ADJ	ON	2014/11/24 15:53
S6	7	microscope and lens group and (minimum adj2 (focal length)) with objective	US-PGPUB; USPAT	ADJ	ON	2014/11/24 15:53
S7	1	S6 and lens group with (minimum adj2 (focal length)) with objective	US-PGPUB; USPAT	ADJ	ON	2014/11/24 15:57
S8	627	G02B21/02.CPC.	US-PGPUB; USPAT	ADJ	ON	2014/11/24 16:02
S9	495	G02B21/0012.CPC.	US-PGPUB; USPAT	ADJ	ON	2014/11/24 16:02
S10	646	G02B21/22.CPC.	US-PGPUB; USPAT	ADJ	ON	2014/11/24 16:02
S11	930	348/79.ccls.	US-PGPUB; USPAT	ADJ	ON	2014/11/24 16:17

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	352	348/79.ccls.	USPAT; UPAD	ADJ	ON	2014/11/25 09:55
S12	351	348/79.ccls.	USPAT; UPAD	ADJ	ON	2014/11/24 16:17

11/ 25/ 2014 9:55:31 AM

C:\Users\hkim3\Documents\EAST\Workspaces\14272866.wsp

Receipt date: 10/14/2014

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

14272866 - GAIL: 2482

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number		14272866	
	Filing Date		2014-05-08	
	First Named Inventor	Artur HEOGELE		
	Art Unit	3738		
	Examiner Name	To Be Determined		
	Attorney Docket Number	0902-046		

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code <sup>1</sup>	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code <sup>1</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

Add

FOREIGN PATENT DOCUMENTS							Remove	
Examiner Initial*	Cite No	Foreign Document Number <sup>3</sup>	Country Code <sup>2</sup>	Kind Code <sup>4</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T <sup>5</sup>
	1	29 27 478	DE	C2	1980-01-24	Canon K.K.	English Abstract Only	<input checked="" type="checkbox"/>

If you wish to add additional Foreign Patent Document citation information please click the Add button

Add

NON-PATENT LITERATURE DOCUMENTS		Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.



<b>Receipt date: 10/14/2014</b>  <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> <b>( Not for submission under 37 CFR 1.99)</b>	Application Number		14272866	14272866 - GAU: 2482
	Filing Date		2014-05-08	
	First Named Inventor	Artur HEOGELE		
	Art Unit		3738	
	Examiner Name	To Be Determined		
	Attorney Docket Number		0902-046	

	1	Decision to Grant in corresponding German Patent Application No. 10 2013 008 090.8, dated March 19, 2014.	<input checked="" type="checkbox"/>
--	---	---	-------------------------------------

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

**EXAMINER SIGNATURE**

Examiner Signature	/Hee-yong Kim/	Date Considered	11/24/2014
--------------------	----------------	-----------------	------------

**\*EXAMINER:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> See Kind Codes of USPTO Patent Documents at [www.USPTO.GOV](http://www.USPTO.GOV) or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached.

<b>Receipt date: 10/14/2014</b>  <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> <b>( Not for submission under 37 CFR 1.99)</b>	Application Number		14272866	14272866 - GAU: 2482
	Filing Date		2014-05-08	
	First Named Inventor	Artur HEOGELE		
	Art Unit	3738		
	Examiner Name	To Be Determined		
	Attorney Docket Number	0902-046		

### CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

### SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/stevenmdubois/	Date (YYYY-MM-DD)	2014-10-14
Name/Print	Steven M. duBois	Registration Number	35,023

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

**Privacy Act Statement**

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
  2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
  3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
  4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
  5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
  6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
  7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
  8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 11/24/2014
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.K./

Receipt date: 06/23/2014

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

14272866 - GAI: 2482

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number		14272866	
	Filing Date		2014-05-08	
	First Named Inventor	Artur HOEGELE		
	Art Unit	3738		
	Examiner Name	TBA		
	Attorney Docket Number	0902-046		

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code <sup>1</sup>	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4299453		1981-11-10	Momiyama et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code <sup>1</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

Add

FOREIGN PATENT DOCUMENTS							Remove	
Examiner Initial*	Cite No	Foreign Document Number <sup>3</sup>	Country Code <sup>2</sup> j	Kind Code <sup>4</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T <sup>5</sup>
	1	195 23 712	DE	C2	1996-01-04	Kabushiki Kaisha Topcon		<input checked="" type="checkbox"/>
	2	10 2005 050 171	DE	A1	2007-04-26	Carl Zeiss Surgical GmbH		<input checked="" type="checkbox"/>

If you wish to add additional Foreign Patent Document citation information please click the Add button

Add

NON-PATENT LITERATURE DOCUMENTS							Remove
---------------------------------	--	--	--	--	--	--	--------

<b>Receipt date: 06/23/2014</b>  <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> <b>( Not for submission under 37 CFR 1.99)</b>	Application Number		14272866	14272866 - GAU: 2482
	Filing Date		2014-05-08	
	First Named Inventor	Artur HOEGELE		
	Art Unit		3738	
	Examiner Name	TBA		
	Attorney Docket Number		0902-046	

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>5</sup>
	1	German Office Action in corresponding German Patent Application No. 10 2013 008 090.8 dated July 17, 2013.	<input checked="" type="checkbox"/>
	2	Decision to Grant in corresponding German Patent Application No. 10 2013 008 090.8 dated July 17, 2013.	<input type="checkbox"/>

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

#### EXAMINER SIGNATURE

Examiner Signature	/Hee-yong Kim/	Date Considered	11/24/2014
<p>*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.</p>			

<sup>1</sup> See Kind Codes of USPTO Patent Documents at [www.USPTO.GOV](http://www.USPTO.GOV) or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached.

<b>Receipt date: 06/23/2014</b>  <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> <b>( Not for submission under 37 CFR 1.99)</b>	Application Number		14272866	14272866 - GAU: 2482
	Filing Date		2014-05-08	
	First Named Inventor	Artur HOEGELE		
	Art Unit	3738		
	Examiner Name	TBA		
	Attorney Docket Number	0902-046		

### CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

### SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/stevenmdubois/	Date (YYYY-MM-DD)	2014-06-23
Name/Print	Steven M. duBois	Registration Number	35,023

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

**Privacy Act Statement**

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.K./

<b>Search Notes</b>  	<b>Application/Control No.</b>  14272866	<b>Applicant(s)/Patent Under Reexamination</b>  HOEGELE, ARTUR
	<b>Examiner</b>  HEE-YONG KIM	<b>Art Unit</b>  2482

CPC- SEARCHED		
Symbol	Date	Examiner
G02B21/02	11/24/2014	HK
G02B21/0012	11/24/2014	HK
G02B21/22	11/24/2014	HK

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
348	79	11/24/2014	HK

SEARCH NOTES		
Search Notes	Date	Examiner
East Search	11/24/2014	HK

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
348	79	11/24/2014	HK

--	--





## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
 United States Patent and Trademark Office  
 Address: COMMISSIONER FOR PATENTS  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450  
 www.uspto.gov

## BIB DATA SHEET

CONFIRMATION NO. 8559

<b>SERIAL NUMBER</b> 14/272,866	<b>FILING or 371(c) DATE</b> 05/08/2014 <b>RULE</b>	<b>CLASS</b> 348	<b>GROUP ART UNIT</b> 2482	<b>ATTORNEY DOCKET NO.</b> 0902-046		
<b>APPLICANTS</b> Carl Zeiss Meditec AG, Jena, GERMANY, Assignee (with 37 CFR 1.172 Interest); <b>INVENTORS</b> Artur HOEGELE, Oberkochen, GERMANY; <b>** CONTINUING DATA *****</b> <b>** FOREIGN APPLICATIONS *****</b> GERMANY 10 2013 008 090.8 05/10/2013 <b>** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **</b> 05/21/2014						
Foreign Priority claimed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 35 USC 119(a-d) conditions met <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Verified and Acknowledged <u>/HEE-YONG KIM/</u> Examiner's Signature		<input type="checkbox"/> Met after Allowance Initials _____	<b>STATE OR COUNTRY</b> GERMANY	<b>SHEETS DRAWINGS</b> 3	<b>TOTAL CLAIMS</b> 21	<b>INDEPENDENT CLAIMS</b> 3
<b>ADDRESS</b> Patent Portfolio Builders, PLLC P.O. Box 7999 Fredericksburg, VA 22404-7999 UNITED STATES						
<b>TITLE</b> Surgical Microscope with Enlarged Working Distance						
<b>FILING FEE RECEIVED</b> 1820	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			<input type="checkbox"/> All Fees		
				<input type="checkbox"/> 1.16 Fees (Filing)		
				<input type="checkbox"/> 1.17 Fees (Processing Ext. of time)		
				<input type="checkbox"/> 1.18 Fees (Issue)		
				<input type="checkbox"/> Other _____		
			<input type="checkbox"/> Credit			



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/272,866	05/08/2014	Artur HOEGELE	0902-046

**CONFIRMATION NO. 8559**

## PUBLICATION NOTICE



\*OC000000071953001\*

113648  
Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

**Title:**Surgical Microscope with Enlarged Working Distance

**Publication No.**US-2014-0340500-A1

**Publication Date:**11/20/2014

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at [www.uspto.gov](http://www.uspto.gov). The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at [www.uspto.gov](http://www.uspto.gov) using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/272,866	05/08/2014	Artur HOEGELE	0902-046	8559

113648 7590 11/04/2014  
Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

EXAMINER
----------

ART UNIT	PAPER NUMBER
2486	

NOTIFICATION DATE	DELIVERY MODE
11/04/2014	ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Emily@ppblaw.com  
Tina@ppblaw.com



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents  
United States Patent and Trademark Office  
P.O. Box 1450  
Alexandria, VA 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

In re Application of	: DECISION ON REQUEST TO
Artur Hoegele	: PARTICIPATE IN THE PATENT
Application No.: 14/272,866	: PROSECUTION HIGHWAY
Filed: 08 May 2014	: PROGRAM AND PETITION
Attorney Docket No.: 0902-046	: TO MAKE SPECIAL UNDER
For: SURGICAL MICROSCOPE WITH	: 37 CFR 1.102(a)
ENLARGED WORKING DISTANCE	

This is a decision on the request to participate in the Patent Prosecution Highway (PPH) program and the petition under 37 CFR 1.102(a), filed 23 June 2014 and renewed on 14 October 2014, to make the above-identified application special.

The request and petition are **GRANTED**.

**DISCUSSION**

A grantable request to participate in the PPH pilot program and petition to make special require:

1. The U.S. application and the corresponding application filed in the PPH 2.0 participating office (with the allowable/patentable claim(s)) must have the same priority/filing date. In particular, the U.S. application (including national stage entry of a PCT application and a so-called bypass application filed under 35 U.S.C. 111 which validly claims benefit under 35 U.S.C. 120 to a PCT application):
  - a. is an application that validly claims priority under 35 U.S.C. § 119(a) and 37 CFR 1.55 to one or more applications filed with the PPH 2.0 participating office, or
  - b. is an application which is the basis of a valid priority claim under the Paris Convention for the application filed in the PPH 2.0 participating office, or
  - c. is an application which shares a common priority document with the application filed in the PPH 2.0 participating office, or
  - d. the application filed in the PPH 2.0 participating office are derived from/related to a PCT application having no priority claim.
2. Applicant must:
  - a. Ensure all the claims in the U.S. application must sufficiently correspond or be amended to sufficiently correspond to the allowable/patentable claim(s) in the PPH 2.0 participating office application(s) and
  - b. Submit a claims correspondence table in English;
3. Examination of the U.S. application has not begun;
4. Applicant must submit:
  - a. Documentation of prior office action:

Art Unit: OPET

- i. a copy of the office action(s) just prior to the “Decision to Grant a Patent” from each of the PPH 2.0 participating office application(s) containing the allowable/patentable claim(s) or
    - ii. if the allowable/patentable claims(s) are from a “Notification of Reasons for Refusal” then the Notification of Reasons for Refusal or
    - iii. if the PPH 2.0 participating office application is a first action allowance then no office action from the PPH 2.0 participating office is necessary should be indicated on the request/petition form;
  - b. An English language translation of the PPH 2.0 participating office action from (4)(a)(i)-(ii) above
5. Applicant must submit:
  - a. An IDS listing the documents cited by the PPH 2.0 participating office examiner in the PPH 2.0 participating office action (unless already submitted in this application)
  - b. Copies of the documents except U.S. patents or U.S. patent application publications (unless already submitted in this application);

On reconsideration, the request to participate in the PPH pilot program and petition comply with the above requirements. Accordingly, the above-identified application has been accorded “special” status.

Telephone inquiries concerning this decision should be directed to the undersigned at (571) 272-3204. All other inquiries concerning the examination or status of the application is accessible in the PAIR system at <http://www.uspto.gov/ebc/index.html>.

This application will be forwarded to the examiner for action on the merits commensurate with this decision.

/SDB/

Sherry D. Brinkley  
Paralegal Specialist  
Office of Petitions

## Office of Petitions: Routing Sheet



**Application No.: 14/272,866**

**This application is being forwarded to your office for further processing. A decision has been rendered on a petition filed in this application.**

☒ **GRANTED**

☐ **DISMISSED**

☐ **DENIED**

## Office of Petitions: Decision Count Sheet

Mailing Month

Application No.

14272866



For US serial numbers: enter number only, no slashes or commas. Ex: 10123456

For PCT: enter "51+single digit of year of filing+last 5 numbers", Ex. for PCT/US05/12345, enter 51512345

Deciding Official:

BRINKLEY, SHERRY

**Count (1) - Palm Credit**

14/272,866

Decision: GRANT

FINANCE WORK NEEDED

☐ Select Check Box for YES

Decision Type: 652 - Petition to make special-PPH



Notes:

**Count (2)**

Decision: n/a

FINANCE WORK NEEDED

☐ Select Check Box for YES

Decision Type: NONE

Notes:

**Count (3)**

Decision: n/a

FINANCE WORK NEEDED

☐ Select Check Box for YES

Decision Type: NONE

Notes:

Initials of Approving Official (if required)

If more than 3 decisions, attach  
2nd count sheet & mark this box ☐

Printed on: 10/30/2014

<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number		14272866	
	Filing Date		2014-05-08	
	First Named Inventor	Artur HEOGELE		
	Art Unit	3738		
	Examiner Name	To Be Determined		
	Attorney Docket Number	0902-046		

U.S.PATENTS							Remove	
Examiner Initial*	Cite No	Patent Number	Kind Code <sup>1</sup>	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear		
	1							
If you wish to add additional U.S. Patent citation information please click the Add button.							Add	
U.S.PATENT APPLICATION PUBLICATIONS							Remove	
Examiner Initial*	Cite No	Publication Number	Kind Code <sup>1</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear		
	1							
If you wish to add additional U.S. Published Application citation information please click the Add button.							Add	
FOREIGN PATENT DOCUMENTS							Remove	
Examiner Initial*	Cite No	Foreign Document Number <sup>3</sup>	Country Code <sup>2</sup> i	Kind Code <sup>4</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T <sup>5</sup>
	1	29 27 478	DE	C2	1980-01-24	Canon K.K.	English Abstract Only	<input checked="" type="checkbox"/>
If you wish to add additional Foreign Patent Document citation information please click the Add button							Add	
NON-PATENT LITERATURE DOCUMENTS							Remove	
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.						T <sup>5</sup>



<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number		14272866
	Filing Date		2014-05-08
	First Named Inventor	Artur HEOGELE	
	Art Unit	3738	
	Examiner Name	To Be Determined	
	Attorney Docket Number	0902-046	

	1	Decision to Grant in corresponding German Patent Application No. 10 2013 008 090.8, dated March 19, 2014.	<input checked="" type="checkbox"/>
--	---	---	-------------------------------------

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

#### EXAMINER SIGNATURE

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> See Kind Codes of USPTO Patent Documents at [www.USPTO.GOV](http://www.USPTO.GOV) or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**  
( Not for submission under 37 CFR 1.99)

Application Number	14272866
Filing Date	2014-05-08
First Named Inventor	Artur HEOGELE
Art Unit	3738
Examiner Name	To Be Determined
Attorney Docket Number	0902-046

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/stevenmdubois/	Date (YYYY-MM-DD)	2014-10-14
Name/Print	Steven M. duBois	Registration Number	35,023

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



Espacenet

## Bibliographic data: DE2927478 (C2) — 1988-09-29

### Zoom lens system with movable diaphragm

**Inventor(s):** MOMIYAMA, KIKUO, ; KAMATA, SHIGERU, ; MOMIYAMA, KIKUO, YOKOHAMA, KANAGAWA, JP, ; KAMATA, SHIGERU, TOKIO/TOKYO, JP

**Applicant(s):** CANON K.K., ; CANON K.K., TOKIO/TOKYO, JP

**Classification:** - international: **G02B15/16; G02B15/177**; (IPC1-7): G02B15/14  
- cooperative: **G02B15/177**

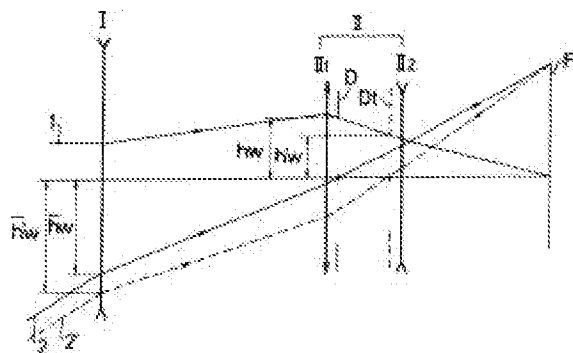
**Application number:** DE19792927478 19790706

**Priority number (s):** JP19780082280 19780706

**Also published as:** DE2927478 (A1) US4299453 (A) JPS559550 (A)

**Abstract not available for DE2927478 (C2)**  
**Abstract of corresponding document: US4299453 (A)**

The present invention relates to an objective lens for zooming by varying the distance between the divergent front lens group and the convergent rear lens group consisting of a first sub-group for forming a convergent light beam and a second sub-group between which sub-groups a photographing aperture is provided so as to be independent from them, whereby when the rear lens group is displaced forward for zooming the photographing aperture is displaced backward with reference to the first sub-group.



⑮ BUNDESREPUBLIK  
DEUTSCHLAND



DEUTSCHES  
PATENTAMT

⑫ Patentschrift  
⑪ DE 2927478 C2

⑤ Int. Cl. 4:  
G02B 15/14

⑲ Aktenzeichen: P 29 27 478.0-51  
⑳ Anmeldetag: 6. 7. 79  
㉑ Offenlegungstag: 24. 1. 80  
㉒ Veröffentlichungstag  
der Patenterteilung: 29. 9. 88

DE 2927478 C2

Innerhalb von 3 Monaten nach Veröffentlichung der Erteilung kann Einspruch erhoben werden

⑩ Unionspriorität: ③② ③③ ③①

06.07.78 JP P53-82280

⑦ Patentinhaber:

Canon K.K., Tokio/Tokyo, JP

⑧ Vertreter:

Tiedtke, H., Dipl.-Ing.; Bühling, G., Dipl.-Chem.;  
Kinno, R., Dipl.-Ing.; Grupe, P., Dipl.-Ing.; Pellmann,  
H., Dipl.-Ing., Pat.-Anwälte, 8000 München

⑦ Erfinder:

Moriyama, Kikuo, Yokohama, Kanagawa, JP;  
Kamata, Shigeru, Tokio/Tokyo, JP

⑤⑥ Für die Beurteilung der Patentfähigkeit  
in Betracht gezogene Druckschriften:

DE 24 08 871 A  
US 38 48 969

⑤④ Varioobjektiv

DE 2927478 C2

FIG. 1

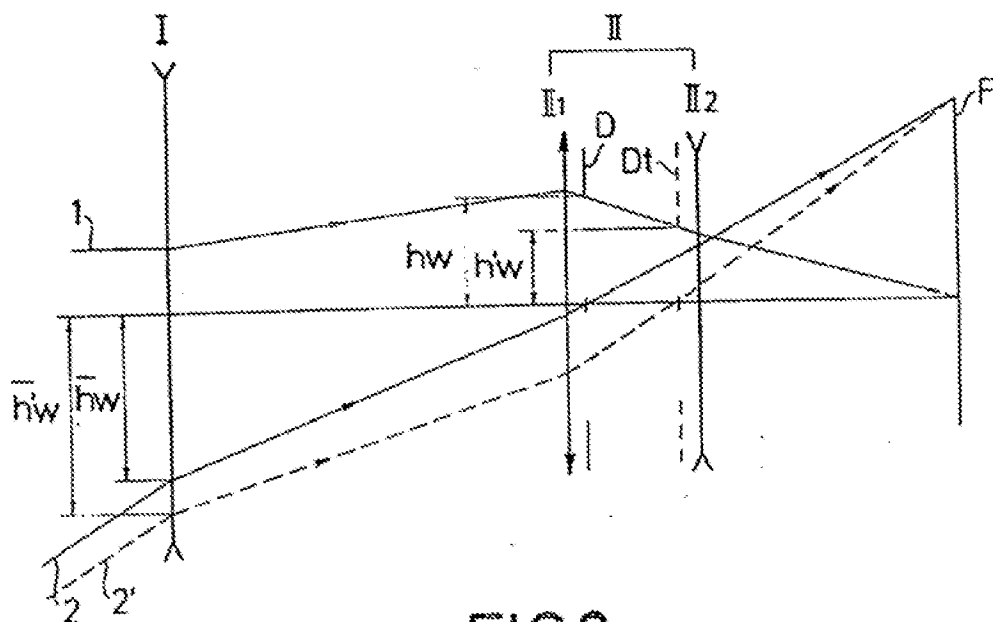
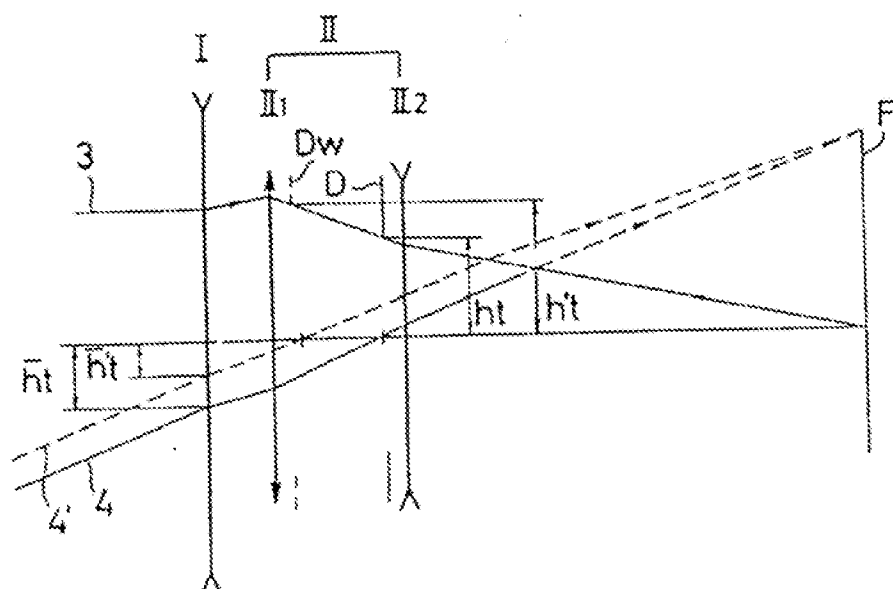


FIG. 2



## Patentansprüche

1. Varioobjektiv, mit  
 5 einer negativen und einer positiven Linsengruppe, deren gegenseitiger Abstand zur Brennweitenänderung variabel ist, und  
 einer Aperturblende, die in der positiven Linsengruppe angeordnet ist,  
 dadurch gekennzeichnet, daß die Aperturblende (D) bei einer Brennweitenänderung relativ zur positiven Linsengruppe (II) bewegbar angeordnet ist.
2. Varioobjektiv nach Anspruch 1, dadurch gekennzeichnet, daß die negative und die positive Linsengruppe  
 10 (I bzw. II) derart ausgelegt sind, daß der Randstrahl des Öffnungsbündels am Ort der Aperturblende (D) konvergiert.
3. Varioobjektiv nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Aperturblende (D) bei Vergrößerung der Objektivbrennweite zur Bildseite bewegbar angeordnet ist.
4. Varioobjektiv nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß bei Vergrößerung der  
 15 Objektivbrennweite die negative Linsengruppe (I) zur Bildseite und die positive Linsengruppe (II) sowie die Aperturblende (D) zur Objektseite bewegt werden, wobei die Bewegung der Aperturblende (D) langsamer als die der positiven Linsengruppe (II) ist.

## Beschreibung

20 Die Erfindung bezieht sich auf ein Varioobjektiv gemäß dem Oberbegriff des Anspruchs 1.  
 Wenn bei einem derartigen Varioobjektiv, wie es in der US-PS 38 48 969 offenbart ist, die Brennweite in Richtung auf die Weitwinkelstellung verändert wird, wird der Abstand zwischen der vorderen Linsengruppe und der hinteren Linsengruppe, die eine Aperturblende aufweist, so groß, daß ein außeraxialer Strahl, der durch die  
 25 vordere Linsengruppe einfällt, einen relativ großen Abstand von der optischen Achse hat. Dies führt dazu, daß der Durchmesser der Frontlinse vergrößert werden muß. Eine Vergrößerung des Frontlinsendurchmessers ist aber bezüglich der Abmessungen des Varioobjektivs und der Herstellungskosten nachteilig.

Wird hingegen die Brennweite in Richtung auf die Teilstellung verändert, geraten die vordere Linsengruppe und die hintere Linsengruppe nahe aneinander, wobei die hintere Linsengruppe und damit die Aperturblende  
 30 objektseitig bewegt werden. Ein Randstrahl des Öffnungsbündels, der die Aperturblende durchläuft, hat dabei einen relativ großen Abstand von der optischen Achse, so daß der Durchmesser der Aperturblendenöffnung in nachteiliger Weise vergrößert werden muß.

Um unter Berücksichtigung des letztgenannten Problems die relative Öffnung in der Teilstellung vergrößern zu können, muß der Durchmesser der Aperturblendenöffnung ebenfalls vergrößert werden, so daß eine Linsenfassung mit einer entsprechenden Aperturblendensteuerung notwendig ist. Hierdurch wird jedoch die Linsenfassung in ihren Abmessungen sehr groß. Dies ist nicht nur im Hinblick auf die Handhabung des Varioobjektivs  
 35 nachteilig, sondern ein derartiges Varioobjektiv hat auch ein unvorteilhaftes äußeres Erscheinungsbild.

Der Erfindung liegt die Aufgabe zugrunde, ein Varioobjektiv der bekannten Art zu schaffen, dessen Bildfeld in der Weitwinkelstellung und relative Öffnung in der Teilstellung vergleichsweise groß sind.

40 Diese Aufgabe wird durch das Varioobjektiv gemäß dem Anspruch 1 gelöst.

Das erfindungsgemäße Varioobjektiv weist eine vordere Linsengruppe, eine hintere Linsengruppe und eine Aperturblende auf, wobei während der Brennweitenänderung die Aperturblende relativ zur hinteren Linsengruppe bewegbar angeordnet ist.

Wenn bei einem herkömmlichen Varioobjektiv mit veränderlicher Brennweite die Aperturblende als Einheit  
 45 mit der hinteren Linsengruppe bewegt wird, hat ein Randstrahl des Öffnungsbündels an der Aperturblende einen relativ großen Abstand von der optischen Achse. Demgegenüber kann beim erfindungsgemäßen Varioobjektiv der Durchmesser eines Strahlenbündels an derjenigen Position gesteuert werden, an der der Randstrahl einen relativ geringen Abstand von der optischen Achse hat. Ferner kann der Hauptstrahl relativ nahe der optischen Achse auf die vordere Linsengruppe auftreffen.

50 Das erfindungsgemäße Varioobjektiv hat des weiteren den Vorteil, daß die relative Öffnung sowohl in der Teilstellung als auch in der Weitwinkelstellung bei gleichem Öffnungsdurchmesser während der Brennweitenänderung gleich bleibt.

Weitere vorteilhafte Ausbildungen des erfindungsgemäßen Varioobjektivs ergeben sich aus den Unteransprüchen.

55 Aus der DE-OS 24 08 871 ist ein Varioobjektiv mit einer bewegbaren Aperturblende bekannt, das allerdings einen gegenüber dem erfindungsgemäßen Varioobjektiv grundsätzlich anderen Linsengruppenaufbau aufweist.

Die Erfindung wird anhand nachstehender Ausführungsbeispiele unter Bezugnahme auf die beigelegten Zeichnungen näher erläutert.

In den Zeichnungen zeigt

60 Fig. 1 eine schematische Seitenansicht eines ersten Ausführungsbeispiels der Erfindung, bei welchem das Varioobjektiv sich in einer Weitwinkelstellung befindet,

Fig. 2 eine schematische Seitenansicht des ersten Ausführungsbeispiels, wobei sich das Varioobjektiv in einer Teilstellung befindet,

Fig. 3 einen Schnitt durch das erfindungsgemäße Varioobjektiv in einer Weitwinkelstellung,

65 Fig. 4 einen Schnitt durch das erfindungsgemäße Varioobjektiv in einer Teilstellung,

Fig. 5A bis 5C graphische Darstellungen der Abbildungsfehler des erfindungsgemäßen Varioobjektivs in einer Weitwinkelstellung, und

Fig. 6A bis 6C graphische Darstellung der Abbildungsfehler des erfindungsgemäßen Varioobjektivs in einer

Telestellung.

In den Fig. 1 und 2 ist eine negative, vordere Linsengruppe I und eine positive, hintere Linsengruppe II dargestellt. Die positive, hintere Linsengruppe II besteht im wesentlichen aus einer Untergruppe II<sub>1</sub> mit einer stark positiven Brechkraft und einer Untergruppe II<sub>2</sub> mit einer negativen Brechkraft. Hierbei sind in der positiven, hinteren Linsengruppe II der Abstand zwischen den beiden Untergruppen II<sub>1</sub> und II<sub>2</sub> sowie ein Luftraum, in dem die Randstrahlen des Öffnungsbündels relativ stark konvergieren, groß, und es ist eine längs der optischen Achse bewegliche Aperturblende D in dem Abschnitt angeordnet.

Fig. 1 zeigt das erfindungsgemäße Varioobjektiv einschließlich des Strahlengangs in der Weitwinkelstellung; Fig. 2 zeigt dasselbe System in der Telestellung. Zur Brennweitenvergrößerung werden die negative, vordere Linsengruppe I in nicht-linearer Weise zur Bildseite und gleichzeitig die positive hintere Linsengruppe II linear zur Objektseite bewegt. Die Aperturblende D ist so ausgelegt, daß sie in der extremen Weitwinkelstellung dicht an der positiven Untergruppe II<sub>1</sub> der positiven, hinteren Linsengruppe II und der extremen Telestellung dicht an der negativen Untergruppe II<sub>2</sub> angeordnet ist. Hierzu wird die Aperturblende D bei einer Brennweitenvergrößerung bezüglich der positiven, hinteren Linsengruppe II zur Bildseite bewegt.

Im folgenden wird erläutert, wie aufgrund der vorstehend erläuterten Anordnung nicht nur die relative Öffnung in der extremen Telestellung groß, sondern auch der Durchmesser an der vorderen Linse in der extremen Weitwinkelstellung klein gehalten werden kann, ohne daß dazu der Öffnungsdurchmesser vergrößert werden muß.

Gemäß Fig. 1 wird ein in die negative, vordere Linsengruppe I einfallender paraxialer Strahl 1 von dieser gestreut und von der positiven Untergruppe II<sub>1</sub> der positiven, hinteren Linsengruppe II konvergent gemacht. Nach Durchgang durch die Aperturblende D in einem Abstand  $hw$  von der optischen Achse wird der Strahl 1 von der negativen Untergruppe II<sub>2</sub> der positiven, hinteren Linsengruppe II leicht gestreut. Danach schneidet der Strahl 1 eine Bildebene F auf der optischen Achse. Ein außeraxialer Strahl 2, der einen Objektpunkt mit dem größten Abstand von der optischen Achse auf der Bildebene F abbildet, tritt in einem Abstand  $hw$  von der optischen Achse in die negative vordere Linsengruppe I ein und gelangt nach Durchlaufen der positiven hinteren Linsengruppe II zur Bildebene F.

In Fig. 2 ist ein paraxialer Strahl 3 in der Telestellung des Varioobjektivs dargestellt. Zwar trifft der Strahl 3 mit dem gleichen Neigungswinkel wie der paraxiale Strahl 1 in Fig. 1 auf die Bildebene F auf, seine Einfallshöhe in die negative vordere Linsengruppe I ist jedoch wegen der Brennweitenvergrößerung größer. Seine Einfallshöhe in die positive hintere Linsengruppe II ist deutlich größer als die Einfallshöhe des paraxialen Strahls 1 in Fig. 1 in der Weitwinkelstellung, da die negative vordere und die positive hintere Linsengruppe I bzw. II sehr viel näher aneinander angeordnet sind. Da sich gemäß Fig. 2 die Aperturblende D nahe der negativen Untergruppe II<sub>2</sub> befindet und der paraxiale Strahl 3 von der positiven Untergruppe II<sub>1</sub> stark zur optischen Achse abgelenkt wird und dann die Aperturblende D durchläuft, gewährleistet eine in eine kompakte Linsenfassung einbaubare Steuerung zur Verschiebung der Aperturblende eine ausreichende Öffnungshöhe  $ht$ .

Würde hingegen die Aperturblende D in einer Position  $Dw$  nahe der positiven Untergruppe II<sub>1</sub> angeordnet, dann durchläufe der paraxiale Strahl 3 die Aperturblende D in einem Abstand  $h't$  von der optischen Achse, der sehr viel größer als der Abstand  $ht$  wäre. In diesem Fall müßte der Durchmesser der Aperturblende D größer sein, so daß eine Vergrößerung der Linsenfassung oder eine Auslegung der Linsenfassung derart, daß sie die Lichtstärke des Varioobjektivs nicht beeinträchtigt, notwendig wäre.

Wäre die Aperturblende D auf der Seite der negativen Untergruppe II<sub>2</sub> fest angeordnet, beispielsweise in der in Fig. 1 wiedergegebenen Position D<sub>1</sub>, dann würde der paraxiale Strahl 1 die Aperturblende D mit einem geringen Abstand  $h'w$  von der optischen Achse durchlaufen. Diese Anordnung bringt aber insoweit keinen Vorteil, da in eine kompakte Linsenfassung bereits eine Aperturblendensteuerung einbaubar ist, die einen Abstand  $hw$  von der optischen Achse für einen paraxialen Strahl 1 zuläßt.

Der außeraxiale Strahl 2 würde in diesem Fall gemäß der gestrichelten Linie 2' verlaufen, so daß dessen ursprüngliche Einfallshöhe  $hw$  erhöht wäre. Dies wiederum hat zur Folge, daß der Durchmesser der Frontlinse der negativen vorderen Linsengruppe I vergrößert werden müßte.

Würde nun die Aperturblende D in der Telestellung gemäß Fig. 2 an der Position Dw angeordnet werden, dann fiele der durch die Aperturblende D verlaufende außeraxiale Strahl 4' mit einem kleinen Abstand  $h't$  von der optischen Achse in die Frontlinse der negativen vorderen Linsengruppe I ein. In diesem Fall würde der wirksame Frontlinsendurchmesser verringert. Der in diesem Fall benötigte Frontlinsendurchmesser ist erheblich kleiner als derjenige in der Weitwinkelstellung, so daß insofern keine Probleme auftreten.

Falls der Abstand zwischen der positiven Untergruppe II<sub>1</sub> und der negativen Untergruppe II<sub>2</sub> der positiven hinteren Linsengruppe II so weit vergrößert ist, daß die Aperturblende D darin verschoben werden kann, sind weder in der Telestellung eine Verringerung der relativen Öffnung und/oder der Linsenfassung noch in der Weitwinkelstellung eine Vergrößerung des Frontlinsendurchmessers erforderlich.

In den Fig. 3 und 4 ist ein Schnitt durch ein Varioobjektiv dargestellt, wobei Fig. 3 die Anordnung in der Weitwinkelstellung und Fig. 4 die Anordnung in der Telestellung zeigen. Hierbei ist ein Raum für die Bewegung der Aperturblende D dadurch vorgesehen, daß der Abstand zwischen der positiven Linse D<sub>13</sub> und der negativen Linse D<sub>12</sub> vergrößert ist.

Aus den vorstehenden Ausführungen ergibt sich, daß die relative Öffnung in der Telestellung vergrößert werden kann, ohne daß der Durchmesser D der Blendenöffnung vergrößert werden müßte. Würde dagegen bei gleicher relativer Öffnung der Öffnungsdurchmesser in Weitwinkelstellung gegenüber demjenigen in der Telestellung unterschiedlich sein, dann würde es notwendig, eine Steuerungseinrichtung zur Änderung des Öffnungsdurchmessers bei Verschiebung der Aperturblende D vorzusehen. Demnach führt eine geeignete Wahl des Konvergenzgrades des paraxialen Strahls, bezogen auf den Abstand, an welchem die Aperturblende D angeordnet ist, und des Abstands der Aperturblende D usw. dazu, daß ein Varioobjektiv konstruierbar ist, bei welchem



der Öffnungsdurchmesser bei gleicher relativer Öffnung von der Weitwinkelstellung bis zur Teilstellung gleich bleibt.

Ein Varioobjektiv mit Linsen, deren numerische Daten nachstehend wiedergegeben sind, weist diesen Vorteil auf. Hierbei bedeuten  $R_i$  die Krümmungsradien der Linsenoberflächen,  $D_i$  die Linsendicken oder die Abstände zwischen den Linsen,  $n_i$  die Brechungsindizes für die  $d$ -Linie und  $v_i$  die Abbe'sche Zahl für die  $d$ -Linie der entsprechenden Linsen in den Fig. 3 und 4.

Hierbei ist der Öffnungsdurchmesser gleich 0,586 für die relative Öffnung von 2,8. Die sphärische Aberration, der Stigmatismus und die Verzeichnung in der Weitwinkelstellung sind in den Fig. 5A bis 5C dargestellt. Die entsprechenden Bildfehler in der Teilstellung sind in den Fig. 6A bis 6C dargestellt.

10	Brennweite $f = 1-1,586$ ; Bildfeld $2\omega = 64^\circ - 42^\circ$			
	$R_1 = 2,10896$	$D_1 = 0,06435$	$n_1 = 1,8061$	$v_1 = 25,4$
	$R_2 = 0,9047$	$D_2 = 0,22807$		
15	$R_3 = 5,0260$	$D_3 = 0,16786$	$n_2 = 1,61293$	$v_2 = 37$
	$R_4 = -1,73211$	$D_4 = 0,00560$		
	$R_5 = -1,89286$	$D_5 = 0,04196$	$n_3 = 1,713$	$v_3 = 53,9$
	$R_6 = 1,27556$	$D_6 = 0,11095$		
	$R_7 = 1,46504$	$D_7 = 0,09792$	$n_4 = 1,7136$	$v_4 = 29,5$
20	$R_8 = 1,86587$	$D_8 = 0,00280$		
	$R_9 = 1,30302$	$D_9 = 0,11190$	$n_5 = 1,74077$	$v_5 = 27,8$
	$R_{10} = 2,85805$	$D_{10} = 1,11562 - 0,16443$		
	$R_{11} = 26,66649$	$D_{11} = 0,08393$	$n_6 = 1,713$	$v_6 = 53,9$
	$R_{12} = -4,38342$	$D_{12} = 0,00280$		
25	$R_{13} = 1,59713$	$D_{13} = 0,08393$	$n_7 = 1,713$	$v_7 = 53,9$
	$R_{14} = 4,14978$	$D_{14} = 0,00280$		
	$R_{15} = 0,83574$	$D_{15} = 0,12589$	$n_8 = 1,713$	$v_8 = 53,9$
	$R_{16} = 4,19642$	$D_{16} = 0,03637 - 0,23500$		
	$R_{17} = (\text{Apertur})$	$D_{17} = 0,22940 - 0,03077$		
30	$R_{18} = 3,25410$	$D_{18} = 0,09745$	$n_9 = 1,8061$	$v_9 = 25,4$
	$R_{19} = 0,63899$	$D_{19} = 0,19795$		
	$R_{20} = 1,98222$	$D_{20} = 0,10351$	$n_{10} = 1,713$	$v_{10} = 53,9$
	$R_{21} = -1,20997$			

Hierzu 4 Blatt Zeichnungen

FIG.3

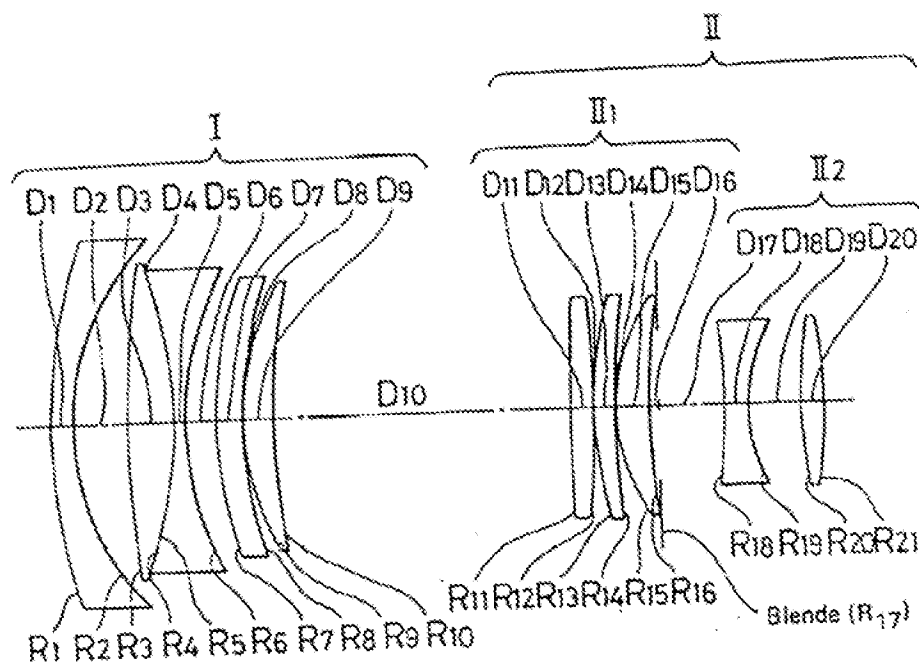


FIG.4

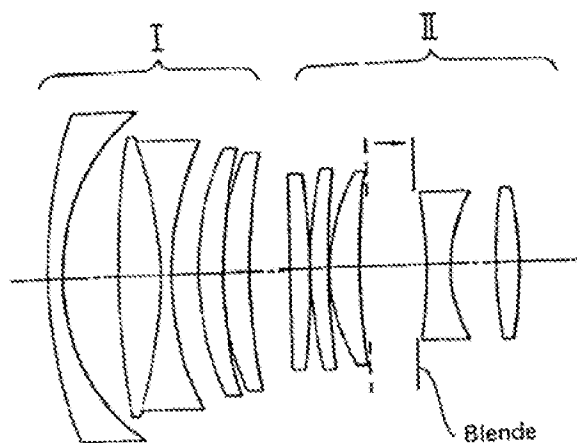


FIG. 5A

FIG. 5B

FIG. 5C

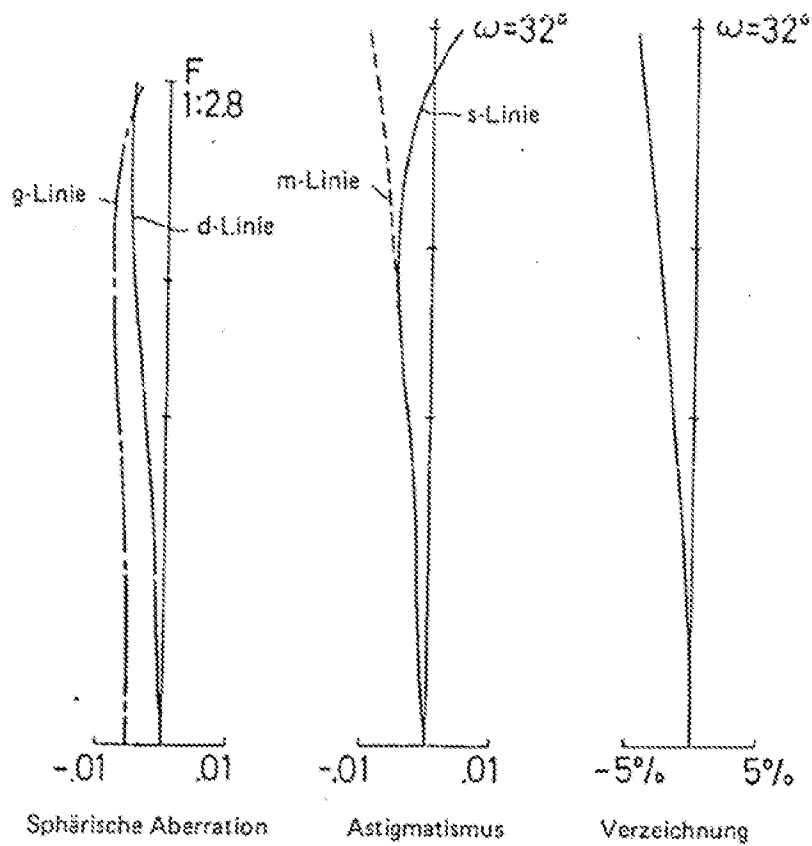
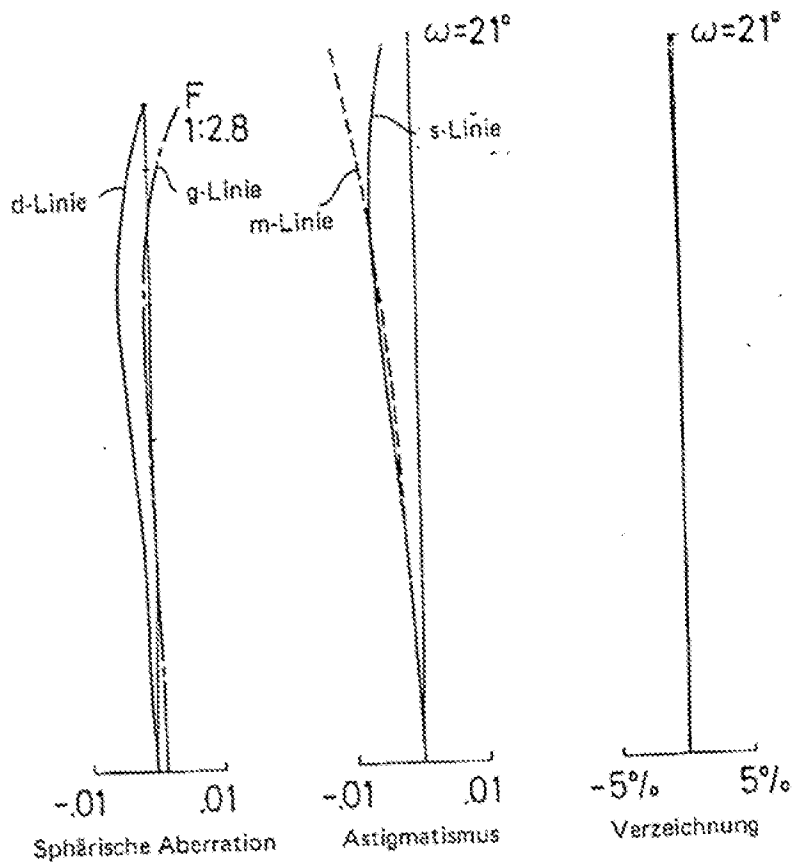


FIG. 6A

FIG. 6B

FIG. 6C



## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	20409563
<b>Application Number:</b>	14272866
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8559
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE
<b>Customer Number:</b>	113648
<b>Filer:</b>	Steven Maurice Dubois/Andrea Terry
<b>Filer Authorized By:</b>	Steven Maurice Dubois
<b>Attorney Docket Number:</b>	0902-046
<b>Receipt Date:</b>	14-OCT-2014
<b>Filing Date:</b>	08-MAY-2014
<b>Time Stamp:</b>	15:07:02
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
------------------------	----

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition to make special under Patent Prosecution Hwy	Z12033- US_2014-10-14_Response_to_ PPH_Decision_0902-046.pdf	82485  523162ef11673153ad03dfc90f3fe019c685825e	no	2

### Warnings:

### Information:

2	Information Disclosure Statement (IDS) Form (SB08)	Z12033_US_2014-10-14_IDS_0 902-046.pdf	612303 <small>2e26ad8375990d2709a136b292b8b276afa 2ef08</small>	no	4
<b>Warnings:</b>					
<b>Information:</b>					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
3	Foreign Reference	DE2927478_with_EnglishAbstr act.pdf	2008545 <small>0e6c7f95bdc90c7872fe340427a95eb73de0 28df</small>	no	9
<b>Warnings:</b>					
<b>Information:</b>					
4	Non Patent Literature	10-2013-008-090-8_GermanDe cisionToGrant_with_EnglishTra nslation.pdf	1685255 <small>4813c68a6584a2a102e772a025e77abf550 613d8</small>	no	10
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>			4388588		
<p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of	)	
	)	
Artur HOEGELE	)	Group Art Unit: 3738
	)	
Application No.: 14/272,866	)	Examiner: Unassigned
	)	
Filed: May 8, 2014	)	Confirmation No.: 8559
	)	
For: SURGICAL MICROSCOPE	)	
WITH ENLARGED WORKING	)	
DISTANCE	)	

**RESPONSE TO DECISION ON REQUEST TO PARTICIPATE**  
**IN THE PATENT PROSECUTION HIGHWAY PROGRAM AND PETITION**  
**TO MAKE SPECIAL UNDER 37 C.F.R. § 1.102(a)**

Commissioner for Patents  
Alexandria, VA 22313-1450  
**Mail Stop Petitions**

Sir:

In response to the Decision on Request to Participate in the Patent Prosecution Highway Program and Petition to Make Special under 37 C.F.R. § 1.102(a), Applicant understands from a helpful conversation with Ms. Brinkley of the Petitions Office that the Deficiency noted by the U.S. Patent and Trademark Office in the original Patent Prosecution Highway filing can be corrected by a supplemental filing rather than re-filing the original documentation in corrected form. Accordingly, Applicant has listed the omitted reference DE 29 27 478 (C2) in an Information Disclosure Statement and corrected the date of the previously submitted Non-Patent Reference 2 to reflect the date of March 19, 2014.

It is respectfully submitted that this application is now in condition for expedited examination and a Notice granting Applicant's petition is hereby requested.

Respectfully submitted,  
PATENT PORTFOLIO BUILDERS PLLC

By: /stevenmdubois/  
Steven M. duBois  
Registration No. 35,023

Date: October 14, 2014

Customer No. 113648

Patent Portfolio Builders PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404  
(540) 361-1863, Ext. 125





# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/272,866	05/08/2014	Artur HOEGELE	0902-046	8559

113648 7590 09/16/2014  
Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

EXAMINER
----------

ART UNIT	PAPER NUMBER
----------	--------------

2486

NOTIFICATION DATE	DELIVERY MODE
-------------------	---------------

09/16/2014

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Emily@ppblaw.com  
Tina@ppblaw.com



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents  
United States Patent and Trademark Office  
P.O. Box 1450  
Alexandria, VA 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

In re Application of	: DECISION ON REQUEST TO
Artur Hoegele	: PARTICIPATE IN THE PATENT
Application No.: 14/272,866	: PROSECUTION HIGHWAY
Filed: 08 May 2014	: PROGRAM AND PETITION
Attorney Docket No.: 0902-046	: TO MAKE SPECIAL UNDER
For: SURGICAL MICROSCOPE WITH	: 37 CFR 1.102(a)
ENLARGED WORKING DISTANCE	

This is a decision on the request to participate in the Patent Prosecution Highway (PPH) program and the petition under 37 CFR 1.102(a), filed 23 June 2014, to make the above-identified application special.

The request and petition are **DISMISSED**.

**DISCUSSION**

A grantable request to participate in the PPH pilot program and petition to make special require:

1. The U.S. application and the corresponding application filed in the PPH 2.0 participating office (with the allowable/patentable claim(s)) must have the same priority/filing date. In particular, the U.S. application (including national stage entry of a PCT application and a so-called bypass application filed under 35 U.S.C. 111 which validly claims benefit under 35 U.S.C. 120 to a PCT application):
  - a. is an application that validly claims priority under 35 U.S.C. § 119(a) and 37 CFR 1.55 to one or more applications filed with the PPH 2.0 participating office, or
  - b. is an application which is the basis of a valid priority claim under the Paris Convention for the application filed in the PPH 2.0 participating office, or
  - c. is an application which shares a common priority document with the application filed in the PPH 2.0 participating office, or
  - d. the application filed in the PPH 2.0 participating office are derived from/related to a PCT application having no priority claim.
2. Applicant must:
  - a. Ensure all the claims in the U.S. application must sufficiently correspond or be amended to sufficiently correspond to the allowable/patentable claim(s) in the PPH 2.0 participating office application(s) and
  - b. Submit a claims correspondence table in English;
3. Examination of the U.S. application has not begun;
4. Applicant must submit:
  - a. Documentation of prior office action:

Art Unit: OPET

- i. a copy of the office action(s) just prior to the “Decision to Grant a Patent” from each of the PPH 2.0 participating office application(s) containing the allowable/patentable claim(s) or
    - ii. if the allowable/patentable claims(s) are from a “Notification of Reasons for Refusal” then the Notification of Reasons for Refusal or
    - iii. if the PPH 2.0 participating office application is a first action allowance then no office action from the PPH 2.0 participating office is necessary should be indicated on the request/petition form;
  - b. An English language translation of the PPH 2.0 participating office action from (4)(a)(i)-(ii) above
5. Applicant must submit:
  - a. An IDS listing the documents cited by the PPH 2.0 participating office examiner in the PPH 2.0 participating office action (unless already submitted in this application)
  - b. Copies of the documents except U.S. patents or U.S. patent application publications (unless already submitted in this application);

The request to participate in the PPH pilot program and petition fails meet condition 5.

In this regard, an IDS listing all the documents cited by the PPH 2.0 participating office examiner in the PPH 2.0 participating office action, including copies thereof, have not been submitted.

Applicant is given **ONE** opportunity within a time period of **ONE MONTH or THIRTY DAYS**, whichever is longer, from the mailing date of this decision to correct the deficiencies. **NO EXTENSION OF TIME UNDER 37 CFR 1.136 IS PERMITTED.** If the deficiencies are not corrected within the time period given, the application will await action in its regular turn.

Response must be filed via the Electronic Filing System (EFS) using the document description: Petition to make special under Patent Pros Hwy. Any preliminary amendments and IDS submitted with the PPH documents must be separately indexed as a preliminary amendment and IDS, respectively.

Telephone inquiries concerning this decision should be directed to the undersigned at 571-272-3204. All other inquiries concerning the examination or status of the application is accessible in the PAIR system at <http://www.uspto.gov/ebc/index.html>.

/SDB/

Sherry D. Brinkley  
Paralegal Specialist  
Office of Petitions

## Office of Petitions: Decision Count Sheet

Mailing Month

Application No.

14272866



For US serial numbers: enter number only, no slashes or commas. Ex: 10123456

For PCT: enter "51+single digit of year of filing+last 5 numbers", Ex. for PCT/US05/12345, enter 51512345

Deciding Official:

BRINKLEY, SHERRY

**Count (1) - Palm Credit**

14/272,866

Decision:

DISMISSED

FINANCE WORK NEEDED

☐ Select Check Box for YES

Decision Type:

652 - Petition to make special-PPH



Notes:

**Count (2)**

Decision:

n/a

FINANCE WORK NEEDED

☐ Select Check Box for YES

Decision Type:

NONE

Notes:

**Count (3)**

Decision:

n/a

FINANCE WORK NEEDED

☐ Select Check Box for YES

Decision Type:

NONE

Notes:

Initials of Approving Official (if required)

If more than 3 decisions, attach  
2nd count sheet & mark this box

Printed on: 9/12/2014

## Office of Petitions: Routing Sheet



**Application No.: 14/272,866**

**This application is being forwarded to your office for further processing. A decision has been rendered on a petition filed in this application.**

☐ **GRANTED**

☒ **DISMISSED**

☐ **DENIED**

# PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number  
14/272,866

## APPLICATION AS FILED - PART I

(Column 1)		(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(j))	21 minus 20 =	*			OR	x 80 =	80
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1680

## APPLICATION AS AMENDED - PART II

(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
Total (37 CFR 1.16(i))	*	Minus	**	=		OR	x	=
Independent (37 CFR 1.16(h))	*	Minus	***	=		OR	x	=
Application Size Fee (37 CFR 1.16(s))						OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						OR		
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
Total (37 CFR 1.16(i))	*	Minus	**	=		OR	x	=
Independent (37 CFR 1.16(h))	*	Minus	***	=		OR	x	=
Application Size Fee (37 CFR 1.16(s))						OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						OR		
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

\*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
14/272,866	05/08/2014	2486	1820	0902-046	21	3

CONFIRMATION NO. 8559

UPDATED FILING RECEIPT



113648  
Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

Date Mailed: 08/13/2014

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Artur HOEGELE, Oberkochen, GERMANY;

**Applicant(s)**

Carl Zeiss Meditec AG, Jena, GERMANY

**Assignment For Published Patent Application**

Carl Zeiss Meditec AG, Jena, GERMANY

**Power of Attorney:** None

**Domestic Applications for which benefit is claimed - None.**

*A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.*

**Foreign Applications** (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

GERMANY 10 2013 008 090.8 05/10/2013

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

**If Required, Foreign Filing License Granted:** 05/21/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/272,866**

**Projected Publication Date:** 11/20/2014

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

Surgical Microscope with Enlarged Working Distance

**Preliminary Class**

348

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No**

**PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).



**LICENSE FOR FOREIGN FILING UNDER**  
**Title 35, United States Code, Section 184**  
**Title 37, Code of Federal Regulations, 5.11 & 5.15**

**GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

---

***SelectUSA***

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

US Appl. No.  
14/272,866  
Filed: May 8, 2014

# BUNDESREPUBLIK DEUTSCHLAND



Artur HOEGELE  
Patent Portfolio  
Builders PLLC  
(540) 361-1863  
1081

## Prioritätsbescheinigung DE 10 2013 008 090.8 über die Einreichung einer Patentanmeldung

**Aktenzeichen:** 10 2013 008 090.8  
**Anmeldetag:** 10. Mai 2013  
**Anmelder/Inhaber:** Carl Zeiss Meditec AG, 07745 Jena, DE  
**Bezeichnung:** Operationsmikroskop mit vergrößertem Arbeitsabstand  
**IPC:** G02B 21/02; G02B 9/00; G02B 21/22; A61B 19/00

Die angehefteten Stücke sind eine richtige und genaue Wiedergabe der Teile der am 10. Mai 2013 eingereichten Unterlagen dieser Patentanmeldung unabhängig von gegebenenfalls durch das Kopierverfahren bedingten Farbabweichungen.

München, den 27. März 2014  
Deutsches Patent- und Markenamt  
Die Präsidentin

Im Auftrag

Pförtner

**OPERATIONSMIKROSKOP MIT VERGRÖßERTEM ARBEITSABSTAND**

Die vorliegende Anmeldung betrifft ein Operationsmikroskop, das eine sehr große Variation des Arbeitsabstandes erlaubt.

5

Operationsmikroskope sind optische Auflichtmikroskope, die während medizinischer Eingriffe verwendet werden und eine Abbildungsvergrößerung von üblicherweise zwischen 5-fach und 30-fach bereitstellen. Verglichen mit anderen optischen Auflichtmikroskopen weisen Operationsmikroskope eine vergrößerte Brennweite des verwendeten Objektivsystems von typischerweise zwischen 175 mm und 550 mm und einen entsprechend großen Arbeitsabstand (Abstand zwischen dem Linsenscheitel der einem mit dem Operationsmikroskop abzubildenden Objekt am nächsten angeordneten Objektivlinse und dem Objekt) von typischerweise zwischen 200 mm und 500 mm auf. Um einem Benutzer einen räumlichen Eindruck des abzubildenden Objekts zu vermitteln, sind Operationsmikroskope häufig als Stereomikroskop ausgebildet, bei welchem den Augen des Benutzers ein Paar von Abbildungsstrahlengängen bereitgestellt wird, welche Abbildungsstrahlengänge sich in der Nähe einer Fokusebene des Operationsmikroskops unter Einschluss eines Stereowinkels von zwischen  $3^\circ$  und  $14^\circ$  schneiden. Das Gesichtsfeld von Operationsmikroskopen, d. h. die Fläche in der Fokusebene, welche von dem wenigstens einen Abbildungsstrahlengang zu einem bestimmten Zeitpunkt auf die Netzhaut eines Benutzers abgebildet werden kann, ist typischerweise größer als  $1 \text{ mm}^2$ . Das Gesichtsfeld eines Operationsmikroskops umfasst somit nicht nur einen einzigen Bildpunkt, wie es bei Scanmikroskopen der Fall ist; vielmehr findet zu jedem Zeitpunkt eine mehrdimensionale (zwei- oder dreidimensionale) Abbildung des betrachteten Objekts durch das Operationsmikroskop statt. Häufig sind Operationsmikroskope mit einem Zoomsystem oder Vergrößerungswechsler zur Veränderung der Abbildungsvergrößerung und einem

Fokussiersystem zur Änderung des Arbeitsabstandes ausgestattet. Häufige Einsatzgebiete sind die Chirurgie und Mikrochirurgie.

- 5 In Operationsmikroskopen wird die Abbildung des mittels des Operationsmikroskops abgebildeten Objekts einem Benutzer wahlweise über ein Okular (bzw. bei stereoskopischen Operationsmikroskopen über ein Paar von Okularen) bereitgestellt, oder die Abbildung wird mittels eines
- 10 Bildwandlers (bzw. bei stereoskopischen Operationsmikroskopen mittels eines Stereobildwandlers oder eines Paares von Bildwandlern) in elektrische Signale umgesetzt und dem Benutzer zusätzlich oder alternativ zu Okularen über einen Monitor und/oder ein Head-Mounted-Display angezeigt.

15

- Getragen werden Operationsmikroskope häufig von Stativen, die am Boden oder an der Decke eines Behandlungssaals befestigt oder frei am Boden des Behandlungssaals positionierbar sind. Das Stativ kann manuell über Motoren verstellbar sein, und
- 20 ermöglicht eine gewünschte Anordnung und Orientierung des Operationsmikroskops über dem abzubildenden Objekt..

- Zusätzlich zu Operationsmikroskopen werden während medizinischer Eingriffe häufig auch monoskopische
- 25 Übersichtskameras verwendet, die bei einem Arbeitsabstand von typischerweise größer 1.000 mm keine oder nur eine geringe Abbildungsvergrößerung aufweisen. Das gleichzeitige Vorsehen einer Übersichtskamera zusätzlich zu einem Operationsmikroskop erhöht die Komplexität, da zwei
- 30 unterschiedliche Geräte bedient werden müssen, und die Kosten, da zwei unterschiedliche Geräte beschafft und gewartet werden müssen.

- Trotz des gegenüber herkömmlichen Auflichtmikroskopen
- 35 vergrößerten Arbeitsabstandes ist die bei bekannten Operationsmikroskopen erreichbare Bandbreite des

Arbeitsabstandes ungenügend.

Ausführungsformen sind daher auf ein Operationsmikroskop gerichtet, welches eine sehr große Variation des  
5 Arbeitsabstandes und insbesondere eines verglichen mit bekannten Operationsmikroskopen vergrößerten Arbeitsabstand erlaubt.

Ausführungsformen eines Operationsmikroskops weisen ein  
10 Abbildungssystem mit einem Objektivsystem auf, welches ein in einer Fokusebene des Abbildungssystems angeordnetes (in der Regel dreidimensionales) Objekt entlang wenigstens eines Abbildungsstrahlengangs vergrößert in ein mehrdimensionales (insbesondere zwei- oder dreidimensionales) Abbild des  
15 Objekts abbildet.

Das Objektivsystem umfasst mindestens zwei Linsengruppen, die von dem wenigstens einen Abbildungsstrahlengang nacheinander durchsetzt werden, und die Fokusebene des Abbildungssystems  
20 festlegen. Gemäß einer Ausführungsform umfasst das Objektivsystem genau zwei Linsengruppen.

Gemäß einer Ausführungsform wird unter einer Linsengruppe eine Teilmenge der in dem Operationsmikroskop angeordneten  
25 optischen Linsen verstanden, die sich durch folgende gleichzeitig erfüllte Merkmale auszeichnet:

- Die optischen Linsen der Teilmenge werden von dem selben  
30 wenigstens einen Abbildungsstrahlengang nacheinander durchsetzt. In der Folge sind zwischen den optischen Linsen einer Linsengruppe entlang des selben wenigstens einen Abbildungsstrahlengangs keine optischen Linsen vorhanden, die einer anderen Linsengruppe oder keiner Linsengruppe angehören.

35

- Die optischen Linsen der Teilmenge sind relativ zueinander

- ortsfest, d. h. die Abstände zwischen benachbarten optischen Linsen aller optischen Linsen einer Linsengruppe sind konstant. Dies schließt jedoch nicht aus, dass alle optischen Linsen dieser Linsengruppe relativ zu einer optischen Linse oder Linsengruppe verlagert werden, die dieser Linsengruppe nicht angehört bzw. von der betrachteten Linsengruppe verschieden ist.
- Zwischen optischen Linsen der Teilmenge findet keine Abbildung der Fokusebene nach Unendlich statt. D. h. eine Linsengruppe kann keine afokale Schnittstelle umfassen, sondern beginnt ggf. nach einer afokalen Schnittstelle bzw. endet ggf. vor einer afokalen Schnittstelle.
- Wenigstens eine Linsengruppe des Objektivsystems ist entlang ihrer optischen Achse relativ zu wenigstens einer anderen Linsengruppe des Objektivsystems verlagerbar. Die erste Linsengruppe des Objektivsystems, die der Fokusebene entlang des wenigstens einen Abbildungsstrahlengangs unmittelbar benachbart ist, besteht aus mindestens drei optischen Linsen und weist insgesamt eine negative Brechkraft (Kehrwert der Brennweite) auf.
- Dabei schließt der Begriff "unmittelbar benachbart" ausdrücklich nicht aus, dass zwischen der Fokusebene und dem Objektivsystem zusätzliche optische Elemente angeordnet sein können, die keine oder nur eine sehr geringe Brechkraft aufweisen. Dabei werden unter optischen Elementen mit sehr geringer Brechkraft optische Elemente verstanden, deren Brechkraft dem Betrag nach 10% und insbesondere 5% und weiter insbesondere 3% der gesamten Brechkraft des Operationsmikroskops nicht übersteigt. Somit sollen optische Elemente ohne oder mit sehr geringer Brechkraft wie z. B. Abdeckscheiben oder plane Filter bei Prüfung des Merkmals "unmittelbar benachbart" unberücksichtigt bleiben. Dies bedeutet, dass zwischen der ersten Linsengruppe und der

Fokusebene keine weiteren optischen Linsen oder Linsengruppen angeordnet sind.

- Der Aufbau des Objektivsystems aus zwei Linsengruppen, von denen eine Linsengruppe aus wenigstens drei Linsen besteht und insgesamt eine negative Brechkraft aufweist, erlaubt es, den Arbeitsabstand in einem Bereich zu variieren, der über den bei Operationsmikroskopen üblichen Bereich hinausgeht.
- 5
- 10 Gemäß einer Ausführungsform weist das Objektivsystem eine einstellbare Brennweite von zwischen 150 mm und unendlich und insbesondere von zwischen 200 mm und 1.200 mm und weiter insbesondere von zwischen 300 mm und 600 mm auf.
- 15 Gemäß einer Ausführungsform weist das Objektivsystem einen einstellbaren Arbeitsabstand von zwischen 200 mm und 5.000 mm auf.

- Das Abbildungssystem kann neben dem Objektivsystem eine oder mehrere weitere optische Linsen umfassen, welche nacheinander von dem wenigstens einen Abbildungsstrahlengang durchsetzt werden. Das Objektivsystem ist dem abgebildeten Objekt entlang des wenigstens einen Abbildungsstrahlengangs am nächsten angeordnet. Dies bedeutet, dass das Objektivsystem zwischen anderen optischen Linsen des Abbildungssystems und der Fokusebene angeordnet ist. Die optischen Linsen einschließlich der optischen Linsen des Objektivsystems können einfache Linsenelemente und/oder Kittglieder sein. Zusätzlich kann das Abbildungssystem eine oder mehrere optische Spiegelflächen umfassen, welche den wenigstens einen Abbildungsstrahlengang nacheinander falten.
- 20
- 25
- 30

- Gemäß einer Ausführungsform weist die Brennweite der ersten Linsengruppe des Objektivsystems dem Betrage nach insgesamt höchstens 35 % und insbesondere höchstens 25 % und weiter insbesondere höchstens 20% der minimalen Brennweite des
- 35

Objektivsystems auf. Gemäß einer Ausführungsform weist die Brennweite der ersten Linsengruppe des Objektivsystems dem Betrage nach gleichzeitig wenigstens 10 % und insbesondere wenigstens 15 % der minimalen Brennweite des Objektivsystems auf.

Damit kommt der ersten Linsengruppe des Objektivsystems dem Betrage nach verglichen mit bekannten Objektivsystemen von Operationsmikroskopen ein ungewöhnlich großer Anteil an der Brechkraft zu, zumal die erste Linsengruppe insgesamt ja negative Brechkraft aufweist.

Gemäß einer Ausführungsform weisen die einzelnen optischen Linsen der ersten Linsengruppe des Objektivsystems jeweils dem Betrage nach Brennweiten zwischen 80% und 300% und insbesondere jeweils zwischen 95% und 200% der Brennweite der ersten Linsengruppe des Objektivsystems auf.

Somit ist die Brechkraft innerhalb der ersten Linsengruppe relativ gleichmäßig auf die optischen Linsen der ersten Linsengruppe verteilt.

Gemäß einer Ausführungsform beträgt der Quotient der Brennweite der ersten Linsengruppe des Objektivsystems zur Brennweite der zweiten Linsengruppe des Objektivsystems dem Betrag nach zwischen 0,75 und 1,00 und insbesondere zwischen 0,80 und 0,90 und weiter insbesondere zwischen 0,82 und 0,88.

Gemäß einer Ausführungsform besteht die erste Linsengruppe des Objektivsystems aus genau drei optischen Linsen, von denen zwei optische Linsen insbesondere durch Verkleben dauerhaft miteinander zu einem Kittglied verbunden sind und die dritte optische Linse ein von dem Kittglied separates Linsenelement ist. Dabei bestehen die dauerhaft miteinander verbundenen Linsen aus Materialien mit unterschiedlichem Brechungsindex. Dann kann das Kittglied wahlweise zwischen



der Fokusebene und dem separaten Linsenelement angeordnet sein, oder das separate Linsenelement ist zwischen der Fokusebene und dem Kittglied angeordnet.

- 5 Gemäß einer Ausführungsform weist die der ersten Linsengruppe entlang des wenigstens einen Abbildungsstrahlengangs unmittelbar benachbarte zweite Linsengruppe des Objektivsystems insgesamt eine positive Brechkraft auf.
- 10 Gemäß einer Ausführungsform besteht die zweite Linsengruppe des Objektivsystems aus genau drei optischen Linsen, von denen zwei optische Linsen insbesondere durch Verkleben miteinander dauerhaft zu einem Kittglied verbunden sind und die dritte optische Linse ein von dem Kittglied separates
- 15 Linsenelement ist. Dabei bestehen die dauerhaft miteinander verbundenen Linsen aus Materialien mit unterschiedlichem Brechungsindex. Dann kann das Kittglied wahlweise zwischen der Fokusebene und dem separaten Linsenelement angeordnet sein, oder das separate Linsenelement ist zwischen der
- 20 Fokusebene und dem Kittglied angeordnet.

Gemäß einer Ausführungsform werden die optischen Linsen jeder Linsengruppe von dem selben wenigstens einen Abbildungsstrahlengang nacheinander durchsetzt, und sind die

25 optischen Linsen jeder Linsengruppe jeweils relativ zu anderen Linsen der selben Linsengruppe ortsfest.

- Gemäß einer Ausführungsform findet innerhalb einer Linsengruppe keine Abbildung der Fokusebene nach Unendlich
- 30 statt.

- Gemäß einer Ausführungsform bewirkt das Objektivsystem insgesamt eine Abbildung des in der Fokusebene des
- 35 Abbildungssystems anordenbaren Objektes nach Unendlich. Dies erlaubt einen modularen Aufbau des Operationsmikroskops.

Gemäß einer Ausführungsform erfolgt innerhalb des Objektivsystems keine Abbildung des in der Fokusebene des Abbildungssystems anordenbaren Objektes nach Unendlich.

- 5 Gemäß einer Ausführungsform stellt das Abbildungssystem wenigstens ein Paar von Abbildungsstrahlengängen bereit, welche sich in der Fokusebene des Abbildungssystems unter Einschluss eines Stereowinkels  $\alpha$  von zwischen  $3^\circ$  und  $14^\circ$  schneiden und das in der Fokusebene des Abbildungssystems
- 10 angeordnete Objekt jeweils vergrößert in ein mehrdimensionales Abbild des Objekts abbilden; auf diese Weise kann insgesamt eine dreidimensionale Abbildung des Objektes gewonnen werden. Dabei werden die optischen Linsen des Objektivsystems von dem wenigstens einen Paar von
- 15 Abbildungsstrahlengängen gemeinsam durchsetzt. Die Abbildungsstrahlengänge des wenigstens einen Paares von Abbildungsstrahlengängen können sich in den optischen Linsen des Objektivsystems teilweise überlappen oder auch nicht überlappen. Insbesondere können Hauptstrahlen der
- 20 Abbildungsstrahlengänge von den optischen Achsen der von ihnen durchsetzten optischen Linsen des Objektivsystems paarweise gleich weit beabstandet sein.

- Gemäß einer Ausführungsform weist das Operationsmikroskop
- 25 weiter ein Zoomsystem mit mehreren optischen Linsen auf, wobei die optischen Linsen des Zoomsystems nacheinander von nur einem Abbildungsstrahlengang des wenigstens einen Paares von Abbildungsstrahlengängen durchsetzt werden.

- 30 Gemäß einer Ausführungsform weist das Operationsmikroskop weiter für jeden Abbildungsstrahlengang des wenigstens einen Paares von Abbildungsstrahlengängen eine variable Aperturblende auf.

- 35 Gemäß einer Ausführungsform weist das Operationsmikroskop weiter wenigstens einen Bildsensor auf, welcher in einer

Bildebene des Abbildungssystems angeordnet ist und Bilddaten ausgibt, welche das von dem Abbildungssystem erzeugte Abbild des Objekts repräsentieren. Der Bildsensor kann zusätzlich oder alternativ zu Okularen vorgesehen sein. Weist das Operationsmikroskop keine Okulare auf, spricht man von einem "digitalen Operationsmikroskop"; bei diesem ist die Anordnung und Lage des Operationsmikroskops bei der Bilderzeugung von der Anordnung und Lage der Bilddarstellung vollständig entkoppelt.

10

Die von dem wenigstens einen Bildsensor ausgegebenen Bilddaten können in Form eines elektrischen (und ggf. digitalen) Signals vorliegen, das eine - insbesondere auch farbgetreue - Rekonstruktion des von dem Abbildungssystem erzeugten Abbilds des Objekts erlaubt. Dies bedeutet, dass das von dem Bildsensor ausgegebene Signal einen Informationsgehalt aufweist, der dem Informationsgehalt des von dem Abbildungssystem erzeugten Abbilds des Objekts so weitgehend entspricht, dass eine Darstellung des Abbilds auf einer Anzeige basierend auf dem Signal möglich ist. Bei dem wenigstens einen Bildsensor kann es sich beispielsweise um einen Siliziumsensor und insbesondere um einen CCD-Sensor (wahlweise mit vorgeschaltetem Filterrad oder aber farbsensitiven Sensoren) oder einen auf der CMOS-Technologie basierenden Active Pixel Sensor handeln. Gemäß einer Ausführungsform weist eine lichtempfindliche Sensorfläche des Bildsensors eine Fläche von wenigstens  $100 \times 100$  Bildpunkten und insbesondere von wenigstens  $320 \times 240$  Bildpunkten auf.

Wird ein Bildssensor verwendet, kann das Operationsmikroskop weiter wenigstens eine Anzeige (beispielsweise ein Monitor, ein Digitalprojektor oder ein Head-Mounted-Display) aufweisen, welche das von dem Bildsensor gewonnene Bild wiedergibt.

35

Gemäß einer Ausführungsform ist die Steuerung ausgebildet,

das Objektivsystem des Abbildungssystems automatisch so zu steuern, dass das abgebildete Objekt kontinuierlich in der Fokusebene des Abbildungssystems liegt. In der Folge erzeugt das Abbildungssystem auch während der Änderung der  
5 Abbildungsvergrößerung ein scharfes Abbild des abgebildeten Objekts. Eine derartige Funktionalität wird auch als Autofokus bezeichnet.

10 Gemäß einer Ausführungsform weist das Operationsmikroskop weiter eine Strahlungsquelle auf, welche einen Beleuchtungsstrahlengang bereitstellt, der die Linsengruppen des Objektivsystems entlang der optischen Achsen der Linsengruppen durchdringt.

15 Gemäß einer Ausführungsform wird das Operationsmikroskop von einem Stativ getragen. Das Stativ kann ortsfest an einer Wand, einem Boden oder einer Decke befestigt oder beispielsweise über Rollen verlagerbar sein.

20 Gemäß einer Ausführungsform ist das Operationsmikroskop ein digitales Operationsmikroskop, dessen Abbildungssystem keine Okulare aufweist.

25 Es wird betont, dass die vorstehend beschriebenen Ausführungsformen beliebig miteinander kombiniert werden können.

Die in dieser Beschreibung und den Ansprüchen zur Aufzählung von Merkmalen verwendeten Begriffe "umfassen", "aufweisen",  
30 "beinhalten", "enthalten" und "mit", sowie deren grammatikalische Abwandlungen, sind generell als nichtabschließende Aufzählung von Merkmalen, wie z. B. Verfahrensschritten, Einrichtungen, Bereichen, Größen und dergleichen aufzufassen, und schließen in keiner Weise das  
35 Vorhandensein anderer oder zusätzlicher Merkmale oder Gruppierungen von anderen oder zusätzlichen Merkmalen aus.

Weitere Merkmale der Erfindung ergeben sich aus der nachfolgenden Beschreibung von Ausführungsbeispielen in Verbindung mit den Ansprüchen sowie den Figuren. In den  
5 Figuren werden gleiche bzw. ähnliche Elemente mit gleichen bzw. ähnlichen Bezugszeichen bezeichnet. Die Erfindung ist nicht auf die Ausführungsformen der beschriebenen Ausführungsbeispiele beschränkt, sondern wird durch den Umfang der Patentansprüche bestimmt. Insbesondere können die  
10 einzelnen Merkmale bei erfindungsgemäßen Ausführungsformen in anderer Anzahl und Kombination als bei den untenstehend angeführten Beispielen verwirklicht sein. Bei der nachfolgenden Erläuterung eines Ausführungsbeispiels der Erfindung wird auf die beiliegenden Figuren Bezug genommen,  
15 von denen zeigt

Figur 1 schematisch eine Einsatzsituation eines Operationsmikroskops gemäß einer Ausführungsform der Erfindung;

20

Figur 2 schematisch im Querschnitt den Aufbau des Operationsmikroskops aus Figur 1; und

25

Figur 3 schematisch vergrößert die optischen Linsen des Objektivsystems des Operationsmikroskops aus Figur 2.

In Figur 1 ist schematisch ein Operationsmikroskop 1 gemäß einer Ausführungsform der Erfindung gezeigt, welches  
30 beispielhaft im Rahmen eines chirurgischen Eingriffes verwendet wird.

Das Operationsmikroskop 1 wird von einem über (nicht gezeigte) Rollen verlagerbaren Bodenstativ 12 getragen und  
35 kann durch einen Benutzer manuell unter Verwendung des Stativs so verlagert werden, dass eine optische Achse A eines

(in Figur 2 gezeigten) Objektivsystems auf einen abzubildenden Operationsbereich 3 ausgerichtet ist. Das von dem Operationsmikroskop 1 erzeugte vergrößerte Abbild des Operationsbereichs 3 wird über (nicht gezeigte) Leitungen and  
5 drei Monitore 11, 11' und 11'' und über eine Luftschnittstelle an ein Head-Mounted-Display 11''' eines Benutzers ausgegeben.

Wie schematisch in Figur 2 gezeigt, handelt es sich bei dem  
10 Operationsmikroskop 1 aus Figur 1 um ein Stereomikroskop mit einem Abbildungssystem 2, welches zwei Abbildungsstrahlengänge 2a, 2b bereitstellt, die sich in einer Fokusebene 4 des Abbildungssystems 2 des Operationsmikroskops 1 unter Einschluss eines Stereowinkels  
15  $\alpha$  schneiden. Die Größe des Stereowinkels  $\alpha$  hängt von dem jeweils verwendeten Arbeitsabstand ab und liegt bei dem gezeigten digitalen Operationsmikroskop zwischen  $6^\circ$  und  $10^\circ$ .

Es wird betont, dass der Verlauf der in Figur 2 gezeigten  
20 Hauptstrahlen der Abbildungsstrahlengänge 2a, 2b nur schematisch ist, und die Brechungswirkung der Linsen nur unvollständig wiedergibt.

Das Abbildungssystem 2 setzt sich in der gezeigten  
25 Ausführungsform aus einem zweigliedrigen Objektivsystem 5 und einem viergliedrigen Zoomsystem 8 zusammen. Es wird betont, dass die vorliegende Erfindung nicht auf zweigliedrige Objektivsysteme oder viergliedrige Zoomsysteme beschränkt ist, sondern allgemein mehrgliedrige Systeme verwenden kann.

30 Das Objektivsystem 5 weist zwei nacheinander gemeinsam von beiden stereoskopischen Abbildungsstrahlengängen 2a, 2b durchsetzte Linsengruppen 6, 7 auf, welche den Operationsbereich 3 insgesamt nach unendlich abbilden. Somit  
35 ist zwischen dem Objektivsystem 5 und dem Zoomsystem 8 eine afokale Schnittstelle vorgesehen.

Die dem abzubildenden Operationsbereich 3 entlang der stereoskopischen Abbildungsstrahlengänge 2a, 2b am nächsten angeordnete Linsengruppe 6 weist insgesamt eine negative Brechkraft auf und besteht aus drei mit festem Abstand relativ zueinander angeordneten optischen Linsen 61, 62, 63. Die beiden dem betrachteten Operationsbereich 3 am nächsten angeordneten optischen Linsen 61, 62 der ersten Linsengruppe 5 bestehen aus Materialien mit unterschiedlichen Brechungsindizes und sind zur Bildung eines Kittgliedes dauerhaft flächig miteinander verklebt. Die verbleibende dritte Linse 63 der ersten Linsengruppe 5 ist ein einfaches Linsenelement, das mit einem festen Abstand zum Kittglied der ersten Linsengruppe 5 angeordnet ist. In der gezeigten Ausführungsform weist die optische Linse 61 dem Betrage nach eine Brennweite von 146%, die optische Linse 62 dem Betrage nach eine Brennweite von 98% und die optische Linse 63 dem Betrage nach eine Brennweite von 157% der Brennweite der ersten Linsengruppe 6 des Objektivsystems 5 auf.

20

Es wird betont, dass die vorliegende Erfindung nicht auf ein Objektivsystem mit einer ersten Linsengruppe beschränkt ist, bei welcher das Kittglied zwischen einem einfachen Linsenelement und der Fokusebene angeordnet ist. Beispielsweise kann das einzelne Linsenelement alternativ auch zwischen dem Kittglied und der Fokusebene angeordnet sein.

25

Die andere zweite Linsengruppe 7 weist insgesamt eine positive Brechkraft auf und besteht ebenfalls aus drei mit festem Abstand relativ zueinander angeordneten optischen Linsen 71, 72, 73. Die beiden dem betrachteten Operationsbereich 3 am nächsten angeordneten optischen Linsen 71, 72 der zweiten Linsengruppe 7 bestehen aus Materialien mit unterschiedlichen Brechungsindizes und sind zur Bildung eines Kittgliedes dauerhaft flächig miteinander verklebt. Die verbleibende dritte Linse 73 der zweiten Linsengruppe 7 ist

30

35

ein einfaches Linsenelement, das mit einem festen Abstand zum Kittglied der zweiten Linsengruppe 7 angeordnet ist.

In der gezeigten Ausführungsform fallen die optischen Achsen A aller optischen Linsen 61, 62, 63, 71, 72, 73 der ersten und zweiten Linsengruppe 6, 7 zusammen.

In der gezeigten Ausführungsform verhält sich der Betrag der Brennweite der ersten Linsengruppe 6 zum Betrag der Brennweite der zweiten Linsengruppe 7 wie 0,85:1. Dem Betrage nach weist die Brennweite der ersten Linsengruppe 6 insgesamt 23% der Brennweite des Objektivsystems 5 auf.

Die erste Linsengruppe 6 ist entlang der optischen Achse A zwischen der Fokusebene 4 des Abbildungssystems 2 und der zweiten Linsengruppe 7 angeordnet. Die zweite Linsengruppe 7 ist mittels eines Aktors 70 entlang der optischen Achse A relativ zur ersten Linsengruppe 6 verlagerbar, um einen Arbeitsabstand des Operationsmikroskops 1 zwischen 200 mm und 5.000 mm einzustellen. Hierfür ist der Aktor 70 mit einer Steuerung 10 verbunden.

Die Erfindung ist jedoch nicht darauf beschränkt, dass die zweite Linsengruppe des Objektivsystems entlang der optischen Achse relativ zur ersten Linsengruppe des Objektivsystems verlagerbar ist. Alternativ kann auch die erste, entlang der optischen Achse zwischen der Fokusebene des Abbildungssystems und der zweiten Linsengruppe angeordnete Linsengruppe entlang der optischen Achse relativ zur zweiten Linsengruppe verlagerbar sein, um den Arbeitsabstand des Operationsmikroskops einzustellen.

Die beiden Linsengruppen 6, 7 des Objektivsystems 5 bilden die Fokusebene 4 insgesamt nach Unendlich ab.

Zwischen dem Objektivsystem 5 und dem Zoomsystem 8 weist



jeder Abbildungsstrahlengang 2a, 2b jeweils eine variable Aperturblende 13, 13' auf, um eine Einstellung der Helligkeit und Tiefenschärfe zu ermöglichen.

- 5 Die vier Glieder des Zoomsystems 8 sind jeweils aus zwei flächig miteinander verklebten optischen Linsen von acht optischen Linsen 81 und 82, 83 und 84, 85 und 86, 87 und 88, 81' und 82', 83' und 84', 85' und 86', 87' und 88' des Zoomsystems 10 aus Materialien mit unterschiedlichen Brechungsindizes gebildete Kittglieder, die nacheinander jeweils nur von einem der beiden stereoskopischen Abbildungsstrahlengänge 2a, 2b durchsetzt werden. Die Linsen 83, 84 bzw. 83', 84' und 85, 86 bzw. 85', 86' der beiden mittleren Glieder sind jeweils mittels eines Antriebs 80, 80' 15 zur Änderung einer Abbildungsvergrößerung von zwischen 8-fach und 20-fach relativ zu den Linsen 81, 82 bzw. 81', 82' und 87, 88 bzw. 87' und 88' verlagerbar.

- Das Abbildungssystem 2 bildet den Operationsbereich 3 entlang der Abbildungsstrahlengänge 2, 2b vergrößert auf die 20 Empfangsflächen 91, 91' zweier CCD-Sensoren 9, 9' ab. Die von den Empfangsflächen 91, 91' empfangenen Abbilder des Operationsbereichs 3 bilden den Operationsbereich 3 unter zwei geringfügig unterschiedlichen Winkeln ab. In der 25 gezeigten Ausführungsform weisen die Empfangsflächen 91, 91' jeweils eine Bayer-Matrix auf, welche eine Auflösung von  $1280 \times 1024$  Bildpunkten bereitstellt. Anhand von elektrischen Signalen, die von den Empfangsflächen 91, 91' ausgegeben werden, erstellen die CCD-Sensoren 9, 9' zweidimensionale 30 digitale Einzelbilder des von dem Abbildungssystem 2 abgebildeten Operationsbereichs 3, und geben diese über die Steuerung 10 an die wenigstens eine Anzeige 11 aus. Auch wenn in Figur 1 insgesamt vier Anzeigen 11, 11', 11'' und 11''' gezeigt sind, ist in Figur 2 der besseren Übersichtlichkeit halber nur die Anzeige 11 dargestellt. Da die CCD-Sensoren 9, 35 9' zwei Bilder ausgeben, die zueinander stereoskopisch sind,

wird vorliegend ein 3D-Monitor als Anzeige 11 verwendet.

Die Steuerung 10, bei welcher es sich um einen programmtechnisch eingerichteten Mikroprozessor handelt, ist über gestrichelt gezeichnete Datenleitungen mit den CCD-Sensoren 9, 9', den Antrieben 80, 80' des Zoomsystems 8, dem Antrieb 70 des Objektivsystems 5, den variablen Aperturblenden 13, 13' sowie der wenigstens einen Anzeige 11 verbunden. Die Datenleitung zwischen Steuerung 10 und den Aperturblenden 13, 13' ist der besseren Übersichtlichkeit wegen in Figur 2 nicht gezeigt.

Über eine Lichtquelle 12, welche entlang der optischen Achse des Objektivsystems 5 angeordnet ist, wird eine Null-Grad-Beleuchtung der Fokusebene 4 erreicht. Da die von der Lichtquelle 12 emittierte Strahlung durch die Linsen des Objektivsystems 5 geführt wird, passt sich die Größe des beleuchteten Abschnitts der Fokusebene 4 automatisch der Größe des mittels des Operationsmikroskops 1 gerade abgebildeten Abschnitts der Fokusebene 4 an.

Die Steuerung 10 steuert den Antrieb 70 des Objektivsystems 5 kontinuierlich so, dass der abgebildete Operationsbereich 3 immer in der Fokusebene 4 des Abbildungssystems 2 liegt, und das Abbildungssystem 2 immer ein scharfes Abbild des abgebildeten Operationsbereichs 3 bereitstellt. Weiter stellt die Steuerung 7 durch automatische Bildumkehr und/oder Drehung der Einzelbilder sicher, dass der abgebildete Operationsbereich 3 lagerichtig auf der wenigstens einen Anzeige 11 dargestellt wird.

Durch Variation des Arbeitsabstandes AA zwischen 200 mm und 1.200 mm kann das Operationsmikroskop so wahlweise als Operationsmikroskop oder als Übersichtskamera verwendet werden. Bei einem kleinen Arbeitsabstand AA zwischen 200 mm und 500 mm wird dabei ein stereoskopisches Bild mit hoher

Abbildungsvergrößerung bereitgestellt, bei großen Arbeitsabständen AA zwischen 1.000 mm und 1.200 mm wird ein sehr großer Abschnitt der Fokusebene gleichzeitig abgebildet.

- 5 In Figur 3 sind die optischen Linsen 61, 62, 63, 71, 72, 73 des Objektivsystems 5 vergrößert dargestellt, und die optischen Oberflächen mit Bezugszeichen versehen.

- Die optischen Parameter dieser optischen Linsen 61, 62, 63, 71, 72, 73 lauten wie folgt:

Linse	Fläche	Radius [mm]	Abstand [mm]	Durchmesser, [mm]	Brechzahl			
					Medium	bei 546	Abbe-Zahl	
						nm		
OBJEKT								
200 ... 5.000								
61	61a	-146,3	3,5	36	Luft	SF8	1,6942	30,94
61 / 62	61b / 62a	-51,7	2	36	BK3		1,5001	64,9
62	62b	146,3	5,5	36	Luft			
63	63a	-48	2	36	CAF2		1,435	94,7
63	63b	-520	24 ... 4	36	Luft			
71	71a	-600	2	40	SF8		1,6942	30,94
71 / 72	71b / 72a	157	6	40	CAF2		1,435	94,7
72	72b	-57,3	0,01	40	Luft			
73	73a	120	4	40	CAF2		1,435	94,7
73	73b	-182	1 ... 21	40	Luft			
BILD								

Dabei gibt der in einer Zeile der Tabelle genannte Abstand die Entfernung der in der Zeile der Tabelle genannten Fläche zur in der nächsten Zeile der Tabelle genannten Fläche an.

- 15 Entsprechend gibt ein in einer Zeile der Tabelle genanntes Medium das Material an, welches sich zwischen der in der Zeile der Tabelle genannten Fläche und der in der nächsten Zeile der Tabelle genannten Fläche befindet.

- 20 Da die zweite Linsengruppe 7 insgesamt verlagert wird, ändern

sich die Werte 24 ... 4 und 1 ... 21 genau entgegengesetzt und im gleichen Maß. Je nach Anordnung der zweiten Linsengruppe 7 ergibt sich ein freier Arbeitsabstand von zwischen 200 mm und 5.000 mm.

5

In der Tabelle bezeichnet SF8, BK3 und CAF2 Bezeichnungen, unter denen das entsprechende Schwerflintglas, Borosilicatglas und Kalziumfluoridglas von der Schott AG in Deutschland bezogen werden kann.

10

Bei dem in Figur 3 gezeigten Objektivsystem beträgt der Quotient der Brennweite der ersten Linsengruppe 6 des Objektivsystems 5 zur Brennweite der zweiten Linsengruppe 7 des Objektivsystems 5 dem Betrag nach 0,85. Weiter beträgt der Quotient der Brennweite der ersten Linsengruppe 6 des Objektivsystems 5 zur minimalen Brennweite des Objektivsystems 5 dem Betrag nach 0,23.

Es wird betont, dass die vorliegende Erfindung nicht auf die vorstehende Ausführungsform und die darin verwendeten optischen Linsen beschränkt ist.

Auch wenn die Erfindung vorstehend am Beispiel eines digitalen Operationsmikroskops beschrieben wurde, welches keine Okulare aufweist, ist die vorliegende Erfindung hierauf nicht beschränkt. So kann jeder Abbildungsstrahlengang des Abbildungssystems zusätzlich oder alternativ zu dem CCD-Sensoren einen Tubus und ein Okular aufweisen. Dabei erfolgt im Tubus eine Bildumkehr, um eine lagerichtige Darstellung des Operationsbereichs mittels der Okulare zu ermöglichen.

Auch wenn vorstehend zwei separate CCD-Sensoren für die stereoskopischen Abbildungsstrahlengänge verwendet wurden, kann alternativ auch für beide Abbildungsstrahlengänge ein gemeinsamer CCD-Sensor mit entsprechend großer Empfangsfläche verwendet werden.

Patentansprüche

1. Operationsmikroskop (1), aufweisend:  
ein Abbildungssystem (2), welches ein in einer  
5 Fokusebene (4) des Abbildungssystems (2) anordenbares  
Objekt (3) entlang wenigstens eines  
Abbildungsstrahlengangs (2a, 2b) vergrößert in ein  
mehrdimensionales Abbild des Objekts (3) abbildet, wobei  
das Abbildungssystem (2) ein Objektivsystem (5) umfasst,  
10 wobei das Objektivsystem (5) mindestens zwei und  
insbesondere genau zwei Linsengruppen (6, 7) umfasst,  
die von dem wenigstens einen Abbildungsstrahlengang (2a,  
2b) nacheinander durchsetzt werden, und die Fokusebene  
(4) des Abbildungssystems (2) festlegen,  
15 wobei wenigstens eine Linsengruppe (6) des  
Objektivsystems (5) entlang ihrer optischen Achse (A)  
relativ zu wenigstens einer anderen Linsengruppe (7) des  
Objektivsystems verlagerbar ist,  
wobei die der Fokusebene (4) entlang des wenigstens  
20 einen Abbildungsstrahlengangs (2a, 2b) unmittelbar  
benachbarte erste Linsengruppe (6) des Objektivsystems  
(5) aus mindestens drei optischen Linsen (61, 62, 63)  
besteht und insgesamt eine negative Brechkraft aufweist.
- 25 2. Operationsmikroskop (1) nach Anspruch 1, wobei die erste  
Linsengruppe (6) des Objektivsystems (5) dem Betrage  
nach insgesamt eine Brennweite von höchstens 35% und  
insbesondere höchstens 25% und weiter insbesondere  
höchstens 20% der minimalen Brennweite des  
30 Objektivsystems (5) aufweist.
3. Operationsmikroskop (1) nach Anspruch 1 oder 2, wobei  
die einzelnen optischen Linsen (61, 62, 63) der ersten  
Linsengruppe (6) des Objektivsystems (5) jeweils dem  
35 Betrage nach Brennweiten zwischen 80% und 300% und  
insbesondere jeweils zwischen 95% und 200% der

Brennweite der ersten Linsengruppe (6) des Objektivsystems (5) aufweisen.

4. Operationsmikroskop (1) nach einem der Ansprüche 1  
5 bis 3,  
wobei das Objektivsystem (5) genau zwei Linsengruppen  
(6, 7) umfasst; und  
wobei ein Quotient der Brennweite der ersten  
Linsengruppe (6) des Objektivsystems (5) zur Brennweite  
10 der zweiten Linsengruppe (7) des Objektivsystems (5) dem  
Betrag nach zwischen 0,75 und 1,00 und insbesondere  
zwischen 0,80 und 0,90 und weiter insbesondere zwischen  
0,82 und 0,88 beträgt.
- 15 5. Operationsmikroskop (1) nach einem der Ansprüche 1, 2, 3  
oder 4,  
wobei die erste Linsengruppe (6) des Objektivsystems (5)  
aus genau drei optischen Linsen (61, 62, 63) besteht,  
von denen zwei optische Linsen (61, 62) miteinander  
20 dauerhaft zu einem Kittglied verbunden sind und die  
dritte optische Linse (63) ein von dem Kittglied  
separates Linsenelement ist.
- 25 6. Operationsmikroskop (1) nach einem der Ansprüche 1  
bis 5,  
wobei die der ersten Linsengruppe (6) entlang des  
wenigstens einen Abbildungsstrahlengangs (2a, 2b)  
unmittelbar benachbarte zweite Linsengruppe (7) des  
Objektivsystems (5) insgesamt eine positive Brechkraft  
30 aufweist; und  
wobei die zweite Linsengruppe (7) des Objektivsystems  
(5) aus genau drei optischen Linsen (71, 72, 73)  
besteht, von denen zwei optische Linsen (71, 72)  
miteinander dauerhaft zu einem Kittglied verbunden sind  
35 und die dritte optische Linse (73) ein von dem Kittglied  
separates Linsenelement ist.

7. Operationsmikroskop (1) nach einem der Ansprüche 1 bis 6,  
wobei die optischen Linsen (61, 62, 63, 71, 72, 73)  
5 jeder Linsengruppe (6, 7) von dem selben wenigstens einen Abbildungsstrahlengang (2a, 2b) nacheinander durchsetzt werden, und relativ zueinander ortsfest sind; und/oder  
wobei innerhalb einer Linsengruppe (6, 7) keine  
10 Abbildung der Fokusebene (4) nach Unendlich stattfindet.
8. Operationsmikroskop (1) nach einem der Ansprüche 1 bis 7,  
wobei das Objektivsystem insgesamt eine Abbildung des in  
15 der Fokusebene (4) des Abbildungssystems (2) anordenbaren Objektes (3) nach Unendlich bewirkt; und/oder  
wobei innerhalb des Objektivsystems keine Abbildung des in der Fokusebene (4) des Abbildungssystems (2)  
20 anordenbaren Objektes (3) nach Unendlich erfolgt.
9. Operationsmikroskop (1) nach einem der Ansprüche 1 bis 8,  
wobei das Abbildungssystem (2) wenigstens ein Paar von  
25 Abbildungsstrahlengängen (2a, 2b) bereitstellt, welche sich in der Fokusebene (4) des Abbildungssystems (2) unter Einschluss eines Stereowinkels ( $\alpha$ ) von zwischen  $3^\circ$  und  $14^\circ$  schneiden und das in der Fokusebene (4) des Abbildungssystems (2) anordenbare Objekt (3) jeweils  
30 vergrößert in ein mehrdimensionales Abbild des Objekts (3) abbilden; und  
wobei die optischen Linsen (61, 62, 63, 71, 72, 73) des Objektivsystems (5) von dem wenigstens einen Paar von Abbildungsstrahlengängen (2a, 2b) gemeinsam durchsetzt  
35 werden.

10. Operationsmikroskop (1) nach Anspruch 9, wobei das Abbildungssystem weiter ein Zoomsystem (8) mit mehreren optischen Linsen (81, 82, 83, 84, 81', 82', 83', 84') aufweist, wobei die optischen Linsen (81, 82, 83, 84, 81', 82', 83', 84') des Zoomsystems nacheinander von nur einem Abbildungsstrahlengang (2a, 2b) des wenigstens einen Paares von Abbildungsstrahlengängen (2a, 2b) durchsetzt werden.
- 10 11. Operationsmikroskop (1) nach einem der Ansprüche 1 bis 10, weiter aufweisend wenigstens einen Bildsensor (9, 9'), welcher in einer Bildebene des Abbildungssystems (2) angeordnet ist und Bilddaten ausgibt, welche das von dem Abbildungssystem (2) erzeugte Abbild des Objekts (3) repräsentieren.
- 15



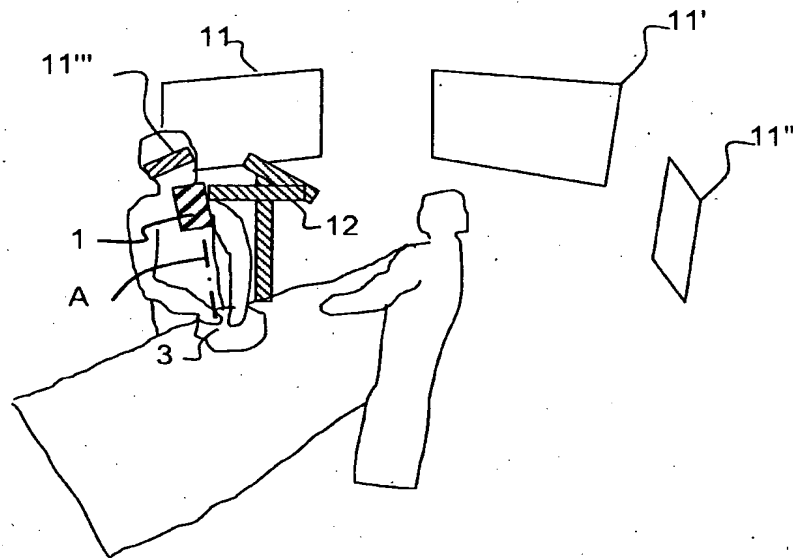
### Zusammenfassung

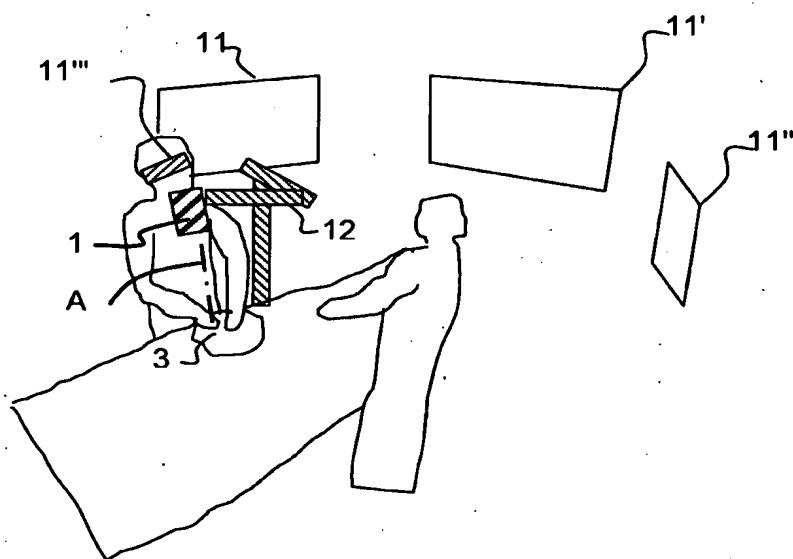
Ein Operationsmikroskop 1 weist ein Abbildungssystem auf, welches ein in einer Fokusebene 4 des Abbildungssystems 2 anordenbares Objekt 3 entlang wenigstens eines Abbildungsstrahlengangs 2a, 2b vergrößert in ein mehrdimensionales Abbild des Objekts 3 abbildet. Das Abbildungssystem 2 umfasst ein Objektivsystem 5 mit mindestens zwei und insbesondere genau zwei Linsengruppen 6, 7, die von dem wenigstens einen Abbildungsstrahlengang 2a, 2b nacheinander durchsetzt werden, und die Fokusebene 4 des Abbildungssystems 2 festlegen. Wenigstens eine Linsengruppe 6 des Objektivsystems 5 ist entlang ihrer optischen Achse A relativ zu wenigstens einer anderen Linsengruppe 7 des Objektivsystems verlagerbar. Die der Fokusebene 4 entlang des wenigstens einen Abbildungsstrahlengangs 2a, 2b unmittelbar benachbarte erste Linsengruppe 6 des Objektivsystems 5 besteht aus mindestens drei optischen Linsen 61, 62, 63 und weist insgesamt eine negative Brechkraft auf.

20

(Fig. 1)

**Zeichnung zur Zusammenfassung  
(Figur 1)**



**Fig. 1**

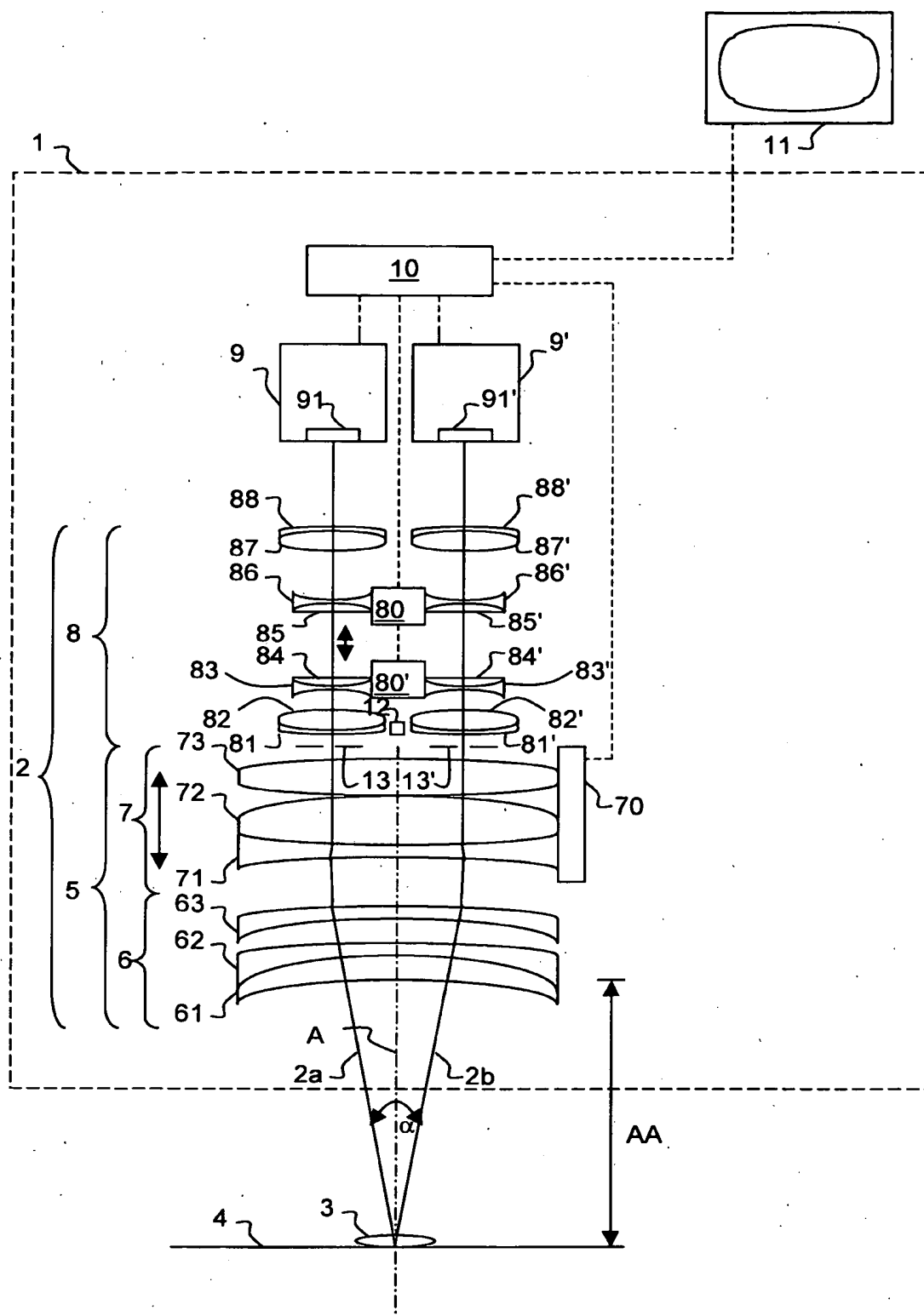
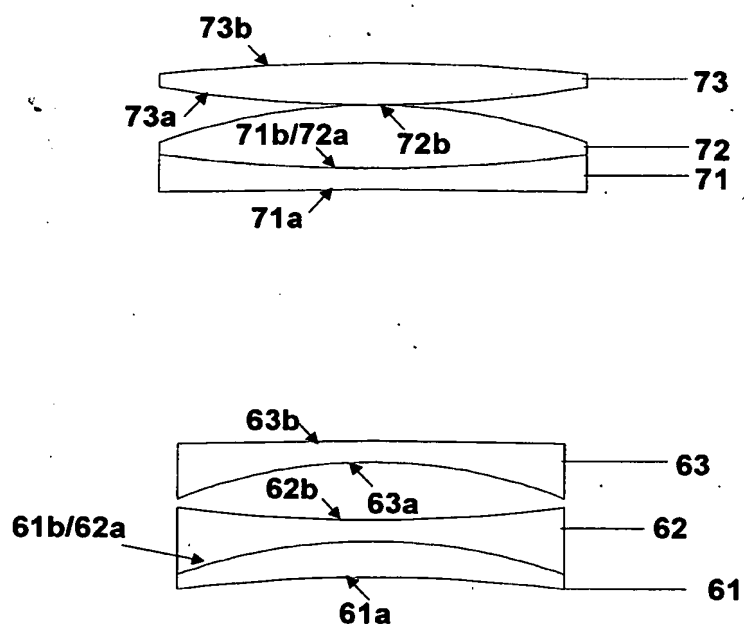


Fig. 2

## BILD



## OBJEKT

Fig. 3



IFJ

Attorney's Docket No. 0902-046

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of	)	
Artur HOEGELE	)	Group Art Unit: 3738
Application No.: 14/272,866	)	Examiner: Unassigned
Filed: May 8, 2014	)	
For: SURGICAL MICROSCOPE WITH	)	
ENLARGED WORKING DISTANCE	)	

**SUBMISSION OF CERTIFIED PRIORITY DOCUMENT**

Commissioner for Patents  
Alexandria, VA 22313-1450

Sir:

Applicants claim priority of German Patent Application No. 10 2013 008 090.8, filed on May 10, 2013 and submit herewith a certified copy of the priority document.

Respectfully submitted,  
PATENT PORTFOLIO BUILDERS PLLC

By: /Steven M. duBois/  
Steven M. duBois  
Registration No. 35,023

Date: June 26, 2014

Customer No. 113648  
Patent Portfolio Builders PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404  
(540) 361-1863, ext. 125

# REQUEST FOR PARTICIPATION IN THE PATENT PROSECUTION HIGHWAY (PPH) PILOT PROGRAM BETWEEN THE GERMAN PATENT AND TRADEMARK OFFICE (DPMA) AND THE USPTO

Application No.:	14/272,866	First Named Inventor:	Artur HOEGELE
Filing Date:	May 8, 2014	Attorney Docket No.:	0902-046
Title of the Invention:	Surgical Microscope with Enlarged Working Distance		

THIS REQUEST FOR PARTICIPATION IN THE PPH PILOT PROGRAM ALONG WITH THE REQUIRED DOCUMENTS MUST BE SUBMITTED VIA EFS-WEB. INFORMATION REGARDING EFS-WEB IS AVAILABLE AT [HTTP://WWW.USPTO.GOV/EBS/EF5 HELP.HTML](http://www.uspto.gov/ebs/efs_help.html).

**APPLICANT HEREBY REQUESTS PARTICIPATION IN THE PATENT PROSECUTION HIGHWAY (PPH) PILOT PROGRAM AND PETITIONS TO MAKE THE ABOVE-IDENTIFIED APPLICATION SPECIAL UNDER THE PPH PILOT PROGRAM.**

The above-identified application and the corresponding DE application(s) have the same priority/filing date. If DPMA is not the office of first filing (OFF), identify the OFF and the OFF application no.

The DE application number(s) is/are: 10 2013 008 090.8

The filing date of the DE application(s) is/are: May 10, 2013

## I. List of Required Documents:

- a. **A copy of the latest DE office action prior to the "Decision to Grant a Patent" in the above-identified DE application(s) along with an English translation (if the office action is not in the English language)**

- ☒ is attached.
- ☐ is not attached because applicant hereby requests the USPTO to obtain the required office action and any required translation thereof via the Dossier Access System.
- ☐ is not attached because the DE application was allowed in a first office action.

### Notes:

- It is not necessary to submit a copy of the "Decision to Grant a Patent" and an English translation thereof.
- The English translation of the office action may be a machine translation.
- An accuracy statement for the English language translation of the office action is not required.

- b. **(1) An information disclosure statement listing the documents cited in the DE office action**

- ☒ is attached.
- ☐ has already been filed in the above-identified U.S. application on \_\_\_\_\_.

- (2) Copies of all documents (except for U.S. patents or U.S. patent application publications)**

- ☒ are attached.
- ☐ have already been filed in the above-identified U.S. application on \_\_\_\_\_.

**REQUEST FOR PARTICIPATION IN THE PPH PILOT  
PROGRAM BETWEEN THE DPMA AND THE USPTO**  
(continued)

Application No.:	14/272,866	First Named Inventor:	Artur HOEGELE
------------------	------------	-----------------------	---------------

**II. Claims Correspondence Table:**

Claims in US Application	Patentable Claims in DE Application	Explanation regarding the correspondence
Independent claim 1	1	Identical
Dependent claims 2-3	None	Dependent from Allowable Claim 1
Independent claim 4	1	Has all of the elements of Allowable DE Claim 1 plus the features of "exactly two lens groups" and "wherein a ratio of the absolute value of the focal length of the first lens group to the absolute value of the focal length of the second lens group is greater than 1"
Dependent claims 5-6	5-6	Identical
Dependent claims 7-8	7	Cumulatively claims 7 and 8 equal DE claim 7
Dependent claims 9-10	8	Cumulatively claims 9 and 10 equal DE claim 8
Dependent claim 11	9	Identical
Dependent claim 12	10	Identical
Dependent claim 13	11	Identical
Dependent claims 14-17	None	Depend from Independent claim 4 which has all of the elements of allowable DE claim 1 plus additional elements
Independent claim 18	1	Has all of the elements of Allowable DE Claim 1 plus the features of "wherein the optical lenses of each lens group are consecutively passed through by the same optical element"
Dependent claims 19-21	None	Depend from Independent claim 18 which has all of the elements of allowable DE claim 1 plus additional elements

**III. All the claims in the US application sufficiently correspond to the patentable/allowable claims in the DE application.**

Signature /stevenmdubois/	Date June 23, 2014
Name (Print/Typed) Steven M. duBois	Registration Number 35,023



**Translation of Office Action for DE 10 2013 008 090.8**

GERMAN PATENT AND TRADEMARK OFFICE

Official file number : 10 2013 008 090.8  
Applicant : Carl Zeiss Meditec AG  
Attorney's ref. : Z12033-DE  
Date : July 17, 2013

Request for substantial examination recorded on: May 10, 2013

The examination of the above-identified patent application has led to the result set forth below.

A term of

**4 months**

is granted for filing a response to the office action. If a time limit is set, the term starts to count on the day following the date of service of the office action. Otherwise, the indicated date is the deadline.

If the description, the patent claims or the drawings are amended in the course of the proceedings, the applicant is called upon, unless the amendments have been suggested by the German Patent and Trademark Office, to indicate in detail where in the documents as originally filed the inventive features described in the new documents are disclosed.

**Information on the Possibility of the Branching-off of a Utility Model**

Detailed information about the possibility to branch-off a utility model and about utility model protection in general is contained in the Instruction Sheet for Applicants of a Utility Model (G 6181) which is available, free of charge, at the Patent and Trademark Office and Patent Information Centers (<http://www.dpma.de/gebrauchsmuster/formulare/index.html>).

Date: December 12, 2014

Official file number: 10 2013 008 090.8

Cited references:

**(1) DE 195 23 712 C2**

**(2) DE 29 27 478 C2**

A.

From D(1), see Fig. 1 with appertaining description, a surgical microscope is known, comprising: an imaging system 12, 14, 24 that provides a magnified multidimensional image of an object disposable in a focal plane B1, B2 of the imaging system 12, 14, 24 along an optical imaging path, the imaging system 12, 14, 24 comprising an objective 12, the objective 12 comprising two lens groups 18, 19 through which an optical imaging path L1, L2 passes one after another, and which define the focal plane B1, B2 of the imaging system 12, 14, 24, wherein one lens group 19 of the objective 12 is moveable along its optical axis relative to the one other lens group 18 of the objective 12, and wherein the objective's 12 first lens group 18 which is located directly adjacent to the focal plane B1, B2 along the optical imaging path has a negative optical power.

In order, e.g., to minimize image defects the person skilled in the field of optics will replace the lens 18 having a negative optical power is known from D(1) by three optical lenses having altogether a negative optical power known from D(2), see Figure 3 with appertaining description, and has thus realized all features of the subject matter of current claim 1 without having to exercise an inventive step.

Claim 1 is thus not allowable due to its subject matter lacking inventiveness.

B.

As claim 1 is not allowable, current subclaims 2 to 11 are not allowable either because they refer back to claim 1.

As to the features of subclaim 7 attention is drawn to D(1), see Figure 1 with appertaining description.

The features of subclaim 2 are already known from D(1).

C.

The features of claims 1, 2, 3 and 4 introduced by the optional formulation "in particular" are not necessary for the claimed teaching and are thus no essential features.

According to §9(4)PatV [Patent Application Regulations] a claim shall only include essential features. These features must thus be cancelled.

Optional features should basically only included in the description and not in the claim, but could form the subject matter of a non-optional subclaim.

D.

On the basis of the documents currently on file, the grant of a patent cannot be envisaged; rather, the rejection of the application must be expected.

If it is not intended to file a response in substantive respect, it is requested to formlessly confirm receipt of this office action.

Examining Division in charge of class G02B  
Dr. Rainer Dorsch



Deutsches  
Patent- und Markenamt

POSTANSCHRIFT Deutsches Patent- und Markenamt • 80297 München

Diehl & Partner GbR  
Patent- und Rechtsanwälte  
Postfach 340115  
80098 München



HAUSANSCHRIFT Zweibrückenstraße 12, 80331 München

POSTANSCHRIFT 80297 München

KONTAKT Dr. Rainer Dorsch

TEL +49 89 2195-3042

FAX +49 89 2195-2221

INTERNET [www.dpma.de](http://www.dpma.de)

AKTENZEICHEN 10 2013 008 090.8

ANMELDER/INHABER Carl Zeiss Meditec AG

IHR ZEICHEN Z12033-DE

ERSTELLT AM 17.07.2013

Bitte Aktenzeichen und Anmelder/Inhaber bei allen Eingaben und Zahlungen angeben!

Prüfungsantrag, wirksam gestellt am 10.05.2013

Die Prüfung der oben genannten Patentanmeldung hat zu dem nachstehenden Ergebnis geführt.

Zur Äußerung wird eine Frist

**von 4 Monaten**

gewährt. Bei angegebener Fristdauer beginnt die Frist an dem Tag zu laufen, der auf den Tag des Zugangs des Bescheids folgt. Ansonsten gilt das angegebene Datum als Fristende.

Werden die Beschreibung, die Patentansprüche oder die Zeichnungen im Laufe des Verfahrens geändert, so hat der Anmelder, sofern die Änderungen nicht vom Deutschen Patent- und Markenamt vorgeschlagen sind, im Einzelnen anzugeben, an welcher Stelle die in den neuen Unterlagen beschriebenen Erfindungsmerkmale in den ursprünglichen Unterlagen offenbart sind.

#### Hinweis auf die Möglichkeit der Gebrauchsmusterabzweigung

Ausführliche Informationen über die Möglichkeit einer Gebrauchsmusterabzweigung sowie zum Gebrauchsmusterschutz generell enthält das Merkblatt für Gebrauchsmusteranmelder (G 6181), welches kostenlos beim Deutschen Patent- und Markenamt, den Patentinformationszentren und im Internet (<http://www.dpma.de/gebrauchsmuster/formulare/index.html>) erhältlich ist.

Prüfungsstelle für Klasse G02B



Dieses Dokument wurde elektronisch erstellt und ist ohne Unterschrift gültig.

Anlage(n)

DOKUMENTENANNAHME UND NACHTBRIEFKASTEN nur Zweibrückenstraße 12

HAUSADRESSE (FÜR FRACHT): Zweibrückenstraße 12, 80331 München

ZAHLUNGSEMPFÄNGER: Bundeskasse Halle/DPMA, BBk München, Kto.-Nr.: 700 010 54, BLZ: 700 000 00, BIC (SWIFT-Code): MARKDEF1700, IBAN: DE84 7000 0000 0070 0010 54

TB 100a / 10.10



München, den 17.07.2013

Aktenzeichen 10 2013 008 090.8

### Anlagenverzeichnis

- |   |                                    |
|---|------------------------------------|
| 1 | Zitierte Druckschriften            |
| 2 | Prüfungsbescheid                   |
| 3 | DE 195 23 712 C2 - Stereomikroskop |
| 4 | DE 29 27 478 C2 - Varioobjektiv    |



1374060153823249523



**Zitierung in Betracht gezogener Druckschriften**

Aktenzeichen: 10 2013 008 090.8

Nummer	Druckschrift
1	DE 195 23 712 C2
2	DE 29 27 478 C2



1374060153823249523



Datum: 17.07.2013

Aktenzeichen: 10 2013 008 090.8

**(1) DE 195 23 712 C2**

**(2) DE 29 27 478 C2**

A.

Aus D(1), siehe Figur 1 mit dazugehörigem Beschreibungsteil, ist ein Mikroskop bekannt, aufweisend: ein Abbildungssystem 12, 14, 24 welches ein in einer Fokusebene B1, B2 des Abbildungssystems 12, 14, 24 anordenbares Objekt entlang eines Abbildungsstrahlengangs vergrößert in ein mehrdimensionales Abbild des Objekts abbildet, wobei das Abbildungssystem 12, 14, 24 ein Objektivsystem 12 umfasst, wobei das Objektivsystem 12 zwei Linsengruppen 18, 19 umfasst, die von dem einen Abbildungsstrahlengang L1, L2 nacheinander durchsetzt werden, und die Fokusebene B1, B2 des Abbildungssystems 12, 14, 24 festlegen, wobei eine Linsengruppe 19 des Objektivsystems 12 entlang ihrer optischen Achse relativ zu der anderen Linsengruppe 18 des Objektivsystems 12 verlagerbar ist, wobei die der Fokusebene B1, B2 entlang des einen Abbildungsstrahlengangs unmittelbar benachbarte erste Linse 18 des Objektivsystems 12 eine negative Brechkraft aufweist.

Ein Fachmann auf dem Gebiet der Optik wird, z.B. um Abbildungsfehler zu minimieren, die Linse mit negativer Brechkraft 18 aus D(1) durch drei optische Linsen mit insgesamt negativer Brechkraft nach D(2), siehe Figur 3 mit dazugehörigem Beschreibungsteil, ersetzen und ist damit schon bei sämtlichen Merkmalen des Gegenstands des geltenden Anspruchs 1 angelangt, ohne dabei erfinderisch tätig werden zu müssen.

Der Anspruch 1 ist somit mangels erfinderischer Tätigkeit seines Gegenstandes nicht gewährbar.

B.

Die geltenden Unteransprüche 2 bis 11 fallen mit dem nicht gewährbaren Anspruch 1, auf den sie rückbezogen sind.

Zu den Merkmalen aus Unteranspruch 7 wird auf D(1), siehe Figur 1 mit dazugehörigem Beschreibungsteil, verwiesen.

Die Merkmale des Unteranspruchs 2 sind bereits aus D(1)

C.

Die durch „insbesondere“ eingeleiteten fakultativen Merkmale in den Ansprüchen 1, 2, 3 und 4 sind Merkmale, die für die beanspruchte Lehre nicht notwendig sind und stellen somit keine wesentlichen Merkmale dar.

Nach § 9 (4) PatV sind jedoch nur die wesentlichen Merkmale der Erfindung im Patentanspruch anzugeben. Sie sind deshalb zu streichen.

Fakultative Merkmale gehören grundsätzlich in die Beschreibung und nicht in den Anspruch, können aber Gegenstand eines nicht fakultativen Unteranspruchs sein.

D.

Mit den vorliegenden Unterlagen kann eine Patenterteilung nicht in Aussicht gestellt werden; es muss vielmehr mit der Zurückweisung der Anmeldung gerechnet werden.

Falls eine Äußerung in der Sache nicht beabsichtigt ist, wird eine formlose Mitteilung über den Erhalt des Bescheides erbeten.

Prüfungsstelle für Klasse G02B

Dr. Rainer Dorsch



13740601538232449523



**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION  
USING AN APPLICATION DATA SHEET (37 CFR 1.76)**

<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance
--------------------------------	--

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The application attached hereto. If the application is not attached hereto, the application is identified by the Attorney docket number and title as set forth above.

☒ United States application or PCT international application number 14/272,866  
filed on May 8, 2014.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I have reviewed and understand the contents of the above-identified application, including the claims.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

LEGAL NAME OF INVENTOR

Inventor: Artur HOEGELE Date: June 4, 2014

Signature: Artur Hoegele

<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number		14272866	
	Filing Date		2014-05-08	
	First Named Inventor	Artur HOEGELE		
	Art Unit	3738		
	Examiner Name	TBA		
	Attorney Docket Number	0902-046		

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code <sup>1</sup>	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4299453		1981-11-10	Momiyama et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code <sup>1</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

Add

FOREIGN PATENT DOCUMENTS							Remove	
Examiner Initial*	Cite No	Foreign Document Number <sup>3</sup>	Country Code <sup>2</sup> i	Kind Code <sup>4</sup>	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T <sup>5</sup>
	1	195 23 712	DE	C2	1996-01-04	Kabushiki Kaisha Topcon		<input checked="" type="checkbox"/>
	2	10 2005 050 171	DE	A1	2007-04-26	Carl Zeiss Surgical GmbH		<input checked="" type="checkbox"/>

If you wish to add additional Foreign Patent Document citation information please click the Add button

Add

NON-PATENT LITERATURE DOCUMENTS							Remove
---------------------------------	--	--	--	--	--	--	--------

<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> ( Not for submission under 37 CFR 1.99)	Application Number		14272866
	Filing Date		2014-05-08
	First Named Inventor	Artur HOEGELE	
	Art Unit	3738	
	Examiner Name	TBA	
	Attorney Docket Number	0902-046	

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>5</sup>
	1	German Office Action in corresponding German Patent Application No. 10 2013 008 090.8 dated July 17, 2013.	<input checked="" type="checkbox"/>
	2	Decision to Grant in corresponding German Patent Application No. 10 2013 008 090.8 dated July 17, 2013.	<input type="checkbox"/>

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

#### EXAMINER SIGNATURE

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> See Kind Codes of USPTO Patent Documents at [www.USPTO.GOV](http://www.USPTO.GOV) or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**  
( Not for submission under 37 CFR 1.99)

Application Number	14272866
Filing Date	2014-05-08
First Named Inventor	Artur HOEGELE
Art Unit	3738
Examiner Name	TBA
Attorney Docket Number	0902-046

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/stevenmdubois/	Date (YYYY-MM-DD)	2014-06-23
Name/Print	Steven M. duBois	Registration Number	35,023

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**Description**

[0001]

5 The invention relates to a stereo microscope according to the preamble of the claim.

[0002]

In fig. 5, reference numeral 10 is a binocular microscope body, reference numeral 11 denotes an eyepiece tube, the reference characters B1 and B2 denote an object point as in the prior art, the  
10 reference numeral P indicates a working distance of an optical system of the binocular microscope, and the reference numeral H change the working distance.

An object to be observed which is located between the object points B1 and B2, can be observed at the focal point.

[0003]

15

From U.S. 4,361,379, a stereomicroscope is known in the optical system at least a part of a front lens, which is common to a beam of illumination light and a beam of the observation light can be moved in a direction of its optical axis to adjust the position of an object point to to change.

In the optical system of this type of a stereomicroscope plate for interrupting light along the  
20 optical axis is arranged to prevent the reflected light from the interface between air and the front lens, the illumination light enters into an optical observation path.

[0004]

To reduce the amount of movement of the front lens, and to increase the change of the working  
25 distance between a position of an object point where there is an observed object, and a position of another object point, it is preferable that the front lens has two groups of lenses. fig. 6 is a schematic view of the front lens 71.

In fig. 6, reference numeral 1 is a positive lens (converging lens), 2 denotes a negative lens (diverging lens), H1 denotes a front principal plane of the positive lens 1, H1 'denotes a rear  
30 principal plane of the positive lens 1, H2 denotes a front principal plane of the negative lens 2, H2 'denotes a rear principal plane of the negative lens 2, d designates a main plane distance between the positive lens 1 and the negative lens 2, and p denotes a working distance between the rear principal plane of H2 "of the negative lens 2 and an object point B. The front lens 3 is composed of the positive lens and one negative lens 2.

35 In this stereo microscope, the positive lens 1 are movable and the negative lens 2 immobile.

[0005]

The relationship between the pitch  $p$  and the main working plane distance  $d$  is represented as follows: [mathematical formula] wherein  $f_1$  is a focal length of the positive lenses 1 and  $f_2$  is a focal length of the negative lens 2.

5 [0006]

If  $160 \text{ mm} < p < 220 \text{ mm}$  and  $31 \text{ mm} < d < 15 \text{ mm}$ , the positive and negative lens 1 and 2 have the following focal lengths  $f_1$  and  $f_2$ : [mathematical formula]

[0007]

10

As shown in FIG. 7 is shown, having a front lens 12, the cut surface 12a parallel to a plane containing the optical axes  $O_2$ ,  $O_2'$  of the right and left observation optical path  $K_1$ ,  $K_2$ , and which is cut off by a plane substantially to the right and to the left observation light  $L_1$ ,  $L_1'$  (FIG. 8) is adjacent.

15 An observation lens is arranged close to the cut surface 12a.

In fig. 7, reference numeral 01 an optical axis of the illumination optical path  $S_1$ , and reference numeral 03 denotes an optical axis of the front lens 12.

When the front lens 12 and the illumination lens are separated from each other, when the illumination lens close to the cut surface 12a of the fixed lens of the front lens 12 is placed, a distance between the optical axis  $O_2$  of the observation light  $L_1$  and the optical axis 01 of the illumination light  $L_2$  can be made small.

20

Accordingly, one between the optical axis 01 and the optical axis  $O_2$  angle formed can be made small.

For example, the angle between them can be made at 5 [deg.].

25 Such an arrangement is known from DE 29 32 486 A1.

[0008]

U.S. 5,140,458 describes an optical illuminating and observing apparatus having a first drive system for changing the magnification and a second drive system for changing the illuminating field of the device.

30

The two drive systems can be either coupled to one another or operate independently.

[0009]

DE 40 28 605 A1 shows an illumination system for a surgical microscope which is arranged outside the optical axis of the microscope objective, and is provided with a arranged in front of

35

the optical axis of the microscope objective deflection which hinlenkt the illumination light by the microscope objective to the object point.

Here, a first is arranged in front of the optical axis of the microscope objective deflector is designed such that it directs into it only a part of the illumination light in achsnäher oblique  
 5 illumination to the object point; and a second deflection element is arranged in or behind the optical axis of the microscope objective, which directs another portion of the illumination light perpendicularly or achsnäher than the first deflecting element to the object point.  
 Preferably, the first deflecting element directing the illumination light under an angle of 6 [deg.] To the optical axis and the second deflection element, the illumination light at a between 0 [deg.]  
 10 And 4 [deg.] Variable angle of inclination to the optical axis to the object point.  
 [0010]

DE 31 05 018 A1 finally discloses a surgical microscope with a lens of variable focal intercept in which the objective is housed together with means for deflecting the observation beam path in  
 15 two coordinate directions in an arranged before the microscope housing housing.  
 This lens housing also includes a pair of rotary wedge for lateral displacement of the observation beam path.  
 [0011]

20 By a prior public use of the company Carl Zeiss, Oberkochen, a stereo microscope has become known, which can be coupled to an auxiliary device sold under the name "Varioskop" that allows a variable working distance in the range of 200-400 mm without changing lenses.  
 In this, the front lens is also made of an object that faces the stationary lens and an object remote displaceable for changing the focal length of the lens.  
 25 The lighting assembly comprises a deflecting reflector which is mechanically coupled with the movable lens, that during a displacement of the lens and the deflection reflector is pivoted.  
 This gives an automatic adaptation of the illumination to the respective focal length of the front lens.  
 [0012]

30 Starting from this prior art it is the object of the present invention, the mechanical coupling means between the front lens and the lighting device as simple and fail-safe form.  
 [0013]

35 This object is achieved according to the invention by the features specified in claim characteristics.



[0014]

The invention is explained in more detail below with reference to embodiments shown in the figures.

5 In the drawings:

[0015]

fig. 1 is a schematic representation of a stereomicroscope according to the present invention,

[0016]

10

fig. 2 is a plan view of a device for varying the illuminated position,

[0017]

fig. 3 is a side view of the device according to fig. 2,

15

[0018]

fig. 4 is a rear view of the device according to fig. 2,

[0019]

20

fig. 5, the external view of a conventional stereo microscope,

[0020]

fig. 6 is a schematic view of a conventional front lens,

[0021]

25

fig. 7 is a sectional view of the optical path of the observation light and the illumination light in a well-known stereoscopic microscope, was added to a line containing a point Q2 in FIG. 8 and

[0022]

30

fig.

8 longitudinal sections in fig. 7 shown in cross-section the optical paths.

[0023]

35

As shown in FIG. 1 is shown, the binocular microscope body 10 includes a front lens 12 for observing an illumination lens 13, a zoom system 14 with variable magnification and an illumination assembly 15.

The eyepiece tube 11 includes an eye width Einstellprisma 16 and eyepieces 17th  
 Monitoring the front lens 12 is composed of a fixed lens 18 and movable lens 19th  
 The fixed lens 18, which faces the object points B1 and B2.

Monitoring the front lens 12 and the illumination lens 13, which are each described in detail  
 5 below, are separated from each other.

The zoom system 14 with variable magnification lenses containing 20, 21 and 22 with variable  
 magnification, a beam splitter 23, an imaging lens 24, and an erecting prism 25th

The zoom system 14 with variable magnification consists of a right and a left optical system, of  
 which one in fig. 1 is omitted, because it is arranged directly behind the other.

10 The lighting assembly 15 includes a light source 26, a condenser lens 27, an illumination field  
 stop 28, and a reflecting prism with a lens 29th

The group from the observational front lens 12, the zoom system 14 variable magnification, the  
 eye width Einstellprisma 16 and the eyepieces 17 forms an observation optical system.

For example, the light emitted from the object point B2 observation light L1 is aligned in parallel  
 15 by the observation front lens 12 and then to the zoom system 14 with variable magnification.

The collimated monitoring light L1 passing through the zoom system 14 with variable  
 magnification through which is an afocal optical system, and is then guided to the beam splitter  
 23.

A part of the parallel-aligned observation light L1 is reflected by the beam splitter 23 and then to  
 20 a television image receiving device (not shown), etc., made to form an image.

The observation light L1, which has passed through the beam splitter 23, is by means of the  
 imaging lens 24 at an image point I is a real image.

An operator places the eyes to an eye point E and an observed object to be observed, located at  
 the object point of B2, through the eyepieces 17th

25 The eye width Einstellprisma 16 is rotatable about its optical incident axis to adjust the  
 interpupillary distance of the operator.

[0024]

The light emitted from the light source 26, illumination light L2 is condensed by the condenser  
 30 lens 27 and illuminates the illumination field stop-28th

That passed through the field stop 28, the illumination light L2 is collimated by the reflecting  
 prism 29, and then guided to the illumination lens 13.

The focal point of the illumination lens 13 is coincident with the object point B2.

[0025]

An image of the field stop 28 is formed at the object point B2, so that the object point B2 is uniformly illuminated.

An image of the light source 26 is formed by the condenser lens 27 at a point which is close to the illumination lens 13 on the side of the object point, that is, in other words, an exit pupil of the illumination assembly 15 is located near a cut surface 12a of the fixed lens 18, which Hereinafter described in detail, on the side of the object point.

Accordingly, the lighting efficiency of the light source 26 can be improved.

[0026]

A light-intercepting plate 30 is disposed between the front lens 12 and the illumination lens 13. The light interrupting plate 30 serves to prevent the entry of reflected illuminating light which has been reflected at the interface between the illumination lens 13 and air into the observation optical path.

[0027]

The movement of the movable lens 19 to the point represented by dashed lines in fig. 1 causes the change in position of the object point from B2 to B1.

When illuminated by the illumination light L2 position without change in the object point B2 is retained, occurs at this time on a deviation between the illuminated position and the changed position of the object point.

To avoid this, in the present invention, an apparatus for changing of the illuminated position is provided for changing an illuminated by the illumination light according to the position L2 caused by the reciprocating movement of the movable lens 19, change of the object point.

[0028]

As shown in FIG. 1 is shown, changing the position of the object point from B2 to B1 in the movement of the movable lens 19 in the position indicated by dashed lines.

Simultaneously, the reflecting prism 29 is rotated in the direction of an arrow X, so that a reflective surface 29a of the prism 29 coincides with the dashed line shown.

As a result, with the illumination light L 2 to be illuminated position is changed to the position B1 of the object point, according to the caused by the reciprocating movement of the movable lens 19, change of position of the object point.

In other words, a lit center can be changed according to the change in position of the object point.

[0029]

The fig. 2 to fig. 4 show the device for varying the illuminated position.

In the fig. 2 and FIG. 3, reference numeral 31 a fixed lens holder, and reference numeral 32 denotes a movable lens holder.

The fixed lens holder 31 has projecting therefrom guide pins 33, 33rd

- 5 The movable lens holder 32 is moved along the guide pins 33, 33 up and down.

The illumination lens 13 and the fixed lens 18 are held by the fixed lens holder 31.

The movable lens 19 is held by the movable lens holder 32.

The fixed lens holder 31 is provided with a pair of support plates 34, 34 as shown in FIG. 4 is shown.

- 10 Aufrichtbereiche 34a, 34a of the support plates 34, 34 are each provided with a movement supporting pin 35.

A holding frame 36 is movably supported by the support pins 35.

The reflective prism 29 to adhere the both side surfaces of the side plates 36a, 36a of the support frame 36 is held by this.

- 15 An upper portion of the side plate 36a is provided with a support pin 37.

The support pin 37 is movably supported by a roller 38.

[0030]

- 20 The light intercepting plate 30 is adhered to the cut surface 12a of the fixed lens 18, and is fixed to the fixed lens holder 31.

As shown in FIG. 3 is shown, a gear rack 39 is fixed by a screw 39c of the movable lens holder 32.

The rack 39 includes teeth 39a and a contact surface 39b.

A pinion 40 is meshed with the teeth 39a.

- 25 The pinion 40 is fixed to an output shaft 41 of a motor (not shown).

The roller 38 is brought into contact with the contact surface 39b.

The contact surface 38b is inclined with respect to a vertical line.

The holding frame 36 is constantly by a torsion spring (not shown) biased in a direction in which the roller 38 comes into contact with the contact surface 39b.

- 30 The movable lens holder 32 by the motor (not shown), the pinion 40 and the rack 39 in a direction of the optical axis of the front lens 12 to reciprocate.

[0031]

- 35 As shown, the front observation lens, which directs a light emitted from an object point of the observation light beam in parallel and the illumination lens, which projects a beam of illumination light to the object point, separated from each other; Monitoring the front lens

comprises a movable lens, which is moved along its optical axis back and forth to adjust the position of the object point, and a fixed lens that is disposed on the side of the object point on.

[0032]

- 5 In this case, regardless of the arrangement in which the observation front lens that aligns a light emitted from an object point beam of the observation light parallel, and the illumination lens, which projects a beam of illumination light to the object point, are separated from one another, causing an illuminated spot coincident with the object point.

Claims

## 1. Stereomicroscope,

a front lens (12) and a downstream zoom lens system (14) into which the front of the lens  
 5 (12) enters the object emerging light parallel,

with an illumination arrangement (15) for the object illumination, a next to the front lens  
 (12) arranged in the illumination lens (13) and on whose side facing away from an object,  
 the illumination light to the illumination lens toward deflecting Umlenkreflektoranordnung  
 (29),

10 a lighting lens (13) of the front lens (12) severing stray light blocking plate (30),

wherein the front lens (12) consists of two lenses (18, 19), one of which is fixed the object  
 facing the lens (18) and the object which faces away from the lens (19) of the front lens  
 (12) mechanically connected to the Umlenkreflektoranordnung (29) is coupled and a  
 displacement of the object facing away from the lens (19) of the front lens (12) along in  
 15 order to modify the focal length causes the optical axis of a synchronous tracking of the  
 Umlenkreflektoranordnung (29) for all positions of the object facing away from the lens  
 (19) of the front lens (12) focusing the illumination light in the respective the focal point of  
 the front lens (12) ensures

with a fixed lens holder (31) for holding the object which faces the lens (18) and the  
 20 illumination lens (13),

with a pair of guide pins (33, 33) projecting from the fixed lens holder (31), and

a movable lens holder (32) for holding the object facing away from the lens (19) (33 33) is  
 of the guide pins (33, 33) supported along the guide pin to reciprocate,  
 characterized by

25 one in the fixed lens holder (31) of movement provided support pin (35),

a movement of the support pin (35) movably supported holder frame (36),

a reflecting prism (29) as Umlenkreflektoranordnung that of the support frame (36) is  
 supported and one of a light source (26) of the emitted light beam to the illumination lens  
 (13) is reflected,

30 one of the reflecting prism (29) provided on the support pin (37) which is provided with a  
 roller (38), and

a rolling surface (39b) having, to the movable lens holder (32) attached to the rack (39)  
 with which the roller (38) is brought into contact, and whose teeth (39a) with a drivable  
 pinion (40) meshing with the rolling surface (39b) is inclined with respect to a vertical line  
 35 so as to change a state of the reflected prism (29) according to the up and down movement  
 of the movable lens holder (32).

**Abstract**

5 The observation front lens (12) is for the parallel alignment of a ray from the observation light (L1,L1') emitted by a lens point (B1,B2). An illumination lens (13) projects a ray from the illumination light (L2) onto the lens point. The observation front lens and illumination lens are separated. The observation front lens has a movable (19) and a fixed (18) lens. The movable lens is moved to-and-fro along its optical axis to alter the position of the lens point. The fixed lens has a cut edge parallel to the plane containing the optical axes of a right and left optical observation path. The observation lens is positioned near to the cut edge of the fixed lens.



① BUNDESREPUBLIK  
DEUTSCHLAND



DEUTSCHES  
PATENT- UND  
MARKENAMT

# Patentschrift

## DE 195 23 712 C 2

⑤ Int. Cl.<sup>7</sup>:  
**G 02 B 21/22**  
G 02 B 21/06  
G 02 B 21/12  
G 02 B 21/02

⑦ Aktenzeichen: 195 23 712.9-42  
⑧ Anmeldetag: 22. 6. 1995  
⑨ Offenlegungstag: 4. 1. 1996  
⑩ Veröffentlichungstag  
der Patenterteilung: 21. 6. 2000

Innerhalb von 3 Monaten nach Veröffentlichung der Erteilung kann Einspruch erhoben werden

⑪ Unionspriorität:  
6-141442 23. 06. 1994 JP

⑫ Patentinhaber:  
Kabushiki Kaisha Topcon, Tokio/Tokyo, JP

⑬ Vertreter:  
PFENNING MEINIG & PARTNER GbR, 80336  
München

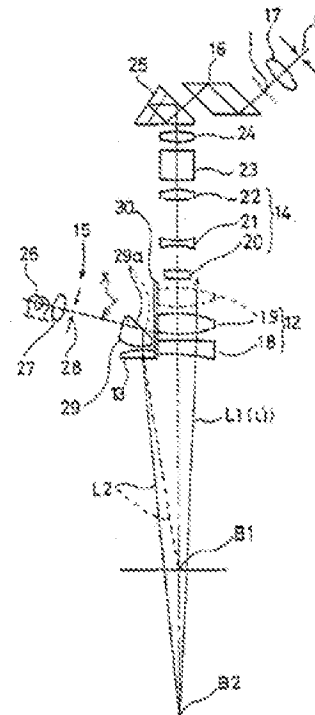
⑭ Erfinder:  
Kitajima, Nobuaki, Tokio/Tokyo, JP

⑮ Für die Beurteilung der Patentfähigkeit in Betracht  
gezogene Druckschriften:

DE	40 28 605 A1
DE	31 05 018 A1
DE	29 32 486 A1
US	51 40 458
US	43 61 379

### ⑭ Stereomikroskop

⑮ Stereomikroskop,  
mit einem Frontobjektiv (12) und einem nachgeschalteten  
Zoomliniensystem (14), in welches das aus dem Frontobjektiv (12) austretende Objektlicht parallel eintritt,  
mit einer Beleuchtungsanordnung (15) zur Objektbe-  
leuchtung, die eine neben dem Frontobjektiv (12) ange-  
ordnete Beleuchtungslinse (13) und auf deren objektab-  
gewandter Seite eine das Beleuchtungslicht zu der Be-  
leuchtungslinse hin umlenkende Umlenkreflektoranord-  
nung (29, 42, 43) aufweist, und  
mit einer die Beleuchtungslinse (13) von dem Frontobjek-  
tiv (12) abtrennenden Streulichtschutzplatte (30),  
wobei das Frontobjektiv (12) aus zwei Linsen (18, 19) be-  
steht, von denen die objektzugewandte Linse (18) fest-  
steht und die objektabgewandte Linse (19) zwecks Ände-  
rung der Brennweite des Frontobjektivs (12) längs der op-  
tischen Achse verschiebbar ist,  
dadurch gekennzeichnet,  
daß die objektabgewandte Linse (19) des Frontobjektivs  
(12) mechanisch mit der Umlenkreflektoranordnung (29,  
42, 43) gekoppelt ist und eine Verschiebung der objektab-  
gewandten Linse (19) des Frontobjektivs (12) eine syn-  
chrone Nachführung der Umlenkreflektoranordnung (29,  
42, 43) bewirkt,  
die für alle Stellungen der objektabgewandten Linse (19)  
des Frontobjektivs (12) eine Fokussierung des Beleuch-  
tungslichtes in den jeweiligen Brennpunkt des Frontobjek-  
tivs (12) gewährleistet.



DE 195 23 712 C 2

DE 195 23 712 C 2



Die Erfindung bezieht sich auf ein Stereomikroskop nach dem Oberbegriff des Anspruchs 1.

In Fig. 6 bezeichnet das Bezugszeichen 10 einen binokularen Mikroskopkörper, das Bezugszeichen 11 bezeichnet ein Okularrohr, die Bezugszeichen B1 und B2 bezeichnen jeweils einen Objektpunkt wie beim Stand der Technik, das Bezugszeichen p bezeichnet einen Arbeitsabstand eines optischen Systems des binokularen Mikroskops, und das Bezugszeichen h bezeichnet eine Veränderung des Arbeitsabstandes. Ein zu beobachtender Gegenstand, der sich zwischen den Objektpunkten B1 und B2 befindet, kann im Brennpunkt beobachtet werden.

Aus US 4 361 379 ist ein Stereomikroskop bekannt, in dessen optischem System zumindest ein Teil einer Frontlinse, die für einen Strahl von Beleuchtungslicht und einen Strahl von Beobachtungslicht gemeinsam ist, in einer Richtung ihrer optischen Achse bewegt werden kann, um die Position eines Objektpunktes zu verändern. In dem optischen System dieses Typs von Stereomikroskop ist eine Platte zum Unterbrechen von Licht entlang der optischen Achse angeordnet, um zu verhindern, daß das von der Grenzfläche zwischen Luft und der Frontlinse reflektierte Beleuchtungslicht in einen optischen Beobachtungspfad eintritt.

Um die Größe der Bewegung der Frontlinse herabzusetzen und die Veränderung eines Arbeitsabstandes zwischen einer Position eines Objektpunktes, an dem sich ein beobachteter Gegenstand befindet, und einer Position eines anderen Objektpunktes zu vergrößern, ist es bevorzugt, daß die Frontlinse zwei Gruppen von Linsen umfaßt. Fig. 7 ist eine schematische Ansicht 71 der Frontlinse. In Fig. 7 bezeichnet das Bezugszeichen 1 eine positive Linse (konvergierende Linse), 2 bezeichnet eine negative Linse (divergierende Linse), H1 bezeichnet eine vordere Hauptebene der positiven Linse 1, H1' bezeichnet eine hintere Hauptebene der positiven Linse 1, H2 bezeichnet eine vordere Hauptebene der negativen Linse 2, H2' bezeichnet eine hintere Hauptebene der negativen Linse 2, d bezeichnet einen Hauptebenen-Abstand zwischen der positiven Linse 1 und der negativen Linse 2, und p bezeichnet einen Arbeitsabstand zwischen der hinteren Hauptebene H2' der negativen Linse 2 und einem Objektpunkt B. Die Frontlinse 3 ist aus der positiven Linse 1 und der negativen Linse 2 zusammengesetzt. In diesem Stereomikroskop sind die positive Linse 1 beweglich und die negative Linse 2 unbeweglich.

Die Beziehung zwischen dem Arbeitsabstand p und dem Hauptebenen-Abstand d wird wie folgt dargestellt:

$$p = ((f_1 - d) \times f_2) / (f_1 + f_2 - d)$$

worin  $f_1$  eine Brennweite der positiven Linse 1 und  $f_2$  eine Brennweite der negativen Linse 2 sind.

Wenn  $160 \text{ mm} < p < 220 \text{ mm}$  und  $31 \text{ mm} > d > 15 \text{ mm}$  sind, haben die positive und negative Linse 1 und 2 die folgenden Brennweiten  $f_1$  bzw.  $f_2$ :

$$f_1 = 130 \text{ mm}, f_2 = -200 \text{ mm}.$$

Wie in Fig. 8 gezeigt ist, hat eine Frontlinse 12 die Schnittoberfläche 12a, die parallel zu einer Ebene verläuft, welche die optischen Achsen 02, 02' des rechten und des linken optischen Beobachtungspfades K1, K2 enthält, und welche durch eine Ebene abgeschnitten ist, die im wesentlichen an das rechte und an das linke Beobachtungslicht L1, L1' (Fig. 9) angrenzt. Eine Beobachtungslinse ist nahe der Schnittoberfläche 12a angeordnet. In Fig. 8 bezeichnet das Bezugszeichen 01 eine optische Achse des optischen Be-

leuchtungspfades S1 und das Bezugszeichen 03 bezeichnet eine optische Achse der Frontlinse 12. Wenn die Frontlinse 12 und die Beleuchtungslinse voneinander getrennt sind, kann, wenn die Beleuchtungslinse nahe der Schnittoberfläche 12a der festen Linse der Frontlinse 12 angeordnet ist, ein Abstand zwischen der optischen Achse 02 des Beobachtungslichts L1 und der optischen Achse 01 des Beleuchtungslichts L2 klein gemacht werden. Demgemäß kann ein Winkel zwischen der optischen Achse 01 und der optischen Achse 02 gebildeter Winkel klein gemacht werden. Zum Beispiel kann der Winkel dazwischen zu  $5^\circ$  gemacht werden. Eine derartige Anordnung ist aus der DE 29 32 486 A1 bekannt.

Die US 5 140 458 beschreibt eine optische Beleuchtungs- und Beobachtungsvorrichtung mit einem ersten Antriebssystem zum Verändern der Vergrößerung und einem zweiten Antriebssystem zum Verändern des Beleuchtungsfeldes der Vorrichtung. Die beiden Antriebssysteme können entweder miteinander gekoppelt sein oder unabhängig voneinander arbeiten.

Die DE 40 28 605 A1 zeigt ein Beleuchtungssystem für ein Operationsmikroskop, das außerhalb der optischen Achse des Mikroskopobjektivs angeordnet ist und mit einer vor der optischen Achse des Mikroskopobjektivs angeordneten Umlenkvorrichtung versehen ist, welche das Beleuchtungslicht durch das Mikroskopobjektiv zum Objektpunkt hinlenkt. Hierbei ist ein erstes vor der optischen Achse des Mikroskopobjektivs angeordnetes Umlenkelement so gestaltet, daß es nur einen Teil des Beleuchtungslichtes in achsnaher Schrägbeleuchtung zum Objektpunkt hineinlenkt; und ein zweites Umlenkelement ist in oder hinter der optischen Achse des Mikroskopobjektivs angeordnet, welches einen anderen Teil des Beleuchtungslichtes senkrecht oder achsnäher als das erste Umlenkelement zum Objektpunkt lenkt. Vorzugsweise lenken das erste Umlenkelement das Beleuchtungslicht unter einem Neigungswinkel von  $6^\circ$  zur optischen Achse und das zweite Umlenkelement das Beleuchtungslicht unter einem zwischen  $0^\circ$  und  $4^\circ$  variierbaren Neigungswinkel zur optischen Achse auf den Objektpunkt.

Die DE 31 05 018 A1 schließlich offenbart ein Operationsmikroskop mit einem Objektiv veränderlicher Schnittweite bei dem das Objektiv zusammen mit Mitteln zur Umlenkung des Beobachtungsstrahlenganges in zwei Koordinatenrichtungen in einem vor dem Mikroskopgehäuse angeordneten Gehäuse untergebracht ist. Dieses Objektivgehäuse enthält außerdem ein Drehkeilpaar zur Lateralverschiebung des Beobachtungsstrahlenganges.

Es ist die Aufgabe der vorliegenden Erfindung, ein Stereomikroskop zu schaffen, das in der Lage ist, eine zu beleuchtende Position entsprechend der Bewegung eines Objektpunktes zu verändern.

Diese Aufgabe wird erfindungsgemäß gelöst durch die im kennzeichnenden Teil des Anspruchs 1 angegebenen Merkmale. Vorteilhafte Weiterbildungen des erfindungsgemäßen Stereomikroskops ergeben sich aus den Unteransprüchen.

Die Erfindung wird im Folgenden anhand von in den Figuren dargestellten Ausführungsbeispielen näher erläutert. Es zeigen:

Fig. 1 eine schematische Darstellung eines Stereomikroskops gemäß der vorliegenden Erfindung,

Fig. 2 eine Draufsicht auf eine Vorrichtung zum Verändern der beleuchteten Position,

Fig. 3 eine Seitenansicht der Vorrichtung nach Fig. 2,

Fig. 4 eine Rückansicht der Vorrichtung nach Fig. 2,

Fig. 5 eine schematische Darstellung einer anderen Vorrichtung zum Verändern der beleuchteten Position,

Fig. 6 die äußere Ansicht eines bekannten Stereomikroskops,

Fig. 7 eine schematische Darstellung einer herkömmli-

chen Frontlinse.

Fig. 8 eine Schnittansicht der optischen Pfade des Beobachtungslichts und des Beleuchtungslichts bei einem bekannten Stereomikroskop, aufgenommen auf einer Linie enthaltend einen Punkt  $q_2$  in Fig. 9, und

Fig. 9 Längsschnitte der in Fig. 8 im Querschnitt dargestellten optischen Pfade.

Wie in Fig. 1 gezeigt ist, enthält der binokulare Mikroskopkörper 10 eine Frontlinse 12 zum Beobachten einer Beleuchtungslinse 13, ein Zoom-System 14 mit veränderbarer Vergrößerung und eine Beleuchtungsanordnung 15. Das Okularrohr 11 enthält ein Augenbreiten-Einstellprisma 16 und Okulare 17. Die Beobachtungs-Frontlinse 12 besteht aus einer festen Linse 18 und einer bewegbaren Linse 19. Die feste Linse 18 ist den Objektpunkten B1 und B2 zugewandt. Die Beobachtungs-Frontlinse 12 und die Beleuchtungslinse 13, die jeweils nachfolgend im einzelnen beschrieben werden, sind voneinander getrennt. Das Zoom-System 14 mit veränderbarer Vergrößerung enthält Linsen 20, 21 und 22 mit veränderbarer Vergrößerung, einen Strahlenteiler 23, eine Abbildungslinse 24 und ein Aufrichtprisma 25. Das Zoom-System 14 mit veränderbarer Vergrößerung besteht aus einem rechten und einem linken optischen System, von denen eines in Fig. 1 weggelassen ist, da es direkt hinter dem anderen angeordnet ist. Die Beleuchtungsanordnung 15 enthält eine Lichtquelle 26, eine Kondensorlinse 27, eine Beleuchtungs-Schleifblende 28 und ein reflektierendes Prisma mit einer Linse 29. Die Gruppe aus der Beobachtungs-Frontlinse 12, dem Zoom-System 14 mit veränderbarer Vergrößerung, dem Augenbreiten-Einstellprisma 16 und den Okularen 17 bildet ein optisches Beobachtungssystem. Das beispielsweise von dem Objektpunkt B2 emittierte Beobachtungslicht L1 wird mittels der Beobachtungs-Frontlinse 12 parallel ausgerichtet und dann zu dem Zoom-System 14 mit veränderbarer Vergrößerung geführt. Das parallel ausgerichtete Beobachtungslicht L1 geht durch das Zoom-System 14 mit veränderbarer Vergrößerung hindurch, welches ein brechenloses optisches System ist, und wird dann zu dem Strahlenteiler 23 geführt. Ein Teil des parallel ausgerichteten Beobachtungslichts L1 wird von dem Strahlenteiler 23 reflektiert und dann zu einer Fernseh-Bildaufnahmeverrichtung (nicht gezeigt), usw. geführt, um ein Bild zu bilden. Das Beobachtungslicht L1, das durch den Strahlenteiler 23 hindurchgegangen ist, bildet mittels der Abbildungslinse 24 an einem Bildpunkt I ein reelles Bild. Eine Bedienungsperson setzt die Augen auf einen Augenpunkt E und beobachtet einen zu beobachtenden Gegenstand, der sich an dem Objektpunkt B2 befindet, durch die Okulare 17. Das Augenbreiten-Einstellprisma 16 ist um seine optische Auftreffachse drehbar, um den Pupillenabstand der Bedienungsperson einzustellen.

Das von der Lichtquelle 26 emittierte Beleuchtungslicht L2 wird durch die Kondensorlinse 27 konzentriert und beleuchtet die Beleuchtungs-Schleifblende 28. Das durch die Schleifblende 28 hindurchgegangene Beleuchtungslicht L2 wird durch das reflektierende Prisma 29 parallel gerichtet und dann zu der Beleuchtungslinse 13 geführt. Der Brennpunkt der Beleuchtungslinse 13 fällt mit dem Objektpunkt B2 zusammen.

Ein Bild der Schleifblende 28 wird an dem Objektpunkt B2 gebildet, so daß der Objektpunkt B2 gleichförmig beleuchtet wird. Ein Bild der Lichtquelle 26 wird von der Kondensorlinse 27 an einem Punkt gebildet, der nahe der Beleuchtungslinse 13 auf der Seite des Objektpunktes ist, das heißt mit anderen Worten, eine Austrittspupille der Beleuchtungsanordnung 15 befindet sich nahe einer Schnittoberfläche 12a der festen Linse 18, die nachfolgend im einzelnen beschrieben wird, auf der Seite des Objektpunktes. Demge-

maß kann der Beleuchtungswirkungsgrad der Lichtquelle 26 verbessert werden.

Eine lichtunterbrechende Platte 30 ist zwischen der Frontlinse 12 und der Beleuchtungslinse 13 angeordnet. Die lichtunterbrechende Platte 30 dient dazu, den Eintritt von reflektiertem Beleuchtungslicht, das an der Grenzfläche zwischen der Beleuchtungslinse 13 und Luft reflektiert wurde, in den optischen Beobachtungspfad zu verhindern.

Die Bewegung der bewegbaren Linse 19 an die gestrichelt dargestellte Stelle in Fig. 1 bewirkt die Positionsveränderung des Objektpunktes von B2 nach B1. Wenn eine durch das Beleuchtungslicht L2 beleuchtete Position ohne Änderung an dem Objektpunkt B2 gehalten wird, tritt zu dieser Zeit eine Abweichung zwischen der beleuchteten Position und der veränderten Position des Objektpunktes auf. Um dies zu vermeiden, ist bei der vorliegenden Erfindung eine Vorrichtung zur Veränderung der beleuchteten Position vorgesehen zum Verändern einer durch das Beleuchtungslicht L2 beleuchteten Position entsprechend der durch die hin- und hergehende Bewegung der bewegbaren Linse 19 bewirkten Veränderung des Objektpunktes.

Wie in Fig. 1 gezeigt ist, wird bei der Bewegung der bewegbaren Linse 19 in die gestrichelt angezeichnete Stellung die Position des Objektpunktes von B2 nach B1 verändert. Gleichzeitig wird das reflektierende Prisma 29 in Richtung eines Pfeiles X gedreht, so daß eine reflektierende Oberfläche 29a des Prismas 29 mit der gestrichelt angezeigten Linie zusammenfällt. Als Folge wird gemäß der durch die hin- und hergehende Bewegung der bewegbaren Linse 19 bewirkten Positionsänderung des Objektpunktes die mit dem Beleuchtungslicht L2 zu beleuchtende Position zu der Position B1 des Objektpunktes verändert. Mit anderen Worten, eine beleuchtete Mitte kann entsprechend der Positionsänderung des Objektpunktes verändert werden.

Die Fig. 2 bis 4 zeigen die Vorrichtung zum Verändern der beleuchteten Position. In den Fig. 2 und 3 bezeichnet das Bezugszeichen 31 einen festen Linsenhalter und das Bezugszeichen 32 bezeichnet einen bewegbaren Linsenhalter. Der feste Linsenhalter 31 hat von diesem abgehende Führungsschäfte 33, 33. Der bewegbare Linsenhalter 32 wird entlang der Führungsschäfte 33, 33 auf- und abwärts bewegt. Die Beleuchtungslinse 13 und die feste Linse 18 werden von dem festen Linsenhalter 31 gehalten. Die bewegbare Linse 19 wird von dem bewegbaren Linsenhalter 32 gehalten. Der feste Linsenhalter 31 ist mit einem Paar von Stützplatten 34, 34 versehen, wie in Fig. 4 gezeigt ist. Aufrichtbereiche 34a, 34a der Stützplatten 34, 34 sind jeweils mit einem Bewegungsstützstift 35 versehen. Ein Halterahmen 36 wird bewegbar von den Stützstiften 35 gestützt. Das reflektierende Prisma 29, dessen beide Seitenflächen an Seitenplatten 36a, 36a' des Halterahmens 36 haften, wird von diesem gehalten. Ein oberer Teil der Seitenplatte 36a' ist mit einem Stützstift 37 versehen. Der Stützstift 37 ist bewegbar durch eine Rolle 38 gestützt.

Die lichtunterbrechende Platte 30 haftet an der Schnittoberfläche 12a der festen Linse 18 und ist an dem festen Linsenhalter 31 befestigt. Wie in Fig. 3 gezeigt ist, ist eine Zahnstange 39 mittels einer Schraube 39c an dem bewegbaren Linsenhalter 32 befestigt. Die Zahnstange 39 weist Zähne 39a und eine Kontaktfläche 39b auf. Ein Ritzel 40 kämmt mit den Zähnen 39a. Das Ritzel 40 ist an einer Ausgangswelle 41 eines Motors (nicht gezeigt) befestigt. Die Rolle 38 wird in Kontakt mit der Kontaktfläche 39b gebracht. Die Kontaktfläche 38b ist in bezug auf eine vertikale Linie geneigt. Der Halterahmen 36 wird ständig durch eine Torsionsfeder (nicht gezeigt) in eine Richtung vorgespannt, in welcher die Rolle 38 in Kontakt mit der Kontaktfläche 39b gelangt. Der bewegbare Linsenhalter 32 wird durch den

Motor (nicht gezeigt), das Ritzel 40 und die Zahnstange 39 in einer Richtung der optischen Achse der Frontlinse 12 hin- und herbewegt.

Fig. 5 zeigt eine Abwandlung der Vorrichtung zum Verändern der beleuchteten Position. Bei der Abwandlung sind anstelle der Drehung des reflektierenden Prismas 29 ablenkende Prismen 42 und 43, deren Öffnungswinkel einander gleich sind, zwischen dem reflektierenden Prisma 29 und der Sehfeldblende 28 angeordnet. Die ablenkenden Prismen 42 und 43 dienen als parallele Ebenen, die insgesamt keine ablenkende Funktion haben, indem sie wie in Fig. 5 gezeigt angeordnet sind, wenn sich der Objektpunkt an der Bezugsposition B2 befindet. Gemäß der Positionsänderung des Objektpunktes von der Bezugsposition B2 (d. h. synchron mit der Bewegung der bewegbaren Linse 19) wurden die beiden ablenkenden Prismen 42 und 43 in entgegengesetzten Richtungen gedreht, so daß die optische Achse des optischen Beleuchtungspfad abgelenkt wird. Als eine Folge wird die beleuchtete Mitte entsprechend der Positionsänderung des Objektpunktes verändert. In Fig. 5 werden aus Gründen der vereinfachten Darstellung die ablenkenden Prismen 42 und 43 um 90° um die optische Achse des optischen Beleuchtungspfad gedreht.

Wie gezeigt ist, sind die Beobachtungs-Frontlinse, welche einen von einem Objektpunkt emittierten Strahl aus Beobachtungslicht parallel ausrichtet, und die Beleuchtungslinse, welche einen Strahl aus Beleuchtungslicht auf den Objektpunkt projiziert, voneinander getrennt; die Beobachtungs-Frontlinse weist eine bewegbare Linse, welche entlang ihrer optischen Achse hin- und herbewegt wird, um die Position des Objektpunktes zu verändern, und eine feste Linse, welche auf der Seite des Objektpunktes angeordnet ist, auf.

Dabei kann ungeachtet der Anordnung, bei welcher die Beobachtungs-Frontlinse, welche einen von einem Objektpunkt emittierten Strahl aus Beobachtungslicht parallel ausrichtet, und die Beleuchtungslinse, welche einen Strahl aus Beleuchtungslicht auf den Objektpunkt projiziert, voneinander getrennt sind, bewirkt werden, daß ein beleuchteter Punkt mit dem Objektpunkt zusammenfällt.

#### Patentansprüche

1. Stereomikroskop, mit einem Frontobjektiv (12) und einem nachgeschalteten Zoomlinsensystem (14), in welches das aus dem Frontobjektiv (12) austretende Objektlicht parallel eintritt, mit einer Beleuchtungsanordnung (15) zur Objektbeleuchtung, die eine neben dem Frontobjektiv (12) angeordnete Beleuchtungslinse (13) und auf deren objektabgewandter Seite eine das Beleuchtungslicht zu der Beleuchtungslinse hin umlenkende Umlenkreflektoranordnung (29, 42, 43) aufweist, und mit einer die Beleuchtungslinse (13) von dem Frontobjektiv (12) abtrennenden Streulichtschutzplatte (30), wobei das Frontobjektiv (12) aus zwei Linsen (18, 19) besteht, von denen die objektzugewandte Linse (18) feststeht und die objektahgewandte Linse (19) zwecks Änderung der Brennweite des Frontobjektivs (12) längs der optischen Achse verschiebbar ist, **dadurch gekennzeichnet**, daß die objektahgewandte Linse (19) des Frontobjektivs (12) mechanisch mit der Umlenkreflektoranordnung (29, 42, 43) gekoppelt ist und eine Verschiebung der objektahgewandten Linse (19) des Frontobjektivs (12) eine synchrone Nachführung der Umlenkreflektoranordnung (29, 42, 43) bewirkt,

die für alle Stellungen der objektahgewandten Linse (19) des Frontobjektivs (12) eine Fokussierung des Beleuchtungslichtes in den jeweiligen Brennpunkt des Frontobjektivs (12) gewährleistet.

2. Stereomikroskop nach Anspruch 1, gekennzeichnet durch

einen festen Linsenhalter (31) zum Halten der objektzugewandten Linse (18) und der Beleuchtungslinse (13),

ein Paar von Führungsstiften (33, 33), die von dem festen Linsenhalter (31) vorstehen, einen bewegbaren Linsenhalter (32) zum Halten der objektahgewandten Linse (19), der von den Führungsstiften (33, 33) gestützt und entlang der Führungsstifte (33, 33) hin- und herbewegt ist,

einen in dem festen Linsenhalter (31) vorgesehenen Bewegungsunterstützungsstift (35),

einen von dem Bewegungsunterstützungsstift (35) bewegbar gestützten Halterahmen (36),

ein reflektierendes Prisma (29) als Umlenkreflektoranordnung, das von dem Halterahmen (36) gehalten wird und einen von einer Lichtquelle (26) emittierten Lichtstrahl zu der Beleuchtungslinse (13) reflektiert,

einen in dem reflektierenden Prisma (29) vorgesehenen Stützstift (37), der mit einer Rolle (38) versehen ist, und

eine eine Rolloberfläche (39b) aufweisende Zahnstange (39), mit der die Rolle (38) in Kontakt gebracht ist und deren Zähne (39a) mit einem antreibbaren Ritzel (40) kämmen, wobei die Rolloberfläche (39b) mit Bezug auf eine vertikale Linie geneigt ist, um einen Zustand des reflektierten Prismas (29) gemäß der Auf- und Abwärtsbewegung des bewegbaren Linsenhalters (32) zu verändern.

3. Stereomikroskop nach Anspruch 1, dadurch gekennzeichnet, daß die Umlenkreflektoranordnung ein Paar von relativ zueinander bewegbaren Ablenkungsprismen (42, 43) aufweist, die zwischen der Beleuchtungslinse (13) und der Lichtquelle (26) angeordnet sind.

Hierzu 6 Seite(n) Zeichnungen

Fig. 1

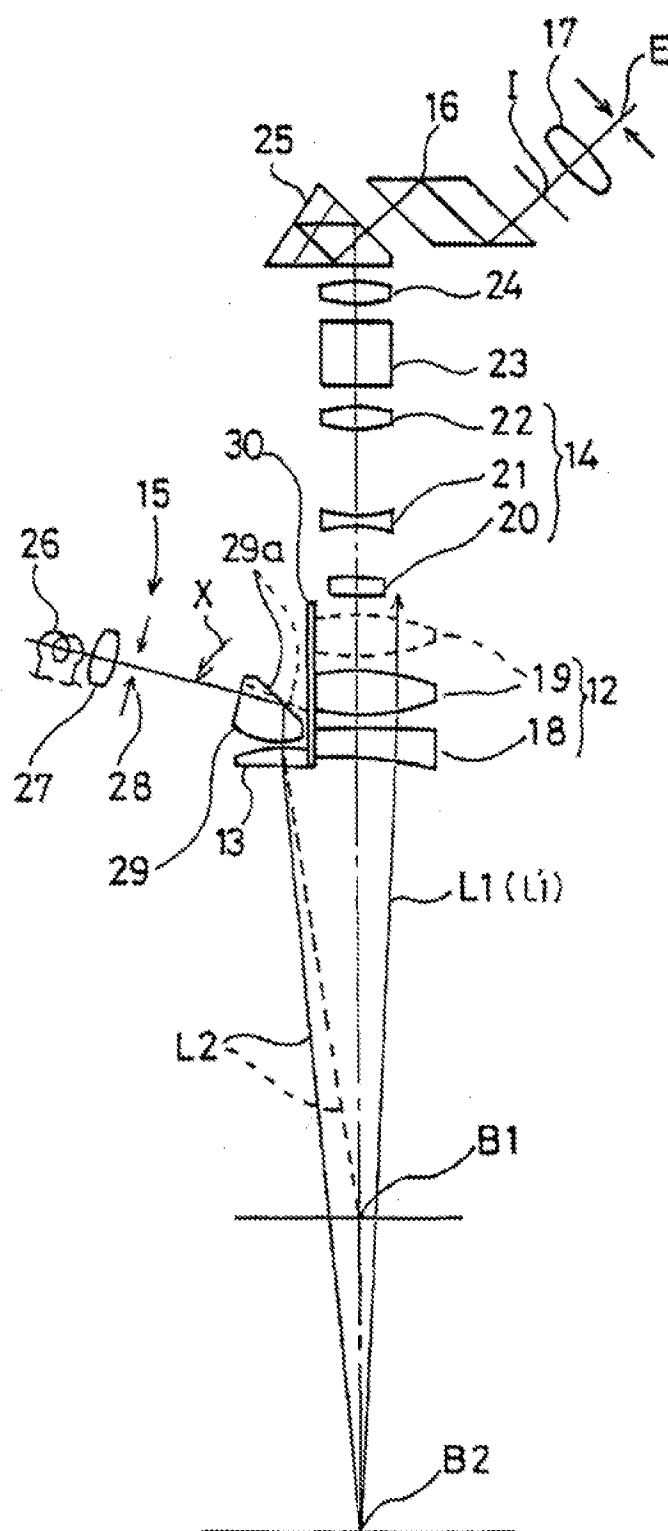


Fig. 2

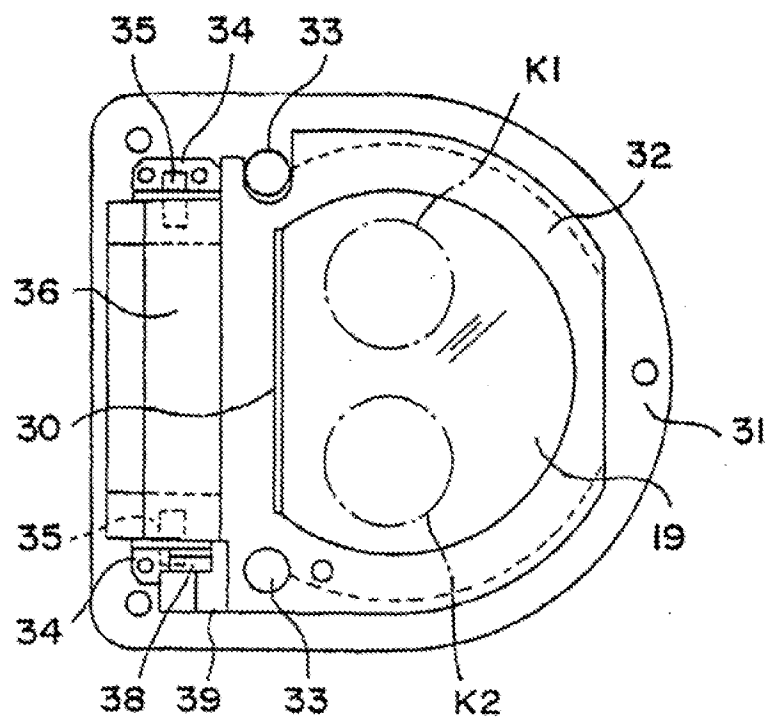


Fig. 3

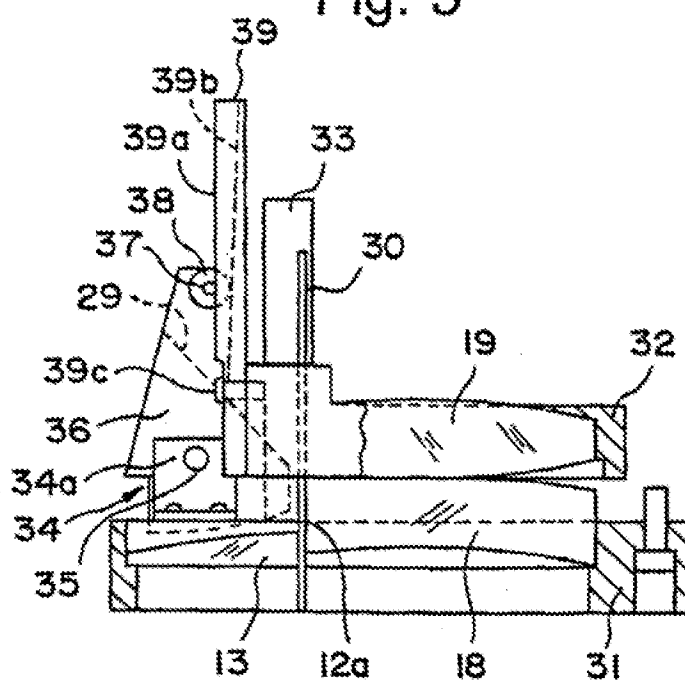


Fig. 4

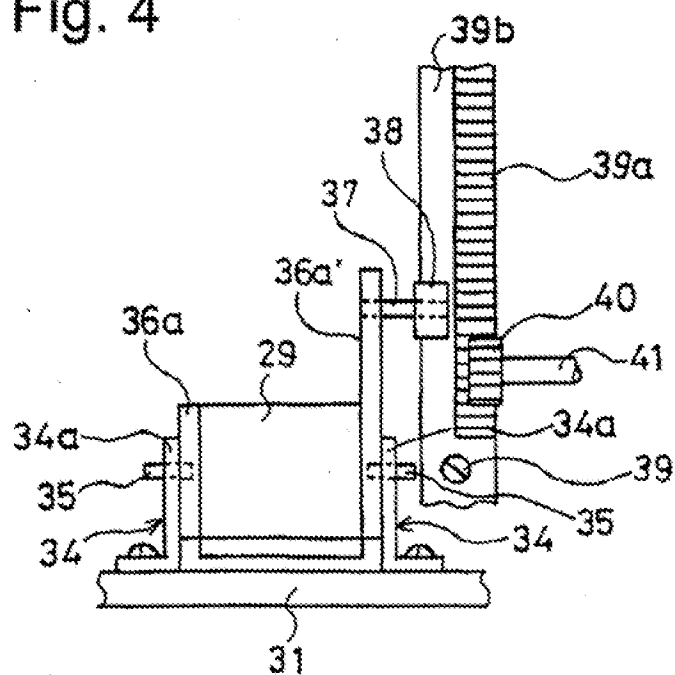


Fig. 5

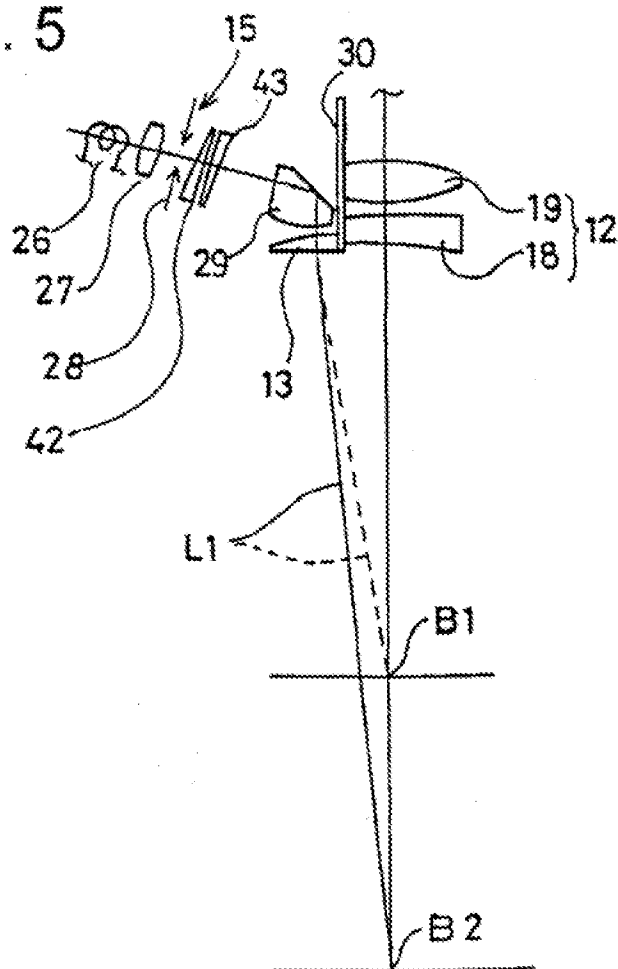


Fig. 6

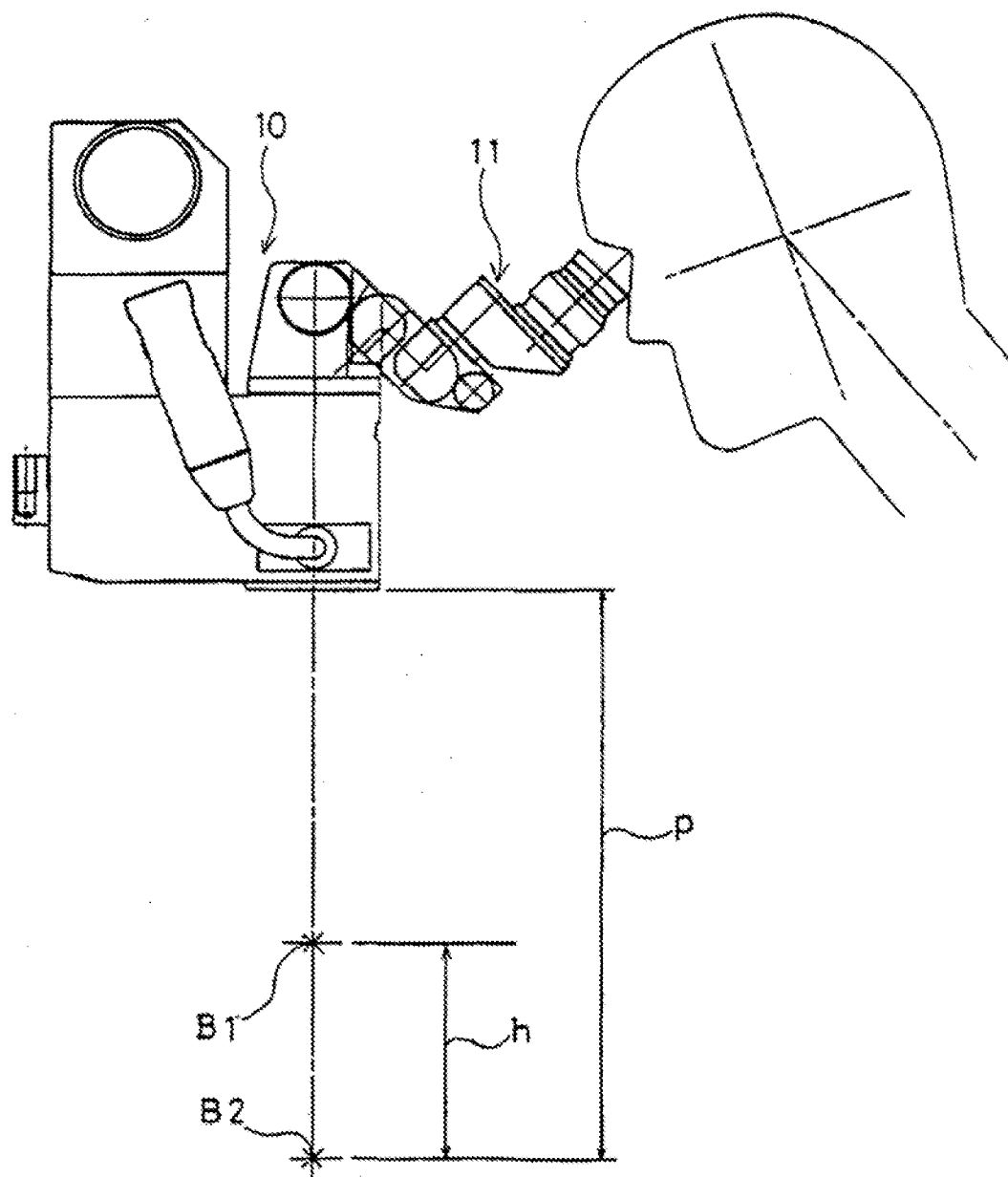


Fig. 7

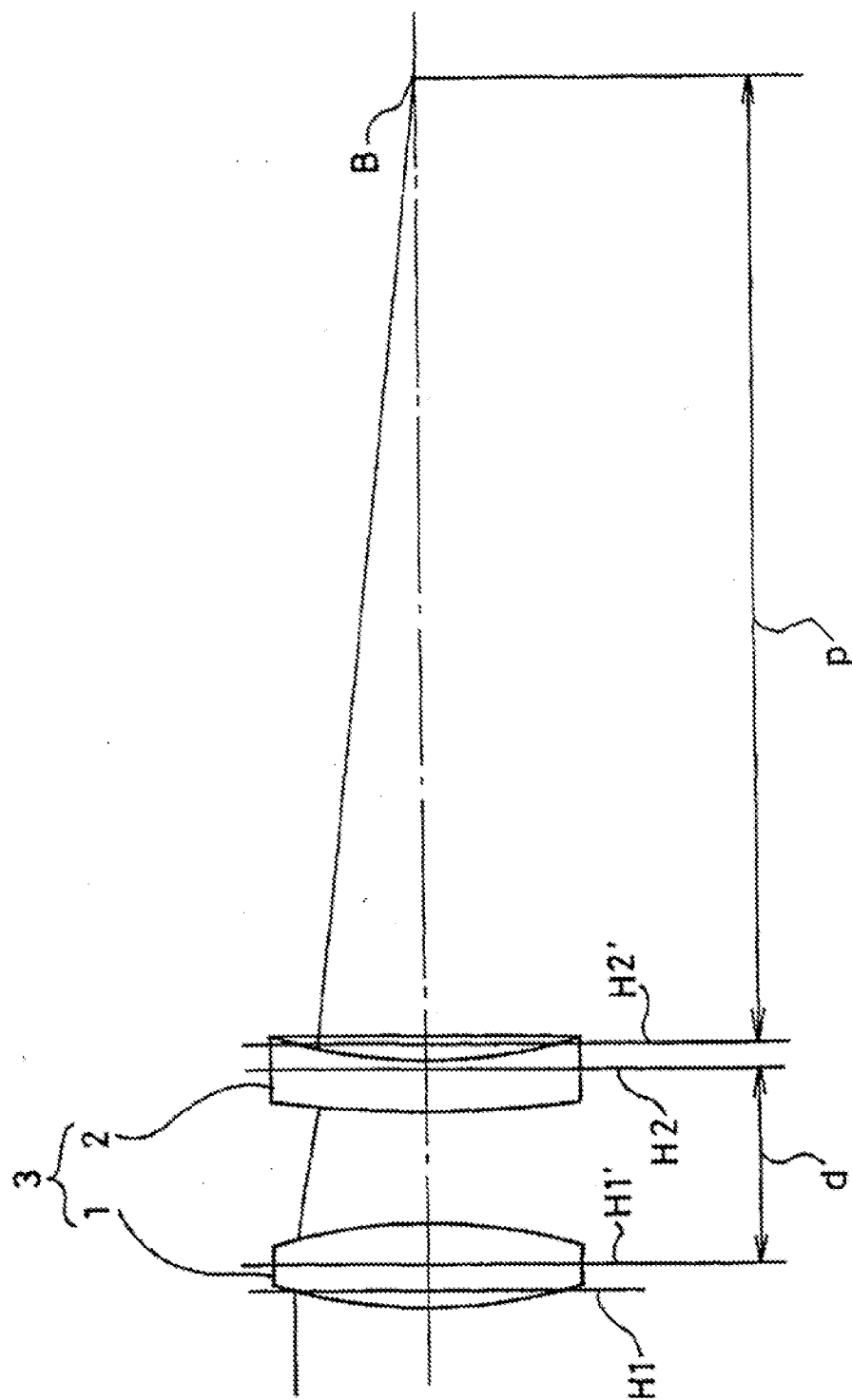




Fig. 8

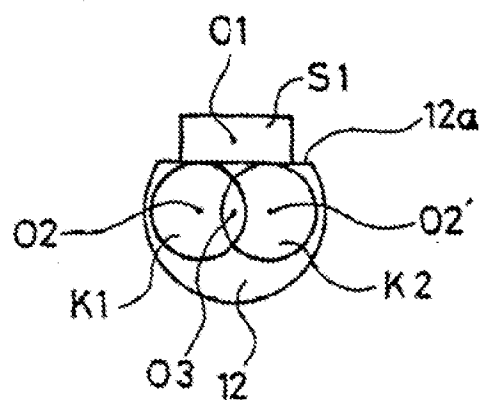
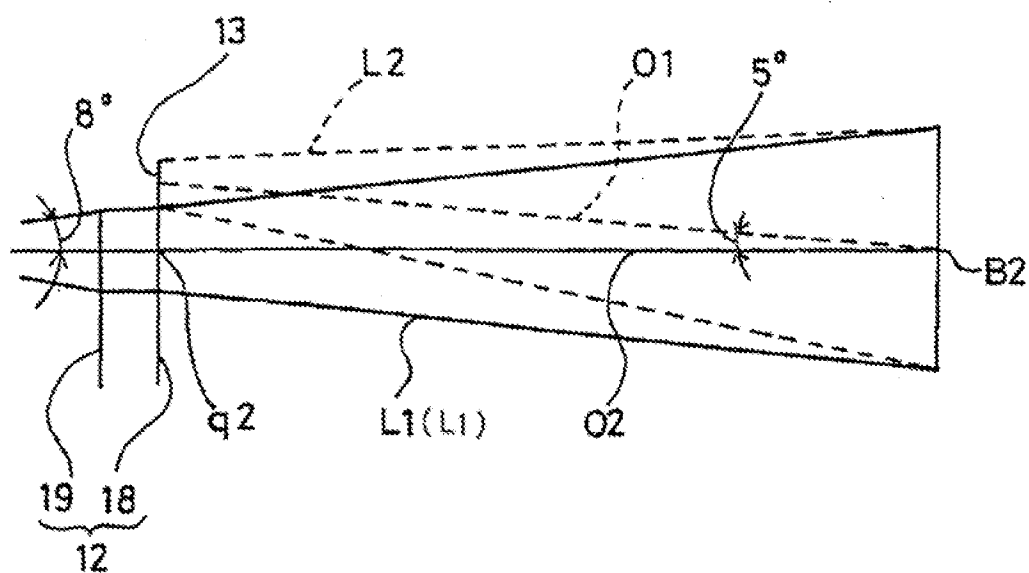


Fig. 9



**Description**

[0001]

- 5 The present invention relates to an optical magnification changing system for providing optical image magnifications, and a microscope, in particular stereo surgical microscope with such a material.

[0002]

- 10 Such magnification change systems are known from the prior art, in particular in the context of stereo microscopes, in particular between a first imaging optical magnification, which allows, for example, an overview of a viewed object plane, and a second image magnification, which, for example, shows an enlarged detail of the object plane with a correspondingly increased detail detectability to switch.
- 15 It is necessary for a high user acceptance of the magnification changing system that switching is quick and easy.

State of the art

[0003]

- 20 For this purpose, it is known for a stereo microscope for a to perform a lens or eyepiece to switch between two magnifications.
- So, for example, increases when replacing a 10x eyepiece through an eyepiece 12.5x, the total magnification by the so caused additional magnification in the entire magnification range linearly by 25%.

25 [0004]

Alternatively, it is known to provide a Galileo system between a zoom system, and a tube of an ocular of a stereomicroscope.

This is illustrated in Figure 4A,

30 4B and

4C schematically shown.

[0005]

Here, in Figure

- 35 4A two outgoing from an object plane P ray paths B1 and B2, which enclose a stereo angle  $[\alpha]$  in the object plane P, shown separately.

[0006]

In Figure

4A shown, which has in the prior art known stereomicroscope along the extending from the  
5 object plane P imaging paths B1 and B2 initially a lens system C, which is passed jointly out of  
the imaging beam paths B1 and B2.

After passing through the lens system C, the two imaging beam paths are guided separately B1  
and B2 in an optical zoom system E '.

Between the zoom system E 'and separately for the two imaging paths B1 and B2 provided the  
10 tube L is a Galilean System D \* in the form of two Galilei changer D1 \*, D2 \* is located.

[0007]

Figures

4B and

4C are side views in Figure

4A shown in supervision Galilei changer D1 \*, D2 \*.

It shows

4B is a side view in the direction of the imaging beam paths B1, B2 and Figures

4C is a side view perpendicular to the imaging beam paths B1, B2.

[0008]

The Galilean changer D1 \*, D2 \* each have two separate single-stage magnification systems  
with pairwise different magnification for the two imaging paths B1 and B2.

The two pairs of single-stage magnification systems are in the Galilei-changers D1 \*, D2 \* pairs  
25 by 90 deg. twisted arranged.

By mechanical rotation of the Galilean changer D1 \*, D2 \* 90 deg. a of the imaging beam paths  
B1 and B2, substantially vertical axis of rotation R, a pair of single-stage magnification systems  
is selectively pivoted into the imaging beam paths B1 and B2.

This optional swinging a pair of the two pairs of single-stage magnification systems in the two  
30 imaging paths B1 and B2 causes a switch between exactly two optical imaging magnifications.

[0009]

Known from the prior art structure has the following disadvantages:

Firstly, the known from the prior art Galileo system (and also the exchange of eyepieces) in the  
35 lens C and the zoom system E 'of the stereomicroscope downstream imaging stage arranged  
which, due to the previous magnification through the zoom system e' are each an opposite the

lens system C reduced aperture and thus a smaller opening angle  $[\beta]_1$  and  $[\beta]_2$  has the imaging beam paths.

In a post-magnification through the Galileo system (or an exchange of eyepieces) now there is a danger that the respective opening angle of the imaging beam paths falls below the resolving power of the eye of an observer or a digital camera used by the additional magnification.

In this case we speak of an "empty magnification", since the generated image enlargement will not cause the recognition of detail and thus the object resolution.

Further, it comes at a post-magnification at this point due to the already over the lens C reduced aperture to a high brightness decrease.

[0010]

Another disadvantage of the prior art structure is that during switching a portion of the optically active components of the Galileo system D \* from the respective imaging beam path B1 or B2 is swung.

As a result, there will be no picture during switching.

Next, a construction volume of the stereo microscope using a Galilean system of the prior art will be substantially increased, since outside of the imaging beam paths B1 and B2, additional space must be provided for the pivoted out of the imaging beam paths B1 and B2 components of the Galileo system.

Task

[0011]

It is therefore an object of the present invention to provide an optical magnification changing system for the provision of exactly two optical imaging magnifications available, which has a simple and compact structure.

It is another object of the present invention to provide a microscope having an optical magnification changing system for providing exactly two optical imaging magnifications.

[0012]

The above object is achieved according to the invention by a change in optical magnification system with the features of the independent claim 1.

[0013]

Advantageous further developments are found in the dependent claims.

[0014]

According to the present invention, an optical magnification changing system for providing exactly two optical imaging magnifications disclosed wherein the magnification changing system includes three of an imaging beam path successively prevailed optical assemblies.

Thereby forming a first assembly of three modules with a fixed distance from a second component of the three modules is arranged, and a third module of the three modules being arranged between the first and second assemblies.

Further, the magnification changing system according to the invention includes positioning the third assembly comprising exactly two predetermined operating conditions.

The third assembly is arranged in a first of the two operating states with a predetermined first distance from the first assembly and located in a second of the two operating states, a predetermined second distance from the first assembly.

[0015]

As is clear from the different label "first distance" and "second distance" is the distance between the first middle third assembly from the outer first subassembly different from said second distance of the middle third of the outer assembly of the first assembly.

This is also absolutely necessary, otherwise no two different, clearly distinguishable image enlargements can be effected.

[0016]

Since the two arranged in the beam path external first and second components of the inventive tripartite optical system having a constant distance from each other, they establish the outer dimensions of the system fixed permanently.

This determination is made relative to the two first and second stationary outer assembly during a shift of the middle third assembly.

The fixed outer boundary allows a lightweight, compact and modular integration of the system in an optical setup such as a microscope or telescope.

[0017]

Further, the optical system according to the invention a particularly simple construction, since only the central third assembly is movable and the other outer first and second assemblies are stationary.

The structure is further simplified in that an exact positioning of the third assembly in the optical path is required only at two predetermined distances from the outer first subassembly and thus at two predetermined positions.

[0018]

A by a skilled person on the basis of his expert knowledge, readily to be carried out of the optical selection assembly, and distances used allows the system in each case has one of two desired predetermined imaging magnifications of a desired image quality in both predetermined  
5 distances of the average third assembly.

[0019]

It may be advantageous if the optical magnification changing system further comprises a permeated by the imaging beam path of the lens system, the first module between the second  
10 assembly and the lens system is arranged, and wherein said lens system having a positive refractive power.

[0020]

This arrangement of the inventive enlargement system immediately after the lens system allows  
15 a direct magnification of the lens system provided by the beam path.

Since the aperture and thus the aperture angle of the optical structure on the lens system is at a maximum, as a rule, in such an arrangement the risk of a "blank enlargement", that is, an enlargement, which leads to a not resolvable angle is small.

Further, in such an arrangement, the drop in brightness with the magnification associated with  
20 the magnifying system is minimal.

[0021]

To facilitate integration of the lens system, it may be advantageous, when the lens system having an object plane, which is imaged by the objective optical system for realizing an afocal interface  
25 to infinity.

[0022]

According to an embodiment may include two optical lens assemblies, the lens system includes at least, which are displaceable relative to each other to change a distance from an object plane  
30 of the lens system of the lens system.

[0023]

The so-realized Varioskop function allows an adaptation of a working distance between the lens system and an observed object.

35 [0024]

Further, it may be advantageous if a formed from the three modules of optical magnification switch having an image plane, which is imaged by magnifying switch to infinity, thereby forming a afocal interface.

[0025]

5

According to a preferred embodiment, the imaging beam path by setting the three components even during a change of the arrangement of the third subassembly between two predetermined first and second distances from said first assembly in succession.

[0026]

10

Thus, all three components are always arranged in the imaging beam path in accordance with this embodiment, during a displacement of the middle third assembly.

This tells the system an overall compact design, since outside the imaging beam path is no room for a shift of the middle third assembly must be provided.

15 Next always a picture is thus also obtained during a displacement of the middle third assembly.

[0027]

According to a further advantageous embodiment, the positioning means comprise a Verlagerer which shifts the third assembly in response to a respective operating state of the positioning  
20 between the two predetermined first and second distances from the first assembly.

[0028]

It can be advantageous if the Verlagerer shifts the third assembly by sliding translational movement along the imaging path relative to the first and second assemblies.

25 [0029]

The reason is that such a translational sliding motion can be realized structurally simple and miniature size.

Further allows a translatory sliding movement of a particularly rapid displacement of the middle  
30 third assembly between the predetermined first and second distances.

[0030]

According to a preferred embodiment may comprise a permeated by the imaging beam path of the zoom system with a variable imaging magnification, the magnification changing system  
35 further wherein the zoom system comprises at least two optical zoom assembly which are relatively movable, to change the imaging magnification of the zoom system variable.

[0031]

Thus, the first to fourth optical components and the optical zoom module are connected in series. This may optionally be disposed between the second assembly to the first assembly and the  
5 zoom system, or the first board between the second assembly and the zoom system.

[0032]

According to this embodiment, the three, the two optical imaging magnifications causing optical components of the magnification change in the system upstream of the zoom system and  
10 cooperating imaging magnifications along the imaging optical path multiplication, the zoom system in order to achieve a predetermined total magnification of the system may correspondingly simpler, that is, be designed with a smaller magnifying area.

[0033]

15 In this case, the variable imaging magnification of the zoom system may preferably be up to six times, preferably a maximum of five times, preferably more than four times and more preferably is three times.

[0034]

20 According to a particularly preferred embodiment, the first assembly and the second assembly each comprise an identical refractive power, and the third module may have a refractive power different from the refractive power of the first and second assemblies.

[0035]

25 In this case, it may be particularly advantageous when the power of the first and second assembly and the positive power of the third assembly is negative.

[0036]

Then the first and second module may preferably be a convex lens, respectively.

30 [0037]

Preferably may then have two identical concave lenses, the third assembly are spaced apart by a predetermined constant distance.

[0038]

35



It is known to the skilled person that, for all three modules depending on the requirements either normal lenses or cemented components can be used.

[0039]

- 5 According to one embodiment, the first and second module each have identical lenses, and the third module comprises two identical lenses.

[0040]

- By use of identical lenses of the construction and manufacture of the novel magnification  
10 changing system can be considerably simplified.

The identical lenses of the first and second optical assembly, for example, convex lenses and the lenses of the third identical assembly may be for example optical concave lenses.

[0041]

- 15 In one embodiment, be equal to a difference between the fixed distance between the first assembly and the second assembly and the first predetermined distance of the third module of the first module of the second predetermined distance of the third assembly of the first assembly.

[0042]

- 20 This has the result that an arrangement of the three components of the magnification change in the system in the first mode is symmetric to the arrangement of the three modules in the second operating state.

[0043]

- 25 In one embodiment, a first optical imaging magnification of the magnification change in the system equal to the reciprocal of a second optical imaging magnification of the magnification-varying system.

[0044]

- 30 Such a structure leads to the fact that the novel optical magnification system despite constructive another construction optically behaves like a Galilean changer.

[0045]

- According to a further embodiment may be greater in each case free diameter of the first  
35 assembly, the second assembly and third assembly each forming optical lens, as a maximum beam diameter of the lenses passing through in both operating modes the imaging beam path.

[0046]

Here, under free diameters are the diameters of the lenses be understood without the respective version of the lens.

- 5 This free diameter of each lens, for example 5%, but preferably 1% larger than the maximum beam diameter of each lens passing through the imaging beam path to be.

With such dimensions of the lenses, the three components do not limit the aperture of passing through it the imaging beam path and avoid an "empty" magnification.

[0047]

10

In one embodiment, the magnification changing system in a stereomicroscope, and preferably an operating microscope, and particularly preferably a digital integrated operating microscope.

[0048]

- 15 Such surgical microscopes are used for example in dental medicine use where frequent switching between two clearly distinguishable image magnifications is required.

[0049]

- 20 The above object is also achieved by a microscope comprising at least one of an imaging beam path interspersed lens system, an imaging system, which preferably comprises at least a pair of eyepieces and / or a stereo camera, and an optical magnification changing system according to one of claims 1 to 19.

[0050]

- 25 Hereinafter, preferred embodiments of the inventive optical magnification changing system will be described in detail.

Where the same or similar elements having the same or similar reference numerals in the figures are possible.

Show It

- 30 [0051]

Figure

1A, Figure

- 35 1B an imaging beam path through central components of the inventive optical magnification changing system according to a preferred embodiment,

[0052]

Figure

2A, 2B, 2C, FIGS

2D an imaging beam path through an embodiment in which the in Figures

5 1A and

1B shown structure is used,

[0053]

Figure

10 3A,

3B an imaging beam path by two embodiments in which the invention optical magnification changing system is integrated into a stereo microscope,

[0054]

15 Figure

4A, an imaging beam path by means of a stereo microscope having a magnification changing system of the prior art, and

[0055]

20 Figure

4B, Fig

4C are side views of the in Figure

4A shown in plan view magnification changing system.

Embodiment

25 [0056]

Figures

1A and

1B show an imaging beam path B by central components of the inventive optical magnification changing system according to a preferred embodiment.

[0057]

The illustrated embodiment of the inventive optical magnification changing system for providing exactly two different optical imaging magnifications is composed of three optical components

35 D1, D5 and D4.

The three optical components D1, D5 and D4 are penetrated by an outgoing from an object plane P imaging beam path B in sequence and together form an optical magnification switch D.

[0058]

- 5 It is at an outer first subassembly and an outer second component D1 D5 two identical convex lenses having the same positive refractive power, which are spaced apart at a fixed distance K.

In Figures

1A and

- 1B is the fixed distance K between the two outer first and second modules D1 and D5 defined by  
10 a common version H.

[0059]

- Arranged between the outer first and second components D1 and D5 D4 middle third assembly is formed in the shown embodiment, of two identical concave lenses D2 and D3, which are spaced  
15 apart at a predetermined constant distance K3.

Thus, the average D4 third assembly to a total negative refractive power.

[0060]

- Thereby respective free diameter of the first, second and third module D1, D4, D5 respectively  
20 forming lenses D1, D2, D3, D5 1% are greater than a maximum beam diameter of the lenses each passing through the imaging beam path to be.

D5 thus the aperture of the through passing the imaging beam path do not limit, the three components D1, D4,.

[0061]

25

As is clear from a comparison of FIGS

1A and

1B shows the central third unit D4 can be supplied with a first distance or a second distance K1 K2 of the first assembly spaced.

- 30 Be seen, the first distance is different from K1 while the second distance K2.

The two distances K1 and K2 are a function of the optical properties of the three components D1, D5, and D4 are so predetermined that the inventive zoom switch D each having a predetermined, preferably clearly distinguishable image magnification in the two predetermined positions of the middle third assembly D4 at the same time the magnification and working  
35 distance of the system are adjusted.

[0062]

For the arrangement of the middle third assembly D4 between the two outer modules D1 and D5, a positioning device G is provided.

These positioning means G has two operating states.

- 5 In a first operating state, the average D4 third module is spaced with the first spacing K1 and in the second operating state, with the second distance K2 from the outer first subassembly D1.  
[0063]

- 10 The displacement of the middle third assembly D4 is performed in the shown embodiment by means of a Verlagerer G1 of the positioning G. The Verlagerer G1 serves as a common mount for both the middle third assembly D4 forming concave lenses D2 and D3, and so sets the predetermined constant distance K3 between the two concave lenses D2 and D3 fixed.  
[0064]

- 15 In Figures 1A and 1B, the predetermined second spacing K2 of the third assembly of the first assembly D4 D1 equal to a difference between the fixed distance K and the predetermined first clearance C1.  
[0065]

- 20 This has the result that an arrangement of three modules D1, D5, D4, of the magnification D switch in the first operating state of the positioning device G is symmetrical to the arrangement of the three components D1, D5, D4, in the second operating condition of the positioning G.  
[0066]

- 25 Accordingly, a first optical imaging magnification  $[\gamma]$  is 1 in the case where the average third assembly D4 is spaced the first distance K1 from the first module D1, equal to the reciprocal value of a second optical imaging magnification  $[\gamma]$  2 for the case where the middle third assembly D4 is spaced the second distance from the first assembly K2 D1.  
30 [0067]

- The in Figures 1A and 1B illustrated arrangement of the outer first and second modules D1 and D5 at a constant  
35 distance from each other K it easy to integrate the novel optical magnification changing system in existing optical setups allowed.

Further, the system has a particularly simple construction, because only one optical assembly is displaceable.

[0068]

5 The in Figures 1A, Figure 1B shown embodiment of an inventive zoom switch D has the following system information:

EMI15.1

EMI16.1

[0069]

10

For  $K = 27\text{mm}$ ,  $25\text{mm}$  and  $K1 = K2 = 2\text{ mm}$  is obtained in this embodiment for the in Figure 1A shown first operating state in which the intermediate third assembly D4 is spaced apart from the first assembly by the first distance D1, K1, a magnification factor  $[\gamma] = 1.4$ .

For the in Figure

15 1B the second operating state shown in the middle third assembly D4 is spaced apart from the first module by the second distance D1, K2 there is a magnification factor  $[\gamma]_2 = 0.7$ .

The selectable magnification factors are thus clearly distinguishable.

[0070]

20 It is emphasized that the above system data are only exemplary and may be varied suitably. Although normal lenses have been used previously for all three modules D1, D5 and D4 of the optical magnification switch D, the two outer modules can D1 and D5 and / or the like, the average third module D4 also cemented components be realized.

[0071]

25

Figures

2A to Figure

2D show, respectively, an imaging beam path by various embodiments in which the in Figures 1A and

30 1B shown inventive optical magnification switch D is employed.

The H version is not specifically shown to increase the overview.

Also the positioning G 'is only in FIG

2C separately shown.

[0072]

35

Figures

2A and

2C show operating states, in which the average D4 third module is spaced with the distance K1 from the first outer module of the magnifying optical switch D D1.

Accordingly, Figures

5 2B and

2D operating states, in which the middle third assembly D4 is spaced with the distance K2 from the outer first subassembly D1.

[0073]

10 In Figure

Shown 2A, the optical magnification changing system can have next to the magnification switch D is a permeated with the imaging beam path B C lens system having positive refractive power.

In this case, the lens system C on the side of the object plane of the Figure

1A and

15 1B shown disposed magnification switch D, so that the first assembly is located between D1 and D5 of the second assembly of the lens system C.

[0074]

Such an arrangement causes the enlargement is effected by the enlargement switch D at a location of the optical structure on which the aperture and thus the maximum opening angle.

20 Thereby magnifying the risk of an empty and a brightness drop is kept low.

Thereby magnifying the risk of an empty and a brightness drop is kept low.

[0075]

As is clear from the comparison of FIGS

25 2A and

2C and

Figure

2B and

2D shows the three optical lens modules C1, C2 and C3 of the C lens system are movable relative to each other that a working distance A1, A2 of the objective plane P of the lens system C. adjustable.

30 relative to each other that a working distance A1, A2 of the objective plane P of the lens system C. adjustable.

Further takes place in the in FIGS

2A to Figure

2D illustrated embodiment, so that the lens system C comprises a depiction of the object plane P through the lens system C to infinity at a magnifying switch D side facing afocal interface.

35 through the lens system C to infinity at a magnifying switch D side facing afocal interface.

[0076]

The magnification switch D and the lens system C are shown in Figure 2A also shown enlarged, so that the optically effective surfaces 1 to 16 are more distinguishable. It is clear that it is C1 and C3 each constitute a cemented elements in the lens assemblies.

5 [0077]

In Figure

Shown 2A, facing away on a side of the object plane P in Figure

1A and

10 1B shown Enlargement switch D further be provided a permeated with the imaging beam path B zoom system e.

This includes using multiple relatively displaceable optical zoom modules E1, E2 and E3 to a variable variable magnification imaging.

[0078]

15

Due to the upstream switch, the variable magnification image magnification of the zoom system can be kept low and is in the in Figure

2A example shown  $\max \leq 3$

Such a low variable zoom magnification is sufficient because, B2 the picture enlargements complement multiplicative along the imaging beam path B1.

20

However, the variable image magnification of the zoom system can alternatively be, for example,  $\leq 4 \leq 5$  or  $\leq 6$  be.

[0079]

25 In Figure

2A indicated, also includes the zoom switch D is preferably an image plane, which is imaged to infinity.

Thus, the magnification switch D has an afocal interface, which facilitates its integration into modular optical systems.

30 [0080]

In Figures

2C and FIGS

2D is the positioning G 'is schematically shown.

35 In this case, the positioning G 'the Verlagerer G'1 at which the average third assembly D4 in dependence on a respective operating state of the positioning device G' by translational sliding



movement along said imaging light path B, relative to the outer first and second components D1 and D5 between the two predetermined first and second distances K1 and K2 are shifted from the first assembly D1.

To operate the Verlagerers G'1, the in Figure

5 2C shown positioning G 'a manually operable switch lever G'2 on.

Alternatively, the positioning G 'for actuating the Verlagerers G'1 for example also comprise an electric motor or the like.

[0081]

10 Such translational sliding motion can be realized particularly simple design and miniature size. further allows a translatory sliding movement of a particularly rapid displacement of the middle third assembly D4 between the predetermined first and second distances K1 and K2, and thus a more rapid switching between the two optical imaging magnifications.

[0082]

15

As is clear from a comparison of FIGS

2A to

2D can be seen passing through the imaging optical path B, all three components D1, D5, and D4 during a change of the arrangement of the third average unit D4 between two predetermined first and second distances K1 and K2 of the first outer module D1.

20

It follows that, not D4 comes with a shift of the middle third module D4 to a pivoting out of the middle third module from the imaging beam path B, the inventive structure is particularly compact.

Further, the third middle module D4 will always get a picture during a shift.

25

However, this image is out of focus, as a rule, while the middle third assembly D4 is spaced apart from the first or second distance K1 or K2 of the outer first subassembly D1.

[0083]

Refers to the focal length of lens system C by  $f$ , it is possible to in FIGS

30

2A to

2D embodiment shown an effective focal length  $F_1$ ,  $F_2$ ,  $F_3$ ,  $F_4$  from the enlargement of the switch D and the objective system C formed structure can be calculated as follows:  $F = f / [\gamma]$ .

[0084]

35

From this, the corresponding enlargement of the VO1 from the magnification switch D and the objective system C formed structure can be calculated as follows:  $VO1 = 250 / F = (250 / f)$  [gamma].

The value 250 corresponds to the normalized visual range of a magnifying glass in millimeters

[0085]

In the embodiment shown, the lens system for a variation of the working distance A1, A2, A1 = A2 = 200mm to 400mm is arranged, and has a extending between  $f = 271\text{mm}$  and  $f = 452\text{mm}$  changing focal length f.

[0086]

Thus, by means of the magnification switch D is the effective focal length F1, F2, F3, F4 of from the magnification switch D and the objective system C formed structure, for example, the working distance A1 = 200mm between F1 = 192mm and F2 = 384mm and corresponding enlargements are switched.

In this way, both the enlargement VO1 and a corresponding Field of view in the object plane P by a factor of two are switched.

[0087]

The in Figures

2A to Figure

2D illustrated embodiment of an inventive magnification changing system has without in Figure 2A zoom system additionally shown e the following system data:

EMI20.1

EMI21.1

[0088]

The for  $K = 27\text{mm}$ ,  $25\text{mm}$  and  $K1 = K2 = 2\text{ mm}$  resulting associated focal lengths, magnifications and fields of view are shown in the following tables:

EMI21.2

[0089]

When calculating the total magnification and field of vision a tube L with a focal length  $f_T$  was of a zoom system = 0.4 and = 2.4, = 170 and assumed eyepieces 10x/21.

[0090]

In the embodiment described above, the change in magnification of the zoom switch D further automatic adjustment of the object resolution and the stereo angle  $[\alpha]$  to the new size of the visual field.

5 [0091]

Even if the lens system described above C and the above-described zoom system E are each displaceable optical lenses or

Cemented have to cause a function or a variable Varioskop image magnification, it is  
10 alternatively or additionally also possible, instead of displaceable lenses or

Cemented elements, optical elements variable power to use.

[0092]

Figures

15 3A and

3B show an example of an imaging beam path by two embodiments in which the in Figures

1A and

1B magnification switch D shown is integrated in a stereo microscope.

[0093]

20

The stereomicroscope shown includes a lens system C, a zoom switch D, a zoom system E 'and a tube with an L eyepiece.

Here, the lens system C and the magnification switches have the D in Figures

2A to

25 2D shown on construction.

[0094]

In which in Figures

3A and

30 3B shown zoom system E 'are ray paths B1 and B2 of the imaging beam path B, which in the object plane P is the stereo angle  $[\alpha]$  Include, unlike from that in Figure

2A shown Zoom E system managed by separate optical elements.

[0095]

35 The zoom system E 'has zoom assemblies E'1, E'2, E'3 and E'4 or E'5, E'6, E'7 and E'8 on.

Here are the zoom assemblies E'2, E'3 or  
 E'6, E'7 relative to the zoom assembly E'1, E'4 or  
 E'5, E'8 displaceable to effect a variable imaging magnification of the optical paths B1 and B2.  
 [0096]

5

Also in the tube of the L in Figures  
 3A and

3B shown stereomicroscope, the beam paths B1 and B2 of the imaging beam path B out  
 separately.

10 For this purpose, the tube including L eyepiece suitable lenses L1, L4, L5, L6, L7, L10, L11,  
 L12 and prisms L2, L3, L8, L9 on.  
 [0097]

The in Figures

15

3A and  
 3B shown Stereo microscopes differ from each other only in that in Figure

3A B is intended for both beam paths B1 and B2 of the imaging beam path, a common  
 magnification switch D, whereas the beam paths B1 and B2 of the imaging beam path B in  
 Figure

20 3B are performed in the magnification switch D 'separately.

For this purpose, the zoom switch D 'in each beam path B1 or

B2 pairs identical optical modules D'1 to D'10.

The structure of the magnification switch D 'for each beam path B1 and B2 corresponds to the  
 structure of the in Figure

25

1A and  
 1B shown Enlargement switch D. In this case, corresponding to identical optical assemblies D'1  
 and D'6 of the first outer assembly that identical optical modules D'5 and D'10 of the outer  
 assembly and the second identical optical modules D'2, D'3 and D'7, D'8 of the middle third  
 assembly of the magnification switch D '.

30 Further, the optical assemblies D'2, D'3 and D'7, D'8 is mechanically coupled in the shown  
 embodiment, so that a displacement of the optical components D'2, D'3 and D'7 D'8 together  
 takes place.

[0098]

35 As is apparent from Figure

3A and

3B can be seen, the magnification switch D, D' and the respective zoom system E' is preferably connected in series, so that the quoted figure caused enlargements multiplicative.

[0099]

5 Even when the enlargement switch D, D' in FIGS

3A and

3B is in each case arranged between the lens system and the zoom system E C', the present invention is not limited to this order of arrangement.

10 Rather, the zoom system E' between the enlargement switch D, D', and the lens system C is arranged (not specifically shown).

Further, in the zoom system (as well as in the in Figure

3A shown Enlargement switch D) optionally both beam paths of the imaging beam path are routed together.

15 In this case, the zoom system zoom module with a correspondingly large diameter (not specifically shown).

[0100]

Such stereo microscopes are used for example in dental medicine as a surgical microscopes use.

20 Especially when used as a surgical microscope brings realized with the inventive optical magnification change system, fast switching between two clearly distinguishable optical imaging magnifications considerable advantages since so a doctor can quickly switch between a view of an operating environment and an enlarged range of operation.

[0101]

25 Of course, it may also optionally be a digital operation microscope in which the viewed object plane is mapped onto one or more image sensors.

Claims

1. Optical magnification changing system for the provision of exactly two optical imaging magnifications, the magnification changing system comprises three of an imaging beam path (B) are successively set by optical components (D1, D5, D4),  
 5 wherein a first module (D1) of the three components (D1, D5, D4) with a fixed distance (K) of a second assembly (D5) of the three components (D1, D5, D4) is arranged, wherein a third assembly (D4), the three assemblies (D1, D5, D4) is arranged between the first and second assemblies (D1, D5), and  
 10 said magnification changing system includes a positioning means (G) for the third subassembly (D4), which has exactly two predetermined operating conditions, wherein in a first of the two operating states of the third subassembly (D4) having a predetermined first distance (C1) from the first module (D1) is arranged in a second of the two operating states of the third subassembly (D4) having a predetermined second distance  
 15 (K2 ) from the first module (D1) is arranged.
2. Optical magnification changing system of claim 1, further comprising of the imaging beam path (B) interspersed lens system (C), wherein the first module (D1) between the second subassembly (D5) and the lens system (C) is arranged, and wherein the lens system (C)  
 20 having a positive refractive power.
3. Optical magnification changing system according to claim 2, wherein the lens system (C) an object plane (P) which is imaged by the lens system (C) to infinity.
- 25 4. Optical magnification changing system according to claim 2 or 3, wherein the lens system (C) comprises at least two optical lens assemblies (C1, C2, C3) which are relatively displaceable, by a distance (A1, A2) of an object plane (P) of the objective system (C) of the lens system (C) to change.
- 30 5. Optical magnification changing system according to one of the preceding claims, wherein one of the three modules (D1, D5, D4) formed magnifying optical switch (D) having an image plane which is imaged by magnifying switch (D) to infinity.
- 35 6. Optical magnification changing system according to one of the preceding claims, in which the imaging beam path (B) of all three modules (D1, D5, D4) during a change of the

arrangement of the third subassembly (D4) between the predetermined first and second distances (K1, K2) of the first module (D1) passing through in succession.

- 5 7. Optical magnification changing system according to one of the preceding claims, wherein the positioning means (G) comprises a Verlagerer (G1) of the third subassembly (D4) in dependence on a respective operating state of the positioning means (G) between the two predetermined first and second distances (K1, K2) of the first module (D1) is moved.
- 10 8. Optical magnification changing system in claim 7, wherein the Verlagerer (G1) shifts the third assembly (D4) by sliding translational movement along the imaging beam path (B) relative to the first and second assemblies (D1, D5).
- 15 9. Optical magnification changing system according to one of the preceding claims, further comprising one of the imaging beam path (B) is reacted zoom system (E) having a variable imaging magnification, the zoom system (E) comprises at least two optical zoom module (E1, E2, E3), which relative to each other are movable, to change the imaging magnification of the zoom system (E) is variable.
- 20 10. Optical magnification changing system according to claim 9, wherein the variable imaging magnification of the zoom system (E) is up to six times, preferably a maximum of five times, preferably more than four times and more preferably three fold.
- 25 11. Optical magnification changing system according to one of the preceding claims, wherein the first module (D1) and the second subassembly (D5) in each case have identical refractive power, and the third subassembly (D4) has a refractive power different from the refractive power of the first and second assemblies (D1, D5).
- 30 12. Optical magnification changing system of claim 11, wherein the refractive power of the first and second assemblies (D1, D5), and the positive refractive power of the third subassembly (D4) is negative.
13. Optical magnification changing system of claim 11 or 12, wherein the first and second assembly (D1, D5) is a convex lens, respectively.

14. Optical magnification changing system of claim 11, 12 or 13, wherein the third module (D 4) comprises two identical concave lenses (D2, D3) separated from each other by a predetermined constant distance (K3) are spaced apart.
- 5 15. Optical magnification changing system of claim 11, 12 or 13, wherein the first and second assembly (D1, D5) are in each case identical lenses, and herein the third module (D 4) comprises two identical lenses (D2, D3).
- 10 16. Optical magnification changing system according to one of the preceding claims, wherein said predetermined second distance (L2) of the third subassembly (D4) of the first module (D1) equal to a difference between the fixed distance (K) between the first module (D1) and said second module (D5) and the predetermined first clearance (C1) of the third subassembly (D4) of the first module (D1).
- 15 17. Optical magnification changing system according to one of the preceding claims, wherein a. first optical imaging magnification ( $[\gamma] 1$ ) of the magnification changing system is equal to the reciprocal value of a second optical imaging magnification ( $[\gamma] 2$ ) of the magnification-varying system.
- 20 18. Optical magnification changing system according to one of the preceding claims, wherein said free diameter of the first module (D1), the second subassembly (D5) and the third subassembly (D4) in each case forming optical lenses (D1, D2, D3, D5) are in each case greater than a maximum beam diameter of the lenses (D1, D4, D5) that traverse the two operating states imaging beam path.
- 25 19. Optical magnification changing system according to one of the preceding claims, wherein said magnification changing system, a surgical microscope, and more preferably a digital operation microscope is integrated in a stereo microscope and are preferred.
- 30 20. Microscope, comprising at least one of an imaging beam path interspersed lens system and an imaging system, which preferably comprises at least a pair of eyepieces and / or a stereo camera, characterized in that the microscope further comprises an optical magnification changing system according to one of claims 1 to 19.



**Abstract**

5 An optical image enlargement system has three optical modules (D1,D5,D4) in the enlargement variation system. And a first module (D1) has a fixed spacing (K) from a second module (D5) and a third module (D4) is between first and second modules (D1,D5).The enlargement variation system has a positioning device (G) for the third module (D4) arranged with a given first spacing (K1) from the first module (D1) in a first of the two working states. An independent claim is included for a microscope having an objective system and an imaging system.



(19)  
Bundesrepublik Deutschland  
Deutsches Patent- und Markenamt

(10) DE 10 2005 050 171 A1 2007.04.26

(12)

## Offenlegungsschrift

(21) Aktenzeichen: 10 2005 050 171.0

(22) Anmeldetag: 19.10.2005

(43) Offenlegungstag: 26.04.2007

(51) Int. Cl.: G02B 21/02 (2006.01)

(71) Anmelder:

Carl Zeiss Surgical GmbH, 73447 Oberkochen, DE

(74) Vertreter:

Diehl & Partner GbR, 80333 München

(72) Erfinder:

Strähle, Fritz, Dr., 73540 Heubach, DE; Hauger, Christoph, Dr., 73431 Aalen, DE

(56) Für die Beurteilung der Patentfähigkeit in Betracht gezogene Druckschriften:

DE 12 82 314 A5

US 63 92 816 B1

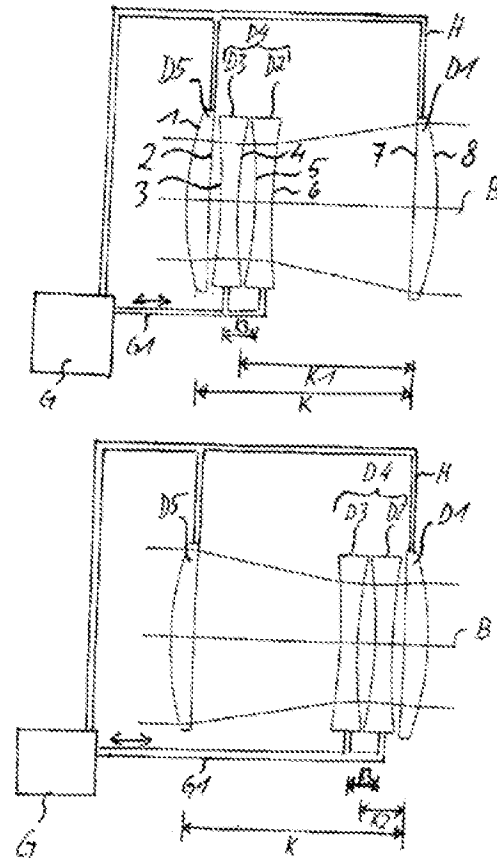
US 62 39 920 B1

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gemäß § 44 PatG ist gestellt.

(54) Bezeichnung: **Optisches Vergrößerungsänderungssystem zur Bereitstellung von optischen Abbildungsvergrößerungen und Mikroskop mit einem solchen**

(57) Zusammenfassung: Die vorliegende Erfindung offenbart ein optisches Vergrößerungsänderungssystem zur Bereitstellung von optischen Abbildungsvergrößerungen und ein Mikroskop, insbesondere ein Stereo-Operationsmikroskop, mit einem solchen Vergrößerungsänderungssystem. Das Vergrößerungsänderungssystem umfaßt drei von einem Abbildungsstrahlengang (B) nacheinander durchsetzte optische Baugruppen (D1, D5, D4), wobei eine erste Baugruppe (D1) der drei Baugruppen (D1, D5, D4) mit einem festen Abstand (K) von einer zweiten Baugruppe (D5) der drei Baugruppen (D1, D5, D4) angeordnet ist, wobei eine dritte Baugruppe (D4) der drei Baugruppen (D1, D5, D4) zwischen der ersten und der zweiten Baugruppe (D1, D5) angeordnet ist und wobei das Vergrößerungsänderungssystem eine Positioniereinrichtung (G) für die dritte Baugruppe (D4) umfaßt, welche genau zwei vorbestimmte Betriebszustände aufweist, wobei in einem ersten der beiden Betriebszustände die dritte Baugruppe (D4) mit einem vorbestimmten ersten Abstand (K1) von der ersten Baugruppe (D1) angeordnet ist und in einem zweiten der beiden Betriebszustände die dritte Baugruppe (D4) mit einem vorbestimmten zweiten Abstand (K2) von der ersten Baugruppe (D1) angeordnet ist.



## Beschreibung

[0001] Die vorliegende Erfindung betrifft ein optisches Vergrößerungsänderungssystem zur Bereitstellung von optischen Abbildungsvergrößerungen und ein Mikroskop, insbesondere ein Stereo-Operationsmikroskop mit einem solchen.

[0002] Derartige Vergrößerungsänderungssysteme sind aus dem Stand der Technik insbesondere im Zusammenhang mit Stereomikroskopen bekannt, um insbesondere zwischen einer ersten optischen Abbildungsvergrößerung, welche beispielsweise eine Übersicht über eine betrachtete Objektebene erlaubt, und einer zweiten Abbildungsvergrößerung, welche beispielsweise einen vergrößerten Ausschnitt dieser Objektebene mit entsprechend erhöhter Detaillierbarkeit zeigt, umzuschalten. Dabei ist es für eine hohe Benutzerakzeptanz des Vergrößerungsänderungssystems erforderlich, daß die Umschaltung einfach und schnell erfolgt.

## Stand der Technik

[0003] Hierfür ist es bei einem Stereomikroskop zum einen bekannt, einen Objektiv- oder Okularwechsel durchzuführen, um zwischen zwei Vergrößerungen umzuschalten. So erhöht sich beispielsweise bei einem Austausch eines Okulars 10x durch ein Okular 12.5x die Gesamtvergrößerung durch die so bewirkte Nachvergrößerung im gesamten Vergrößerungsbereich linear um 25%.

[0004] Alternativ ist es bekannt, zwischen einem Zoomsystem und einem Tubus eines Okularsystems eines Stereomikroskops ein Galilei-System vorzusehen. Dies ist in den Fig. 4A, 4B und 4C schematisch gezeigt.

[0005] Dabei sind in Fig. 4A zwei von einer Objektebene P ausgehende Abbildungsstrahlengänge B1 und B2, welche in der Objektebene P einen Stereowinkel  $\alpha$  einschließen, getrennt dargestellt.

[0006] Wie in Fig. 4A gezeigt, weist das aus dem Stand der Technik bekannte Stereomikroskop entlang der von der Objektebene P ausgehenden Abbildungsstrahlengänge B1 und B2 zunächst ein Objektivsystem C auf, welches von den Abbildungsstrahlengängen B1 und B2 gemeinsam durchlaufen wird. Nach dem Durchlaufen des Objektivsystems C werden die beiden Abbildungsstrahlengänge B1 und B2 getrennt in einem optischen Zoomsystem E' geführt. Zwischen dem Zoomsystem E' und einem für die beiden Abbildungsstrahlengänge B1 und B2 getrennt vorgesehenen Tubus L ist ein Galilei-System D\* in Form zweier Galilei-Wechsler D1\*, D2\* angeordnet.

[0007] Die Fig. 4B und 4C zeigen Seitenansichten der in Fig. 4A in Aufsicht gezeigten Galilei-Wechsler D1\*, D2\*. Dabei zeigt Fig. 4B eine Seitenansicht in Richtung der Abbildungsstrahlengänge B1, B2 und Fig. 4C eine Seitenansicht quer zu den Abbildungsstrahlengängen B1, B2.

[0008] Die Galilei-Wechsler D1\*, D2\* weisen für die beiden Abbildungsstrahlengänge B1 und B2 jeweils zwei getrennte einstufige Vergrößerungssysteme mit paarweise unterschiedlicher Vergrößerung auf. Die beiden Paare einstufiger Vergrößerungssysteme sind in den Galilei-Wechslern D1\*, D2\* jeweils paarweise um 90° verdreht angeordnet. Durch mechanische Drehung der Galilei-Wechsler D1\*, D2\* um 90° um eine zu den Abbildungsstrahlengängen B1 und B2 im wesentlichen senkrechte Drehachse R wird ein Paar der einstufigen Vergrößerungssysteme wahlweise in die Abbildungsstrahlengänge B1 und B2 eingeschwenkt. Dieses wahlweise Einschwenken eines Paares der zwei Paare von einstufigen Vergrößerungssystemen in die beiden Abbildungsstrahlengänge B1 und B2 bewirkt eine Umschaltung zwischen genau zwei optischen Abbildungsvergrößerungen.

[0009] Der aus dem Stand der Technik bekannte Aufbau weist die folgenden Nachteile auf:

Zum einen ist das aus dem Stand der Technik bekannte Galilei-System (und auch ein Austausch von Okularen) in einer dem Objektiv C und dem Zoomsystem E' des Stereomikroskops nachgelagerten Abbildungsstufe angeordnet, welche aufgrund der vorangegangenen Vergrößerung durch das Zoomsystem E' jeweils eine gegenüber dem Objektivsystem C verkleinerte Apertur und damit einen verkleinerten Öffnungswinkel  $\beta_1$  bzw.  $\beta_2$  der Abbildungsstrahlengänge aufweist. Bei einer Nachvergrößerung durch das Galilei-System (oder einem Austausch von Okularen) besteht nun die Gefahr, daß der jeweilige Öffnungswinkel der Abbildungsstrahlengänge nach der Nachvergrößerung das Auflösungsvermögen eines Auges eines Betrachters oder einer verwendeten Digitalkamera unterschreitet. In diesem Fall spricht man von einer "leeren Vergrößerung", da die erzielte Abbildungsvergrößerung keine Erhöhung der Detaillierbarkeit und damit der Objektauflösung bewirkt. Weiter kommt es bei einer Nachvergrößerung an dieser Stelle aufgrund der bereits gegenüber dem Objektiv C verkleinerten Apertur zu einem hohen Helligkeitsabfall.

[0010] Ein weiterer Nachteil des vorbekannten Aufbaues ist, daß während eines Umschaltens ein Teil der optisch wirksamen Bauelemente des Galilei-Systems D\* aus dem jeweiligen Abbildungsstrahlengang B1 bzw. B2 herausgeschwenkt wird. In der Folge findet während des Umschaltens keine Abbildung statt. Weiter wird ein Bauvolumen des Stereomikroskops bei Verwendung eines Galilei-Systems nach dem Stand der Technik erheblich vergrößert, da außerhalb der Abbildungsstrahlengänge B1 und B2 zusätzlicher Raum für die aus den Abbildungsstrahlengängen B1 und B2 herausgeschwenkten Bauelemente des Galilei-Systems bereitgestellt werden muß.

#### Aufgabenstellung

[0011] Es ist daher Aufgabe der vorliegenden Erfindung ein optisches Vergrößerungsänderungssystem zur Bereitstellung von genau zwei optischen Abbildungsvergrößerungen zur Verfügung zu stellen, welches einen einfachen und kompakten Aufbau aufweist. Weiter ist es Aufgabe der vorliegenden Erfindung, ein Mikroskop bereitzustellen, welches ein optisches Vergrößerungsänderungssystem zur Bereitstellung von genau zwei optischen Abbildungsvergrößerungen aufweist.

[0012] Die vorstehende Aufgabe wird erfindungsgemäß durch ein optisches Vergrößerungsänderungssystem mit den Merkmalen des unabhängigen Anspruchs 1 gelöst.

[0013] Vorteilhafte Weiterbildungen finden sich in den Unteransprüchen.

[0014] Gemäß der vorliegenden Erfindung wird ein optisches Vergrößerungsänderungssystem zur Bereitstellung von genau zwei optischen Abbildungsvergrößerungen offenbart, wobei das Vergrößerungsänderungssystem drei von einem Abbildungsstrahlengang nacheinander durchsetzte optische Baugruppen umfaßt. Dabei ist eine erste Baugruppe der drei Baugruppen mit einem festen Abstand von einer zweiten Baugruppe der drei Baugruppen angeordnet, und eine dritte Baugruppe der drei Baugruppen ist zwischen der ersten und der zweiten Baugruppe angeordnet. Weiter umfaßt das erfindungsgemäße Vergrößerungsänderungssystem eine Positioniereinrichtung für die dritte Baugruppe, welche genau zwei vorbestimmte Betriebszustände aufweist. Dabei ist die dritte Baugruppe in einem ersten der beiden Betriebszustände mit einem vorbestimmten ersten Abstand von der ersten Baugruppe angeordnet und in einem zweiten der beiden Betriebszustände mit einem vorbestimmten zweiten Abstand von der ersten Baugruppe angeordnet.

[0015] Wie sich bereits aus der unterschiedlichen Bezeichnung "erster Abstand" und "zweiter Abstand" ergibt, ist der erste Abstand der mittleren dritten Baugruppe von der äußeren ersten Baugruppe unterschiedlich zu dem zweiten Abstand der mittleren dritten Baugruppe von der äußeren ersten Baugruppe. Dies ist auch zwingend erforderlich, da sonst keine zwei unterschiedlichen und damit deutlich unterscheidbaren Abbildungsvergrößerungen bewirkt werden können.

[0016] Da die beiden im Strahlengang angeordneten äußeren ersten und zweiten Baugruppen des erfindungsgemäßen dreigliedrigen optischen Systems zueinander einen konstanten Abstand aufweisen, legen sie die äußeren Abmessungen des Systems dauerhaft fest. Diese Festlegung bleibt auch während einer Verlagerung der mittleren dritten Baugruppe relativ zu den beiden feststehenden äußeren ersten und zweiten Baugruppen bestehen. Die feststehende äußere Begrenzung erlaubt eine leichte, kompakte und modulare Integration des Systems in einen optischen Aufbau wie beispielsweise ein Mikroskop oder Fernrohr.

[0017] Weiter weist das erfindungsgemäße optische System einen besonders einfachen Aufbau auf, da lediglich die mittlere dritte Baugruppe verlagerbar ist und die übrigen äußeren ersten und zweiten Baugruppen ortsfest sind. Der Aufbau wird weiter dadurch vereinfacht, daß eine genaue Positionierung der dritten Baugruppe im Strahlengang lediglich an zwei vorgegebenen Abständen von der äußeren ersten Baugruppe und damit an zwei vorgegebenen Positionen erforderlich ist.

[0018] Eine durch einen Fachmann anhand seines Fachwissens ohne weiteres vorzunehmende Wahl der verwendeten optischen Baugruppen und Abstände ermöglicht es, daß das System in beiden vorgegebenen Abständen für die mittlere dritte Baugruppe jeweils eine von zwei gewünschten vorgegebenen Abbildungsvergrößerungen mit einer gewünschten Abbildungsqualität aufweist.

[0019] Es kann vorteilhaft sein, wenn das optische Vergrößerungsänderungssystem ferner ein von dem Abbildungsstrahlengang durchsetztes Objektivsystem umfaßt, wobei die erste Baugruppe zwischen der zweiten Baugruppe und dem Objektivsystem angeordnet ist und wobei das Objektivsystem eine positive Brechkraft aufweist.

[0020] Diese Anordnung des erfindungsgemäßen Vergrößerungssystems direkt nach dem Objektivsystem erlaubt eine direkte Vergrößerung des vom Objektivsystem bereitgestellten Strahlenganges. Da am Objektivsystem die Apertur und damit der Öffnungswinkel des optischen Aufbaus in der Regel maximal ist, ist bei einer derartigen Anordnung die Gefahr einer "leeren Vergrößerung", das heißt einer Vergrößerung, welche zu einem nicht mehr auflösbaren Öffnungswinkel führt, gering. Weiter ist bei einer derartigen Anordnung der mit der Vergrößerung durch das Vergrößerungssystem verbundene Helligkeitsabfall minimal.

[0021] Um die Einbindung des Objektivsystems zu erleichtern, kann es vorteilhaft sein, wenn das Objektivsystem eine Objektebene aufweist, welche von dem Objektivsystem zur Realisierung einer afokalen Schnittstelle nach Unendlich abgebildet wird.

[0022] Gemäß einer Ausführungsform kann das Objektivsystem wenigstens zwei optische Objektiv-Baugruppen umfassen, welche relativ zueinander verlagerbar sind, um einen Abstand einer Objektebene des Objektivsystems von dem Objektivsystem zu ändern.

[0023] Die so realisierte Varioskop-Funktion erlaubt eine Anpassung eines Arbeitsabstandes zwischen Objektivsystem und einem betrachteten Objekt.

[0024] Weiter kann es vorteilhaft sein, wenn ein aus den drei Baugruppen gebildeter optischer Vergrößerungsschalter eine Bildebene aufweist, welche von dem Vergrößerungsschalter nach Unendlich abgebildet wird und so eine afokale Schnittstelle bildet.

[0025] Gemäß einer bevorzugten Ausführungsform kann der Abbildungsstrahlengang alle drei Baugruppen auch während einer Änderung der Anordnung der dritten Baugruppe zwischen den beiden vorbestimmten ersten und zweiten Abständen von der ersten Baugruppe nacheinander durchsetzen.

[0026] Somit sind alle drei Baugruppen gemäß dieser Ausführungsform auch während einer Verlagerung der mittleren dritten Baugruppe immer im Abbildungsstrahlengang angeordnet. Hierdurch weist das System insgesamt eine kompakte Bauform auf, da außerhalb des Abbildungsstrahlenganges kein Raum für eine Verlagerung der mittleren dritten Baugruppe bereitgestellt werden muß. Weiter wird so auch während einer Verlagerung der mittleren dritten Baugruppe immer eine Abbildung erhalten.

[0027] Gemäß einer weiteren vorteilhaften Ausführungsform kann die Positioniereinrichtung einen Verlagerer aufweisen, der die dritte Baugruppe in Abhängigkeit von einem jeweiligen Betriebszustand der Positioniereinrichtung zwischen den beiden vorbestimmten ersten und zweiten Abständen von der ersten Baugruppe verlagert.

[0028] Dabei kann es Vorteile bringen, wenn der Verlagerer die dritte Baugruppe durch translatorische Schiebebewegung entlang des Abbildungsstrahlenganges relativ zu der ersten und zweiten Baugruppe verlagert.

[0029] Der Grund ist, dass eine derartige translatorische Schiebebewegung konstruktiv einfach und mit kleinem Bauvolumen realisiert werden kann. Weiter erlaubt eine translatorische Schiebebewegung eine besonders schnelle Verlagerung der mittleren dritten Baugruppe zwischen den vorbestimmten ersten und zweiten Abständen.

[0030] Gemäß einer bevorzugten Ausführungsform kann das Vergrößerungsänderungssystem ferner ein von dem Abbildungsstrahlengang durchsetztes Zoomsystem mit variabler Abbildungsvergrößerung umfassen, wobei das Zoomsystem wenigstens zwei optische Zoom-Baugruppen umfaßt, welche relativ zueinander verlagerbar sind, um die Abbildungsvergrößerung des Zoomsystems variabel zu ändern.

[0031] Somit sind die ersten bis vierten optischen Baugruppen und die optischen Zoom-Baugruppen in Reihe geschaltet. Dabei kann wahlweise die zweite Baugruppe zwischen der ersten Baugruppe und dem Zoomsystem oder die erste Baugruppe zwischen der zweiten Baugruppe und dem Zoomsystem angeordnet sein.

[0032] Da gemäß dieser Ausführungsform die drei die beiden optischen Abbildungsvergrößerungen bewirkenden optischen Baugruppen des Vergrößerungsänderungssystems dem Zoomsystem vorgeschaltet sind und die Abbildungsvergrößerungen entlang des Abbildungsstrahlenganges multiplikativ zusammenwirken, kann das Zoomsystem zur Erzielung einer vorgegebenen Gesamtvergrößerung des Systems entsprechend einfacher, das heißt mit einem kleineren Vergrößerungsbereich ausgestaltet sein.

- [0033] In diesem Fall kann die variable Abbildungsvergrößerung des Zoomsystems vorzugsweise maximal sechsfach, vorzugsweise maximal fünffach, bevorzugt maximal vierfach und besonders bevorzugt dreifach sei.
- [0034] Gemäß einer besonders bevorzugten Ausführungsform können die erste Baugruppe und die zweite Baugruppe jeweils eine gleiche Brechkraft aufweisen, und kann die dritte Baugruppe eine Brechkraft aufweisen, die unterschiedlich zu der Brechkraft der ersten und zweiten Baugruppe ist.
- [0035] In diesem Fall kann es besonders vorteilhaft sein, wenn die Brechkraft der ersten und zweiten Baugruppe positiv und die Brechkraft der dritten Baugruppe negativ ist.
- [0036] Bevorzugt kann dann die erste und zweite Baugruppe jeweils eine Konvexlinse sein.
- [0037] Vorzugsweise kann dann die dritte Baugruppe zwei identische Konkavlinsen aufweisen, die voneinander mit einem vorgegebenen gleichbleibenden Abstand beabstandet sind.
- [0038] Es ist dem Fachmann ohne weiteres bekannt, dass für alle drei Baugruppen je nach Anforderung wahlweise normale Linsen oder auch Kittglieder verwendet werden können.
- [0039] Gemäß einer Ausführungsform sind die erste und zweite Baugruppe jeweils identische Linsen, und weist die dritte Baugruppe zwei identische Linsen auf.
- [0040] Durch Verwendung identischer Linsen können der Aufbau und die Herstellung des erfindungsgemäßen Vergrößerungsänderungssystems erheblich vereinfacht werden. Dabei können die identischen Linsen der ersten und zweiten Baugruppe beispielsweise optische Konvexlinsen und die identischen Linsen der dritten Baugruppe beispielsweise optische Konkavlinsen sein.
- [0041] Gemäß einer Ausführungsform kann der vorbestimmte zweite Abstand der dritten Baugruppe von der ersten Baugruppe gleich einer Differenz zwischen dem festen Abstand zwischen der ersten Baugruppe und der zweiten Baugruppe und dem vorbestimmten ersten Abstand der dritten Baugruppe von der ersten Baugruppe sein.
- [0042] Dies hat zur Folge, dass eine Anordnung der drei Baugruppen des Vergrößerungsänderungssystems im ersten Betriebszustand symmetrisch zu der Anordnung der drei Baugruppen im zweiten Betriebszustand ist.
- [0043] Gemäß einer Ausführungsform kann eine erste optische Abbildungsvergrößerung des Vergrößerungsänderungssystems gleich dem Kehrwert einer zweiten optischen Abbildungsvergrößerung des Vergrößerungsänderungssystems sein.
- [0044] Ein derartiger Aufbau führt dazu, daß sich das erfindungsgemäße optische Vergrößerungssystem trotz konstruktiv anderen Aufbaus optisch wie ein Galilei-Wechsler verhält.
- [0045] Gemäß einer weiteren Ausführungsform können freie Durchmesser von die erste Baugruppe, die zweite Baugruppe und die dritte Baugruppe jeweils bildenden optischen Linsen jeweils größer sein, als ein maximaler Strahlbündeldurchmesser des die Linsen in beiden Betriebszuständen durchsetzenden Abbildungsstrahlengangs.
- [0046] Dabei sollen unter freien Durchmessern die Durchmesser der Linsen ohne die jeweilige Fassung der Linse verstanden werden. Dieser freie Durchmesser der jeweiligen Linse kann beispielsweise 5%, bevorzugt jedoch 1% größer als der maximale Strahlbündeldurchmesser des die jeweilige Linse durchsetzenden Abbildungsstrahlengangs sein. Bei einer derartigen Dimensionierung der Linsen begrenzen die drei Baugruppen die Apertur des sie durchsetzenden Abbildungsstrahlengangs nicht und vermeiden so eine "leere" Vergrößerung.
- [0047] Gemäß einer Ausführungsform kann das Vergrößerungsänderungssystem in ein Stereomikroskop und bevorzugt ein Operationsmikroskop und besonders bevorzugt ein digitales Operationsmikroskop integriert sein.
- [0048] Derartige Operationsmikroskope finden beispielsweise in der Dentalmedizin Verwendung, wo eine häufige Umschaltung zwischen zwei deutlich unterscheidbaren Abbildungsvergrößerungen erforderlich ist.
- [0049] Die vorstehende Aufgabe wird auch durch ein Mikroskop gelöst, das wenigstens ein von einem Abbil-

dungsstrahlengang durchsetztes Objektivsystem, ein bildgebendes System, welches vorzugsweise wenigstens ein Paar von Okularen und/oder eine Stereokamera umfasst, sowie ein optisches Vergrößerungsänderungssystem nach einem der Ansprüche 1 bis 19 aufweist.

[0050] Im Folgenden werden bevorzugte Ausführungsformen des erfindungsgemäßen optischen Vergrößerungsänderungssystems detailliert beschrieben. Soweit möglich sind in den Figuren gleiche oder ähnliche Elemente mit den gleichen oder ähnlichen Bezugszeichen versehen. Dabei zeigen

[0051] Fig. 1A, Fig. 1B einen Abbildungsstrahlengang durch zentrale Baugruppen des erfindungsgemäßen optischen Vergrößerungsänderungssystems gemäß einer bevorzugten Ausführungsform,

[0052] Fig. 2A, Fig. 2B, Fig. 2C, Fig. 2D einen Abbildungsstrahlengang durch eine Ausführungsform, in welcher der in den Fig. 1A und Fig. 1B gezeigte Aufbau Verwendung findet,

[0053] Fig. 3A, Fig. 3B einen Abbildungsstrahlengang durch zwei Ausführungsformen, in denen das erfindungsgemäße optische Vergrößerungsänderungssystem in ein Stereomikroskop integriert ist,

[0054] Fig. 4A, einen Abbildungsstrahlengang durch ein Stereomikroskop, welches ein Vergrößerungsänderungssystem nach dem Stand der Technik aufweist, und

[0055] Fig. 4B, Fig. 4C Seitenansichten des in Fig. 4A in Aufsicht gezeigten Vergrößerungsänderungssystems.

#### Ausführungsbeispiel

[0056] Die Fig. 1A und Fig. 1B zeigen einen Abbildungsstrahlengang B durch zentrale Baugruppen des erfindungsgemäßen optischen Vergrößerungsänderungssystems gemäß einer bevorzugten Ausführungsform.

[0057] Die gezeigte Ausführungsform des erfindungsgemäßen optischen Vergrößerungsänderungssystems zur Bereitstellung von genau zwei unterschiedlichen optischen Abbildungsvergrößerungen setzt sich aus drei optischen Baugruppen D1, D5 und D4 zusammen. Die drei optischen Baugruppen D1, D5 und D4 werden von einem von einer Objektebene P ausgehenden Abbildungsstrahlengang B nacheinander durchsetzt und bilden zusammen einen optischen Vergrößerungsschalter D.

[0058] Dabei handelt es sich bei einer äußeren ersten Baugruppe D1 und einer äußeren zweiten Baugruppe D5 um zwei identische Konvexlinsen mit gleicher positiver Brechkraft, die voneinander mit einem festen Abstand K beabstandet sind. In den Fig. 1A und Fig. 1B wird der feste Abstand K zwischen den beiden äußeren ersten und zweiten Baugruppen D1 und D5 durch eine gemeinsame Fassung H festgelegt.

[0059] Die zwischen den äußeren ersten und zweiten Baugruppen D1 und D5 angeordnete mittlere dritte Baugruppe D4 wird in der gezeigten Ausführungsform von zwei identischen Konkavlinsen D2 und D3, die voneinander mit einem vorgegebenen gleichbleibenden Abstand K3 beabstandet sind, gebildet. Somit weist die mittlere dritte Baugruppe D4 insgesamt eine negative Brechkraft auf.

[0060] Dabei sind jeweilige freie Durchmesser der die erste, zweite und dritte Baugruppe D1, D4, D5 jeweils bildenden Linsen D1, D2, D3, D5 1% größer als ein maximaler Strahlbündeldurchmesser des die Linsen jeweils durchsetzenden Abbildungsstrahlengangs sein. Somit begrenzen die drei Baugruppen D1, D4, D5 die Apertur des sie durchsetzenden Abbildungsstrahlengangs nicht.

[0061] Wie sich aus einer Zusammenschau der Fig. 1A und Fig. 1B ergibt, ist die mittlere dritte Baugruppe D4 wahlweise mit einem ersten Abstand K1 oder einem zweiten Abstand K2 von der ersten Baugruppe beabstandet. Ersichtlich ist der erste Abstand K1 dabei unterschiedlich zu dem zweiten Abstand K2. Die beiden Abstände K1 und K2 sind in Abhängigkeit von den optischen Eigenschaften der drei Baugruppen D1, D5 und D4 so vorbestimmt, daß der erfindungsgemäße Vergrößerungsschalter D in den beiden vorgegebenen Positionen für die mittlere dritte Baugruppe D4 jeweils eine vorgegebene, vorzugsweise deutlich unterscheidbare Abbildungsvergrößerung aufweist, bei der gleichzeitig die Vergrößerung und ein Arbeitsabstand des Systems angepaßt sind.

[0062] Für die Anordnung der mittleren dritten Baugruppe D4 zwischen den beiden äußeren Baugruppen D1 und D5 ist eine Positioniereinrichtung G vorgesehen. Diese Positioniereinrichtung G weist zwei Betriebszu-

stände auf. In einem ersten Betriebszustand ist die mittlere dritte Baugruppe D4 mit dem ersten Abstand K1 und in dem zweiten Betriebszustand mit dem zweiten Abstand K2 von der äußeren ersten Baugruppe D1 beabstandet angeordnet.

[0063] Die Verlagerung der mittleren dritten Baugruppe D4 erfolgt in der gezeigten Ausführungsform mittels eines Verlagerers G1 der Positioniereinrichtung G. Der Verlagerer G1 dient als gemeinsame Fassung für die beiden die mittlere dritte Baugruppe D4 bildenden Konkavlinsen D2 und D3 und legt so den vorgegebenen gleichbleibenden Abstand K3 zwischen den beiden Konkavlinsen D2 und D3 fest.

[0064] In den Fig. 1A und Fig. 1B ist der vorbestimmte zweite Abstand K2 der dritten Baugruppe D4 von der ersten Baugruppe D1 gleich einer Differenz zwischen dem festen Abstand K und dem vorbestimmten ersten Abstand K1.

[0065] Dies hat zur Folge, dass eine Anordnung der drei Baugruppen D1, D5, D4 des Vergrößerungsschalters D im ersten Betriebszustand der Positioniereinrichtung G symmetrisch zu der Anordnung der drei Baugruppen D1, D5, D4 im zweiten Betriebszustand der Positioniereinrichtung G ist.

[0066] Entsprechend ist eine erste optische Abbildungsvergrößerung  $y_1$  in dem Fall, in dem die mittlere dritte Baugruppe D4 mit dem ersten Abstand K1 von der ersten Baugruppe D1 beabstandet ist, gleich dem Kehrwert einer zweiten optischen Abbildungsvergrößerung  $y_2$  für den Fall, in dem die mittlere dritte Baugruppe D4 mit dem zweiten Abstand K2 von der ersten Baugruppe D1 beabstandet ist.

[0067] Die in den Fig. 1A und Fig. 1B gezeigte Anordnung der äußeren ersten und zweiten Baugruppen D1 und D5 mit konstantem Abstand K voneinander erlaubt es, das erfindungsgemäße optische Vergrößerungsänderungssystem leicht in bestehende optische Aufbauten zu integrieren. Weiter weist das System einen besonders einfachen Aufbau auf, da lediglich eine optische Baugruppe verlagerbar ist.

[0068] Die in den Fig. 1A, Fig. 1B gezeigte Ausführungsform eines erfindungsgemäßen Vergrößerungsschalters D weist die folgenden Systemdaten auf:

Tabelle 1

Oberfläche Nr.	Radius [mm]	Dicke [mm]	Medium	Freier Durchmesser [mm]
		Tubus L/Zoomsystem E		
1	52,771			32,0
		4,0	NBAF51	
2	781,49			32,0
		K-K1 bzw. K-K2 (2mm bzw. 25mm)	Luft	
3	-120,88			30,0
		3,0	LAFN7	
4	88,004			30,0
		3,0	Luft	
5	-88,004			30,0
		3,0	LAFN7	
6	120,88			30,0
		K1 bzw. K2 (25mm bzw. 2mm)	Luft	
7	-781,49			32,0
		4,0	NBAF51	
8	-52,771			32,0

	Objektivsystem C/Objektebene P	
--	--------------------------------	--

[0069] Für  $K = 27\text{mm}$ ,  $K1 = 25\text{mm}$  und  $K2 = 2\text{mm}$  ergibt sich bei dieser Ausführungsform für den in Fig. 1A gezeigten ersten Betriebszustand, in dem die mittlere dritte Baugruppe D4 von der ersten Baugruppe D1 um



den ersten Abstand K1 beabstandet ist, ein Vergrößerungsfaktor  $\gamma_1 = 1,4$ . Für den in Fig. 1B gezeigten zweiten Betriebszustand, in dem die mittlere dritte Baugruppe D4 von der ersten Baugruppe D1 um den zweiten Abstand K2 beabstandet ist, ergibt sich ein Vergrößerungsfaktor  $\gamma_2 = 0,7$ . Die wählbaren Vergrößerungsfaktoren sind somit deutlich unterscheidbar.

[0070] Es wird betont, dass die vorstehenden Systemdaten nur beispielhaft sind und geeignet variiert werden können. Auch wenn vorstehend für alle drei Baugruppen D1, D5 und D4 des optischen Vergrößerungsschalters D normale Linsen verwendet worden sind, können die beiden äußeren Baugruppen D1 und D5 und/oder die mittlere dritte Baugruppe D4 auch durch Kittglieder o.ä. realisiert sein.

[0071] Die Fig. 2A bis Fig. 2D zeigen jeweils einen Abbildungsstrahlengang durch verschiedene Ausführungsformen, in denen der in den Fig. 1A und Fig. 1B gezeigte erfindungsgemäße optische Vergrößerungsschalter D Verwendung findet. Dabei ist zur Erhöhung der Übersicht die Fassung H nicht eigens dargestellt. Auch die Positioniereinrichtung G' ist lediglich in Fig. 2C eigens gezeigt.

[0072] Die Fig. 2A und Fig. 2C zeigen Betriebszustände, in denen die mittlere dritte Baugruppe D4 mit dem Abstand K1 von der äußeren ersten Baugruppe D1 des optischen Vergrößerungsschalters D beabstandet ist. Entsprechend zeigen die Fig. 2B und Fig. 2D Betriebszustände, in denen die mittlere dritte Baugruppe D4 mit dem Abstand K2 von der äußeren ersten Baugruppe D1 beabstandet ist.

[0073] Wie in Fig. 2A gezeigt, kann das optische Vergrößerungsänderungssystem neben dem Vergrößerungsschalter D ein von dem Abbildungsstrahlengang B durchsetztes Objektivsystem C mit positiver Brechkraft aufweisen. Dabei ist das Objektivsystem C auf der Seite der Objektebene des in den Fig. 1A und Fig. 1B gezeigten Vergrößerungsschalters D angeordnet, so daß die erste Baugruppe D1 zwischen der zweiten Baugruppe D5 und dem Objektivsystem C angeordnet ist.

[0074] Eine derartige Anordnung bewirkt, daß die Vergrößerung durch den Vergrößerungsschalter D an einer Stelle des optischen Aufbaues erfolgt, an dem die Apertur und damit auch der Öffnungswinkel maximal ist. Hierdurch wird die Gefahr einer leeren Vergrößerung und ein Helligkeitsabfall gering gehalten.

[0075] Wie sich aus der Zusammenschau der Fig. 2A und Fig. 2C bzw. Fig. 2B und Fig. 2D ergibt, sind die drei optischen Objektiv-Baugruppen C1, C2 und C3 des Objektivsystems C so relativ zueinander verlagerbar, daß ein Arbeitsabstand A1, A2 der Objektebene P des Objektivsystems C einstellbar. Weiter erfolgt in der in den Fig. 2A bis Fig. 2D gezeigten Ausführungsform eine Abbildung der Objektebene P durch das Objektivsystem C nach Unendlich, so daß das Objektivsystem C an einer dem Vergrößerungsschalter D zugewandten Seite eine afokale Schnittstelle aufweist.

[0076] Der Vergrößerungsschalter D und das Objektivsystem C sind in Fig. 2A zusätzlich vergrößert dargestellt, so dass die optisch wirksamen Oberflächen 1 bis 16 besser unterscheidbar sind. Hieraus wird deutlich, dass es sich bei den Objektiv-Baugruppen C1 und C3 jeweils um Kittglieder handelt.

[0077] Wie in Fig. 2A gezeigt, kann auf einer der Objektebene P abgewandten Seite des in Fig. 1A und Fig. 1B gezeigten Vergrößerungsschalters D weiter ein von dem Abbildungsstrahlengang B durchsetztes Zoomsystem E vorgesehen sein. Dieses weist durch Verwendung mehrerer relativ zueinander verlagerbarer optischer Zoom-Baugruppen E1, E2 und E3 eine variabel veränderbare Abbildungsvergrößerung  $\Gamma$  auf.

[0078] Aufgrund des vorgeschalteten Vergrößerungsschalters kann die variable Abbildungsvergrößerung  $\Gamma$  des Zoomsystems gering gehalten werden und beträgt in dem in Fig. 2A gezeigten Beispiel maximal  $\Gamma \leq 3$ . Eine derart geringe variable Zoomvergrößerung ist ausreichend, da sich entlang des Abbildungsstrahlenganges B1, B2 die Abbildungsvergrößerungen multiplikativ ergänzen. Die variable Abbildungsvergrößerung des Zoomsystems kann jedoch alternativ auch beispielsweise  $\Gamma \leq 4$ ,  $\Gamma \leq 5$  oder  $\Gamma \leq 6$  sein.

[0079] Wie in Fig. 2A angedeutet, weist auch der Vergrößerungsschalter D bevorzugt eine Bildebene auf, die nach Unendlich abgebildet wird. Somit verfügt auch der Vergrößerungsschalter D über eine afokale Schnittstelle, was seine Integration in modular aufgebaute optische Systeme erleichtert.

[0080] In den Fig. 2C und Fig. 2D ist die Positioniereinrichtung G' schematisch gezeigt. Dabei weist die Positioniereinrichtung G' den Verlagerer G'1 auf, der die mittlere dritte Baugruppe D4 in Abhängigkeit von einem jeweiligen Betriebszustand der Positioniereinrichtung G' durch translatorische Schiebewegung entlang des Abbildungsstrahlenganges B relativ zu den äußeren ersten und zweiten Baugruppen D1 und D5 zwischen den

beiden vorbestimmten ersten und zweiten Abständen K1 und K2 von der ersten Baugruppe D1 verlagert. Zur Betätigung des Verlagerers G'1 weist die in **Fig. 2C** gezeigte Positioniereinrichtung G' einen manuell betätigbaren Umschalthebel G'2 auf. Alternativ kann die Positioniereinrichtung G' zur Betätigung des Verlagerers G'1 beispielsweise auch einen Elektromotor oder ähnliches aufweisen.

[0081] Eine derartige translatorische Schiebbewegung kann konstruktiv besonders einfach und mit kleinem Bauvolumen realisiert werden, weiter erlaubt eine translatorische Schiebbewegung eine besonders schnelle Verlagerung der mittleren dritten Baugruppe D4 zwischen den vorbestimmten ersten und zweiten Abständen K1 und K2 und damit ein besonders schnelles Umschalten zwischen den beiden optischen Abbildungsvergrößerungen.

[0082] Wie aus einer Zusammenschau der **Fig. 2A** bis **Fig. 2D** ersichtlich, durchsetzt der Abbildungsstrahlengang B alle drei Baugruppen D1, D5 und D4 auch während einer Änderung der Anordnung der mittleren dritten Baugruppe D4 zwischen den beiden vorbestimmten ersten und zweiten Abständen K1 und K2 von der ersten äußeren Baugruppe D1. Da es somit bei einer Verlagerung der mittleren dritten Baugruppe D4 nicht zu einem Herausschwenken der mittleren dritten Baugruppe D4 aus dem Abbildungsstrahlengang B kommt, ist der erfindungsgemäße Aufbau besonders kompakt. Weiter wird auch während einer Verlagerung der dritten mittleren Baugruppe D4 immer eine Abbildung erhalten. Dabei ist diese Abbildung jedoch in der Regel unscharf, solange die mittlere dritte Baugruppe D4 nicht mit dem ersten oder zweiten Abstand K1 oder K2 von der äußeren ersten Baugruppe D1 beabstandet ist.

[0083] Bezeichnet man die Brennweite des Objektivsystems C mit  $f$ , so kann für die in den **Fig. 2A** bis **Fig. 2D** gezeigte Ausführungsform eine effektive Brennweite  $F_1, F_2, F_3, F_4$  des aus dem Vergrößerungsschalter D und dem Objektivsystem C gebildeten Aufbaus wie folgt berechnet werden:  $F = f/y$ .

[0084] Hieraus läßt sich die entsprechende Vergrößerung  $VO_1$  des aus dem Vergrößerungsschalter D und dem Objektivsystem C gebildeten Aufbaus wie folgt berechnen:  $VO_1 = 250/F = (250/f)y$ . Der Wert 250 entspricht dabei der normierten Sehweite einer Lupe in Millimetern mm.

[0085] In der gezeigten Ausführungsform ist das Objektivsystem für eine Variation des Arbeitsabstandes  $A_1, A_2$  von  $A_1 = 200\text{mm}$  bis  $A_2 = 400\text{mm}$  ausgelegt und weist eine sich zwischen  $f = 271\text{mm}$  und  $f = 452\text{mm}$  verändernde Brennweite  $f$  auf.

[0086] Somit kann mittels des Vergrößerungsschalters D die effektive Brennweite  $F_1, F_2, F_3, F_4$  des aus dem Vergrößerungsschalter D und dem Objektivsystem C gebildeten Aufbaus beispielsweise für den Arbeitsabstand  $A_1 = 200\text{mm}$  zwischen  $F_1 = 192\text{mm}$  und  $F_2 = 384\text{mm}$  und entsprechenden Vergrößerungen umgeschaltet werden. Hierdurch kann sowohl die Vergrößerung  $VO_1$  als auch ein entsprechender Sehfelddurchmesser in der Objektebene P um den Faktor zwei umgeschaltet werden.

[0087] Die in den **Fig. 2A** bis **Fig. 2D** gezeigte Ausführungsform eines erfindungsgemäßen Vergrößerungsänderungssystems weist ohne das in **Fig. 2A** zusätzlich gezeigte Zoomsystem E die folgenden Systemdaten auf:

Tabelle 2

Oberfläche Nr.	Radius [mm]	Dicke [mm]	Medium	Freier Durchmesser [mm]
Zoomsystem E				
1	52,771			32,0
		4,0	NBAF51	
2	781,49			32,0
		K-K1 bzw. K-K2 (2mm bzw. 25mm)	Luft	
3	-120,88			30,0
		3,0	LAFN7	
4	88,004			30,0
		3,0	Luft	

Oberfläche Nr.	Radius [mm]	Dicke [mm]	Medium	Freier Durchmesser [mm]
5	-88,004			30,0
		3,0	LAFN7	
6	120,88			30,0
		K1 bzw. K2 (25mm bzw. 2mm)	Luft	
7	-781,49			32,0
		4,0	NBAF51	
8	-52,771			32,0
		2,0-13,5	Luft	
9	105,26			32,0
		4,0	NPSK53	
10	-70,005			32,0
		3,0	SF56A	
11	-344,27			32,0
		0,1	Luft	
12	99,174			32,0
		3,0	NSSK8	
13	Plan			32,0
		12,0-0,5	Luft	
14	Plan			31,0
		3,0	NSSK8	
15	30,178			30,0
		3,0	NSF8	
16	46,827			28,0
		A1, A2 = 200-400	Luft	
		Objektebene P		

[0088] Die sich für  $K = 27\text{mm}$ ,  $K1 = 25\text{mm}$  und  $K2 = 2\text{mm}$  ergebenden zugehörigen Brennweiten, Vergrößerungen und Sehfelder sind in den folgenden Tabellen angegeben:

Tabelle 3

Arbeits- abstand A1, A2 [mm]	Objektivsystem Brennweite $f$ [mm]	Abstand zwischen dritter und erster Baugruppe	Effektive Brennweite F1, F2, F3, F4 [mm]	Vergrößerung Objektivsystem + Vergrößerungs- schalter $V_{01}$	Gesamtver- größerung $V$	Sehfeld SF [mm]
200	271			0,92	2,5-15	14-84
		K1	192	1,30	3,5-21	10-60
		K2	384	0,65	1,8-11	19-115
400	452			0,55	1,5-9	23-140
		K1	320	0,78	2,1-13	16-97
		K2	640	0,39	1,1-6	35-210

[0089] Bei der Berechnung der Gesamtvergrößerung und der Sehfelder wurde von einem Zoomsystem  $\Gamma = 0,4$  bis  $\Gamma = 2,4$ , einem Tubus L mit einer Brennweite  $f_L = 170$  und Okularen 10x/21 ausgegangen.

[0090] Bei der vorstehend beschriebenen Ausführungsform bewirkt eine Änderung der Vergrößerung des Vergrößerungsschalters D weiter eine automatische Anpassung der Objektauflösung und des Stereowinkels  $\alpha$  an die neue Größe des Sehfeldes.

[0091] Auch wenn das vorstehend beschriebene Objektivsystem C und das vorstehend beschriebene Zoomsystem E jeweils verlagerbare optische Linsen bzw. Kittglieder aufweisen, um eine Varioskop-Funktion bzw. eine variable Abbildungsvergrößerung zu bewirken, ist es alternativ oder zusätzlich auch möglich, anstelle verlagerbarer Linsen bzw. Kittglieder optische Elemente variabler Brechkraft zu verwenden.

[0092] Die Fig. 3A und Fig. 3B zeigen beispielhaft einen Abbildungsstrahlengang durch zwei Ausführungsformen, in welchen der in den Fig. 1A und Fig. 1B gezeigte Vergrößerungsschalter D in ein Stereomikroskop integriert ist.

[0093] Das gezeigte Stereomikroskop weist ein Objektivsystem C, einen Vergrößerungsschalter D, ein Zoomsystem E' und einen Tubus L mit einem Okularsystem auf. Dabei weisen das Objektivsystem C und der Vergrößerungsschalter D den in den Fig. 2A bis Fig. 2D gezeigten Aufbau auf.

[0094] In dem in den Fig. 3A und Fig. 3B gezeigten Zoomsystem E' werden Strahlengänge B1 und B2 des Abbildungsstrahlengangs B, welche in der Objektebene P den Stereowinkel  $\alpha$  einschließen, anders als von dem in Fig. 2A gezeigten Zoomsystem E von separaten optischen Elementen geführt.

[0095] Das Zoomsystem E' weist Zoom-Baugruppen E'1, E'2, E'3 und E'4 bzw. E'5, E'6, E'7 und E'8 auf. Dabei sind die Zoom-Baugruppen E'2, E'3 bzw. E'6, E'7 relativ zu den Zoom-Baugruppen E'1, E'4 bzw. E'5, E'8 verlagerbar, um eine variable Abbildungsvergrößerung der Strahlengänge B1 und B2 zu bewirken.

[0096] Auch in dem Tubus L des in den Fig. 3A und Fig. 3B gezeigten Stereomikroskops werden die Strahlengänge B1 und B2 des Abbildungsstrahlengangs B getrennt geführt. Hierfür weist der Tubus L inklusive Okular geeignete Linsen L1, L4, L5, L6, L7, L10, L11, L12 und Prismen L2, L3, L8, L9 auf.

[0097] Die in den Fig. 3A und Fig. 3B gezeigten Stereomikroskope unterscheiden sich voneinander lediglich dadurch, dass in Fig. 3A für beide Strahlengänge B1 und B2 des Abbildungsstrahlengangs B ein gemeinsamer Vergrößerungsschalter D vorgesehen ist, wohingegen die Strahlengänge B1 und B2 des Abbildungsstrahlengangs B in Fig. 3B in dem Vergrößerungsschalter D' getrennt geführt werden. Hierfür weist der Vergrößerungsschalter D' in jedem Strahlengang B1 bzw. B2 paarweise identische optische Baugruppen D'1 bis D'10 auf. Der Aufbau des Vergrößerungsschalters D' für jeden Strahlengang B1 und B2 entspricht jeweils dem Aufbau des in Fig. 1A und Fig. 1B gezeigten Vergrößerungsschalters D. Dabei entsprechen die identischen optischen Baugruppen D'1 und D'6 der äußeren ersten Baugruppe, die identischen optischen Baugruppen D'5 und D'10 der äußeren zweiten Baugruppe und die identischen optischen Baugruppen D'2, D'3 und D'7, D'8 der mittleren dritten Baugruppe des Vergrößerungsschalters D'. Weiter sind die optischen Baugruppen D'2, D'3 und D'7, D'8 in der gezeigten Ausführungsform mechanisch gekoppelt, so dass eine Verlagerung dieser optischen Baugruppen D'2, D'3 und D'7, D'8 gemeinsam erfolgt.

[0098] Wie aus den Fig. 3A und Fig. 3B ersichtlich, sind der Vergrößerungsschalter D, D' und das jeweilige Zoomsystem E' vorzugsweise in Reihe geschaltet, so dass sich die bewirkten Abbildungsvergrößerungen multiplikativ ergänzen.

[0099] Auch wenn der Vergrößerungsschalter D, D' in den Fig. 3A und Fig. 3B jeweils zwischen dem Objektivsystem C und dem Zoomsystem E' angeordnet ist, ist die vorliegende Erfindung nicht auf diese Reihenfolge der Anordnung beschränkt. Vielmehr kann das Zoomsystem E' auch zwischen dem Vergrößerungsschalter D, D' und dem Objektivsystem C angeordnet sein (nicht eigens gezeigt). Weiter können in dem Zoomsystem (wie auch in dem in Fig. 3A gezeigten Vergrößerungsschalter D) wahlweise beide Strahlengänge des Abbildungsstrahlengangs gemeinsam geführt werden. In diesem Fall weist das Zoomsystem Zoom-Baugruppen mit entsprechend großen Durchmessern auf (nicht eigens gezeigt).

[0100] Derartige Stereomikroskope finden beispielsweise in der Dentalmedizin als Operationsmikroskope Verwendung. Gerade bei einer Verwendung als Operationsmikroskop bringt die mit dem erfindungsgemäßen optischen Vergrößerungsänderungssystem realisierte schnelle Umschaltung zwischen zwei deutlich unterscheidbaren optischen Abbildungsvergrößerungen erhebliche Vorteile, da so ein Arzt schnell zwischen einer Ansicht eines Operationsumfeldes und einem vergrößerten Operationsbereich umschalten kann.

[0101] Selbstverständlich kann es sich wahlweise auch um ein digitales Operationsmikroskop handeln, bei dem die betrachtete Objektebene auf einen oder mehrere Bildsensoren abgebildet wird.

## Patentansprüche

1. Optisches Vergrößerungsänderungssystem zur Bereitstellung von genau zwei optischen Abbildungsvergrößerungen, wobei das Vergrößerungsänderungssystem drei von einem Abbildungsstrahlengang (B) nacheinander durchsetzte optische Baugruppen (D1, D5, D4) umfaßt, wobei eine erste Baugruppe (D1) der drei Baugruppen (D1, D5, D4) mit einem festen Abstand (K) von einer zweiten Baugruppe (D5) der drei Baugruppen (D1, D5, D4) angeordnet ist, wobei eine dritte Baugruppe (D4) der drei Baugruppen (D1, D5, D4) zwischen der ersten und der zweiten Baugruppe (D1, D5) angeordnet ist, und wobei das Vergrößerungsänderungssystem eine Positioniereinrichtung (G) für die dritte Baugruppe (D4) umfaßt, welche genau zwei vorbestimmte Betriebszustände aufweist, wobei in einem ersten der beiden Betriebszustände die dritte Baugruppe (D4) mit einem vorbestimmten ersten Abstand (K1) von der ersten Baugruppe (D1) angeordnet ist und in einem zweiten der beiden Betriebszustände die dritte Baugruppe (D4) mit einem vorbestimmten zweiten Abstand (K2) von der ersten Baugruppe (D1) angeordnet ist.
2. Optisches Vergrößerungsänderungssystem nach Anspruch 1, ferner umfassend ein von dem Abbildungsstrahlengang (B) durchsetztes Objektsystem (C), wobei die erste Baugruppe (D1) zwischen der zweiten Baugruppe (D5) und dem Objektsystem (C) angeordnet ist und wobei das Objektsystem (C) eine positive Brechkraft aufweist.
3. Optisches Vergrößerungsänderungssystem nach Anspruch 2, wobei das Objektsystem (C) eine Objektebene (P) aufweist, welche von dem Objektsystem (C) nach Unendlich abgebildet wird.
4. Optisches Vergrößerungsänderungssystem nach Anspruch 2 oder 3, wobei das Objektsystem (C) wenigstens zwei optische Objektiv-Baugruppen (C1, C2, C3) umfaßt, welche relativ zueinander verlagerbar sind, um einen Abstand (A1, A2) einer Objektebene (P) des Objektsystems (C) von dem Objektsystem (C) zu ändern.
5. Optisches Vergrößerungsänderungssystem nach einem der vorangegangenen Ansprüche, wobei ein aus den drei Baugruppen (D1, D5, D4) gebildeter optische Vergrößerungsschalter (D) eine Bildebene aufweist, welche von dem Vergrößerungsschalter (D) nach Unendlich abgebildet wird.
6. Optisches Vergrößerungsänderungssystem nach einem der vorangegangenen Ansprüche, wobei der Abbildungsstrahlengang (B) alle drei Baugruppen (D1, D5, D4) auch während einer Änderung der Anordnung der dritten Baugruppe (D4) zwischen den beiden vorbestimmten ersten und zweiten Abständen (K1, K2) von der ersten Baugruppe (D1) nacheinander durchsetzt.
7. Optisches Vergrößerungsänderungssystem nach einem der vorangegangenen Ansprüche, wobei die Positioniereinrichtung (G) einen Verlagerer (G1) aufweist, der die dritte Baugruppe (D4) in Abhängigkeit von einem jeweiligen Betriebszustand der Positioniereinrichtung (G) zwischen den beiden vorbestimmten ersten und zweiten Abständen (K1, K2) von der ersten Baugruppe (D1) verlagert.
8. Optisches Vergrößerungsänderungssystem nach Anspruch 7, wobei der Verlagerer (G1) die dritte Baugruppe (D4) durch translatorische Schiebewegung entlang des Abbildungsstrahlenganges (B) relativ zu der ersten und zweiten Baugruppe (D1, D5) verlagert.
9. Optisches Vergrößerungsänderungssystem nach einem der vorangegangenen Ansprüche, ferner umfassend ein von dem Abbildungsstrahlengang (B) durchsetztes Zoomsystem (E) mit variabler Abbildungsvergrößerung, wobei das Zoomsystem (E) wenigstens zwei optische Zoom-Baugruppen (E1, E2, E3) umfaßt, welche relativ zueinander verlagerbar sind, um die Abbildungsvergrößerung des Zoomsystems (E) variabel zu ändern.
10. Optisches Vergrößerungsänderungssystem nach Anspruch 9, wobei die variable Abbildungsvergrößerung des Zoomsystems (E) maximal sechsfach, vorzugsweise maximal fünffach, bevorzugt maximal vierfach und besonders bevorzugt dreifach ist.
11. Optisches Vergrößerungsänderungssystem nach einem der vorangegangenen Ansprüche, wobei die erste Baugruppe (D1) und die zweite Baugruppe (D5) jeweils gleiche Brechkraft aufweisen, und die dritte Baugruppe (D4) eine Brechkraft aufweist, die unterschiedlich zu der Brechkraft der ersten und zweiten Baugruppe

(D1, D5) ist.

12. Optisches Vergrößerungsänderungssystem nach Anspruch 11, wobei die Brechkraft der ersten und zweiten Baugruppe (D1, D5) positiv und die Brechkraft der dritten Baugruppe (D4) negativ ist.

13. Optisches Vergrößerungsänderungssystem nach Anspruch 11 oder 12, wobei die erste und zweite Baugruppe (D1, D5) jeweils eine Konvexlinse ist.

14. Optisches Vergrößerungsänderungssystem nach Anspruch 11, 12 oder 13, wobei die dritte Baugruppe (D4) zwei identische Konkavlinsen (D2, D3) aufweist, die voneinander mit einem vorgegebenen gleichbleibenden Abstand (K3) beabstandet sind.

15. Optisches Vergrößerungsänderungssystem nach Anspruch 11, 12 oder 13, wobei die erste und zweite Baugruppe (D1, D5) jeweils identische Linsen sind, und wobei die dritte Baugruppe (D4) zwei identische Linsen (D2, D3) aufweist.

16. Optisches Vergrößerungsänderungssystem nach einem der vorangegangenen Ansprüche, wobei der vorbestimmte zweite Abstand (K2) der dritten Baugruppe (D4) von der ersten Baugruppe (D1) gleich einer Differenz zwischen dem festen Abstand (K) zwischen der ersten Baugruppe (D1) und der zweiten Baugruppe (D5) und dem vorbestimmten ersten Abstand (K1) der dritten Baugruppe (D4) von der ersten Baugruppe (D1) ist.

17. Optisches Vergrößerungsänderungssystem nach einem der vorangegangenen Ansprüche, wobei eine erste optische Abbildungsvergrößerung ( $\gamma_1$ ) des Vergrößerungsänderungssystems gleich dem Kehrwert einer zweiten optischen Abbildungsvergrößerung ( $\gamma_2$ ) des Vergrößerungsänderungssystems ist.

18. Optisches Vergrößerungsänderungssystem nach einem der vorangegangenen Ansprüche, wobei freie Durchmesser von die erste Baugruppe (D1), die zweite Baugruppe (D5) und die dritte Baugruppe (D4) jeweils bildenden optischen Linsen (D1, D2, D3, D5) jeweils größer sind als ein maximaler Strahlbündeldurchmesser des die Linsen (D1, D4, D5) in beiden Betriebszuständen durchsetzenden Abbildungsstrahlengangs.

19. Optisches Vergrößerungsänderungssystem nach einem der vorangegangenen Ansprüche, wobei das Vergrößerungsänderungssystem in ein Stereomikroskop und bevorzugt ein Operationsmikroskop und besonders bevorzugt ein digitales Operationsmikroskop integriert ist.

20. Mikroskop, aufweisend wenigstens ein von einem Abbildungsstrahlengang durchsetztes Objektivsystem und ein bildgebendes System, welches vorzugsweise wenigstens ein Paar von Okularen und/oder eine Stereokamera umfasst, dadurch gekennzeichnet, dass das Mikroskop ferner ein optisches Vergrößerungsänderungssystem nach einem der Ansprüche 1 bis 19 umfasst.

Es folgen 7 Blatt Zeichnungen

Anhängende Zeichnungen

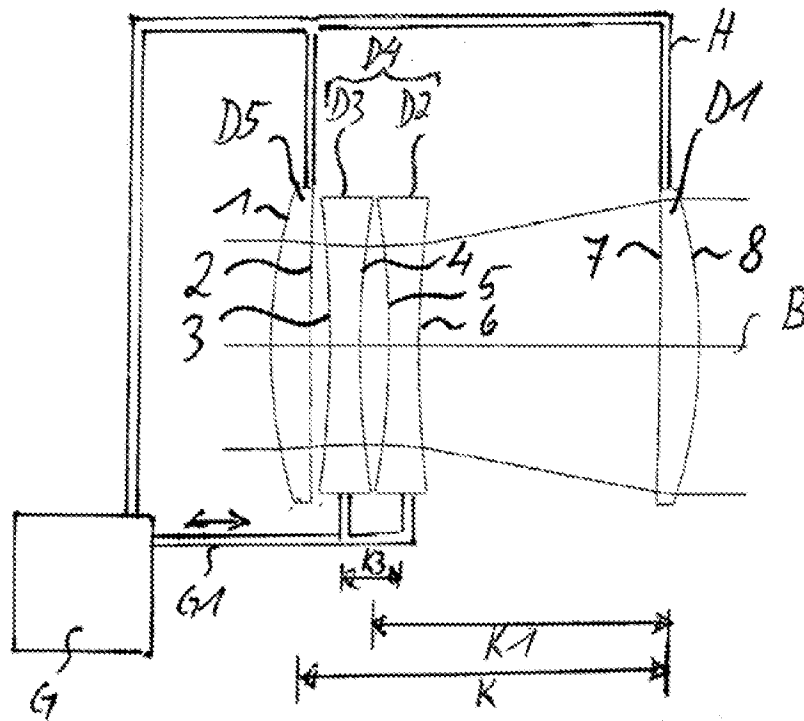


Fig. 1A

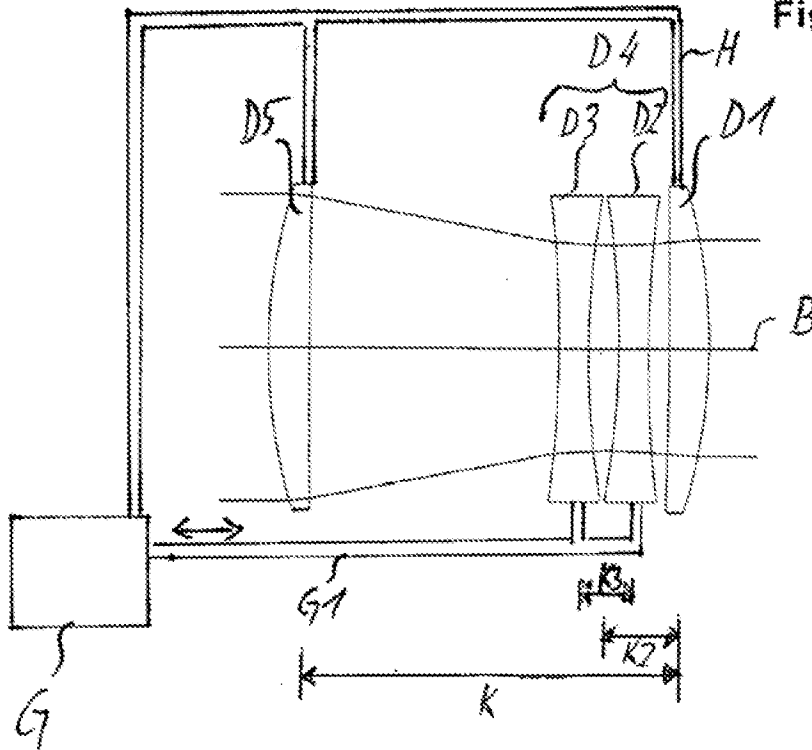
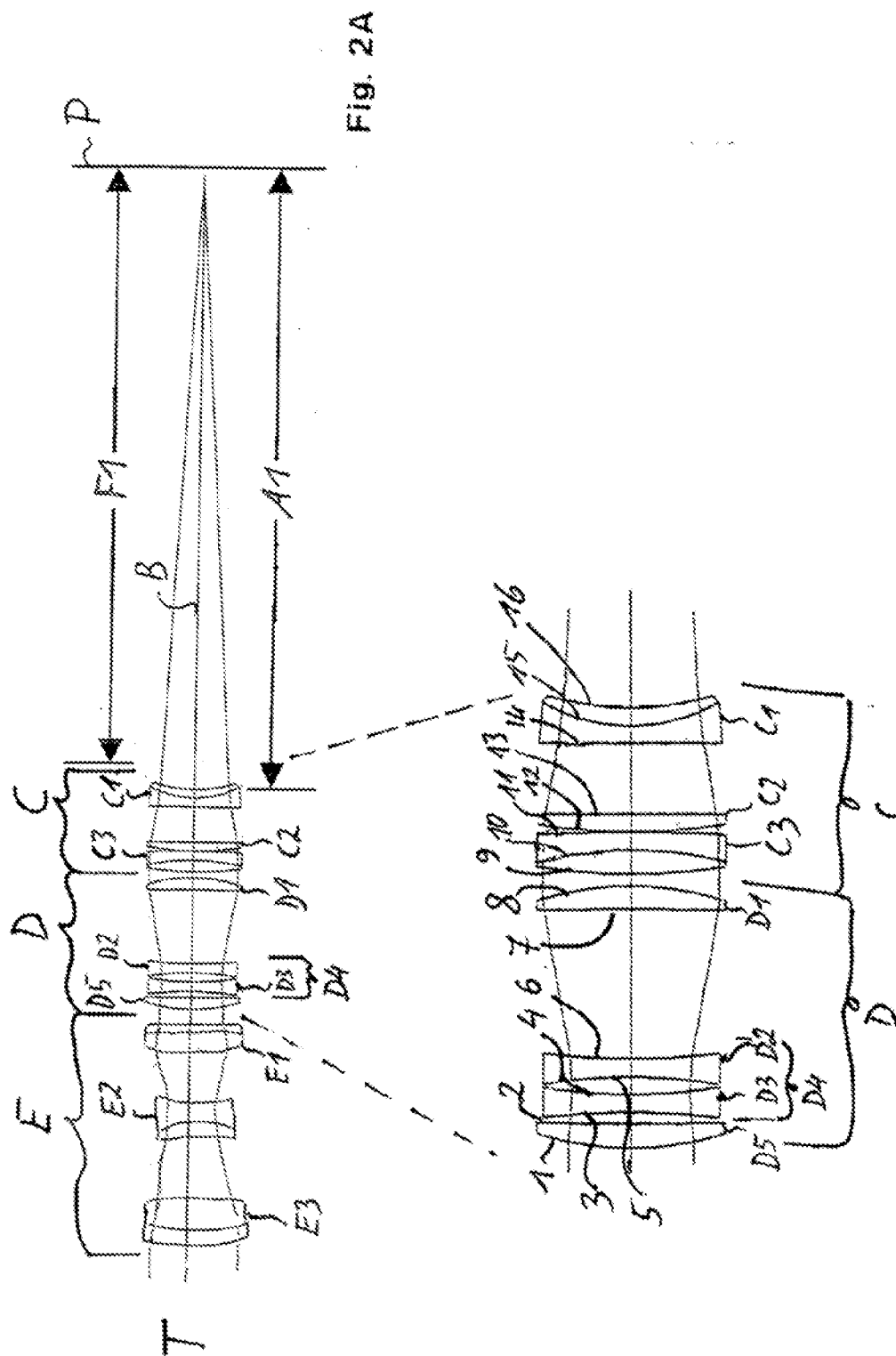


Fig. 1B





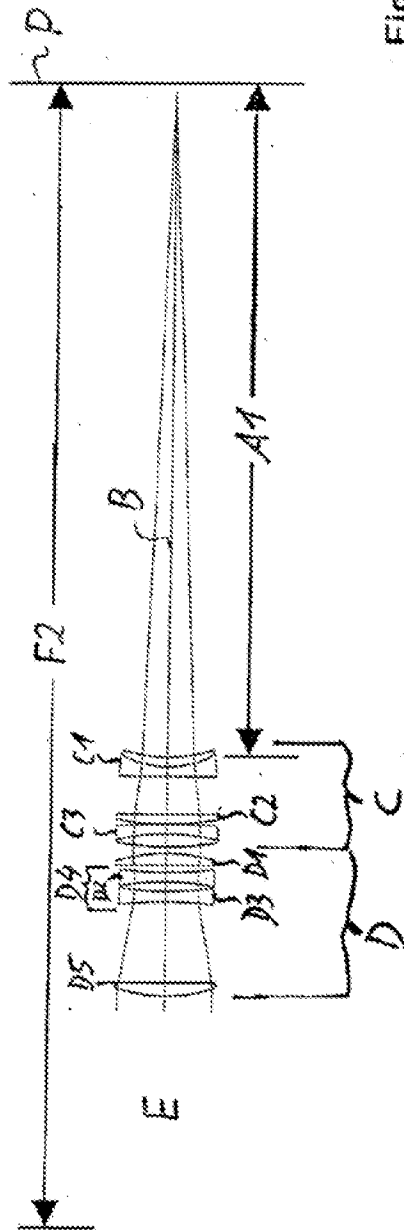


Fig. 2B

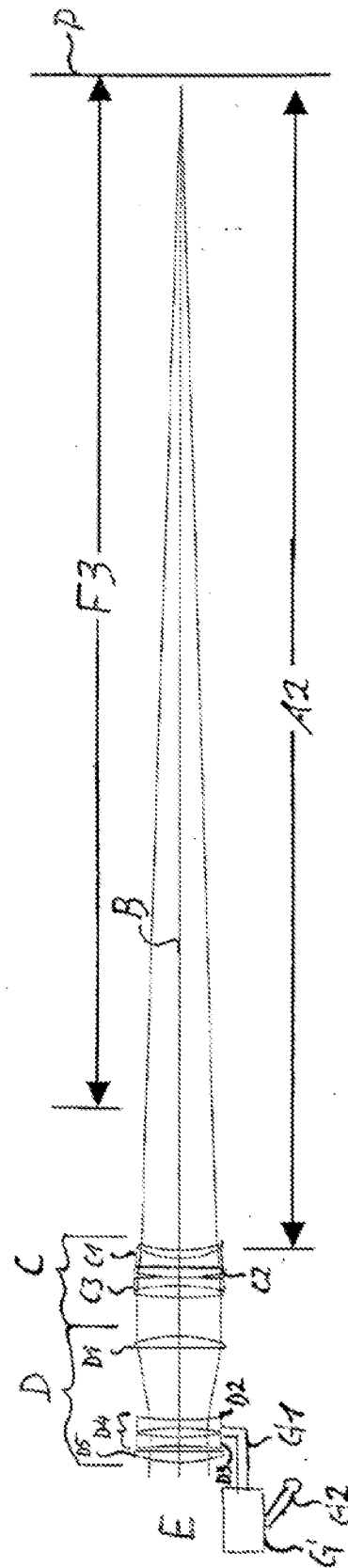
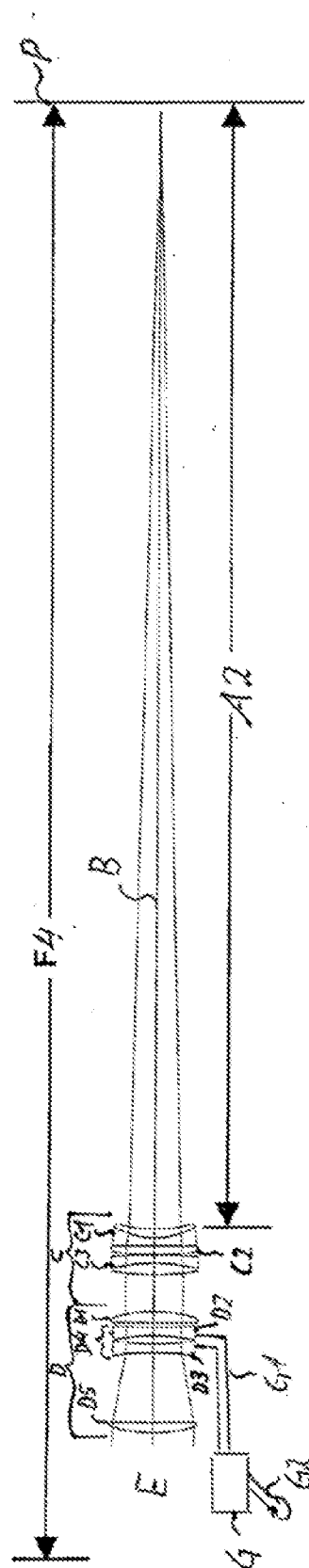


Fig. 2C



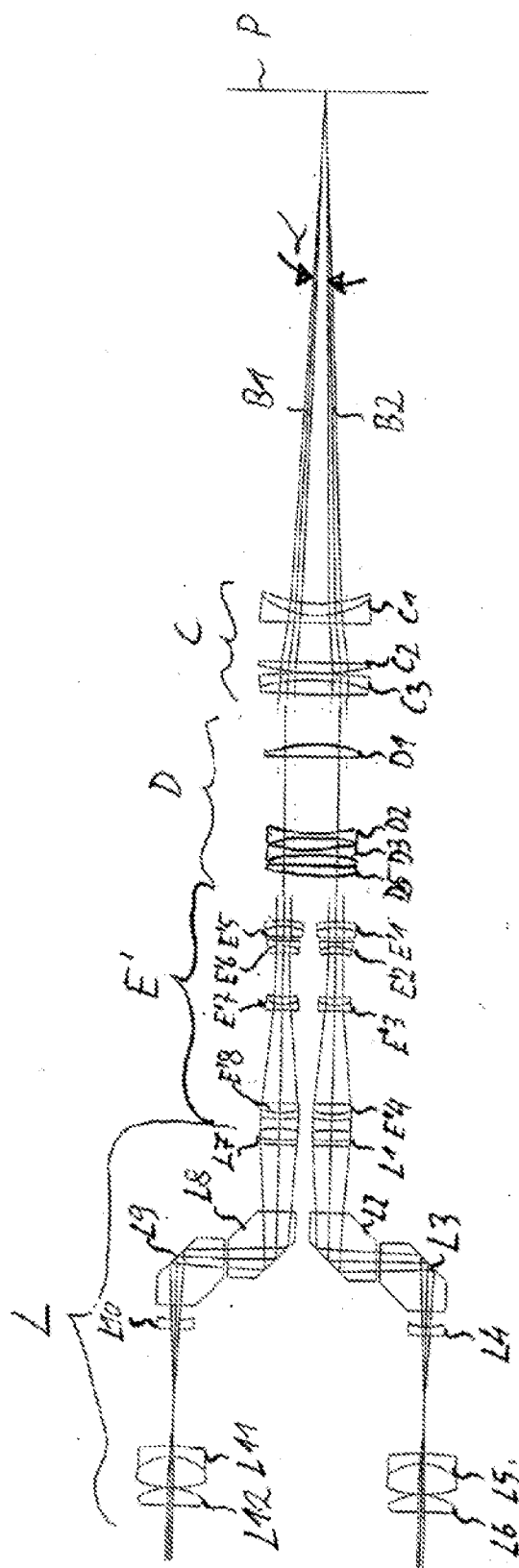


Fig. 3A

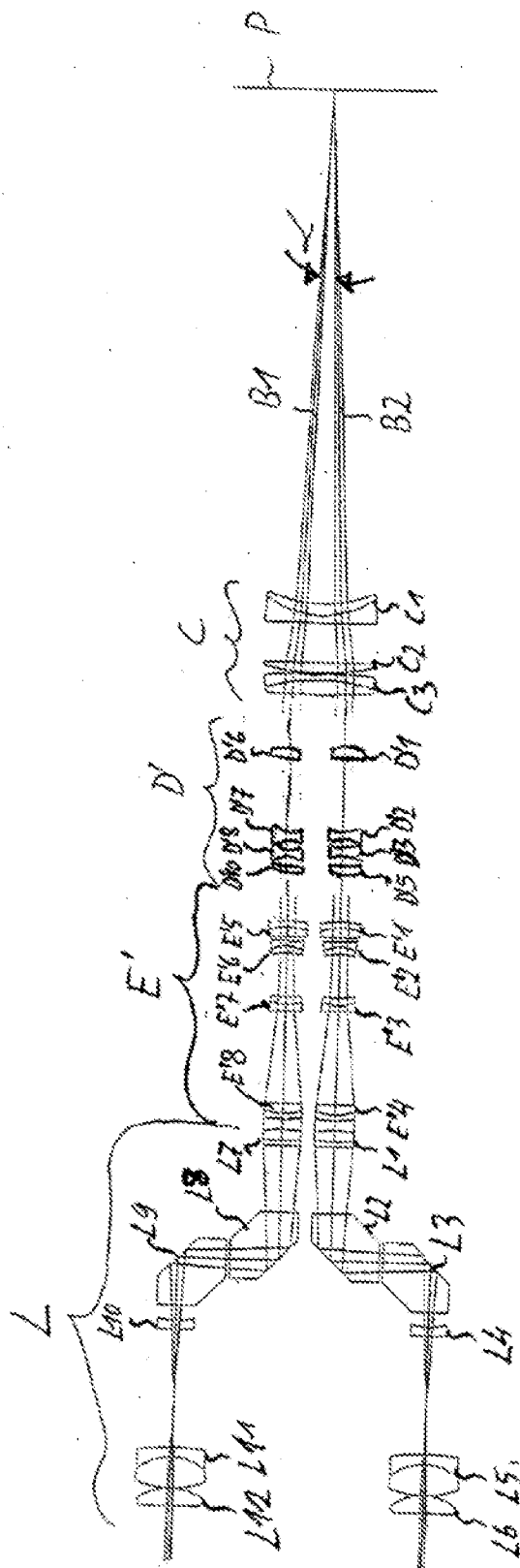


Fig. 3B

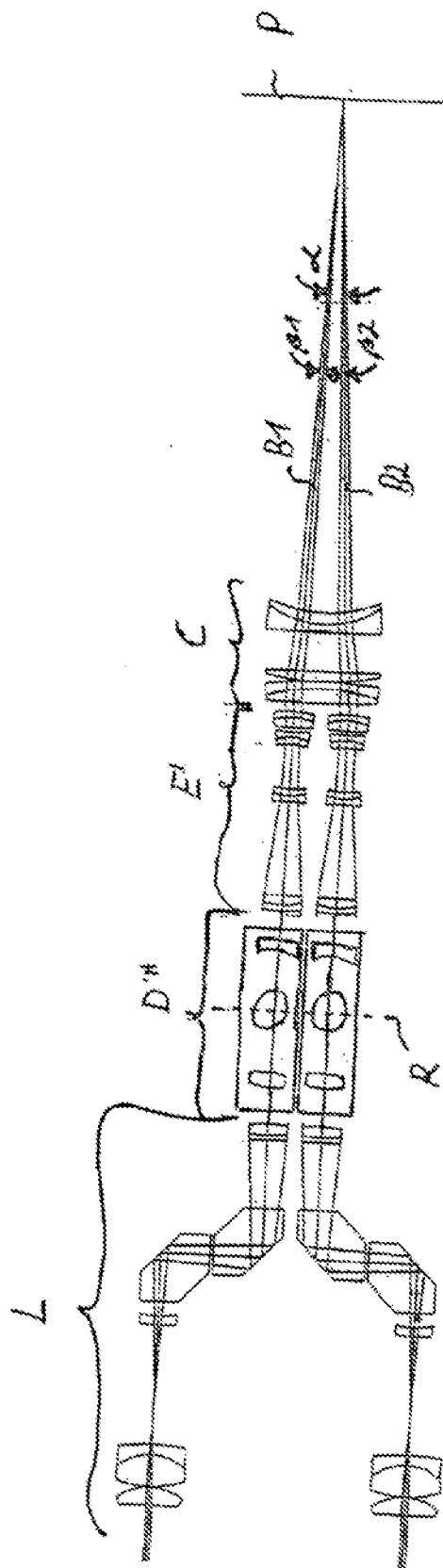


Fig. 4A  
Stand der Technik



Fig. 4B  
Stand der Technik

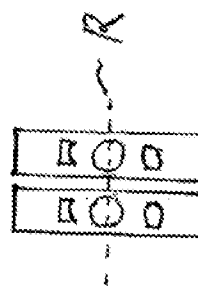


Fig. 4C  
Stand der Technik

## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	14272866			
<b>Filing Date:</b>	08-May-2014			
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance			
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE			
<b>Filer:</b>	Steven Maurice Dubois/Andrea Terry			
<b>Attorney Docket Number:</b>	0902-046			
Filed as Large Entity				
<b>Utility under 35 USC 111(a) Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
Late Filing Fee for Oath or Declaration	1051	1	140	140
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				140

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	19376195
<b>Application Number:</b>	14272866
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8559
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE
<b>Customer Number:</b>	113648
<b>Filer:</b>	Steven Maurice Dubois/Andrea Terry
<b>Filer Authorized By:</b>	Steven Maurice Dubois
<b>Attorney Docket Number:</b>	0902-046
<b>Receipt Date:</b>	23-JUN-2014
<b>Filing Date:</b>	08-MAY-2014
<b>Time Stamp:</b>	14:08:17
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 140
RAM confirmation Number	378
Deposit Account	
Authorized User	

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
-----------------	----------------------	-----------	-------------------------------------	------------------	------------------



1	Petition to make special under Patent Prosecution Hwy	Z12033-US_2014-06-23_Request_Participation_PPH_Pilot_with_OA_0902-046.pdf	1033563 f89e32805511abc23aff07820e22a06cb3eb a6de	no	10
<b>Warnings:</b>					
<b>Information:</b>					
2	Oath or Declaration filed	Z12033_US_2014-06-23_Declaration_HOEGELE_0902-046.pdf	102577 9b8dd51e393bcc5f4aef1736b24ab864d2f 84ae	no	1
<b>Warnings:</b>					
<b>Information:</b>					
3	Information Disclosure Statement (IDS) Form (SB08)	Z12033_US_2014-06-23_IDS_0902-046.pdf	612439 39d160a6d2e5fb7861d6df88b927420ed54 310f8	no	4
<b>Warnings:</b>					
<b>Information:</b>					
4	Foreign Reference	DE-195-23-712-C2_with_MachineTranslation.pdf	5688193 0a78cf076c91118cd3aece6617ab6c92c774 ad05	no	20
<b>Warnings:</b>					
<b>Information:</b>					
5	Foreign Reference	DE10-2005-050-171-A1_with_MachineTranslation.pdf	12736080 2a87781b8d963bfddc3b8e476d77d7ed18e 1f56d	no	44
<b>Warnings:</b>					
<b>Information:</b>					
6	Non Patent Literature	10-2013-008-090-8_GermanOA_with_EnglishTranslation.pdf	1853141 ee9184815cccb8eeff68ed3a2340d6b4d34 64a6a	no	32
<b>Warnings:</b>					
<b>Information:</b>					
7	Non Patent Literature	10-2013-008-090-8_GermanDecisionToGrant_with_EnglishTranslation.pdf	1685255 4813c68a6584a2a102e772a025e77abf550 613d8	no	10
<b>Warnings:</b>					
<b>Information:</b>					
8	Fee Worksheet (SB06)	fee-info.pdf	29963 3454c12259d886e74f78f30d48c7e6fcb082 6fe6	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>			23741211		

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
14/272,866	05/08/2014	3738	1680	0902-046	21	3

CONFIRMATION NO. 8559

113648

Patent Portfolio Builders, PLLC

P.O. Box 7999

Fredericksburg, VA 22404-7999

## FILING RECEIPT



\*OC000000068589659\*

Date Mailed: 05/23/2014

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

### Inventor(s)

Artur HOEGELE, Oberkochen, GERMANY;

### Applicant(s)

Carl Zeiss Meditec AG, Jena, GERMANY

### Assignment For Published Patent Application

Carl Zeiss Meditec AG, Jena, GERMANY

**Power of Attorney:** None

### Domestic Applications for which benefit is claimed - None.

*A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.*

**Foreign Applications** (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

GERMANY 10 2013 008 090.8 05/10/2013

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

**If Required, Foreign Filing License Granted:** 05/21/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/272,866**

**Projected Publication Date:** 11/13/2014

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

Surgical Microscope with Enlarged Working Distance

**Preliminary Class**

623

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No**

**PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

**LICENSE FOR FOREIGN FILING UNDER**  
**Title 35, United States Code, Section 184**  
**Title 37, Code of Federal Regulations, 5.11 & 5.15**

**GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

---

***SelectUSA***

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/272,866	05/08/2014	Artur HOEGELE	0902-046

**CONFIRMATION NO. 8559**

## FORMALITIES LETTER



\*OC000000068589660\*

113648  
Patent Portfolio Builders, PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404-7999

Date Mailed: 05/23/2014

## NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

**FILED UNDER 37 CFR 1.53(b)**

*Filing Date Granted*

### Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing.

Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- Surcharge as set forth in 37 CFR 1.16(f) must be submitted.

The surcharge is due for any one of:

- late submission of the basic filing fee, search fee, or examination fee,
- late submission of inventor's oath or declaration,
- filing an application that does not contain at least one claim on filing, or
- submission of an application filed by reference to a previously filed application.

### SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. No entity status discount is in effect. If applicant is qualified for small entity status, a written assertion of small entity status must be submitted to establish small entity status. (See 37 CFR 1.27). If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- \$ **140** surcharge.
- \$( **0** ) previous unapplied payment amount.
- \$ **140** TOTAL FEE BALANCE DUE.

### Items Required To Avoid Processing Delays:

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):  
Artur HOEGELE

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".  
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/cnguyen/

---

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

# PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number  
14/272,866

## APPLICATION AS FILED - PART I

(Column 1)		(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(j))	21 minus 20 =	*			OR	x 80 =	80
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1680

## APPLICATION AS AMENDED - PART II

(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
Total (37 CFR 1.16(i))	*	Minus	**	=		OR	x	=
Independent (37 CFR 1.16(h))	*	Minus	***	=		OR	x	=
Application Size Fee (37 CFR 1.16(s))						OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						OR		
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
Total (37 CFR 1.16(i))	*	Minus	**	=		OR	x	=
Independent (37 CFR 1.16(h))	*	Minus	***	=		OR	x	=
Application Size Fee (37 CFR 1.16(s))						OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						OR		
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

\*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.



## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	14272866			
<b>Filing Date:</b>				
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance			
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE			
<b>Filer:</b>	Steven Maurice Dubois/Andrea Terry			
<b>Attorney Docket Number:</b>	0902-046			
Filed as Large Entity				
<b>Utility under 35 USC 111(a) Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
Utility application filing	1011	1	280	280
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				280

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	18988098
<b>Application Number:</b>	14272866
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8559
<b>Title of Invention:</b>	Surgical Microscope with Enlarged Working Distance
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE
<b>Customer Number:</b>	113648
<b>Filer:</b>	Steven Maurice Dubois/Andrea Terry
<b>Filer Authorized By:</b>	Steven Maurice Dubois
<b>Attorney Docket Number:</b>	0902-046
<b>Receipt Date:</b>	09-MAY-2014
<b>Filing Date:</b>	
<b>Time Stamp:</b>	12:39:09
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$280
RAM confirmation Number	8219
Deposit Account	
Authorized User	

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
-----------------	----------------------	-----------	-------------------------------------	------------------	------------------

1	Fee Worksheet (SB06)	fee-info.pdf	29959	no	2
			8705157232c163897bb67222da6144e97d44145d		
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>			29959		
<p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p>					

Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

<b>UTILITY PATENT APPLICATION TRANSMITTAL</b>  <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Attorney Docket No.</td> <td>0902-046</td> </tr> <tr> <td>First Named Inventor</td> <td>Artur HOEGELE</td> </tr> <tr> <td>Title</td> <td>Surgical Microscope with Enlarged Working Distance</td> </tr> <tr> <td>Express Mail Label No.</td> <td></td> </tr> </table>	Attorney Docket No.	0902-046	First Named Inventor	Artur HOEGELE	Title	Surgical Microscope with Enlarged Working Distance	Express Mail Label No.	
Attorney Docket No.	0902-046								
First Named Inventor	Artur HOEGELE								
Title	Surgical Microscope with Enlarged Working Distance								
Express Mail Label No.									

<b>APPLICATION ELEMENTS</b> <i>See MPEP chapter 600 concerning utility patent application contents.</i>	<b>Commissioner for Patents</b> <b>P.O. Box 1450</b> <b>Alexandria, VA 22313-1450</b>
<ol style="list-style-type: none"> <li>1. <input type="checkbox"/> <b>Fee Transmittal Form</b> (PTO/SB/17 or equivalent)</li> <li>2. <input type="checkbox"/> <b>Applicant asserts small entity status.</b> See 37 CFR 1.27</li> <li>3. <input type="checkbox"/> <b>Applicant certifies micro entity status.</b> See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.</li> <li>4. <input checked="" type="checkbox"/> <b>Specification</b> [Total Pages <u>18</u>] Both the claims and abstract must start on a new page. (See MPEP § 608.01(a) for information on the preferred arrangement)</li> <li>5. <input checked="" type="checkbox"/> <b>Drawing(s)</b> (35 U.S.C. 113) [Total Sheets <u>3</u>]</li> <li>6. <b>Inventor's Oath or Declaration</b> [Total Pages <u>      </u>] (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))               <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> Newly executed (original or copy)</li> <li>b. <input type="checkbox"/> A copy from a prior application (37 CFR 1.63(d))</li> </ol> </li> <li>7. <input checked="" type="checkbox"/> <b>Application Data Sheet</b> * See note below. See 37 CFR 1.76 (PTO/AIA/14 or equivalent)</li> <li>8. <b>CD-ROM or CD-R</b> in duplicate, large table, or Computer Program (Appendix) <input type="checkbox"/> Landscape Table on CD</li> <li>9. <b>Nucleotide and/or Amino Acid Sequence Submission</b> (if applicable, items a. – c. are required)               <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> Computer Readable Form (CRF)</li> <li>b. <input type="checkbox"/> Specification Sequence Listing on:                   <ol style="list-style-type: none"> <li>i. <input type="checkbox"/> CD-ROM or CD-R (2 copies); or</li> <li>ii. <input type="checkbox"/> Paper</li> </ol> </li> <li>c. <input type="checkbox"/> Statements verifying identity of above copies</li> </ol> </li> </ol>	<b>ACCOMPANYING APPLICATION PAPERS</b> <ol style="list-style-type: none"> <li>10. <input type="checkbox"/> <b>Assignment Papers</b> (cover sheet &amp; document(s)) Name of Assignee _____</li> <li>11. <input type="checkbox"/> <b>37 CFR 3.73(c) Statement</b> <input type="checkbox"/> <b>Power of Attorney</b> (when there is an assignee)</li> <li>12. <input type="checkbox"/> <b>English Translation Document</b> (if applicable)</li> <li>13. <input type="checkbox"/> <b>Information Disclosure Statement</b> (PTO/SB/08 or PTO-1449) <input type="checkbox"/> Copies of citations attached</li> <li>14. <input checked="" type="checkbox"/> <b>Preliminary Amendment</b></li> <li>15. <input type="checkbox"/> <b>Return Receipt Postcard</b> (MPEP § 503) (Should be specifically itemized)</li> <li>16. <input type="checkbox"/> <b>Certified Copy of Priority Document(s)</b> (if foreign priority is claimed)</li> <li>17. <input type="checkbox"/> <b>Nonpublication Request</b> Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.</li> <li>18. <input type="checkbox"/> <b>Other:</b> _____ _____ _____ _____</li> </ol>

**\*Note:** (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).  
 (2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

<b>19. CORRESPONDENCE ADDRESS</b>				
<input checked="" type="checkbox"/> The address associated with Customer Number: <u>113648</u> OR <input type="checkbox"/> Correspondence address below				
Name				
Address				
City	State	Zip Code		
Country	Telephone	Email		

Signature	/stevenmdubois/	Date	May 8, 2014
Name (Print/Type)	Steven M. duBois	Registration No. (Attorney/Agent)	35,023

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	0902-046
		Application Number	
Title of Invention	Surgical Microscope with Enlarged Working Distance		
<p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p>			

## Secrecy Order 37 CFR 5.2

<input type="checkbox"/>	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--------------------------	---

## Inventor Information:

Inventor 1					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Artur		HOEGELE		
Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service					
City	Oberkochen	Country of Residence i	DE		
Mailing Address of Inventor:					
Address 1	Dinkelweg 1				
Address 2					
City	Oberkochen	State/Province			
Postal Code	73447	Country i	DE		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.					
Add					

## Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
<input type="checkbox"/> An Address is being provided for the correspondence information of this application.			
Customer Number	113648		
Email Address		Add Email	Remove Email

## Application Information:

Title of the Invention	Surgical Microscope with Enlarged Working Distance		
Attorney Docket Number	0902-046	Small Entity Status Claimed	<input type="checkbox"/>
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	3	Suggested Figure for Publication (if any)	1

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	0902-046
		Application Number	
Title of Invention	Surgical Microscope with Enlarged Working Distance		

## Filing By Reference :

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

## Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

## Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	<input checked="" type="radio"/> Customer Number	<input type="radio"/> US Patent Practitioner	<input type="radio"/> Limited Recognition (37 CFR 11.9)
Customer Number	113648		

## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the application number blank.

Prior Application Status		<a href="#">Remove</a>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the <b>Add</b> button.			<a href="#">Add</a>

## Foreign Priority Information:



<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	0902-046
		Application Number	
Title of Invention	Surgical Microscope with Enlarged Working Distance		

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove

Application Number	Country <sup>i</sup>	Filing Date (YYYY-MM-DD)	Access Code <sup>i</sup> (if applicable)
10 2013 008 090.8	DE	2013-05-10	
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

## Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	0902-046
		Application Number	
Title of Invention	Surgical Microscope with Enlarged Working Distance		

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
<b>Applicant 1</b>			<b>Remove</b>
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
<b>Clear</b>			
<input checked="" type="radio"/> Assignee	<input type="radio"/> Legal Representative under 35 U.S.C. 117	<input type="radio"/> Joint Inventor	
<input type="radio"/> Person to whom the inventor is obligated to assign.		<input type="radio"/> Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor : <input type="text"/>			
If the Applicant is an Organization check here. <input checked="" type="checkbox"/>			
Organization Name	Carl Zeiss Meditec AG		
<b>Mailing Address Information:</b>			
Address 1	Goeschwitzer Strasse 51-52		
Address 2			
City	Jena	State/Province	
Country <sup>i</sup>	DE	Postal Code	07745
Phone Number		Fax Number	

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	0902-046
		Application Number	
Title of Invention	Surgical Microscope with Enlarged Working Distance		
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button.			<input type="button" value="Add"/>

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.				
<b>Assignee 1</b>				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				<input type="button" value="Remove"/>
If the Assignee or Non-Applicant Assignee is an Organization check here.				<input type="checkbox"/>
Prefix	Given Name	Middle Name	Family Name	Suffix
<b>Mailing Address Information For Assignee including Non-Applicant Assignee:</b>				
Address 1				
Address 2				
City		State/Province		
Country i		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				<input type="button" value="Add"/>

## Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications				
Signature	/stevenmdubois/		Date (YYYY-MM-DD)	2014-05-08
First Name	Steven	Last Name	duBois	Registration Number
				35023
Additional Signature may be generated within this form by selecting the Add button.				<input type="button" value="Add"/>

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	0902-046
		Application Number	
Title of Invention	Surgical Microscope with Enlarged Working Distance		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

# Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of	)	
	)	Confirmation No.: <i>To Be Assigned</i>
Artur HOEGELE	)	
	)	Group Art Unit: <i>To Be Assigned</i>
Application No.: <i>To Be Assigned</i>	)	
	)	Examiner: <i>To Be Assigned</i>
Filed: HERewith (May 8, 2014)	)	
	)	
For: SURGICAL MICROSCOPE	)	
WITH ENLARGED WORKING		
DISTANCE		

**PRELIMINARY AMENDMENT**

Commissioner for Patents  
Alexandria, VA 22313-1450

Sir:

Prior to examination on the merits, kindly amend the above-identified application as follows.

**AMENDMENTS TO THE CLAIMS:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**LISTING OF CLAIMS:**

1. (Currently Amended) A surgical microscope, comprising:  
an imaging system that provides a magnified multidimensional image of an object disposable in a focal plane of the imaging system along at least one optical imaging path, the imaging system comprising an objective, the objective comprising at least two lens groups ~~and in particular exactly two lens groups~~ through which the at least one optical imaging path passes one after another, and which define the focal plane of the imaging system,  
wherein at least one lens group of the objective is moveable along its optical axis relative to the at least one other lens group of the objective, ~~and~~  
wherein the objective's first lens group which is located directly adjacent to the focal plane along the at least one optical imaging path consists of at least three optical lenses and has altogether a negative optical power, and  
wherein the absolute value of the focal length of the first lens group of the objective does altogether not exceed 35 % of the absolute value of the minimum focal length of the objective.
2. (Currently Amended) The surgical microscope according to claim 1, wherein the absolute value of the focal length of the first lens group of the objective does altogether not exceed ~~35 %~~ ~~or~~ 25 % or 20 % of the absolute value of the minimum focal length of the objective.
3. (Currently Amended) The surgical microscope according to claim 1 ~~or~~ 2, wherein the absolute value of the focal length of each single optical lens of the first lens group of

the objective is between 80 % and 300 % or between 95 % and 200 % of the absolute value of the focal length of the first lens group of the objective.

4. (Currently Amended) ~~The A~~ surgical microscope ~~according to one of claims 1 to 3~~ comprising:

an imaging system that provides a magnified multidimensional image of an object disposable in a focal plane of the imaging system along at least one optical imaging path, the imaging system comprising an objective, wherein the objective comprises comprising exactly two lens groups through which the at least one optical imaging path passes, and which define the focal plane of the imaging system,

wherein at least one lens group of the objective is moveable along its optical axis relative to the at least one other lens group of the objective,

wherein the objective's first lens group which is located directly adjacent to the focal plane along the at least one optical imaging path consists of at least three optical lenses and has altogether a negative optical power,

wherein the absolute value of the focal length of the first lens group of the objective does altogether not exceed 35 % of the absolute value of the minimum focal length of the objective, and

wherein a ratio of the absolute value of the focal length of the first lens group of the objective to the absolute value of the focal length of the second lens group of the objective is between 0.75 and 1.00 or between 0.80 and 0.90 or between 0.82 and 0.88.

5. (Currently Amended) The surgical microscope according to ~~one of claims 1, 2, 3 or 4~~ claim 1, wherein the first lens group of the objective consists of just three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element.



6. (Currently Amended) The surgical microscope according to ~~one of claims 1 to 5~~ claim 1,  
wherein the objective's second lens group which is located along the at least one optical imaging path directly adjacent to the first lens group has altogether a positive optical power; and  
wherein the second lens group of the objective consists of exactly three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element.
7. (Currently Amended) The surgical microscope according to ~~one of claims 1 to 6~~ claim 1, wherein the optical lenses of each lens group are consecutively passed through by the same at least one optical imaging path, and are stationary relative to each other.
8. (Currently Amended) The surgical microscope according to ~~one of claims 1 to 7~~ claim 1, wherein no imaging of the focal plane to infinity takes place within each lens group.
9. (Currently Amended) The surgical microscope according to ~~one of claims 1 to 8~~ claim 1, wherein the objective as a whole effects an imaging of the object disposable in the focal plane of the imaging system to infinity.
10. (Currently Amended) The surgical microscope according to ~~one of claims 1 to 8~~ claim 1, wherein no imaging of the object disposable in the focal plane of the imaging system to infinity takes place within the objective.
11. (Currently Amended) The surgical microscope according to ~~one of claims 1 to 10~~ claim 1,  
wherein the imaging system provides at least one pair of optical imaging paths intersecting at the focal plane of the imaging system at a stereoscopic angle of

between 3° and 14°, and provides a magnified multidimensional image of the object disposable in the focal plane of the imaging system; and  
wherein the optical lenses of the objective are collectively passed through by the at least one pair of optical imaging paths.

12. (Original) The surgical microscope according to claim 11, wherein the imaging system, further comprises a zoom system having several optical lenses, with the optical lenses of the zoom system being consecutively passed through by just one optical imaging path of the at least one pair of optical imaging paths.
13. (Currently Amended) The surgical microscope according to ~~one of claims 1 to 12~~ claim 1, further comprising at least one image sensor disposed in an image plane of the imaging system and outputting image data representing the image of the object generated by the imaging system.
14. (New) The surgical microscope according to claim 4, wherein the absolute value of the focal length of each single optical lens of the first lens group of the objective is between 80 % and 300 % or between 95 % and 200 % of the absolute value of the focal length of the first lens group of the objective.
15. (New) The surgical microscope according to claim 4,  
wherein the first lens group of the objective consists of just three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element;  
wherein the objective's second lens group which is located along the at least one optical imaging path directly adjacent to the first lens group has altogether a positive optical power; and  
wherein the second lens group of the objective consists of exactly three optical lenses,

of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element.

16. (New) The surgical microscope according to claim 4,  
wherein the optical lenses of each lens group are consecutively passed through by the same at least one optical imaging path, and are stationary relative to each other; and  
wherein no imaging of the focal plane to infinity takes place within each lens group.
17. (New) The surgical microscope according to claim 4,  
wherein the objective as a whole effects an imaging of the object disposable in the focal plane of the imaging system to infinity; and  
wherein no imaging of the object disposable in the focal plane of the imaging system to infinity takes place within the objective.
18. (New) A surgical microscope, comprising:  
an imaging system that provides a magnified multidimensional image of an object disposable in a focal plane of the imaging system along at least one optical imaging path, the imaging system comprising an objective, the objective comprising at least two lens groups through which the at least one optical imaging path passes, and which define the focal plane of the imaging system,  
wherein at least one lens group of the objective is moveable along its optical axis relative to the at least one other lens group of the objective,  
wherein the objective's first lens group which is located directly adjacent to the focal plane along the at least one optical imaging path consists of at least three optical lenses and has altogether a negative optical power,  
wherein the absolute value of the focal length of the first lens group of the objective does altogether not exceed 35 % of the absolute value of the minimum focal length of the objective,

wherein the optical lenses of each lens group are consecutively passed through by the same at least one optical imaging path, and are stationary relative to each other; and wherein no imaging of the focal plane to infinity takes place within each lens group.

19. (New) The surgical microscope according to claim 18, wherein the absolute value of the focal length of each single optical lens of the first lens group of the objective is between 80 % and 300 % of the absolute value of the focal length of the first lens group of the objective,
20. (New) The surgical microscope according to claim 18,  
wherein the first lens group of the objective consists of just three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element;  
wherein the objective's second lens group which is located along the at least one optical imaging path directly adjacent to the first lens group has altogether a positive optical power; and  
wherein the second lens group of the objective consists of exactly three optical lenses, of which two optical lenses are joined together permanently to form a cemented element, and the third optical lens is a lens element separate from the cemented element.
21. (New) The surgical microscope according to claim 18,  
wherein the objective as a whole effects an imaging of the object disposable in the focal plane of the imaging system to infinity; and  
wherein no imaging of the object disposable in the focal plane of the imaging system to infinity takes place within the objective.

**REMARKS**

Entry of the foregoing amendments, as well as early and favorable consideration of this application are respectfully requested.

Should the Examiner have any questions regarding this response or the application in general, he is invited to contact the undersigned at (540) 361-1863, Ext. 125.

Respectfully submitted,

POTOMAC PATENT GROUP PLLC

By: /stevenmdubois/

Steven M. duBois

Registration No. 35,023

Date: May 8, 2014

Customer No. 113648

Patent Portfolio Builders PLLC  
P.O. Box 7999  
Fredericksburg, VA 22404  
(540) 361-1863, Ext. 125

## **SURGICAL MICROSCOPE WITH ENLARGED WORKING DISTANCE**

### Cross-References to Related Applications

- 5 The present application claims priority of Patent Application No. 10 2013 008 090.8, filed May 10, 2013 in Germany, the entire contents of which are incorporated by reference herein.

### Field of the Invention

- 10 The present invention relates to a surgical microscope (also referred to as operating microscope) adapted for enabling a variation of its working distance to a wide extent.

### Background

- 15 Surgical microscopes are optical reflected-light microscopes designed for use in medical surgery and providing a magnification typically in the range from 5x-30x. Compared to other optical reflected-light microscopes, surgical microscopes use an objective having an enlarged focal distance of typically between 175 mm and 550 mm and a correspondingly large working distance (distance between the lens vertex of the objective lens of a surgical microscope located closest to an object to  
20 be imaged and the object) of typically between 200 mm and 500 mm. For providing a user with a three-dimensional impression of an object to be imaged, surgical microscopes are often configured as stereoscopic microscopes (also referred to as stereo microscopes) providing a pair of optical imaging paths for the eyes of a user, with the optical imaging paths intersecting close to a focal plane of the surgical microscope at a stereoscopic angle of typically between 3° and 14°. The field  
25 of view of surgical microscopes, i.e. the area located in the focal plane that can be imaged at a given time by the at least one optical imaging path onto the retina of a user, is typically larger than 1 mm<sup>2</sup>. The field of view of a surgical microscope thus not only comprises a single image point as is the case with scanning microscopes; rather a multi-dimensional (two or three-dimensional) imaging of the object observed takes place at any point in time. Surgical microscopes are often equipped with a  
30 zoom system or a magnification changer for enabling a change in magnification, and a focusing system for changing the working distance. Regular fields of application are surgery and microsurgery.

In surgical microscopes, the image of an object imaged with the operation microscope is alternatively provided to a user by an eyepiece (or in stereoscopic surgical microscopes by a pair of eyepieces), or the image is converted in electrical signals using an image converter (or in stereoscopic surgical microscopes using a stereo image converter or a pair of image converters), and  
5 is displayed to the user in addition or alternatively to the eyepieces by at least one of a monitor and a head-mounted display.

Surgical microscopes are often supported by stands mounted to a floor or a ceiling of a treatment room or can be positioned freely across the floor of the treatment room. The stand may be adjustable  
10 manually by use of motors, and allows desired positioning and orientation of the surgical microscope above the object to be imaged.

In addition to surgical microscopes, also monoscopical overview cameras having no or only little magnification at a working distance of typically 1,000 mm are frequently used during medical  
15 surgery. The simultaneous provision of an overview camera in addition to a surgical microscope increases complexity, since there are two different tools to be handled, and increases cost, since two different tools need to be procured and maintained.

Despite the larger working distance as compared to conventional reflected-light microscopes, the  
20 range of working distances achieved with common surgical microscopes is unsatisfactory.

### Summary of the Invention

Embodiments are therefore directed to a surgical microscope enabling a variation of its working  
25 distance to a wide extent, and in particular a larger working distance as compared to common surgical microscopes.

Embodiments of a surgical microscope comprise an imaging system that includes an objective (may also be referred to as objective system) capable of generating a magnified multidimensional (in  
30 particular two or three-dimensional) image of a (normally three-dimensional) object located in the focal plane of the imaging system along at least one optical path. If no object is located in the focal plane, the focal plane itself is imaged.

The objective comprises at least two lens groups that are one after another passed through by the at least one optical imaging path, and which define the focal plane of the imaging system.

According to an embodiment, the objective comprises just two lens groups.

5

According to an embodiment, a lens group is to be understood as a subset of the optical lenses disposed in the surgical microscope characterized by meeting all of the following criteria:

- the same at least one optical imaging path consecutively passes through the optical lenses of the  
10 subset. Along the same at least one optical imaging path, no optical lenses belonging to a different lens group or to no lens group are thus present between the optical lenses of a lens group.
- the optical lenses of the subset are fixed with respect to each other, i.e. the distances between  
15 any adjacent optical lenses of all optical lenses of a lens group are non-varying and thus constant. This does, however, not preclude a common movement of all optical lenses of the lens group relative to an optical lens or lens group not being part of this lens group (or being different from the lens group considered).
- no imaging of the focal plane to infinity takes place between optical lenses of the subset, i.e., a  
20 lens group may not comprise an afocal interface. However, where applicable the lens group may begin after an afocal interface and/or end before an afocal interface.

At least one lens group of the objective is moveable along its optical axis relative to at least one  
25 other lens group of the objective. The first lens group of the objective, which is along the at least one imaging path located directly adjacent to the focal plane, consists altogether of at least three optical lenses and has a negative optical power (reciprocal of the focal length).

The term "directly adjacent" does hereby explicitly not exclude that additional optical elements  
30 having no or only very little optical power are disposed between the focal plane and the objective. Optical elements having only very little optical power are understood as optical elements having an optical power the absolute value of which does not exceed 10 %, and in particular does not exceed 5 %, and further in particular does not exceed 3 % of the overall optical power of the surgical



microscope. Optical elements having no or only very little optical power like e.g. cover disks or flat filters are therefore not to be considered when verifying the "directly adjacent" criterion. This means that no further optical lenses or lens groups are disposed between the first lens group and the focal plane.

5

The construction of the objective with two lens groups, with one of these lens groups consisting of at least three lenses and having a negative optical power altogether, enables to vary the working distance in a range that goes beyond the range typical for surgical microscopes.

10 According to an embodiment, the objective has an adjustable focal length of between 150 mm and infinity, and in particular of between 200 mm and 1,200 mm, and further in particular of between 300 mm and 600 mm.

15 According to an embodiment, the objective has an adjustable working distance of between 200 mm and 5,000 mm.

In addition to the objective, the imaging system may have further optical lenses that are one after another passed through by the at least one optical imaging path. The objective is disposed closest to the object imaged along the at least one optical imaging path. This means that the objective is  
20 disposed between other optical lenses of the imaging system and the focal plane. The optical lenses, including the optical lenses of the objective, may be simple lens elements and/or cemented elements. The imaging system may further comprise one or more optical mirrors consecutively folding the optical imaging path.

25 According to an embodiment and with regard to absolute values, the focal length of the objective's first lens group does not exceed 35 %, and in particular not 25 %, and further in particular not 20 % of the minimum overall focal length of the objective. According to an embodiment, the focal length of the objective's first lens group is at the same time, with respect to absolute values, at least 10 %, and in particular at least 15 % of the minimum overall focal length of the objective.

30

The first lens group of the objective accordingly has, with respect to the absolute value, an unusual high proportion on the optical power as compared to common objectives for surgical microscopes, particularly since the first lens group has an altogether negative optical power.

According to an embodiment, each optical lens of the first lens group of the objective has a focal length, which absolute value is between 80 % and 300 %, and in particular between 95 % and 200 % of the absolute value of the focal length of the first lens group of the objective.

5

Within the first lens group, the optical power is thus fairly equally distributed across the optical lenses of the first lens group.

According to an embodiment, the absolute value of the ratio of the focal length of the first lens group of the objective to the focal length of the second lens group of the objective is between 0.75 and 1.00, and in particular between 0.80 and 0.90, and further in particular between 0.82 and 0.88.

10

15

According to an embodiment, the first lens group of the objective consists of exactly three optical lenses, whereby in particular two of the optical lenses are joined together permanently by bonding to form a cemented element, and whereby the third optical lens forms a lens element separate from the cemented element. The permanently joined lenses are hereby made from materials of different refractive index. The cemented element may then be disposed either between the focal plane and the separate lens element or the separate lens element may be disposed between focal plane and the cemented element.

20

According to an embodiment, the optical power of the second lens group of the objective that is located along the at least one optical imaging path directly adjacent to the first lens group is altogether positive.

25

30

According to an embodiment, the second lens group of the objective consists of just three optical lenses, whereby in particular two of the optical lenses are joined together permanently by bonding to form a cemented element, and whereby the third optical lens forms a lens element separate from the cemented element. The permanently joined lenses are hereby made from materials of different refractive index. The cemented element may then be disposed either between the focal plane and the separate lens element or the separate lens element may be disposed between the focal plane and the cemented element.

According to an embodiment, the same at least one optical imaging path consecutively passes

through the optical lenses of each lens group, while the optical lenses of each lens group are stationary relative to other lenses of the same lens group.

According to an embodiment, within a lens group, no imaging of the focal plane to infinity takes place.

According to an embodiment, the objective as a whole causes an imaging of an object disposable in the focal plane of the imaging system to infinity. This enables a modular structure of the surgical microscope.

According to an embodiment, no imaging of an object disposable in the focal plane to infinity is effected within the objective.

According to an embodiment, the imaging system provides at least one pair of optical imaging paths intersecting in the focal plane of the imaging system under a stereoscopic angle  $\alpha$  of between  $3^\circ$  and  $14^\circ$  with each imaging an object disposed in the focal plane of the imaging system into a magnified multidimensional (and in particular two-dimensional) image of the object. Altogether, this enables a provision of a three-dimensional image of the object. Hereby, the at least one pair of optical imaging paths collectively passes through the optical lenses of the objective. The optical imaging paths of the at least one pair of optical imaging paths may overlap each other in part inside the optical lenses of the objective or may not overlap each other. In particular, principal rays of the optical imaging paths may in pairs be equally offset to the optical axes of the lenses of the objective through which they collectively pass.

According to an embodiment, the surgical microscope further comprises a zoom system having a plurality of optical lenses, whereby only one optical imaging path of the at least one pair of optical imaging paths passes through the optical lenses of the zoom system consecutively.

According to an embodiment, the surgical microscope further comprises a variable aperture stop for each optical imaging path of the at least one pair of optical imaging paths.

According to an embodiment, the surgical microscope further comprises at least one imaging sensor disposed in an image plane of the imaging system and outputting image data representing the image

of the object generated by the imaging system. The image sensor may be provided in addition or alternatively to eyepieces. A surgical microscope comprising no eyepieces is referred to as a "digital surgical microscope"; in this case, the arrangement and position of the surgical microscope is completely independent from the arrangement and position of the image display during imaging.

5

The image data output from the at least one image sensor may be provided in form of an electrical (and where required digital) signal, which enables a reconstruction - in particular one ensuring color fidelity - of the object image generated by the imaging system. This means that the signal output from the imaging sensor contains an information content corresponding to the information content of the image of the object generated by the imaging system to an extent enabling a reproduction of the image on a display based on the signal. The at least one image sensor may for instance be a silicon sensor, and in particular a CCD-sensor (optionally with a preceding filter wheel or color sensitive sensors instead), or an active-pixel sensor based on CMOS technology. According to an embodiment, an area of the image sensor sensitive to light has an area of at least 100 x 100 picture elements, and in particular of at least 320 x 240 picture elements.

15

When using an image sensor, the surgical microscope may further comprise a display (for example a monitor, a digital projector, or a head-mounted display), for displaying the image obtained from the image sensor.

20

According to an embodiment, the surgical microscope further comprises a controller configured to automatically control the objective of the imaging system such that the imaged object is continuously maintained in the focal plane of the imaging system. This results in the imaging system producing a sharp image of the object imaged even during a change in magnification. A respective functionality is also referred to as autofocus.

25

According to an embodiment, the surgical microscope further comprises a radiation source providing an illumination beam path passing through the lens groups of the objective along the optical axes of the lens groups.

30

According to an embodiment, a stand supports the surgical microscope. The stand can be fixedly mounted to a wall, a floor, or a ceiling or be for instance moveable by rolls.

According to an embodiment, the surgical microscope is a digital surgical microscope which imaging system does not comprise any eyepieces.

It is noted that the above embodiments may be combined in any possible manner.

5

The terms "including", "comprising", "containing", "having" and "with", as well as grammatical modifications thereof used in this specification or the claims for listing features, are generally to be considered to specify a non-exhaustive listing of features like for instance method steps, components, ranges, dimensions or the like, and do by no means preclude the presence or addition  
10 of one or more other features or groups of other or additional features.

### Brief Description of the Drawings

The forgoing as well as other advantageous features of the disclosure will be more apparent from the  
15 following detailed description of exemplary embodiments together with the claims and the Figures. In the Figures, like or similar elements are indicated by like or similar reference signs. It is noted that the invention is not limited to the embodiments of the exemplary embodiments described, but is defined by the scope of the enclosed claims, and that not all possible embodiments necessarily exhibit each and every, or any, of the advantages identified herein. In particular, embodiments  
20 according to the invention may implement individual features in a different number and combination than the examples instanced below. In the following explanation of an exemplary embodiment of the invention, it is referred to the enclosed Figures, of which

Figure 1 shows a schematic representation of an application of a surgical microscope according to  
25 an embodiment of the invention;

Figure 2 shows a schematic cross sectional view of the construction of the surgical microscope of Figure 1; and

30 Figure 3 shows a magnified schematic representation of the optical lenses of the objective of the surgical microscope of Figure 2.

In the exemplary embodiments described below, components that are alike in function and structure

are indicated as far as possible by alike reference numerals. Therefore, to understand the features of the individual components of a specific embodiment, the descriptions of other embodiments and of the summary of the disclosure should be referred to.

5

### Detailed Description of Exemplary Embodiments

With reference to Figure 1, a schematic representation of an exemplary use of a surgical microscope 1 according to an embodiment of the invention in a surgical procedure is shown.

10 The surgical microscope 1 is supported by a floor stand 12 moveable on rollers (not shown), and by using the stand, a user can move it manually such that an optical axis A of an objective (shown in Figure 2) is directed onto an operation area 3 to be imaged. The magnified image of the operation area 3 generated by the surgical microscope 1 is output via lines (not shown) and three monitors 11, 11', and 11'', as well as to a head-mounted display 11''' of a user via a radio interface.

15

As schematically shown in Figure 2, the surgical microscope 1 of Figure 1 is a stereoscopic microscope having an imaging system 2 providing two optical imaging paths 2a, 2b intersecting in a focal plane 4 of the imaging system 2 of the surgical microscope 1 at a stereoscopic angle  $\alpha$ . The value of the stereoscopic angle  $\alpha$  depends on the respective working distance chosen and is between 20  $6^\circ$  and  $10^\circ$  for the digital surgical microscope shown.

It is noted that the paths of the principal rays of the optical imaging paths 2a, 2b are shown in Figure 2 only schematically. Therefore, Figure 2 shows the refractive effect of the lenses therefore only imperfectly.

25

In the embodiment shown, the imaging system 2 is comprised of a two-part objective 5 and a four-part zoom system 8. It is noted that the present invention is not limited to two-part objectives or four-part zoom systems, but may generally also use multi-part systems.

30 The objective 5 comprises two lens groups 6, 7 consecutively passed through by both stereoscopic optical imaging paths 2a, 2b together, with the two lens groups imaging the whole operation area 3 to infinity. Accordingly, an afocal interface is provided between the objective 5 and the zoom system 8.

The lens group 6 located closest to the operating area 3 to be imaged along the stereoscopic optical imaging paths 2a, 2b has an altogether negative optical power and consists of three optical lenses 61, 62, 63 disposed with a fixed distance relative to each other. The two optical lenses 61, 62 of the first lens group 6 that are closest to the operation area 3 under observation are made from materials with different refractive indices and are permanently bonded face-to-face to each other for forming a cemented element. The remaining third lens 63 of the first lens group 6 is a simple lens element located at a fixed distance from the cemented element of the first lens group 6. In the embodiment shown, the optical lens 61 has a focal length which absolute value is 146 %, the optical lens 62 has a focal length which absolute value is 98 %, and the optical lens 63 has a focal length which absolute value is 157 % of the overall focal length of the first lens group 6 of the objective 5.

It is noted that the present invention is not limited to an objective having a first lens group where the cemented element is located between the ordinary lens element and the focal plane. For example, the single lens element may alternatively also be located between the cemented element and the focal plane.

The other second lens group 7 has altogether a positive optical power and consists also of three optical lenses 71, 72, 73 arranged with fixed distances relative to each other. The two optical lenses 71, 72 of the second lens group 7 that are closest to the operation area 3 under observation are made from materials with different refractive indices and are permanently bonded face-to-face to each other for forming a cemented element. The remaining third lens 73 of the second lens group 7 is a ordinary lens element located at a fixed distance from the cemented element of the second lens group 7.

In the embodiment shown, the optical axes A of all optical lenses 61, 62, 63, 71, 72, 73 of the first and second lens groups 6, 7 coincide and thus are identical.

In the embodiment shown, the ratio between the absolute value of the focal length of the first lens group 6 and the absolute value of the focal length of the second lens group 7 is 0.85 : 1. The absolute value of the first lens group's 6 focal length is 23 % of the absolute value of the overall focal length of the objective 5.

The first lens group 6 is disposed along the optical axis A between the focal plane 4 of the imaging system 2 and the second lens group 7. The second lens group 7 can be moved relative to the first lens group 6 along the optical axis A by actuator 70 for adjusting a working distance of the surgical microscope 1 between 200 mm and 5,000 mm. For this purpose the actuator 70 is coupled to a controller 10.

The invention is, however, not limited to the second lens group of the objective being moveable relative to the first lens group of the objective along the optical axis. Alternatively or additionally, also the first lens group, which is located along the optical axis between the focal plane of the imaging system and the second lens group, may be moveable along the optical axis relative to the second lens group for adjusting the working distance of the surgical microscope.

The two lens groups 6, 7 altogether image the focal plane 4 to infinity.

Between the objective 5 and the zoom system 8, each optical imaging path 2a, 2b respectively comprises a variable aperture stop 13, 13' for enabling an adjustment of intensity and depth of focus.

The four parts of the zoom system 8 each are cemented elements. Each cemented element is formed by two optical lenses of eight optical lenses 81 and 82, 83 and 84, 85 and 86, 87 and 88, 81' and 82', 83' and 84', 85' and 86', 87' and 88' of the zoom system, with the respective two lenses being glued face-to-face together and being made from materials with different refractive indices. The cemented elements are each consecutively passed through (traversed) by only one of the two stereoscopic optical imaging paths.

The lenses 83, 84 and 83', 84', respectively and 85, 86 and 85', 86', respectively, of the two central parts can each be moved by a drive 80, 80' relative to the lenses 81, 82 and 81', 82', respectively, and 87, 88 and 87', 88', respectively, for changing the magnification provided by the zoom system 8 between 8x and 20x.

Along the optical imaging paths 2a, 2b the imaging system 2 generates magnified images of the operation area 3 on reception areas 91, 91' of two CCD-sensors 9, 9'. The images of the operation area 3 received on the reception areas 91, 91' represent views of the operating area 3 at two slightly different angles. In the embodiment shown, the reception areas 91, 91' comprise a Bayer matrix



providing a resolution of 1280 x 1024 image elements. Based on electrical signals output from the reception areas 91, 91', the CCD-sensors 9, 9' construct two-dimensional single images of the operation area 3 imaged by the imaging system 2 which are output by the controller 10 to the at least one display 11. Although a total of four displays 11, 11', 11'', and 11''' is shown in Figure 1, only one display 11 is shown in Figure 2 for the sake of clarity. Since the CCD-sensors 9, 9' output two images that are stereoscopically related to each other, a 3D-monitor is actually used as display 11.

The controller 10, which is a processor configured by software, is coupled to the CCD-sensors 9, 9', the drives 80, 80' of the zoom system 8, the drive 70 of the objective 5, the variable aperture stops 13, 13', and the at least one display 11 by data lines shown as dashed lines. The data line between the controller 10 and the aperture stops 13, 13' is not shown in Figure 2 for sake of clarity.

A zero-degree illumination of the focus plane 4 is achieved with a light source 12 disposed along the optical axis of the objective 5. Since the radiation emitted from the light source 12 is passed through the lenses of the objective 5, the size of the illuminated portion of the focal plane 4 adjusts automatically to the size of the portion of the focal plane 4 that is actually imaged by the surgical microscope 1.

The controller 10 controls the drive 70 of the objective 5 continuously such that the imaged operation area 3 is always located within the focal plane 4 of the imaging system 2, and the imaging system 2 always provides a sharp image of the imaged operation area 3. The controller 7 further ensures by automatic mirroring and/or rotation of the single images that the operation area 3 is shown on the at least one display 11 in its correct position.

By varying the working distance between 200 mm and 1,200 mm, the surgical microscope can thus either be used as a surgical microscope or as an overview camera. A stereoscopic image with high magnification is provided at a short working distance AA of between 200 mm and 500 mm, while a larger portion of the focal plane is imaged with large working distances AA of between 1,000 mm and 1,200 mm.

Figure 3 shows a magnified representation of optical lenses 61, 62, 63, 71, 72, 73 of the objective 5 with the optical surfaces indicated by reference numerals.

The optical parameters of these optical lenses 61, 62, 63, 71, 72, 73 are as follows:

Lens	Surface	Radius [mm]	Distance [mm]	Diameter [mm]	Medium	Refractive Index at 546 nm	Abbe Number
				OBJECT			
			200 ... 5,000		Air		
61	61a	-146.3	3.5	36	SF8	1.6942	30.94
61 / 62	61b / 62a	-51.7	2	36	BK3	1.5001	64.9
62	62b	146.3	5.5	36	Air		
63	63a	-48	2	36	CAF2	1.435	94.7
63	63b	-520	24 ... 4	36	Air		
71	71a	-600	2	40	SF8	1.6942	30.94
71 / 72	71b / 72a	157	6	40	CAF2	1.435	94.7
72	72b	-57.3	0.01	40	Air		
73	73a	120	4	40	CAF2	1.435	94.7
73	73b	-182	1 ... 21	40	Air		
				IMAGE			

The distance specified in a row of the table indicates the distance between the surface specified in said table row and the surface specified in the next row of the table. A medium specified in a table row accordingly indicates the material present between the surface specified in said row of the table and the surface specified in the next row of the table.

Since the second lens group 7 is moved as a whole, the values 24 ... 4 and 1 ... 21 change precisely diametrically opposed and to the same extent. Depending on the position of the second lens group 7, a free working distance of between 200 mm and 5,000 mm is achieved.

In the table, SF8, BK3, and CAF2 represent notations under which the respective dense flint glass, borosilicate glass, and calcium fluoride glass can be obtained from Schott AG in Germany.

For the objective shown in Figure 3, the absolute value of the ratio of the focal length of the first lens group 6 of the objective 5 to the focal length of the second lens group 7 of the objective 5 is

0.85. Further, the absolute value of the ratio of the focal length of the first lens group 6 of the objective 5 to the minimum focal length of the objective 5 is 0.23.

5 It is noted that the present invention is not limited to the above embodiment and the optical lenses used therein.

Although the invention has been described above with respect to an example using a digital surgical microscope having no eyepieces, the present invention is not limited hereupon. Accordingly, each optical imaging path of the imaging system may have a lens barrel and an eyepiece in addition or  
10 alternatively to the CCD-sensors. An image reversal is hereby effected in the lens barrel for enabling a viewing of the correctly positioned operating area.

Although two separate CCD-sensors are used above for the stereoscopic optical imaging paths, also only one CCD-sensor with a respectively large reception area may alternatively be used for both  
15 optical imaging paths together.

While the disclosure has been described with respect to certain exemplary embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the exemplary embodiments of the disclosure set forth herein are intended to be  
20 illustrative and not limiting in any way. Various changes may be made without departing from the spirit and scope of the present disclosure as defined in the following claims.

**Claims**

1. A surgical microscope, comprising:  
an imaging system that provides a magnified multidimensional image of an object disposable  
5 in a focal plane of the imaging system along at least one optical imaging path, the imaging  
system comprising an objective, the objective comprising at least two lens groups and in  
particular exactly two lens groups through which the at least one optical imaging path passes  
one after another, and which define the focal plane of the imaging system,  
wherein at least one lens group of the objective is moveable along its optical axis relative to  
10 the at least one other lens group of the objective, and  
wherein the objective's first lens group which is located directly adjacent to the focal plane  
along the at least one optical imaging path consists of at least three optical lenses and has  
altogether a negative optical power.
- 15 2. The surgical microscope according to claim 1, wherein the absolute value of the focal length  
of the first lens group of the objective does altogether not exceed 35 % or 25 % or 20 % of the  
absolute value of the minimum focal length of the objective.
3. The surgical microscope according to claim 1 or 2, wherein the absolute value of the focal  
20 length of each single optical lens of the first lens group of the objective is between 80 % and  
300 % or between 95 % and 200 % of the absolute value of the focal length of the first lens  
group of the objective.
4. The surgical microscope according to one of claims 1 to 3,  
25 wherein the objective comprises exactly two lens groups; and  
wherein a ratio of the absolute value of the focal length of the first lens group of the objective  
to the absolute value of the focal length of the second lens group of the objective is between  
0.75 and 1.00 or between 0.80 and 0.90 or between 0.82 and 0.88.
- 30 5. The surgical microscope according to one of claims 1, 2, 3 or 4, wherein the first lens group of  
the objective consists of just three optical lenses, of which two optical lenses are joined  
together permanently to form a cemented element, and the third optical lens is a lens element  
separate from the cemented element.

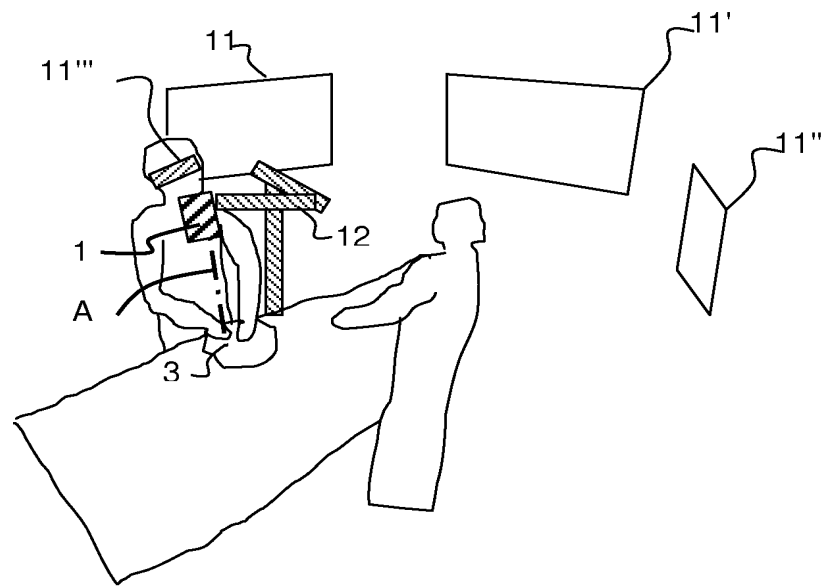
6. The surgical microscope according to one of claims 1 to 5,  
wherein the objective's second lens group which is located along the at least one optical  
imaging path directly adjacent to the first lens group has altogether a positive optical power;  
5 and  
wherein the second lens group of the objective consists of exactly three optical lenses, of  
which two optical lenses are joined together permanently to form a cemented element, and the  
third optical lens is a lens element separate from the cemented element.
- 10 7. The surgical microscope according to one of claims 1 to 6, wherein the optical lenses of each  
lens group are consecutively passed through by the same at least one optical imaging path, and  
are stationary relative to each other.
8. The surgical microscope according to one of claims 1 to 7, wherein no imaging of the focal  
15 plane to infinity takes place within each lens group.
9. The surgical microscope according to one of claims 1 to 8, wherein the objective as a whole  
effects an imaging of the object disposable in the focal plane of the imaging system to infinity.
- 20 10. The surgical microscope according to one of claims 1 to 8, wherein no imaging of the object  
disposable in the focal plane of the imaging system to infinity takes place within the objective.
11. The surgical microscope according to one of claims 1 to 10,  
wherein the imaging system provides at least one pair of optical imaging paths intersecting at  
25 the focal plane of the imaging system at a stereoscopic angle of between 3° and 14°, and  
provides a magnified multidimensional image of the object disposable in the focal plane of the  
imaging system ; and  
wherein the optical lenses of the objective are collectively passed through by the at least one  
pair of optical imaging paths.
- 30 12. The surgical microscope according to claim 11, wherein the imaging system, further  
comprises a zoom system having several optical lenses, with the optical lenses of the zoom  
system being consecutively passed through by just one optical imaging path of the at least one

pair of optical imaging paths.

13. The surgical microscope according to one of claims 1 to 12, further comprising at least one image sensor disposed in an image plane of the imaging system and outputting image data  
5 representing the image of the object generated by the imaging system.

**Abstract**

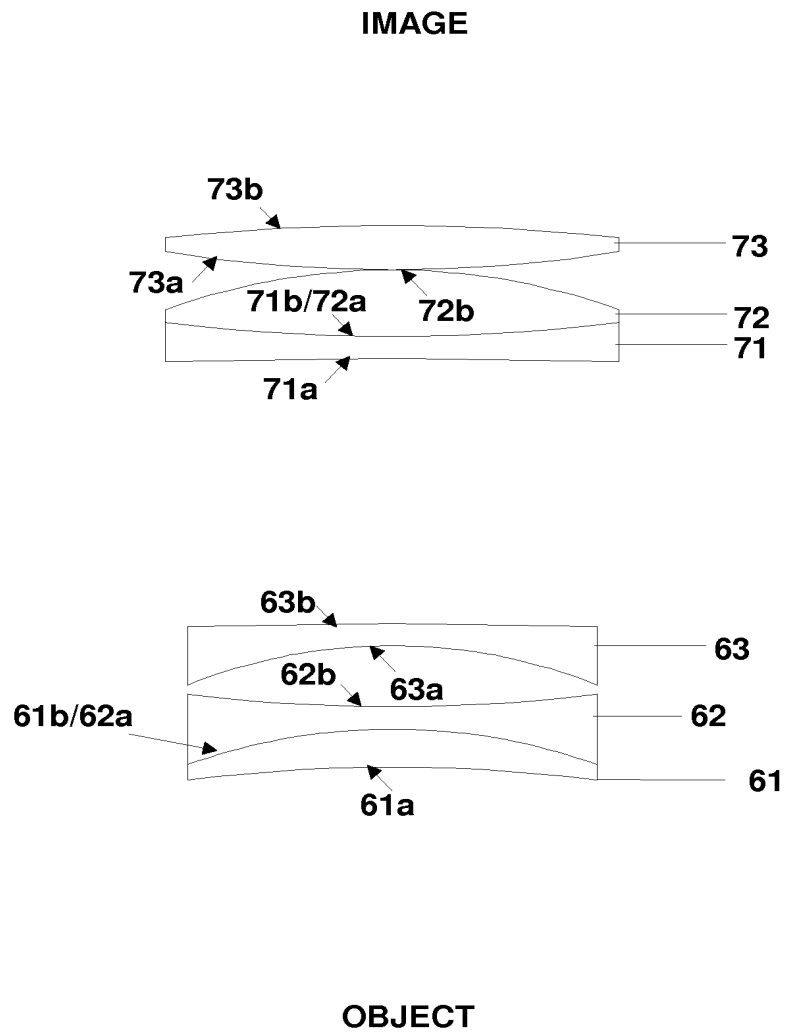
A surgical microscope 1 comprises an imaging system 2 providing a magnified multidimensional image of an object 3 disposable in a focal plane 4 of the imaging system 2 along at least one optical  
5 imaging path 2a, 2b. The imaging system 2 comprises an objective 5 having at least two lens groups 6, 7, through which the at least one optical imaging path 2a, 2b passes consecutively, and which define the focal plane 4 of the imaging system 2. At least one lens group 6 of the objective is moveable along its optical axis relative to the at least one other lens group 7 of the objective. The objective's first lens group 6 located directly adjacent to the focal plane 4 along the at least one  
10 optical imaging path 2a, 2b consists of at least three optical lenses 61, 62, 63 and has altogether a negative optical power.

**Figure 1**





## Figure 2

**Figure 3**

## Electronic Patent Application Fee Transmittal

**Application Number:**

**Filing Date:**

**Title of Invention:**

SURGICAL MICROSCOPE WITH ENLARGED WORKING DISTANCE

**First Named Inventor/Applicant Name:**

Artur HOEGELE

**Filer:**

Steven Maurice Dubois/Andrea Terry

**Attorney Docket Number:**

0902-046

Filed as Large Entity

### Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Basic Filing:</b>				
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720

**Pages:**

**Claims:**

Claims in Excess of 20	1202	1	80	80
------------------------	------	---	----	----

**Miscellaneous-Filing:**

**Petition:**

**Patent-Appeals-and-Interference:**

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1400

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	18976224
<b>Application Number:</b>	14272866
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8559
<b>Title of Invention:</b>	SURGICAL MICROSCOPE WITH ENLARGED WORKING DISTANCE
<b>First Named Inventor/Applicant Name:</b>	Artur HOEGELE
<b>Customer Number:</b>	113648
<b>Filer:</b>	Steven Maurice Dubois/Andrea Terry
<b>Filer Authorized By:</b>	Steven Maurice Dubois
<b>Attorney Docket Number:</b>	0902-046
<b>Receipt Date:</b>	08-MAY-2014
<b>Filing Date:</b>	
<b>Time Stamp:</b>	14:55:24
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 1400
RAM confirmation Number	1086
Deposit Account	
Authorized User	

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
-----------------	----------------------	-----------	-------------------------------------	------------------	------------------

1	Transmittal of New Application	Z12033-US_2014-05-08_Application_Transmittal_0902-046.pdf	275540 458b0ebbdf7540e30f5605c52d0a40d08dc313b	no	2
Warnings:					
Information:					
2	Application Data Sheet	Z12033-US_2014-05-08_ADS_0902-046r.pdf	1571585 4bf67ffd515c594b85854422b370ac805929b8ae	no	7
Warnings:					
Information:					
3		Z12033-US_2014-05-08_as-filed_Preliminary_Amendment_0902-046r.pdf	100397 1df2bb87aa3ada13de2cba70b21fcfc6608acc78	yes	8
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Preliminary Amendment		1	1	
	Claims		2	7	
	Applicant Arguments/Remarks Made in an Amendment		8	8	
Warnings:					
Information:					
4		Z12033-US_2014-05-08_Application_Text_0902-046.pdf	129322 e3328cc10195e2e77a2c3a999b22144c94c6e85a	yes	18
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	14	
	Claims		15	17	
	Abstract		18	18	
Warnings:					
Information:					
5	Drawings-only black and white line drawings	Z12033-US_2014-05-08_Drawings_0902-046.pdf	19263 d404e7fb97283ecb478b1b42b9d24faf3922db33	no	3
Warnings:					
Information:					

6	Fee Worksheet (SB06)	fee-info.pdf	33186 1bf5f01c950737fc727e68758151dcc6a9485c2d	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>				2129293	
<p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p>					