IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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Carl Zeiss Microscopy, LLC,
Petitioner,

v.

Advanced Microscopy Inc.,
Patent Owner

U.S. Pat. No. 6,313,452 to Paragano *et al.*
Issue Date: November 6, 2001
Title: Microscopy System Utilizing a Plurality of Images for Enhanced Image Processing Capabilities

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*Inter Partes* Review No.: Unassigned

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# Petition for *Inter Partes* Review of U.S. Pat. No. 6,313,452

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| Ex. 1008 | Irani, M., *et al*., "Mosaic Based Representations of Video Sequences and Their Applications," presented at Fifth International Conference on Computer Vision, Cambridge, Massachusetts June 20-23, 1995, published in *Proceedings of Fifth International Conference on Computer Vision*, pp.605-611, 1995 ("Irani Paper") |
| Ex. 1009 | U.S. Pat. No. 5,768,447 ("Irani Patent") |
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| Ex. 1014 | Becker, D. E. *et al*., "Fast Automated Mosaic Synthesis Method for 2-D/3-D Image Analysis of Specimens Much Wider than the Field of View," *Proceedings of the 52nd Annual Meeting of the Microscopy Society of America*, G. W. Bailey and A. J. Garratt-Reid (eds.), pp.224-225, August 1994 ("Becker-94") |
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| Ex. 1016 | Henderson, E. *et al*., "Image acquisition of microscopic slides," Proc. *SPIE* 2173, *Image Acquisition and Scientific Imaging Systems*, pp.21-27, May 1994 ("Henderson") |
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| Ex. 1019 | Silage, D. A. *et al*., "Digital image tiles: a method for the processing of large sections," *J. of Microscopy*, Vol. 138, Pt. 2, pp.221-227, 1985 ("Silage") |
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## I. INTRODUCTION

Pursuant to 35 U.S.C. § 311 *et seq*. and 37 C.F.R. § 42.1 *et seq*., Carl Zeiss Microscopy, LLC ("Zeiss" or "Petitioner") files this Petition for *Inter Partes* Review of U.S. Pat. No. 6,313,452 ("the '452 Patent"). Petitioner respectfully submits that all 20 claims of the '452 Patent ("the Challenged Claims") are unpatentable under 35 U.S.C. § 103 over the prior art and that there is a reasonable likelihood that Petitioner will prevail pursuant to 37 C.F.R. § 42.108. Accordingly, it is respectfully requested that the Board institute *inter partes* review.

## II. OVERVIEW

The Challenged Claims of the '452 Patent are unpatentable as obvious over the prior art. The claims are directed to a compilation of conventional features that were well-known in the areas of microscopy and imaging, as set forth in detail in §§ VI and VIII of this Petition.

The Specification of the '452 Patent describes in the Background Information section aspects of conventional microscopes. The '452 Patent describes two alleged problems or shortcomings of prior art microscope systems: limited field of view and lack of image enhancement capabilities. To address the first problem, the '452 Patent mentions the generation of a mosaic image by combining multiple images from a microscope to thereby create an image having a larger field of view than can be seen in a single image. The '452 Patent does not itself describe how to generate mosaic images, instead relying on a prior art patent (incorporated by reference into the '452 Patent) for such disclosure. Similarly, other prior art patents were incorporated by reference into the '452 Patent regarding the functionality of extracting a moving object from an image. To address the second problem of image enhancement, the '452 Patent discloses that overlapping images can be used to increase the amount of detail in an image.

The prosecution history of the application corresponding to the '452 Patent was short. The Examiner issued a first Office Action rejecting some claims and objecting to other claims, citing only a single reference—U.S. Pat. 4,673,988 to Jansson. The Applicant then amended three independent claims to add a limitation pertaining to overlapping images, rewrote a dependent claim in independent format and argued it was distinguishable from Jansson because of a limitation pertaining to sequential mosaics, and rewrote an objected-to claim in independent format including creating a mosaic. The Examiner then allowed the application.

But, techniques related to generation and processing of mosaics in the field of image processing as used in microscopy were well known at the time of the invention of the '452 Patent. In addition to the patents incorporated by reference into the '452 Patent, numerous other prior art references described the same field of view problem as in the '452 Patent and described the use of mosaics in microscopy for addressing that problem.  Similarly, several prior art references disclose overlapping images in the field of microscopy.

## III. MANDATORY NOTICES (37 C.F.R. § 42.8(a)(1))

### A. Real parties-in-interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest in this Petition are Carl Zeiss Microscopy, LLC, Carl Zeiss, Inc., Carl Zeiss Beteiligungs-GmbH, Carl Zeiss Microscopy, GmbH, Carl Zeiss AG, Leica Microsystems, Inc., and Danaher Corporation.

### B. Related matters (37 C.F.R. § 42.8(b)(2))

Petitioner identifies the following judicial and administrative matters that could affect, or be affected by, a decision pertaining to this petition: The '452 Patent has been asserted by Advanced Microscopy Inc. ("Patent Owner") in *Advanced Microscopy Inc. v. Carl Zeiss Microscopy, LLC,* D. Del. Case No. 1:15-cv-00516-LPS-CJB, in which Zeiss was served with a complaint (Ex. 1021) on June 18, 2015; in *Advanced Microscopy Inc. v. Leica Microsystems Inc*., D. Del. Case No. 1:15-cv-00517-LPS-CJB, in which Leica was served with a complaint on June 19, 2015; in *Advanced Microscopy Inc. v. Nikon Instruments*, *Inc*., D. Del. Case No. 1:15-cv-00518-LPS-CJB; and in *Advanced Microscopy Inc. v. Olympus Scientific Solutions Americas Inc*., D. Del. Case No. 1:15-cv-00519-LPS-CJB.

### C. Designation of Lead and Back-up Counsel (37 C.F.R. § 42.8(b)(3))

| |
|---|
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### D. Notice of Service Information (37 C.F.R. § 42.8(b)(4))

Please direct all correspondence to lead and back-up counsel at the above addresses. Petitioner consents to electronic service at the email addresses above.

## IV. GROUNDS FOR STANDING (37 C.F.R. § 42.104(a))

Petitioner certifies that the '452 Patent is available for *inter partes* review and that Petitioner is not barred or estopped from requesting an *inter partes* review challenging the claims on the grounds herein. Based on the filing date of the '452 Patent (December 21, 1998), pre-AIA versions of 35 U.S.C. §§ 102, 103 and 112 govern and are cited herein.

## V. RELIEF REQUESTED (37 C.F.R. § 42.22(a)(1))

Petitioner respectfully requests institution of an *inter partes* review pursuant to 37 C.F.R. § 42.108 and cancellation of all claims of the ’452 Patent.

## VI. REASONS FOR THE REQUESTED RELIEF (37 C.F.R. § 42.22(a)(1))

As explained below and in the attached Declaration of Petitioner’s Expert, Dr. Clark (Ex. 1004), the microcopy systems and methods described and claimed in the ’452 Patent are obvious over the prior art. §§ VII-VIII of this Petition explain where each element of the Challenged Claims is taught or rendered obvious in the prior art and why each of the Challenged Claims would have been obvious to a person of ordinary skill in the art (“POSA”) of image processing as used in microscopy at the time of the invention

### A. Summary of the ’452 Patent

The ’452 Patent is generally directed to a “microscope coupled to a computer to provide enhanced image processing capabilities.” Ex. 1001, 1:11-13; Ex. 1004, ¶ 28. The ’452 Patent acknowledges that computer-controlled microscopes coupled to image display systems were known in the prior art. Ex. 1001, 1:34-45. The ‘452 Patent also describes a prior art microscope system in which a camera coupled to a microscope and computer workstation provides an image of an object being viewed on the microscope to the workstation so that a user can use the workstation to move a platform on the microscope in order to change the view of the object being displayed on the monitor of the workstation. *Id.* at 1:34-45; Ex. 1011, 7:40-41; Ex. 1004, ¶ 28.

The ‘452 Patent describes two alleged shortcomings of prior art microscope systems: limited field of view capabilities and lack of image enhancement capabilities. Ex. 1001, 1:45-2:2; Ex. 1004, ¶ 29. Specifically, the ‘452 Patent states that existing microscope systems limited the field of view to what could be seen through the microscope at any specific instant in time. Ex. 1001, 1:50-52. Regarding the alleged lack of image enhancement shortcoming, the ‘452 Patent does not elaborate, merely stating that "conventional microscope systems are generally limited to capturing a magnified image of an object and providing the captured magnified image to an image display system for display." *Id.* at 1:66-2:2.

The Summary of the Invention section of the ‘452 Patent section describes embodiments for addressing the two above-mentioned alleged shortcomings of existing systems and thus for achieving the two goals of the alleged invention. *Id.* at 2:5-39; Ex. 1004, ¶ 30. For example, regarding the first goal of increasing the field of view, the ‘452 Patent describes an embodiment of creating a mosaic image by combining a plurality of images from a microscope to thereby create an image having a larger field of view than can be seen in a single image. Ex. 1001, 2:19-26. The ‘452 Patent does not include a detailed description of creating a mosaic image, but instead incorporates by reference exemplary techniques and algorithms described in a prior art patent, U.S. Pat. No. 5,649,032 ("Burt"). *Id.* at 5:24-28. In another embodiment, the first goal is achieved by the creation of a submosaic image from the mosaic image. *Id.* at 2:27-30.

With respect to the second stated goal of image enhancement, the '452 Patent describes an embodiment that allows a user to select an area of interest in the image mosaic and then present an enhanced image of the area of interest at a resolution greater than a current resolution setting of the microscope. *Id.* at 2:31-40; Ex. 1004, ¶ 31. The Specification describes that the enhanced image is generated by creating a plurality of images that overlap each other because with higher overlap, there are a greater number of images that may be used to generate any pixel in the image. Ex. 1001, 7:41-43; Ex. 1004, ¶ 31.

The '452 Patent as filed included 20 claims. All claims as filed included a limitation directed to the first goal of an increased field of view by requiring the generation of a mosaic or otherwise creating a resultant image as a function of the plurality of images. None of the independent claims as filed included a limitation directed to the second goal of image enhancement requiring that the plurality of images from which the mosaic is made overlap each other. Ex. 1004, ¶ 32.

### B. Prosecution History

On June 10, 1998, the Applicant filed provisional application number 60/088,779 ("the '779 Provisional," Ex. 1003). Ex. 1001, 1:5-7. Ex. 1004, ¶ 33.

On December 21, 1998, the Applicant filed non-provisional application number 09/217,315 claiming priority to the June 10, 1998 filing date of the '779

Provisional. Ex. 1001, p.1. The first Office Action included rejections of claims 1-4 and 7-20 as being anticipated under 35 U.S.C. § 102 by U.S. Pat. No. 4,673,988 to Jansson. Ex. 1002, p.49. In response, the Applicant filed an amendment with arguments distinguishing Jansson. *Id.* at 54-62; Ex. 1004, ¶ 34.

The Applicant amended independent claims 1, 14, and 18 to add the limitation "wherein sets of captured images overlap adjacent sets of captured images" to each of those claims corresponding to the second goal of image enhancement. Ex. 1002, pp.56-59. The Applicant argued that the added limitation distinguished claims 1, 14, and 18 over Jansson, stating "[t]his feature is beneficial because, as explained in the specification, the overlap provides more information that can be combined for each pixel, so that a more accurate value of each pixel can be computed, and a higher resolution of the image is possible without requiring a higher magnification lens." *Id.* at 61. Thus, the Applicant amended claims 1, 14, and 18 to distinguish the claims over Jansson for the purpose of achieving the second goal of image enhancement. Ex. 1004, ¶ 35.

The Applicant also rewrote dependent claim 9 in independent form and argued that the claim was distinguishable from Jansson because of the limitation "plurality of sequential mosaics." Ex. 1002, pp.57-58. Thus, claim 9 corresponds to the first stated goal of increased field of view of the alleged invention. The dependent claims are all directed to conventional microscopy techniques, none of which were identified in the Specification as having any patentability independent of limitations recited in the independent claims. Ex. 1004, ¶ 36.

### C. Claim Construction

Under 37 C.F.R. § 42.100(b), the patent claims are to be given their broadest reasonable interpretation in light of the specification. Consistent with this standard, a proposed interpretation for the term "mosaic" is provided below. Any claim term not described below is entitled to its broadest reasonable interpretation, which Petitioner does not believe impacts the invalidity analysis described herein. Ex. 1004, ¶ 37. It is noted that this interpretation is applicable only to the *Inter Partes Review* sought herein and should not be construed as constituting, in whole or in part, Petitioner's own interpretation of any claims for any other purposes, including any litigation. Accordingly, Petitioner expressly reserves the right to present an interpretation of a claim term in other proceedings which is different, in whole or in part, from that presented in this Petition.

#### 1. "Mosaic"

The term "mosaic" is expressly recited in claims 2-20. The '452 Patent specification defines the term "mosaic" as follows: "An image mosaic is an image with a larger field-of-view than can be seen in a single image." Ex. 1001, 2:24-26. The Specification also describes that "Mosaics ar[e] formed by combining a plurality of images from a specific video capture device to provide a combination image having a larger field-of-view than would be possible in any single image from the specific video capture device." *Id*. at 4:41-44. Therefore, a person of ordinary skill in the art would understand the term "mosaic" to mean a "combination of a plurality of images having a larger field-of-view than any of the individual images forming part of the combination image." Ex. 1004, ¶ 38.

### D. Person of Ordinary Skill in the Art and the Scope and Content of the Prior Art

A POSA is a hypothetical person who is presumed to be aware of all pertinent prior art, thinks along conventional wisdom in the art, and is a person of ordinary creativity. With respect to the '452 Patent, a POSA in the field of image processing as used in microscopy in the June 10, 1998 timeframe would have had a computer science, electrical engineering, or physics education and experience in the fields of optics and imaging, and knowledge of the scientific literature concerning the same. The education and experience levels may vary between persons of ordinary skill, with some persons holding a basic Bachelor's degree with three years of relevant work experience, and others holding a Masters or Ph.D. but having one to two years of experience. Ex. 1004, ¶ 41.

### E. State of the Art

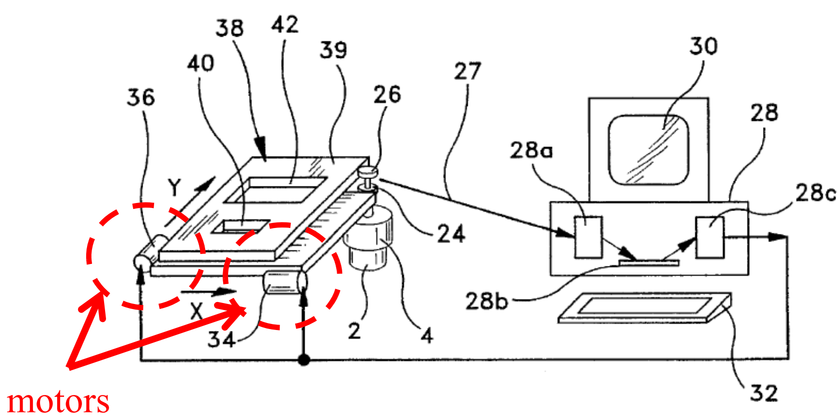
The following section describes the state of the art in imaging as used in microscopy as of the effective filing date, June 1998. *See* § VI.D, *supra;* Ex. 1004, ¶ 42. The prior art references discussed in this section are not relied on by

Petitioner as grounds for invalidity. Instead, these prior art references and discussions of what was known to a POSA provide a general description of the state of the art at the time of the invention, provide additional motivation to modify or combine the references cited in the invalidity grounds, and provide support for why a POSA would have had a reasonable expectation of success in modifying or combining the teachings of the references. These additional prior art references are exemplary in nature, relied upon by Dr. Clark, and are properly included to provide factual support for his opinions and can be properly considered by the Board to show the general state of the art, to identify motivation to modify or combine the teachings of the primary references, to support reasonable expectation of success, to rebut any claims of unpredictability in the art, and to rebut any claims of unexpected results. Ex. 1004, ¶ 42.

#### 1. Computer Controlled Microscopes

As of June 1998, the state of the art pertinent to the ’452 Patent included microscopes that enable an operator to view a magnified specimen on a support such as a glass slide. Ex. 1011, 2:1-2; Ex. 1004, ¶ 43. It was well known to support the slide by a stage that functions like a platform and that could be displaced in a plane (e.g., in x and y directions) in order to select the field of view of the microscope. Ex. 1011, 1:14-30; Ex. 1004, ¶ 43. The ’452 Patent recognizes the prior existence of microscopes having “an eyepiece . . . , lenses that provided varying levels of magnification, a stage for holding a slide . . . , a first mechanical means for moving the stage, and a second mechanical means for adjusting the magnification level." Ex. 1001, 1:22-26; Ex. 1004, ¶ 43. As described in the '452 Patent, one of the limitations of these prior art microscopes was that the selected magnification lens controlled the field of view of the specimen being examined.

It was also known at the time of the invention to couple a microscope to a camera and to a computer, so that the camera provides to the computer an image of the specimen being viewed on the microscope. Ex. 1001, 1:34-45 (describing the conventional system of Engelse); Ex. 1011, 7:39-41; Ex. 1017, 8:17-20; Ex. 1004, ¶ 44. For example, Engelse's prior art microscope stage system is shown below:




Ex. 1011, FIG. 3 (annotations added). The user could manipulate a controller at Engelse's computer 28 to move platform 39 in order to change the view of the specimen displayed on monitor 30. Ex. 1011, FIG. 3; Ex. 1001, 1:42-45; Ex. 1004, ¶ 45. Platform 39 was movable by sending drive signals from computer 28 to motors 34 and 36 that effected displacement of the stage in the x and y directions, respectively. Ex. 1011, 2:37-50, FIG. 3.

Rutenberg described a computer-controlled microscope for displaying images of the specimen being examined on a monitor. Rutenberg disclosed that the user of a computer controlled microscope could selectively position the specimen being examined by controlling movement of the stage. Ex. 1017, 5:37-41. It was known to use various types of motors, such as stepper motors or servo motors, to control movement of the stage. Ex. 1011, 8:48-49; Ex. 1017, 5:26; Ex. 1004, ¶ 46. It was also well known to use position sensors for such motor-based control of a stage. Ex. 1011, 2:9-12, 2:45-48; Ex. 1017, 5:41-43 ("The precise location of the stage 24, and thus the slide, is detected by the position encoder 44."); Ex. 1004, ¶ 46. Rutenberg explained that such a position encoder could be a conventional device that produces conventional pulses representative of movement or location of the stage. Ex. 1017, 5:43-45; Ex. 1004, ¶ 46.

These same references also disclose that images captured by a camera coupled to a microscope are sent to a computer for processing and/or displaying. Ex. 1011, 7:39-41; Ex. 1017, 8:17-23 ("The camera 14 is positioned in the microscope's optical path 29 to capture a focused, magnified electronic image of the area of the slide being viewed. The camera 14 feeds the electronic image to the computer system 20 for classification of the cells appearing in the imaged area."); Ex. 1004, ¶ 47. It was known that a microscope and camera could be controlled to take pictures of various regions of a slide in sequence. Ex. 1004, ¶ 47. For example, Rutenberg discloses scan routes that are linear or serpentine (S-shaped). *Id.*; Ex. 1017, 12:35-41.

Some prior art systems simply displayed the image of the specimen captured by the microscope and thus suffered from the same field of view restriction as conventional microscopes. Ex. 1001, 1:40-52; Ex. 1004, ¶ 48. Thus, even though multiple individual images of the specimen could be captured, each image was limited to the field of view presented by the magnification level of the microscope. Ex. 1004, ¶ 48. The field of view problem is a function of the size of an object area which is imaged by an objective having a predetermined magnification resulting in a fixed image size for that field of view. *Id.* Thus for a given object, in order to increase the field of view the magnification of the objective must be decreased. *Id.* This creates an inherent conflict between the field of view of the object and the desired level of resolution or detail of the object—as the magnification increases, the field of view decreases. *Id.*

### 2. Image Processing

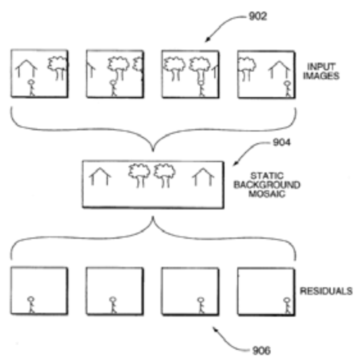
Various techniques for processing and analyzing images with a computer were known, because digital image processing was a well-developed field at the time of the invention of the '452 Patent. Ex. 1004, ¶ 49. For example, Gonzalez, a textbook published in 1977, discloses digital image processing techniques and expressly teaches that they apply broadly to many different applications in diverse fields such as mapping, archaeology, medicine, astronomy, and electron microscopy. Ex. 1013, pp.3-4; Ex. 1004, ¶ 49.

Use of computers in microscopy allowed prior art digital processing techniques to be applied to the images being examined by the microscope. Ex. 1017, 8:30-49; Ex. 1004, ¶ 50. For example, Rutenberg discloses the use of several digital imaging techniques including determining the location of a specimen on a slide. Ex. 1017, 12:43-53, 13:16-26; Ex. 1004, ¶ 50.

It was also well known that individual images (e.g. still photographs or frames of video) could be combined into a mosaic image. Ex. 1004, ¶ 51. For example, U.S. Pat. 5,649,032 to Burt titled "System for Automatically Aligning Images to Form a Mosaic Image" discloses the use of computer processing to combine individual images from an image source into a single mosaic. Ex. 1010, Abstract, 2:26-43. Burt identifies that a problem with this prior art mosaic generation was that the individual images had to be manually aligned, which is time-consuming and costly. *Id*. at 1:36-37. Burt's proposed solution to this problem is an automatic process for generating a mosaic image from a plurality of individual images. *Id*. at 1:49-55. Specifically, Burt discloses that individual images could be overlapped in various ways as part of the mosaic construction process. *Id*. at FIGS. 2A-2C, 4:44-48; Ex. 1004, ¶ 51.

### 3. Motion Detection Based on Imaging

Burt also discloses that the use of sequential imaging at respective locations was well known and was common in various applications such as surveillance and mapping for identifying moving objects. Ex. 1010, 20:20-67; Ex. 1004, ¶ 52. For example, Burt discloses that a moving object could be identified by generating a background mosaic and then identifying as residuals objects having movement relative to that background mosaic, as shown below:




Ex. 1010, FIG. 9, 16:58-67. The teachings of Burt are not limited to any particular image source, and the '452 Patent acknowledges that Burt describes a prior art mosaic generation technique that was suitable for images where a microscope is the image source, including algorithms for automatically generating dynamic mosaics (mosaics including imagery that is time variant) and static mosaics (mosaics including imagery that is time invariant). Ex. 1010, 1:65-2:2, 5:35-12:42; Ex. 1001, 5:25-29; Ex. 1004, ¶ 52.

It was further known that mosaics could be used to represent video sequences and that such representations could be used in various applications such as detection and identification of moving objects within video sequences. Ex. 1004, ¶ 43. For example, U.S. Pat. 5,768,447 to Irani ("the Irani Patent") describes a solution to the problem of managing and retrieving images contained in a video sequence. Ex. 1009, 4:15-42; Ex. 1001, 5:63-6:4; Ex. 1004, ¶ 53. The teachings of the Irani Patent are not limited to any particular image source, and the '452 Patent acknowledges that the Irani Patent discloses a prior art technique to detect and track a moving object in the plurality of images where a microscope is the image source. Ex. 1001, 5:63-6:5; Ex. 1004, ¶ 53.

#### 4. Use of Mosaics in Microscopy

In addition to generation of mosaic images generally, it was also known to generate mosaic images in the microscopy context. Ex. 1004, ¶ 54. For example, U.S. Pat. No. 4,673,988 to Jansson, titled "Electronic Mosaic Imaging Process," which was cited during prosecution for claim rejections under 35 U.S.C. § 102, discloses an "imaging system with computer-controlled, multiple electronic image acquisition and assembly means for producing a high resolution, large-field electronic mosaic image from a series of smaller field image segments" in the context of microscopy. Ex. 1012, Abstract, 3:28-32.

Like the '452 Patent, Jansson discloses that a common problem with the use of prior art microscopy systems was field of view limitations. *Id.* at 1:15-19; Ex. 1004, ¶ 55. Jansson also discloses that the creation of mosaics from individual images was the "classical solution" to the field of view limitations in microscopy. Ex. 1012, 1:15-32. Jansson's creation of a mosaic image includes the sequential capture and storage of individual images and matching the edges of adjacent images to form a continuous field mosaic. *Id.* at 1:47-53.

A recognized benefit of creating a mosaic image is that the mosaic facilitates further analysis of the specimen, e.g., by allowing a user to select a region of an image and display information accordingly based on the selected region. Ex. 1004, ¶ 56; Ex. 1012, 3:28-32 ("the operator is able to interactively manipulate the mosaic image in various ways, including zooming and roaming, much as he would do with the live image on the microscope by changing objectives and manipulating the stage."); Ex. 1004, ¶ 56. As another example, Silage discloses a video camera mounted on a microscope to facilitate image processing for microscopy. Ex. 1019, p.222. Silage discloses creating a mosaic from individual image tiles and using the mosaic to select a portion of the image to zoom in on. *Id.* Thus, it was well known to display a first mosaic and enable the user to zoom in on a region that would be displayed as a second mosaic. Ex. 1004, ¶ 56.

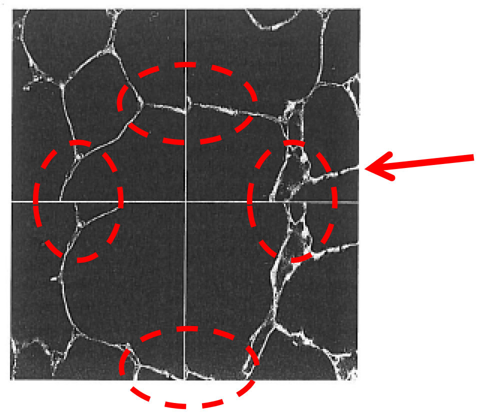
At the time of invention of the '452 Patent, mosaics were known to be useful for determining and visualizing motion and/or growth of objects in the context of microscopy. For example, the 1995 article by Jay *et al.* titled "A mechanical function of myosin II in cell motility" describes time-lapse motion directly observable in dynamic mosaics and uses parameters from the detected motion to determine that certain organisms crawl more slowly than other cells. Ex. 1020, p.387, Summary section, p.388, right column ("Interference reflection microscopy"), p.389, right column ("As illustrated by the trajectories, Ax2 cells translocate effectively on an adhesive substratum and traverse up to several cell lengths during a 15 minute experiment."), FIG. 3; Ex. 1004, ¶ 57.

#### 5. Use of Overlapping Individual Images for Mosaic Images

At the time of the invention of the '452 Patent, a known technique for generating a mosaic image from a plurality of individual images in the field of microscopy was to capture overlapping images of the specimen being examined. Ex. 1004, ¶ 58. For example, the article by Henderson titled "Image Acquisition of Microscopic Slides" describes that the use of overlapping image segments compensates for camera-to-image coordinate position errors at the neighboring segment boundaries. Ex. 1016, p.23. Henderson describes that the use of overlapping image segments achieves two goals: "First it overcomes the resolution limitation of the capture system and second, it expands the field of view of the microscope for a fixed magnification." *Id.* at 21. Importantly, these two goals match the two goals identified in the '452 Patent of increasing the field of view and enhancing images. Ex. 1004, ¶ 58.

The article titled "Methods For Large Data Volumes From Confocal Scanning Laser Microscopy of Lung" ("Oldmixon") is directed to image registration in the field of microscopy using overlapping images. Ex. 1018, p.221, left column. Image registration is the alignment of two or more images into one image. Ex. 1004, ¶ 59. One goal of Oldmixon is to generate a high resolution image with a wider field of view than that normally associated with a high resolution image. Ex. 1018, p.221, left column. Oldmixon explained that usually, extensive fields of view were only obtainable with low-numerical-aperture (not fine resolution) objective lenses. *Id.* By performing a sequence of operations that included overlapping regions of images and fusing images to form a resultant composite image, Oldmixon simultaneously achieved wide field of view and high resolution. *Id.* at 221 ("resulting stack may contain . . . a complete cross-section of an alveolar ductal unit about 500 μm or more in diameter at about 1-μm pixel resolution"); Ex. 1004, ¶ 59.

Specifically, Oldmixon discloses that digitized images in square format (e.g., 256 x 256-pixel images) were obtained from a microscope. *Id.* at 222, 225; Ex. 1004, ¶ 60. The four images shown below are from FIG. 1 of Oldmixon (annotations added), to show that "[e]ach quadrant image's content duplicates some content in the neighbour images." Ex. 1018, p.222.




Oldmixon explains that these four images can be fused to form a resultant composite image (q) using relative displacements determined from the overlapping of the images, as shown below in FIG. 3 of Oldmixon. Ex. 1004, ¶ 61.

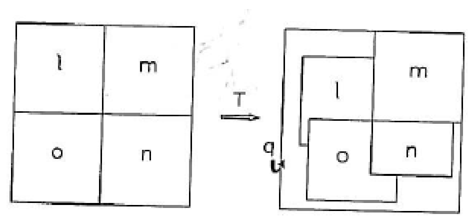



Fig. 3. An example of four 256 × 256-pixel images (*l*, *m*, *n*, *o*) translated and fused to form 512 × 512-pixel image *q* (see text).

Ex. 1018, FIG. 3, pp.225-226. Thus, Oldmixon teaches that its resultant composite image is a mosaic made from overlapping individual images from a microscope to provide high resolution image with a wider field of view than that associated with the individual images. Ex. 1004, ¶ 61.

Similarly, the prior art article by Becker titled "Fast Automated Mosaic Synthesis Method of 2D/3D Image Analysis of Specimens Much Wider Than the Field of View" establishes that overlapping partial views of a specimen using a microscope could be combined to provide a mosaic having a much wider field of view than the field of view of the microscope itself. Ex. 1014, p.224. A POSA knew that overlapping images was helpful or even necessary for image alignment and registration in order to yield accurate mosaic images. *Id*. ("It only requires each partial view to have an adequate overlap with the adjoining partial view. Adequate overlap is needed to ensure a sufficient number of common landmark points."); Ex. 1004, ¶ 62.

A POSA also knew how to capture overlapping images. Ex. 1004, ¶ 63. For example, the prior art article by Becker titled "Automated 3-D Montage Synthesis From Laser-Scanning Confocal Images: Application to Quantitative Tissue-Level Cytological Analysis" discloses controlling a microscope system to automatically capture overlapping images in sequence, e.g., at respective positions along paths. Ex. 1015, pp.235-236, FIG. 2. It would have been obvious to control motors governing the stage location to obtain such overlapped images with a conventional microscope. Ex. 1004, ¶ 63.

Thus, at the time of invention of the '452 Patent it was well known that the use of overlapping images improved the resolution of the resultant image. Ex. 1004, ¶ 64.

## VII. IDENTIFICATION OF CHALLENGES

### A. Challenged Claims

All 20 claims of the '452 Patent are challenged in this Petition.

### B. Statutory Grounds for Challenges

Challenge 1: Claims 1-8, 14-15, and 18-19 are obvious under 35 U.S.C. § 103 over Bacus in view of Ott.

Challenge 2: Claims 9-13 are obvious under 35 U.S.C. § 103 over Bacus in view of Irani Paper.

Challenge 3: Claims 16-17 and 20 are obvious under 35 U.S.C. § 103 over Bacus in view of Ott and Irani Paper.

## VIII. THE CHALLENGED CLAIMS ARE NOT PATENTABLE

### A. Challenge 1: Claims 1-8, 14-15, and 18-19 are obvious over Bacus in view of Ott

Claims 1-8, 14-15, and 18-19 are rendered obvious under 35 U.S.C. § 103 by Bacus (Ex. 1006) in view of Ott (Ex. 1007). As shown below, each of the limitations of these claims are taught or rendered obvious by Bacus in view of Ott, and any potential distinction that may be argued by the Patent Owner would have been obvious. Ex. 1004, ¶ 69.

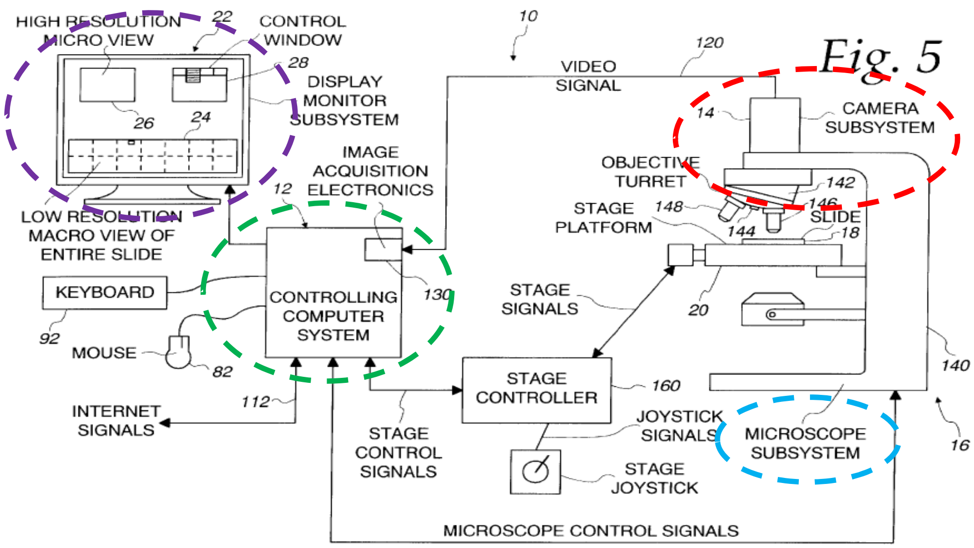
#### 1. Bacus

U.S. Patent 6,101,265 to Bacus *et al.* ("Bacus") is titled "Method and Apparatus for Acquiring and Reconstructing Magnified Specimen Images from a Computer-Controlled Microscope." Bacus qualifies as prior art to the '452 Patent at least under 35 U.S.C. § 102(e). Bacus was not considered or cited by the Examiner during prosecution of the '452 Patent. Ex. 1004, ¶ 70.

Bacus discloses that a user of an existing computer-controlled, automated microscope could select an objective lens, and the microscope automatically changed ("switch[ed] in") and adjusted the lens (e.g., from a 10x objective to a 40x objective) and lighting settings to present the user with the requested view of a specimen. Ex. 1006, 2:28-47; Ex. 1004, ¶ 71.

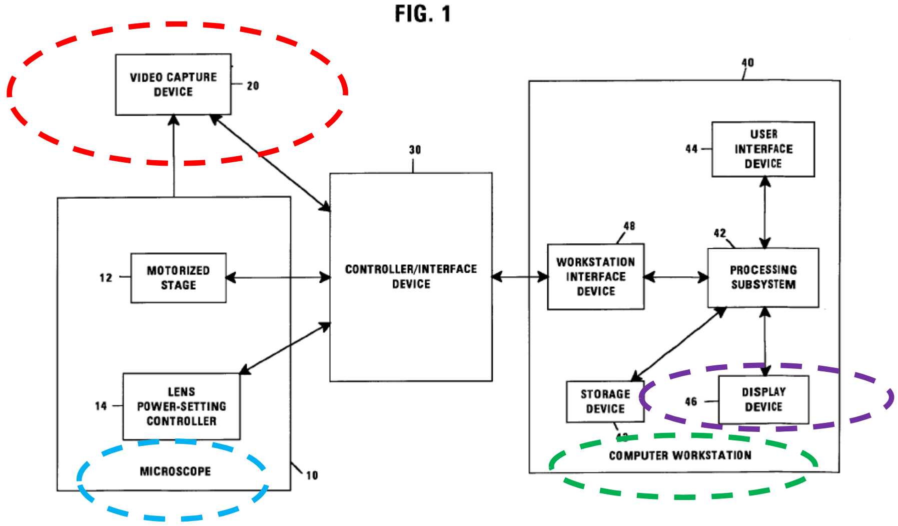
Bacus explains that a problem with existing systems was a limited field of view which required a user viewing a portion of a specimen at a given magnification (e.g., 40x) to change to a lower magnification to locate another desired portion of the specimen. *Id.* at 1:26-40; 2:4-5 ("The 40x objective provides a narrow field of view"). Bacus explains that because changing magnification also involved changing other settings (e.g., diaphragms, light levels, etc.), the user might simply try to locate the desired region at the higher magnification, "without changing objectives, which is very slow and time-consuming, and often important cancer areas can be missed." *Id.* at 1:35-40; Ex. 1004, ¶ 72.

Bacus addresses this problem of limited field of view, which is one of the goals of the '452 Patent as explained at § VI.A, *supra*, by using a microscope system including a microscope coupled to a camera and computer to "acquir[e] a large number of low magnification images of the specimen through a microscopic scanning system, e.g., 35 image tiles of the specimen at 1.25×, and then assembl[e] and coordinat[e] the tiles to form an overall, low magnified image of the specimen, i.e., a macro image of the specimen." Ex. 1006, 4:48-53; Ex. 1004, ¶ 73. Bacus' system is illustrated in FIG. 5 as shown below (annotations added):



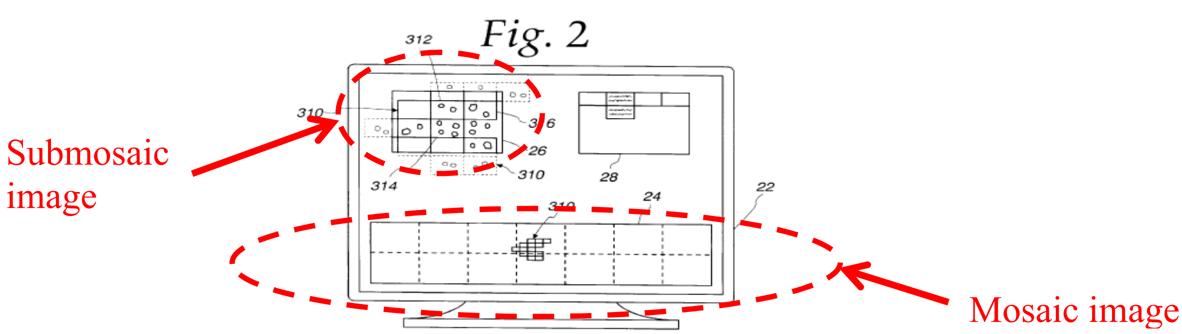

Thus, Bacus discloses a computer system coupled to camera, microscope, and display monitor subsystems, and is similar to the disclosure of FIG. 1 of the '452 Patent (shown below with annotations).

FIG. 1




Ex. 1001, FIG. 1; Ex. 1004, ¶ 74.

The macro image created by Bacus is a mosaic image as described and claimed by the '452 Patent. Ex. 1004, ¶ 75. The mosaic image of Bacus is captured through the use of motors controlling the movement of the stage just like in the '452 Patent. Bacus' image tiles are automatically acquired based on the use of motors to control the travel paths of the stage 20 of the microscope along two axes of motion. Ex. 1006, FIG. 11A (showing motors 279, 281), 10:39-43 ("X and Y stepper motors 279, and 281"). Tiles of Bacus' mosaic image 24 are at the bottom of Bacus FIG. 2 (shown below with annotations):

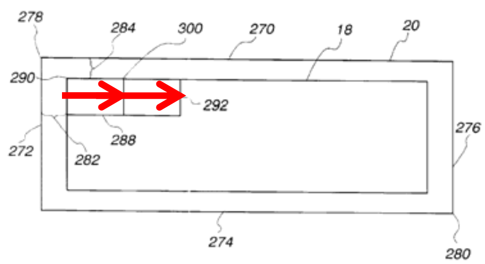



The mosaic image 24, which Bacus also calls a "low magnification composite image," is displayed to allow the user to interactively select points of interest to be displayed at high magnification. *Id.* at 4:67-5:3; Ex. 1004, ¶ 76. Bacus discloses that when the specimen is first scanned at low magnification to provide the mosaic, locations of the tile images and/or pixels for the composite image are acquired. Ex. 1006, 5:7-10. Then, when the user selects a region in the mosaic image (e.g., by using a mouse to draw a box) for higher magnification, the stage of Bacus' microscope is automatically repositioned under the higher magnification lens based on the previously acquired location data. *Id.* at 5:10-13. Bacus discloses that higher magnification, digitized image tiles are then acquired and assembled into a micro image. *Id.* at 5:13-15. The micro image created by Bacus is a submosaic image as described and claimed by the '452 Patent. FIG. 2 of Bacus (shown above) includes a depiction of tiles 312, 314, 316 of a submosaic image displayed in window 26. *Id.* at 10:29-38.

Thus, Bacus uses the same mosaic-based approach (using the nomenclature of "tiles," "macro" and "micro" images and "composite image") as the '452 Patent and for the same reason—to increase field of view. *Id.* at 5:15-19, 5:50-58 ("Often, when restricted to a field of view of an objective microscope, the pathologist has a difficult time . . . seeing the forest for the trees. In the present invention, the pathologist . . . can . . . see a region of the 'forest' at higher magnification by scrolling adjacent 'trees' images onto the high magnification screen."); Ex. 1004, ¶ 77.

Bacus discloses that computer 12 controls the travel paths of stage 20 of microscope 16 by sending appropriate control signals. Ex. 1006, FIG. 5; Ex. 1004, ¶ 78. For generation of the mosaic image, Bacus discloses scanning the entire slide at a relatively low magnification in step 204 and then tiling the acquired images. Ex. 1006, 8:56-60. In particular, Bacus discloses macro image tiling "by moving the stage appropriately." *Id.* at 10:13-14, FIG. 11 (annotation added):

Fig. 11




An example of travel paths is shown with red arrows

Bacus also describes using position information for automatically repositioning the stage for a different set of travel paths for the generation of a submosaic image. *Id.* at 5:10-15 ("any selected region of interest in the macro image has locations to which the microscopic stage may be automatically repositioned under a changed, higher magnification lens to acquire higher magnification, digitized image tiles that can be assembled into a micro image."); Ex. 1004, ¶ 79.

A POSA would have known that the travel paths for the movement of the stage to create the mosaic image are different than the travel paths for the stage to create the submosaic. *Id.* at ¶ 80. For example, FIG. 2 of Bacus illustrates one set of travel paths for moving the stage to create the mosaic and a second set of travel paths for moving the stage to create the submosaic. *Id.* A POSA recognizes that the arrows annotated in FIG. 2 (see below at § VIII.A.4, regarding limitation [3.2]) are only one example of travel paths for moving the stage, and that various other travel paths could be used instead. *Id.* at ¶ 81.

Bacus describes collecting position information for the stage and using that information for automatically repositioning the stage for generation of a micro image. Ex. 1006, 5:7-15. A POSA would have known that this position information could be used to generate a plurality of predetermined paths for the stage based on the selected region of interest and selected magnification. Ex. 1004, ¶ 82.

Bacus also describes generating the mosaic or submosaic from overlapping images as well as from images without substantial overlap. Ex. 1006, 10:16-19; Ex. 1004, ¶ 83.

### 2. Ott

The article titled "Acquisition of High-Resolution Digital Images in Video Microscopy: Automated Image Mosaicking on a Desktop Microcomputer" by Swidbert R. Ott ("Ott") was published in *Microscopy Research and Technique* on August 1, 1997. Ott qualifies as prior art to the '452 Patent at least under 35 U.S.C. § 102(a). Ott was not considered or cited by the Examiner during prosecution of the '452 Patent. Ex. 1004, ¶ 84.

Ott is directed to an automatic mosaicking technique using a desktop computer to address the limited field of view problem in microscopy. Ex. 1007, p.335, Abstract. Ott uses a CCD video camera attached to a compound microscope to capture images, and a conventional desktop computer for image processing. *Id.*

at 336, left column; Ex. 1004, ¶ 85. Ott discloses that with the rapid development of desktop computers, "digital imaging processing has become increasingly important in microscopy research." Ex. 1007, p.335, left column. Ott discloses that once an image is digitized, "virtually every image-processing technique can be employed to extract information." *Id*. Ott discloses the overlapping of individual images from a microscope to create a mosaic and explains that overlapping presents a trade-off between reliability and efficiency. *Id.* at 336, right column. Ott describes a technique for creating a mosaic on a desktop computer that minimizes the computation time. For example, having overlap allows cross-correlation techniques to be utilized only between successive frames of images in order to minimize computation time. *Id*. at 336, left column. Ott teaches that overlap of approximately 15-20% allowed reliable mosaicking of real-world frames. *Id.* at 336, right column.

### 3. Motivation to Combine Bacus and Ott

While Bacus identifies the benefit of using overlapping images to create a mosaic, Bacus describes the techniques to process the overlapping images as time-consuming and requiring expensive software. Ex. 1004, ¶ 86. Ott describes a technique for processing overlapping images that uses inexpensive software loaded on a conventional desktop for real-time creation of a mosaic image. *Id.* Both Bacus and Ott are directed to the same field of view limitation of conventional microscopes and teach the benefit of using mosaics. Thus, a POSA would have been motivated to use Ott's simplified overlapping technique with the teaching of Bacus to automatically produce mosaic images from individual overlapping images generated by a microscope in order to increase the field of view and enhance image resolution. *Id.* Hence, a POSA at the time of the invention looking to solve the problem identified by the '452 Patent would have looked to how others had solved the same problem and would have been motivated to combine the teachings of Bacus and Ott as described above. *Id.* Motivation for the specific combination of features from Bacus and Ott is discussed further in §VIII.A.4.

#### 4. Detailed Analysis of Claims 1-8, 14-15, and 18-19

The following analysis shows where each of the elements of Claims 1-8, 14-15, and 18-19 are taught or rendered obvious by Bacus in view of Ott:

***Claim 1***: [1.0][1] A microscopy system comprising:

Bacus discloses a microscope system. Ex. 1006, Title, Abstract, FIG. 5; Ex. 1004, ¶ 88.

***[1.1] a microscope including [1.1.1] a stage, [1.1.2] at least one magnifying lens, and [1.1.3] a lens controller;***

Bacus discloses this limitation. Bacus discloses a microscope 16 including

[1] For ease of reference, claim elements have been number sequentially: [1.0], [1.1], [1.1.1], [2.0], [3.0], etc.

[1.1.1] a stage 20, [1.1.2] at least one magnifying lens (any of objectives 144, 146, 148, *see* Ex. 1006, 7:25-39, 8:29), and [1.1.3] a lens controller (Ex. 1006, 8:47-50). Ex. 1004, ¶ 89.

***[1.2] a video capture device coupled to the microscope capturing a plurality of images of an object on the stage of the microscope, [1.2.1] wherein sets of captured images overlap adjacent sets of captured images; and***

Bacus discloses a video capture device (video camera 14) coupled to the microscope (microscope 16) capturing a plurality of images of an object (sample 21) on the stage of the microscope. Ex. 1006, 7:20-33 ("The system includes a computer 12 which is a dual Pentium Pro personal computer in combination with a Hitachi HV-C20 video camera 14 associated with a Zeiss Axioplan 2 microscope 16. The computer system 12 is able to receive signals from the video camera 14 which captures light from the microscope 16 having a microscope slide 18 positioned on [a] stage 20. . . . . A microscope slide 18 includes a biological specimen 21 which is to be viewed by the microscope and whose image is to be digitized both at low magnification and at high magnification as selected by a user."), FIG. 5 (showing "VIDEO SIGNAL" transmitted from camera subsystem); Ex. 1004, ¶ 90.

Moreover, Bacus expressly discloses that the captured (adjacent) images being acquired at the same magnification level are overlapping. *Id*. at 10:16-20 ("The image tiles 288 and 292 may be abutted without any substantial overlap <u>or</u>

they may be overlapped slightly, such as a one pixel [width] overlap, which is negligible insofar as blurring of any adjacent edges of abutted image tiles.") (emphasis added). The claims do not require any minimum level of overlap; neither does the specification, which only mentions that "the Burt '032 Patent does not require a substantial amount of overlap between the plurality of images." Ex. 1001, 8:24-25; Ex. 1004, ¶ 91.

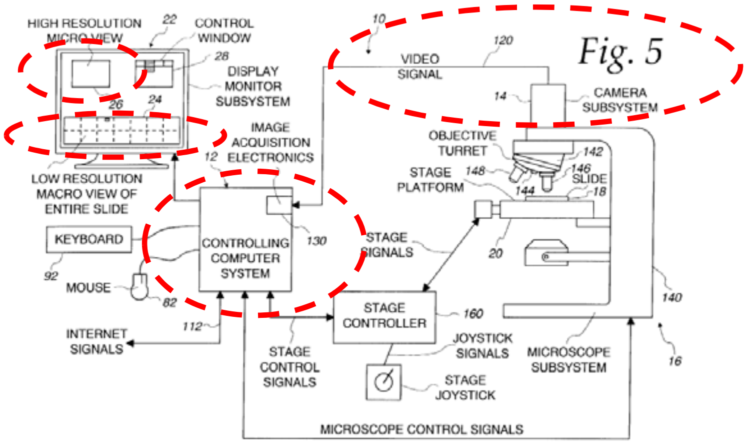
Thus, the express disclosure that the images "may be overlapped slightly" and the illustration in FIG. 2 showing adjacent sets of images overlapping adjacent sets of images satisfies the limitation that the "captured images overlap adjacent sets of captured images." Ex. 1004, ¶ 92.

Alternately, Bacus also discloses an overlap between a first mosaic 24, which has been generated from a first set of images acquired at a first (e.g., low) magnification level, with a second mosaic 310, which has been generated from a second set of images which acquired at a second (e.g., high) magnification level. Ex. 1006, Fig 2; Ex. 1004, ¶ 93.

Bacus discloses a trade-off between sufficient overlap for creating a mosaic and too much overlap that requires techniques that are time consuming and require expensive software processing. However, Ott discloses a simplified software program that can be run on a conventional desktop computer to automatically generate a mosaic from overlapping images in real-time at the time of the invention of the ‘452 Patent. Ex. 1007, p.336. To the extent that the Patent Owner argues that Bacus teaches to minimize overlap, Ott discloses a technique suitable for use with Bacus. Both Bacus and Ott are directed to overcoming the same field of view limitation of conventional microscopes through the generation and use of mosaics. Thus, a POSA would have been motivated to use Ott’s simplified overlapping technique with the teaching of Bacus to automatically produce mosaic images from the individual images generated by a microscope in order to obviate Bacus’ concern regarding time consuming and expensive processing of overlapping images and because it was known that the use of overlapping images improved the resolution of the resultant image. Thus, a POSA at the time of the invention looking to solve the problems identified by the ‘452 Patent would have looked to how others had solved the same problem and would have been motivated to combine the teachings of Bacus and Ott as described above. Ex. 1004, ¶ 94.

***[1.3] a processing subsystem receiving the plurality of images from the video capture device, the processing subsystem generating at least one resultant image as a function of the plurality of images.***

Bacus describes a processing subsystem receiving the plurality of images from the video capture device. The processing subsystem is indicated in FIG. 5 of Bacus (shown below with annotations) as controlling computer system 12, which contains image acquisition electronics for receiving images from camera 14 and which generates macro and micro views (mosaic and submosaic) based on the received images. Ex. 1004, ¶ 95; Ex. 1006, FIG. 5:




The plurality of images are melded together to form an overall image, called a macro image, which is the claimed resultant image. Ex. 1006, 8:57-60 ("The images are tiled and melded together into the overall image 24 supplied on the screen 22 to provide the operator in the step 206 with a visually inspectable macro image of relevant regions of the slide of interest."). Thus, the macro image of Bacus is a resultant image per claim 1 and is formed as a function of the multiple stored images which are tiled. Ex. 1004, ¶ 96.

<u>**Claim 2**</u>: ***[2.0] The microscopy system according to claim 1, wherein the at least one resultant image includes a mosaic.***

Bacus discloses this claim limitation. The macro image created by Bacus is a "mosaic" as in claim 1 because it is a combination of a plurality of images having a larger field of view than any of the individual images forming part of the combination image. Ex. 1004, ¶ 97.

**<u>Claim 3</u>**: ***[3.0] The microscopy system according to claim 2, wherein the stage of the microscope includes a motorized stage, the microscopy system further comprising:***

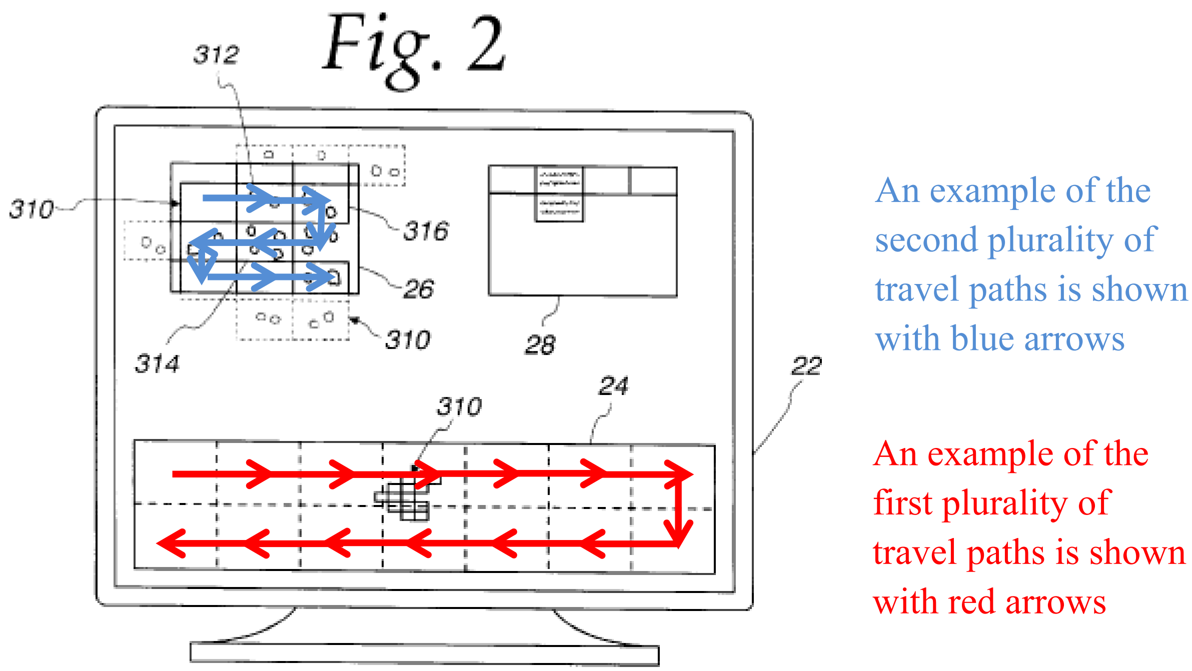
Bacus discloses that the stage of the microscope includes a motorized stage 20. Ex. 1006, 7:25-27 ("microscope 16 having a microscope slide 18 positioned on an LUDL encoded motorized stage 20"); Ex. 1004, ¶ 98.

***[3.1] a controller/interface device coupling the motorized stage to the processing subsystem,***

Bacus describes a controller/interface device coupling the motorized stage to the processing subsystem. Ex. 1004, ¶ 99; Ex. 1006, 7:27-29 ("The encoded motorized stage 20 includes a MAC 2000 stage controller for controlling the stage in response to the computer 12."), FIG. 5 (showing stage controller 160 coupling stage 20 to computer 12).

***[3.2] wherein the processing subsystem causes the motorized stage to traverse a first plurality of predetermined travel paths via the controller/interface device, and wherein the plurality of images corresponds to a plurality of positions of the motorized stage along the first plurality of predetermined travel paths.***

Bacus discloses this limitation. Ex. 1006, 10:1-38, especially 10:3-6 ("Stage boundaries for limits of the stage travel for purposes of the stage [the stage] can be moved all the way from an upper left hand corner of travel 276 to a lower right hand corner of travel 280."), 9:50-53 ("When the slide has been positioned properly, as shown in FIG. 10 in a step 250 the stage is positioned for each of the X and Y coordinate values in stage coordinate values and the digitized image is captured by the cameras"); Ex. 1004, ¶ 100. A POSA would have known that moving the stage under the control of a processor to capture the macro image of the specimen would require moving the stage along a plurality of predetermined travel paths, with one example illustrated in FIG. 2 below. Ex. 1004, ¶ 100.




__Claim 4__: ***[4.0] The microscopy system according to claim 3, wherein the microscope further includes a position sensor coupled to the motorized stage, the position sensor providing position data regarding the plurality of positions of the motorized stage to the processing subsystem, and [4.1] wherein the processing subsystem controls the motorized stage as a function of the position data.***

Bacus discloses this limitation. Bacus discloses that the computer 12 controls the motorized stage. Ex. 1006, 9:31-35 ("In a step 224 the X, Y, and Z offsets will be used for reconstruction of the recorded image at the magnification and in a step 226 __the current position__ will be read from __encoders__ in the __stage__ which are accurate to 0.10 micron.") (emphasis added), 10:39-43 ("The stage 200 is best seen in FIG. 11A and includes the X and Y stepper motors 279 and 281 with their respective encoders, which provide a closed loop system to give the 0.1 micron accuracy versus the usual 5 or 6 micron accuracy of most microscope stages without a closed loop system") (emphasis added). In order to create the mosaic image, the entire slide is scanned. *Id*. at 8:56-57. A POSA would have known that the travel path for the stage to scan the entire slide can be predetermined. Ex. 1004, ¶ 101. For example, the travel paths illustrated with respect to limitation [3.2] may be pre-programmed in the processing subsystem. *Id*.

**Claim 5**: ***[5.0] A microscopy system comprising:***

Bacus discloses this limitation, *see* limitation [1.0]; Ex. 1004, ¶ 102.

***[5.1] a microscope including a stage, at least one magnifying lens, and a lens controller;***

Bacus discloses this limitation, *see* limitation [1.1]; Ex. 1004, ¶ 103.

***[5.2] a video capture device coupled to the microscope capturing a plurality of images of an object on the stage of the microscope; and***

Bacus discloses this limitation, *see* limitation [1.2]; Ex. 1004, ¶ 104.

***[5.3] a processing subsystem receiving the plurality of images from the video capture device,***

Bacus discloses this limitation, *see* limitation [1.3]; Ex. 1004, ¶ 105.

***[5.4] the processing subsystem generating at least one resultant image including a mosaic as a function of the plurality of images,***

Bacus discloses this limitation, *see* limitations [1.3] and [2.0]; Ex. 1004, ¶ 106.

***[5.5] wherein the at least one magnifying lens includes a plurality of magnifying***

***lenses,***

Bacus discloses this limitation. The objective turret 142 includes a plurality of magnifying lenses 144, 146, 148. Ex. 1006, 8:27-29, FIG. 5; Ex. 1004, ¶ 107.

***[5.6] wherein the plurality of images are captured through a selected one of the plurality of magnifying lenses,***

Bacus discloses this limitation. Ex. 1006, 8:42-57 ("For instance, in normal operation, when a specimen is placed on the slide, specimen slide 18 is placed on the stage 20 in a step 200, as shown in FIG. 6, the processors 42 or 44 send a command through the system bus to cause the serial I/O controller 122 to signal the microscope controller to change magnification to 1.25x in a step 202. This is done by rotating the objective turret of the Axioplan 2 microscope to select the objective 144. . . . The entire slide is then scanned in a step 204"); Ex. 1004, ¶ 108.

***[5.7] wherein the lens controller includes a lens power-setting controller for setting the microscope to the selected one of the plurality of magnifying lenses,***

Bacus discloses this limitation, *see* limitation [5.6]; Ex. 1004, ¶ 109.

***[5.8] the microcopy system further comprising: a controller/interface device coupling the lens power-setting controller to the processing subsystem,***

Bacus discloses this limitation, *see* limitation [5.6]; Ex. 1004, ¶ 110.

***[5.9] wherein the processing subsystem selects the selected one of the plurality of magnifying lenses via the controller/interface device and conveys the selection to the lens power-setting controller via the controller/interface device to set the microscope to the selected one of the plurality of magnifying lenses.***

Bacus discloses this limitation, *see* limitation [5.6]; Ex. 1004, ¶ 111.

**<u>Claim 6</u>:** ***[6.0] The microscopy system according to claim 5, wherein the video capture device further captures a second plurality of images of the object on the stage using a second one of the plurality of magnifying lenses,***

Bacus discloses this limitation. Bacus discloses that the video capture device captures a second plurality of images at a second magnification for creating the submosaic shown in FIG. 2. Ex. 1006, 8:61-67 ("In order to provide the magnified image, the mouse may be moved to identify a marker segment or region which, . . . will cause the microscope to change magnification as at step 208 to 4x, 20x, 40x, etc., by rotating the turret to bring the appropriate objective lens system into viewing position."), 10:30-32; Ex. 1004, ¶ 112.

***[6.1] the second one of the plurality of magnifying lenses having a greater magnification power than the first one of the plurality of magnifying lenses, and***

Bacus discloses this limitation. Ex. 1006, 8:47-67 ("to signal the microscope controller to change magnification to 1.25x in a step 202 . . . . The entire slide is then scanned in a step 204" and ". . . which will cause the microscope to change magnification as at step 208 to 4x, 20x, 40x, etc., by rotating the turret to bring the appropriate objective lens system into viewing position."); Ex. 1004, ¶ 113.

***[6.2] wherein the processing subsystem generates a second mosaic from the second plurality of images.***

Bacus discloses this limitation. *See* the submosaic comprising tiled micro images 312, 314, 316, etc. identified above in FIG. 2 as discussed with respect to limitation [6.0]; Ex. 1004, ¶ 114.

**<u>Claim 7</u>:** ***[7.0] The microscopy system according to claim 2, further comprising: a user interface device coupled to the processing subsystem, the user interface device conveying a user input to the processing subsystem,***

Bacus discloses this limitation as seen in FIG. 5 showing keyboard 92 mouse 82, control window 28, display monitor subsystem 22, any of which can be the claimed user interface device. Ex. 1006, 8:61-63; Ex. 1004, ¶ 115.

***[7.1] wherein the user input indicates a selected area of the mosaic, and***

Bacus discloses this limitation. Bacus discloses using a mouse to select a region from the mosaic to generate a submosaic of higher magnification as shown in FIG. 2 as discussed with respect to limitations [6.1] and [6.2]; *see also* Ex. 1006, 9:1-3 ("Next the user, in a step 209a, uses the mouse to select the region on the macro image in order to select the micro image to be viewed on the screen 22."); Ex. 1004, ¶ 116.

***[7.2] wherein the processing subsystem generates a submosaic of the selected area of the mosaic.***

Bacus discloses this limitation, *see* limitations [6.0], [6.1] and [6.2]; Ex. 1006, FIG. 2; Ex. 1004, ¶ 117.

**<u>Claim 8</u>:** ***[8.0] The microscopy system according to claim 3, wherein the processing subsystem causes the motorized stage to travel along a second plurality of predetermined travel paths,***

Bacus discloses this limitation. Ex. 1006, 9:39-58, especially 9:50-58 ("When the slide has been positioned properly, as shown in FIG. 10 in a step 250 the stage is positioned for each of the X and Y coordinate values in stage coordinate values and the digitized image is captured by the cameras and stored in RAM and backed up on the hard disk. The image may be then analyzed quantitatively in various manners such as those set forth in the previously-identified United States application. Optionally the image may be stored for archival purposes in a step 254."); Ex. 1004, ¶ 118.

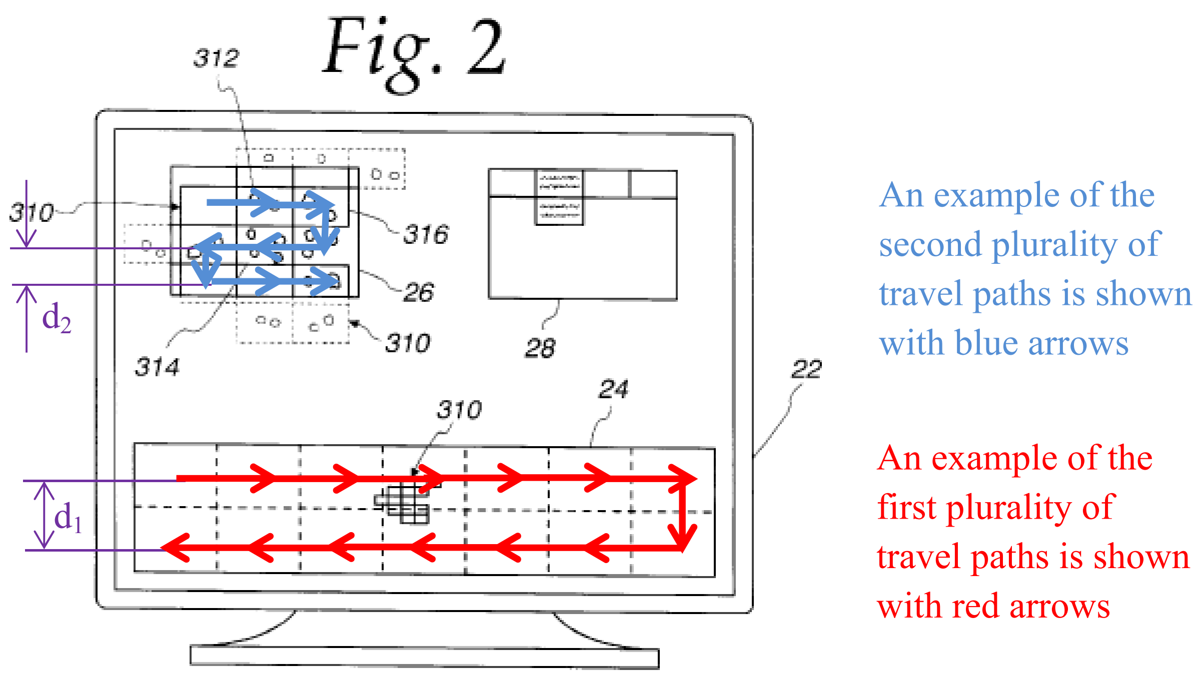
A POSA would have known that moving the stage under the control of a processor to capture the submosaic image of the specimen would require moving the stage along a plurality of predetermined travel paths, with one example illustrated in annotated FIG. 2 shown below at [8.2]. Ex. 1004, ¶ 119. In order to create the submosaic image, a POSA would have known that the travel path for the stage to scan the selected region of the mosaic can be predetermined once the region is selected. *Id*. at ¶ 120. For example, the travel paths illustrated with the submosaic may be pre-programmed in the preprocessing subsystem. *Id*.

***[8.1] wherein the video capture device captures a second plurality of images corresponding to a second plurality of positions of the motorized stage along the second plurality of predetermined travel paths,***

Bacus discloses this limitation, *see* limitations [6.0] [6.1], and [8.0]; Ex. 1004, ¶ 121.

***[8.2] a first distance separating adjacent paths of the first plurality of predetermined travel paths, a second distance separating adjacent paths of the second plurality of predetermined travel paths, the second distance being smaller than the first distance, and***

Bacus discloses this limitation. As shown in annotated FIG. 2 below, the distance $d_2$ between the adjacent travel paths that created the submosaic is less than the distance $d_1$ between the adjacent travel paths that created the mosaic. A POSA would have known that this limitation is a natural byproduct of creating the submosaic at a higher magnification than the mosaic. Ex. 1004, ¶ 122.




***[8.3] wherein the processing subsystem generates a second resultant image from the second plurality of images.***

Bacus discloses this limitation, *see* limitation [6.2]; Ex. 1004, ¶ 123.

<u>**Claim 14**</u>**:** ***[14.0] A method for generating at least one mosaic from a plurality of images of an object on a stage of a microscope, the method comprising the steps of:***

Bacus discloses this limitation, *see* limitations [1.1], [1.1.1], [1.2], [1.3], [2.0]; Ex. 1006, Abstract; Ex. 1004, ¶ 124.

***[14.1]. moving the stage of the microscope in a first plurality of predetermined travel paths;***

Bacus discloses this limitation, *see* limitation [3.2]; Ex. 1004, ¶ 125.

***[14.2] capturing the plurality of images of the object, via a video capture device, corresponding to a plurality of positions of the stage along the first plurality of predetermined travel paths;***

Bacus discloses this limitation, *see* limitations [1.2], [3.2]; Ex. 1004, ¶ 126.

***[14.3] providing the plurality of images to a processing subsystem,***

Bacus discloses this limitation, *see* limitation [1.3]; Ex. 1004, ¶ 127.

***[14.4] wherein sets of captured images overlap adjacent sets of captured images; and***

Bacus in view of Ott renders obvious this limitation, *see* limitation [1.2.1]; Ex. 1004, ¶ 128.

***[14.5] generating the at least one mosaic, via the processing subsystem, as a function of the plurality of images.***

Bacus discloses this limitation, *see* limitations [1.3], [2.0]; Ex. 1004, ¶ 129.

**Claim 15**: ***[15.0] The method according to claim 14, the method further comprising the step of: determining a position of the stage of the microscope along the first plurality of predetermined travel paths via a position sensor,***

Bacus discloses this limitation as discussed with respect to limitations [3.2] or [4.0]; *see also* Ex. 1006, FIG. 5 (showing microscope control signals and stage signals); Ex. 1004, ¶ 130.

***[15.1] wherein the stage of the microscope includes a motorized stage, and***

Bacus discloses this limitation, *see* limitation [3.0]; Ex. 1004, ¶ 131.

***[15.2] wherein the processing subsystem controls the motorized stage as a function of the determined position of the motorized stage.***

Bacus discloses this limitation. Ex. 1006, 7:27-29 ("The encoded motorized stage 20 includes a MAC 2000 stage controller for controlling the stage in response to the computer 12."); Ex. 1004, ¶ 132.

**<u>Claim 18</u>: *[18.0] A method for generating at least one mosaic from a plurality of images of an object on a stage of a microscope, [18.1] the microscope including a plurality of magnifying lenses, the method comprising the steps of:***

Bacus discloses these limitations, *see* limitations [14.0] and [5.5]; Ex. 1004, ¶ 133.

***[18.2] setting the microscope to a selected one of the plurality of magnifying lenses;***

Bacus discloses this limitation, *see* limitations [5.6], [5.7]; Ex. 1004, ¶ 134.

***[18.3] capturing the plurality of images of the object using the selected one of the plurality of magnifying lenses, [18.3.1] via a video capture device;***

Bacus discloses these limitations, *see* limitations [1.2], [5.6], [18.3.1]; Ex. 1004, ¶ 135.

***[18.4] providing the plurality of images to a processing subsystem, [18.4.1] wherein sets of captured images overlap adjacent sets of captured images; and***

Bacus in view of Ott renders obvious limitations [18.4] and [18.4.1] as discussed with respect to limitations [14.3] and [14.4]. Ex. 1004, ¶ 136.

***[18.5] generating the at least one mosaic, via the processing subsystem, as a function of the plurality of images.***

Bacus discloses this limitation, *see* limitation [14.5]; Ex. 1004, ¶ 137.

**<u>Claim 19</u>:** ***[19.0] The method according to claim 18, further comprising the steps of: setting the microscope to a second one of the plurality of magnifying lenses, the second one of the plurality of magnifying lenses having a greater magnification level than the selected one of the plurality of magnifying lenses;***

Bacus discloses this limitation, *see* limitations [6.0], [6.1]; Ex. 1004, ¶ 138.

***[19.1] capturing a second plurality of images of the object using the selected one, via the video capture device;***

To the extent that this limitation contains a typographical error such that "the selected one" should actually read "the second one," this limitation is disclosed by Bacus regarding generating the submosaic from the second plurality of images as discussed with respect to limitation [6.0] and [6.1]. Ex. 1004, ¶ 139.

To the extent that Patent Owner asserts that this limitation does not include a typographical error, this limitation is disclosed by each successive path in the first plurality of paths for creating the mosaic at the same magnification level as discussed with respect to limitation [3.2]. Ex. 1004, ¶ 140.

***[19.2] providing the second plurality of images to the processing subsystem; and***

Bacus discloses this limitation, *see* limitation [1.3]; Ex. 1004, ¶ 141.

***[19.3] generating at least one second mosaic, via the processing subsystem, as a function of the second plurality of images.***

Bacus discloses this limitation, *see* limitations [6.2], [7.2]; Ex. 1004, ¶ 142.

### B. Challenge 2: Claims 9-13 are Unpatentable over Bacus in View of Irani Paper

Claims 9-13 are rendered obvious under 35 U.S.C. § 103 by Bacus in view of Irani Paper as discussed below. Ex. 1004, ¶ 143.

### 1. Irani Paper

"Mosaic Based Representations of Video Sequences and Their Applications" by Irani *et al.* ("Irani Paper"), which was published in 1995 and qualifies as prior art under 35 U.S.C. § 102(b), was not considered or cited by the Examiner during prosecution of the '452 Patent. But, the '452 Patent does identify the Irani Patent and describes that the Irani Patent discloses a prior art technique to detect and track a moving object in the plurality of images where a microscope is the image source. Ex. 1001,. 5:65-6:5. Irani Paper was authored by three people at Sarnoff Research Center (which owned the '452 Patent), and Irani Paper does not limit its teachings to any particular application, but does identify that one of the "most obvious applications" is as a means of visualization "since mosaics provide a wide and stabilized field of view." Ex. 1008, p.608, § 4. Because one of the goals of the '452 Patent is creating a mosaic having a wider field of view, the Irani Paper is in the same field of endeavor as Bacus and a POSA would have understood the teachings to be applicable to microscopy. Ex. 1004, ¶ 144.

Irani Paper describes techniques for constructing a mosaic from overlapping images in a video sequence. Ex. 1008, p.605, § 1. It also describes that the use of mosaics with a video sequence is particularly beneficial due to the large amount of overlap in successive images which provides a significant reduction in the total amount of data to represent a scene. *Id.;* Ex. 1004, ¶ 145.

Irani Paper explains that the most common mosaic representation was a static mosaic, which is generated by segmenting an input video sequence into contiguous scene subsequences and aligning all frames of a given subsequence to a fixed coordinate sequence. Ex. 1008, p.605, § 2.1; Ex. 1004, ¶ 146. Irani Paper provides an example of a static mosaic image in FIG. 2:

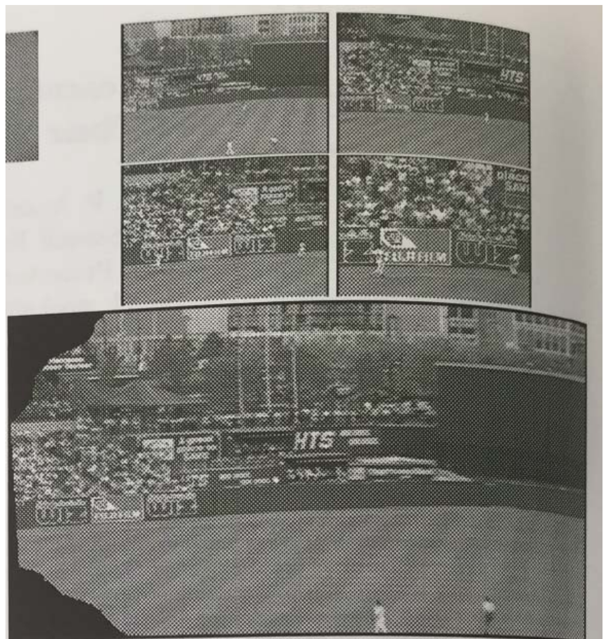



Figure 2: Static mosaic image of a baseball game sequence. *Top rows:* Four out of a 90 frame sequence obtained by a camera panning from right to left and zooming in on the runners. *Bottom row:* The static mosaic image constructed using a temporal median.

Ex. 1008, FIG. 2, p. 606. Four individual frames (images) out of a 90 frame sequence are shown at the top of the figure, and these frames overlap (as evidenced, for example, by the Fuji Film advertisement visible in multiple frames). *Id.*; Ex. 1004, ¶ 147. The static mosaic image at the bottom of FIG. 2 of Irani Paper gives a panoramic view of the scene. Ex. 1008, § 2, p.605.

Irani Paper also describes another type of mosaic referred to as a dynamic mosaic, which is "a sequence of evolving mosaic images" equivalent to the sequential mosaics in the '452 Patent. *Id.* at p.606, § 2.2; Ex. 1001, 5:47-52; Ex. 1004, ¶ 148. Irani Paper explains that dynamic mosaic images depict "the dynamic aspects of [a] video sequence," such as "changes in a scene with respect to the background." Ex. 1008, p.606. An example dynamic mosaic, which Irani Paper stated was also referred to as a "mosaic video" or "sequence of mosaic images," is shown at the right column of FIG. 3 of Irani Paper:

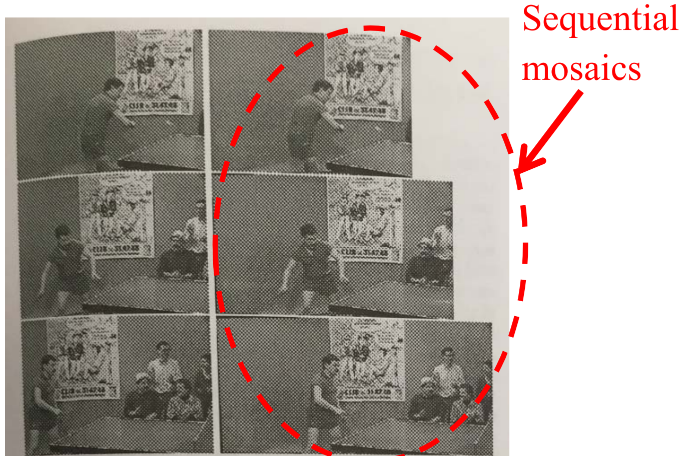



Figure 3: Evolution of the dynamic mosaic images of the table-tennis game sequence. *Left column:* Three frames from the original sequence. *Right column:* The corresponding dynamic mosaic images. Note that the position of the player and the crowd are constantly being updated to match the current frame.

*Id.* at FIG. 3 (annotation added), p.609 ("Mosaic video"). Irani Paper provides details for constructing a mosaic, including the steps of aligning images in a sequence, integrating the images into a mosaic, and computing differences known as significant residuals between the mosaic and the individual frames. *Id.* at 607-608. Residuals can be caused by an object that is moving in the video sequence.

*Id.* at 608, right column; Ex. 1004, ¶ 149.

For example, FIG. 6(b) of Irani Paper (shown below regarding limitation [11.0]) shows the use of a mosaic for identifying and visualizing a moving baseball outfielder. Ex. 1004, ¶ 150.

Irani Paper discloses that another application of mosaics is video enhancement, including "producing high quality stills from video as well as enhancing an entire video sequence." Ex. 1008,. p.609. Irani Paper explains that using mosaics can "provide[] higher spatial resolution," e.g., through a technique referred to as super-resolution for which Irani Paper provided citations to additional prior art references. *Id.* at 609, 611; Ex. 1004, ¶ 151. Irani Paper provides at FIG. 7 an example of using a mosaic for image enhancement:

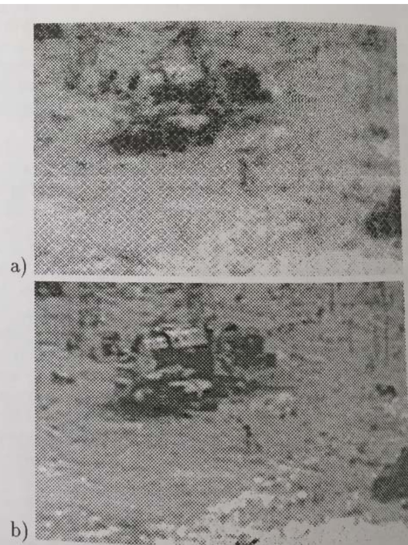



Figure 7: Mosaic-based video enhancement from a surveillance sequence of a deserted truck. (a) One out of 30 frames (all frames are of the same quality). (b) The corresponding enhanced frame in the enhanced video sequence. (All the frames in the enhanced video are of similar quality.)

### 2. Motivation to Combine Bacus and Irani Paper

A POSA would have been motivated to combine Bacus and Irani Paper for several reasons. Ex. 1004, ¶ 152. Like Bacus and the '452 Patent, Irani Paper is in the same field of endeavor and directed to solving the same problem and utilizing the same technique. *Id*. Moreover, Irani Paper describes one of the most obvious applications of its techniques for creating mosaics is as a means of visualization. *Id*. As described above in the State of the Art section, a POSA would understand that (1) using digital imaging processing techniques in microscopy was common to increase the amount of information available, (2) creating mosaics from overlapping images was common to address the field of view limitation of microscopes and increase resolution of the images, (3) using dynamic mosaics was common to detect moving objects, and (4) detecting moving objects in microscopy was an important analytical tool, e.g., for determining motility of organisms. *Id.* Thus a POSA would have been motivated to combine the image processing techniques taught by Irani Paper with the teachings of Bacus to identify moving to create dynamic mosaics to detect moving objects in microscopy. *Id*. Specifically, Irani Paper identifies its techniques of using of mosaics with a video sequence (as described in the '452 patent) as particularly beneficial due to the large amount of overlap in successive images, which provides a significant reduction in the total amount of data to represent a scene. *Id*. Motivation for the specific combination of features from Bacus and Irani Paper is also discussed further below.

**Claim 9**: ***[9.0] A microscopy system comprising:***

Bacus discloses this limitation, *see* limitation [1.0]; Ex. 1004, ¶ 153.

***[9.1] a microscope including a stage, at least one magnifying lens, and a lens controller;***

Bacus discloses this limitation, *see* limitation [1.1]; Ex. 1004, ¶ 154.

***[9.2] a video capture device coupled to the microscope capturing a plurality of images of an object on the stage of the microscope; and***

Bacus discloses this limitation, *see* limitation [1.2]; Ex. 1004, ¶ 155.

***[9.3] a processing subsystem receiving the plurality of images from the video capture device, the processing subsystem generating at least one resultant image as a function of the plurality of images,***

Bacus discloses this limitation, *see* limitation [1.3]; Ex. 1004, ¶ 156.

***[9.4] wherein the at least one resultant image includes a plurality of sequential mosaics.***

Bacus discloses this limitation. *See* Ex. 1006, Fig. 2, where the low-magnification mosaic (macro image 24) and the high-magnification mosaic (micro image 26) are displayed on the same screen display as a composite resultant including sequentially generated mosaics. To the extent that the Patent Owner asserts that Bacus does not explicitly disclose this limitation, Irani Paper discloses a plurality of sequential mosaics. Ex. 1008, p.609, right column ("The panoramic visualization provided by the mosaics is useful not only as a static image, but for dynamic video visualization as well. In this case, a new video sequence is generated (called the ‘mosaic video’) which is a sequence of mosaic images.”), p.606, left column, ll. 13-17 (“This requires a *dynamic* mosaic, which is a *sequence* of evolving mosaic images, where the *content* of each new mosaic image is updated with the most current information from the most recent frame.”) (emphasis in original). Dynamic mosaics are shown at the right column of FIG. 3 of Irani Paper. *See also id*. at 609, right column (“The previously shown Fig. 3 shows an example of video mosaics.”); Ex. 1004, ¶ 157.

In light of the teachings of Irani Paper, it would have been obvious to a POSA to generate a plurality of Bacus’ macro images 24 or macro images 26 (Ex. 1006, FIG. 2) at respective moments in time and sequence those images (frames) to form a sequential mosaic. A POSA would have been motivated to do so, because it was well known to form video from a sequence of frames and Irani Paper describes “two basic advantages [of video] over still images are the ability to obtain a continuously varying set of views of a scene, and the ability to capture the temporal (or ‘dynamic’) evolution of phenomena.” Ex. 1004, ¶ 158; Ex. 1008, p.605. Capturing the dynamic evolution of an object on a microscope slide is an important analytical tool, and modifying Bacus based on the teachings of Irani Paper would have predictably produced this capability. Ex. 1004, ¶ 158.

Such a combination would have had a reasonable expectation of success, particularly because Bacus discloses saving images in memory. Ex. 1006, 9:13-14

("The image may then be archived for later analysis, displayed or analyzed immediately."), 9:57-58 ("Optionally the image may be stored for archival purposes in a step 254."); Ex. 1004, ¶ 159. A POSA would have known that macro or micro images formed by the teachings of Bacus at respective time instants could be saved and used to form a sequential mosaic using the techniques disclosed in Irani Paper for further analysis to detect the dynamic nature of an object being viewed. Ex. 1004, ¶ 159.

**<u>Claim 10</u>:** ***[10.0] The microscopy system according to claim 9, further comprising: [10.1] a display device coupled to the processing subsystem,***

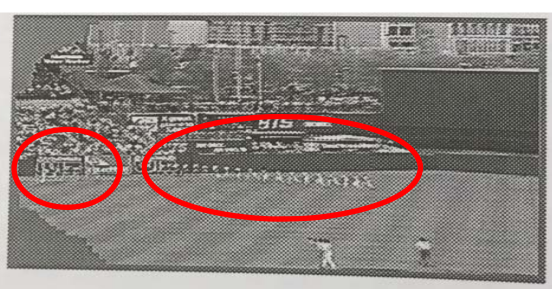
Bacus discloses this limitation as a display monitor subsystem. Ex. 1006, 7:33-39 ("The low magnification digitized image is then displayed on a 21 inch Iiyama video display monitor 22 having resolution of 1600 by 1200 to provide display screens of the type shown in FIGS. 1 through 3 including a low magnification image 24, for instance, at 1.25 power, a high magnification image 26, for instance at 40 power and a control window or image 28"); Ex. 1004, ¶ 160.

***[10.2] wherein the processing subsystem displays the plurality of sequential mosaics in a predetermined order on the display device.***

Bacus does not explicitly describe the processing subsystem displays the plurality of sequential mosaics in a predetermined order on the display device. However, Irani Paper discloses this limitation. Irani Paper describes a video sequence called mosaic video, which corresponds to the sequential mosaics of this limitation. *See* discussion at limitation [9.4]. It was inherent that Irani Paper's video sequence must be displayed in a predetermined order, because an order is intrinsic to the notion of a video sequence to accurately "capture the temporal (or 'dynamic') evolution of phenomena." Ex. 1008, p.605, § 1; Ex. 1004, ¶ 161. Alternatively, it would have been obvious to a POSA to display the sequential mosaics in a predetermined order, e.g., in sequence, because it was routine to display sequential images on a monitor. Ex. 1004, ¶ 161.

**<u>Claim 11</u>: *[11.0] The microscopy system according to claim 9, wherein the processing subsystem detects an object moving independently of the microscopy system in the plurality of sequential mosaics.***

Irani Paper discloses this limitation. Irani Paper describes and illustrates an "event" of a moving object. Ex. 1008, p.608**,** left column, ll. 12-15 ("a mosaic image which contains a panoramic image not only of the scene, but also of the foreground event that took place in that scene sequence"), FIG. 6(b) (annotated below, showing a moving baseball outfielder); Ex. 1004, ¶ 162.



b)

Figure 6: Synopsis mosaic image of the baseball game sequence. (a) The static *background* mosaic of the scene *without* the event. (b) The synopsis mosaic of the baseball sequence showing the event that occurred in the scene on top of the background mosaic (i.e., <u>showing the trajectories of the two runners</u>).

*See also* Ex. 1008, p.608, § 3.3 ("objects that move with respect to the background," "changes in image regions that correspond to independently moving objects will be smaller between the predicted and actual frame"), § 4 ("scene change detection"). Thus, it would have been obvious to a POSA to modify Bacus' processing subsystem to detect an object moving independently of the microscopy system in the plurality of sequential mosaics according to the teachings of Irani Patent. Ex. 1004, ¶ 163. For example, it is desirable to detect movement of objects on slides when observing the growth or motion of living and non-living subjects for analytical purposes as discussed above with respect to limitation [9.4]. *Id*. Such a combination would have had a reasonable expectation of success, because Irani Paper "presents a method for detecting such 'residuals'" (Ex. 1008, p.606, § 2.2, p.608, § 3.3 titled "Significant Residual Estimation"), and the combination would have had predictable results. Ex. 1004, ¶ 163.

**<u>Claim 12</u>:** ***[12.0] The microscopy system according to claim 11, wherein the processing subsystem extracts the moving object from the plurality of sequential mosaics.***

This limitation is disclosed by Irani Paper. Irani Paper discloses dynamic mosaics which depict dynamic aspects of a video sequence and discloses mosaic video which is a sequence of mosaic images. Ex. 1008, pp.606, 609. Irani Paper describes the need to represent "changes in the scene with respect to the background (e.g., moving players)" and presents at § 3.3 "a method for detecting such 'residuals.'" *Id*. at 606, left column, ll. 1-4. Irani Paper identifies a moving object at FIG. 6(b) (shown above with respect to the discussion of limitation [11.0], and described in the figure caption as "showing the trajectories of the two runners") and discloses detection of a "foreground event that took place in that scene sequence." *Id*. at 608, left column, ll. 12-15. Thus Irani Paper expressly discloses extracting the moving objects in the form of residuals from the sequential mosaics. Ex. 1004, ¶ 164.

**Claim 13**: ***[13.0] The microscopy system according to claim 11, wherein the processing subsystem generates a plurality of sequential images of the moving object, and***

Irani Paper discloses this limitation. Irani Paper discloses mosaic video, which is a sequence of mosaic images. Ex. 1008, p.609, right column, ll. 28-38. Because Irani Paper discloses that a mosaic is made up of a plurality of images, a plurality of sequential mosaics necessarily requires a plurality of sequential images. Ex. 1004, ¶ 165.

***[13.1] wherein the processing subsystem displays the plurality of sequential images of the moving object on the display device.***

Irani Paper discloses this limitation, *see* limitation [10.2]; Ex. 1004, ¶ 166.

### C. Challenge 3: Claims 16-17 and 20 are obvious over Bacus in view of Ott and Irani Paper.

Claims 16-17 and 20 are rendered obvious under 35 U.S.C. § 103 by Bacus in view of Ott and Irani Paper as discussed below.

### 1. Motivation to Combine Bacus, Ott, and Irani Paper

As discussed above in § VIII.A.3, it would have been obvious to combine the teachings of Bacus and Ott to produce mosaics from individual images having overlap in the field of microscopy. As discussed above in § VIII.B.2, it would have been obvious to combine the teachings of Bacus and Irani Paper to create dynamic mosaics to detect moving objects in microscopy. Likewise, it would have been obvious to combine the teaching of Bacus, Ott and Irani Paper to generate sequential mosaics to detect a moving object because a POSA understood at the time of the invention of the '452 Patent that (1) using digital imaging processing techniques in microscopy was common to increase the amount of information available, (2) creating mosaics from overlapping images was common to address the field of view limitation of microscopes and improved resolution of the image, (3) using dynamic mosaics was common to detect moving objects, and (4) detecting moving objects in microscopy was an important analytical tool, e.g., for determining motility of organisms. Ex. 1004, ¶ 168. Ott specifically discloses that once an image is digitized, "virtually every image-processing technique can be employed to extract information." Ex. 1007, p.335. A POSA would have been motivated to make this combination because the Irani Paper imaging processing technique applied to microscopy would have resulted in capturing the dynamic evolution of an object on a microscope slide using mosaics, which is an important analytical tool, and the POSA had a reasonable expectation of success to produce predictable results. Ex. 1004, ¶ 168.

**<u>Claim 16</u>:** ***[16.0] The method according to claim 14, wherein the at least one mosaic includes a plurality of sequential mosaics.***

The combination of Bacus and Ott, discussed regarding claim 14, does not explicitly disclose this limitation. But, this limitation is disclosed in Irani Paper, *see* limitation [9.4]; Ex. 1004, ¶ 169. It would have been obvious to combine Bacus with Ott and Irani Paper for the reasons discussed above. Ex. 1004, ¶ 169.

**<u>Claim 17</u>:** ***[17.0] The method according to claim 16, further comprising the step of detecting an object moving independently of the microscope in the plurality of sequential mosaics.***

This limitation is disclosed in Irani Paper, *see* limitation [11.0]; Ex. 1004, ¶ 170. It would have been obvious to a POSA to combine Bacus with Ott and Irani Paper for the reasons discussed above. Ex. 1004, ¶ 170.

**<u>Claim 20</u>:** ***[20.0] The method according to claim 18, wherein the at least one mosaic includes a plurality of sequential mosaics,***

The combination of Bacus and Ott, discussed regarding claim 18, does not explicitly disclose this limitation. But, this limitation is disclosed in Irani Paper, *see* limitation [9.4]; Ex. 1004, ¶ 171. It would have been obvious to combine Bacus with Ott and Irani Paper for the reasons discussed above. Ex. 1004, ¶ 171.

***[20.1] the method further comprising the step of detecting an object moving independently of the microscope in the plurality of sequential mosaics.***

This limitation is disclosed in Irani Paper, *see* limitation [17.0]; Ex. 1004,

¶ 172. It would have been obvious to a POSA to combine Bacus with Ott and Irani Paper for the reasons discussed above. Ex. 1004, ¶ 172.

## IX. Conclusion

For the reasons set forth above, Petitioner has established a reasonable likelihood of prevailing with respect to all claims of the ’452 Patent and requests the Board to institute *inter partes* review and to cancel all claims as unpatentable.

Respectfully submitted,

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Dated: October 16, 2015

**CERTIFICATE OF SERVICE ON PATENT OWNER**
**UNDER 37 C.F.R. § 42.105(a)**

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(b), the undersigned certifies that on the 16th day of October 2015, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided via Federal Express, postage prepaid, to the Patent Owner by serving the correspondence address of record for the '452 Patent:

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