



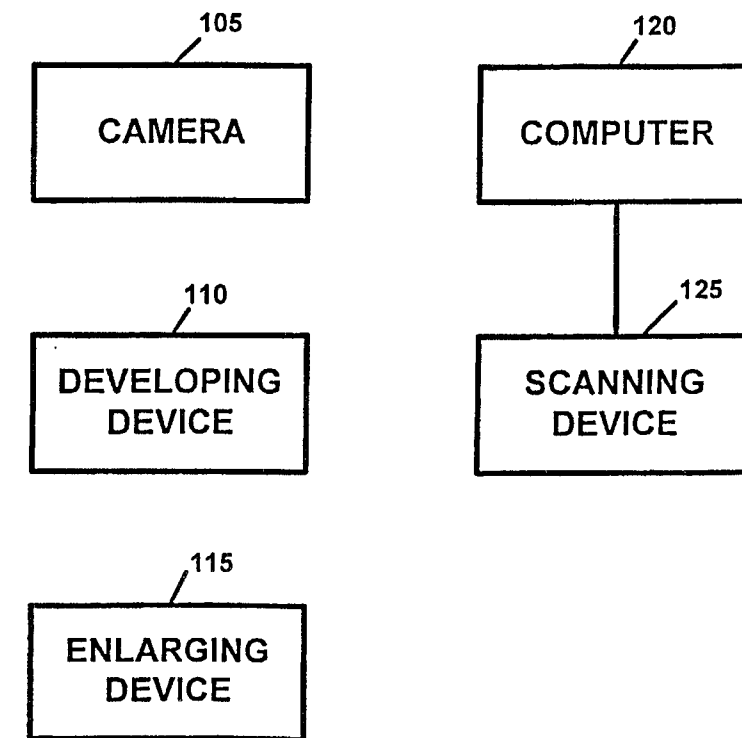
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(54) Title: APPARATUS AND METHOD FOR PRODUCING ENHANCED DIGITAL IMAGES

(57) Abstract

An apparatus and a method for producing a digital image, which includes a device for generating a digital signal file from a print film image, and a processor for processing the digital signal file and for generating an image file. The processor generates a first signal file from the digital signal file. The processor processes the first signal file and generates the image file.



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**APPARATUS AND METHOD FOR PRODUCING  
ENHANCED DIGITAL IMAGES**

**FIELD OF THE INVENTION**

10 The present invention is directed to an apparatus and a method for producing enhanced digital images and, in particular, to an apparatus and a method for producing enhanced resolution digital images from a print film image.

**BACKGROUND OF THE INVENTION**

15 The fields of telecommunications, multimedia, and related areas, are growing at increasing rates. With this continued growth, the need for high resolution digital imagery, for utilization in conjunction with the corresponding technologies, is becoming greater. Current technologies utilize digital panoramic cameras, as opposed to film or print film cameras. While the utilization of digital cameras may appear to many to be a viable manner by which to obtain digital images, there are, in fact, many disadvantages and shortcomings associated with digital camera images.

20 Conventional digital technologies typically have very low zoom quality and low image size restrictions or limitations associated therewith. The differences between digital imagery and print film imagery lie in the respective processing technologies and methods which are used in the processing of digital images versus those technologies and methods utilized in the processing of print film images. Generally speaking, print film produces a higher resolution image, and an associated higher resolution scanning quality, which further facilitates an improved enlargement or  
25 reduction of the image for different sizes and different depths, without pixel distortion. Digital photography, and associated images, utilize pixels which typically have a certain size. When

enlarged or reduced, these pixels of the image become distorted, a feature which typically results in the digital image being fixed to an original size, or being available at very low magnifications, such as, for example, magnifications of from 200 times to 300 times. These digital images are also difficult to enlarge to a full screen size without a tremendous amount of distortion present in the end product.

Currently, panoramic imaging techniques utilize digital images as their starting point. With such associated limitations, the ability to provide enhanced resolution digital images and, especially, an enhanced resolution digital panoramic image, such as those utilized on, or over, the Internet and/or the World Wide Web, has been greatly compromised.

Another major drawback in the current technology lies in the fact that conventional processes often utilize panoramic lenses in order to capture an image. This practice has been criticized as creating distortions in the image immediately upon the image's enlargement or reduction. The conventional techniques associated with the use of panoramic lenses are known to result in image "bending", which further curtails one's ability to obtain realistic views, especially upon performing any associated cropping and/or editing processes. In such instances, the upper end and the lower end of the image must be either erased, or covered, in order to prevent the flaw from being exposed. This typically results in the resulting image having a "fishbowl-type" distortion. In some instances, 32 mm lenses have been utilized in order to obtain enhanced floor to ceiling images without experiencing image bending. In these applications, however, the ability of the lens to capture optimal images varies depending upon the scene or image being photographed.

### SUMMARY OF THE INVENTION

The present invention provides an apparatus and a method for producing digital images which overcomes the shortcomings of the prior art. The apparatus includes a camera, which can be a conventional print film camera, a developing device, which can be any device or collection of devices for developing the image taken by the camera, into a print film image, and an enlarging device, for enlarging the print film image. A digital camera can also be utilized to obtain the image. If the image is taken with a digital camera, a print image is obtained from the digital image. The print image can then be enlarged.

The apparatus also includes a computer and associated peripheral devices for performing the various processing routines of the method of the present invention. The apparatus also includes a scanning device, for scanning the print film image or photograph in order to obtain a digital image representation of same.

The print film image, which is obtained by the camera, can be developed by the developing device, and enlarged by the enlarger. The image print may then be scanned by the scanner in order to generate a digital file or other high quality image extension file. A plurality of these digital files can then be stitched together thereby creating a panoramic scene or image.

The computer may be utilized in order to perform touch-up operations on the obtained image or image collection in order to make refinements and/or enhancements thereto. The image can then be converted from a high resolution image compression extension file to a low resolution graphic or video image extension file.

The resulting file may then be processed so that the image represented therein can be displayed and/or posted for display to a host computer or other suitable device.

The above process can be repeated using different photo depths for any of the obtained images, or portions thereof, in order to create areas of higher resolution for closer inspections of these areas at different image depths.

Accordingly, it is an object of the present invention to provide an apparatus and a method for providing enhanced digital images from print film images.

It is another object of the present invention to provide an apparatus and a method for producing digital images, from print film images, which have improved and enhanced resolution.

5 It is still another object of the present invention to provide an apparatus and a method for producing digital images, from print film images, which are suitable for display and/or downloading in a digital computer and/or in a telecommunications environment.

10 It is still another object of the present invention to provide an apparatus and a method for providing a digital image which is characterized by effective image compression subsequent to a stitching operation, thereby avoiding any dramatic loss in image quality.

It is yet another object of the present invention to provide an apparatus and a method for producing digital images which are characterized by high definition resolution, and which are suitable for high definition television, Web television and large, full screen, panoramic internet applications, without loss of resolution upon image magnification or reduction.

15 It is another object of the present invention to provide an apparatus and a method for producing and transmitting digital images in a network environment which dispenses with the need for plug-in software.

20 It is still another object of the present invention to provide an apparatus and a method for producing digital images which facilitates high speed file transfer in a network environment and/or in a computer environment.

Other objects and advantages of the present invention will be apparent to those skilled in the art upon a review of the Description of the Preferred Embodiment taken in conjunction with the Drawings which follow.

### BRIEF DESCRIPTION OF THE DRAWINGS

In the Drawings:

Figure 1 illustrates the apparatus of the present invention, in block diagram form; and  
Figures 2A, 2B and 2C illustrate the method of the present invention, in flow diagram form.

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### DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention provides an apparatus and a method for providing enhanced digital images which can be utilized and which can be easily managed, when displayed, projected, or posted to an Internet Web server, Web site or Web page. In particular, the present invention provides an  
10 apparatus and a method for producing an enhanced digital image from a print film image, or from a photographic image, which is taken with a print film camera . The digital images which are produced by the apparatus and method of the present invention have improved and enhanced resolution and require far less effort in the associated maintenance and management of same. The digital images, which are produced by the apparatus and method of the present invention, can be  
15 utilized and displayed on computers, projection devices, and, as noted above, can be posted to an Internet Web server, a Web site, and/or a Web page.

The present invention, in a preferred embodiment, is utilized to produce enhanced images for posting and/or for downloading, to a digital display medium, which in the preferred embodiment, is an Internet and/or a World Wide Web server, a Web site, or Web page. In this manner, enhanced  
20 digital images can be produced from print film images, with the resulting digital images having enhanced resolution. This resolution is unaffected by the typical resolution limiting parameters and phenomena which are associated with conventional digital image processing equipment, techniques and methods.

Figure 1 illustrates the apparatus of the present invention which is denoted generally by the  
25 reference numeral 100, in block diagram form. With reference to Figure 1, the apparatus 100

includes a camera 105 which, in the preferred embodiment, is a conventional print film camera, such as those cameras manufactured by Nikon, Canon, Hasselblad, or any other manufacturer. A digital camera may also be utilized to obtain the image. In the preferred embodiment, the camera 105 contains a 24-32 mm lens and can be a hand-held camera, a fixed camera, or a camera which is mountable, such as on a tripod or on a stand. The camera 105 is utilized to obtain the print film image of the image or scene which is being photographed.

The apparatus 100 also includes a developing device 110 which can be any device or collection of devices for developing the film print image which is taken by the camera 105 into a film print image. The apparatus 100 also includes an enlarging device 115 for enlarging the print image.

The apparatus 100 also includes a computer 120, for performing the various processing routines of the method of the present invention. The computer 120 may be a personal computer, a laptop computer, a mini-computer, a microcomputer, a mainframe computer, or any other suitable computer or computer system. The computer 120 includes a central processing unit (CPU), a read only memory (ROM), a random access memory (RAM), a display device, an input device and an output device. The computer 120 may also include any other hardware or software needed to perform any of the processing tasks described herein. The input device may include a keyboard, a mouse, or other pointing device, for allowing for data and/or command input by a user. The output device may include a printer and, in the preferred embodiment, the printer may be a color laser printer or a color inkjet printer.

The apparatus 100 also includes a scanning device 125, for scanning the print film image or photograph in order to obtain a digital image representation of same. Any suitable computer or scanner and any suitable scanning software may be utilized in conjunction with the present invention. In a preferred embodiment, a UMAX™ Astra scanner is utilized in conjunction with Microsoft® Photo Editor software.



Figures 2A, 2B and 2C illustrate the method of the present invention, in flow diagram form. With reference to Figures 2A, 2B and 2C, the method of the present invention commences at step 200. At step 201, a scene or image is photographed by using the print film camera 105.

At step 202, the print film image, which is obtained by the camera 105, is developed by the developing device 110 in order to produce a high gloss photographic image print. If the image is obtained with a digital camera, a print image should be obtained from the digital image. In this manner, the higher resolution print image can then be enlarged and scanned. At step 203, the image print is enlarged by the enlarger 115. In the preferred embodiment, the image prints are enlarged to sizes of between 8"x6" to 8"x12". Although enlargement to any size may be obtained and utilized, the aforementioned sizes represent the respective lower end and upper end limits for the print sizes which provide optimal magnification capability in the preferred embodiment. In the preferred embodiment, a magnification capability of up to 1700 times may be attained for most views or scenes. It is, however, recommended that larger enlargement sizes be obtained for smaller object images.

At step 204, the image print, obtained at step 203, is scanned by the scanner 125 in order to generate a bitmap image file or other high quality image extension file. At step 205, a plurality of bit map files, which are obtained for the image prints, can be stitched together by the scanner 125, thereby creating a panoramic scene or image, or simply a scene requiring a plurality of photographs. This stitching operation is performed by utilizing photo stitching software such as, for example, Photo Vista software by Live Picture, Live Picture Reality Studio, and/or Live Picture Object Modeler and/or Photo Vista software.

At step 206, the computer 120 performs a touch-up operation on the scanned image or stitched image collection in order to make refinements and/or enhancement thereto. This touch-up operation is accomplished by utilizing imaging software. In the preferred embodiment, Adobe Photoshop software is used as the imaging software for touching up the images. At step 207, the

image is then converted from a bitmap file, or any other suitable high resolution image compression extension file, to a JPEG file or other suitable low resolution graphic or video image extension file. In the preferred embodiment, Adobe Image Ready software is utilized to perform the bitmap to JPEG file conversion. The bitmap to JPEG file conversion, which is performed at step 207, serves  
5 to preserve video image quality and resolution, thereby providing an optimum video image. At step 208, the JPEG file of the image is compressed by utilizing image compression software, such as Adobe Image Ready software. The compressed image is, thereafter, ready for display and/or posting to a host computer, a Web server, a Web site, or a Web page.

The above process can be repeated using different depth photos for any of the images  
10 obtained in order to create areas of higher resolution or "hot spots", for closer inspections of these areas at different depths. These depth photos can also be stitched into the respective image or image portion by using the stitching techniques described above, which are hereby incorporated by reference herein. The above process can be utilized in order to create higher zoom capabilities with each new depth layer of an image.

15 At step 208, a determination is made as to whether different depth photographs are desired. If different depth photographs are desired, the method repeats steps 201 through 207 to obtain the desired image. If no additional depth photographs are desired, the method proceeds to step 209.

At step 209, the resulting digital image can be displayed on a digital display device, projected from a projection device, or posted to a host computer, a Web server, a Web site, or a Web page.  
20 In the instance where the image is posted to an Internet Web server, Web site, or Web page, the upload from the computer 120, to the respective server, site, or page, can be performed by utilizing file uploading software, such as WFTP Pro software. The image can then be viewed at reasonable speeds. Upon completion of the file upload at Step 209, the method ceases operation at Step 210.

The processing steps described herein provide for the production of digital images which  
25 have enhanced resolution and which can be easily and effectively managed in applications involving

the display of same, or the posting of same, to a host computer, a Web server, a Web site, a Web page, a computer display, and/or a full screen projection display. Further, the method of the present invention provides for effective image compression after a requisite stitching operation, thereby preserving image quality. The apparatus and method of the present invention provides images which  
5 have enhanced resolution and quality while requiring less file management efforts.

The resulting images are characterized by a high definition resolution and are suitable for high definition television, Web television, and large, full screen, panoramic internet applications, such as those involving displaying video images, while preserving resolution upon image magnification or reduction. The present invention also dispenses with the need for plug-in software  
10 during download and/or file transfer operations. Further, a zoom capacity of up to 1700 times or greater may be easily obtained with the present invention. The present invention also facilitates high speed file transfers of high resolution digital images thereby dispensing with the need to engage in long and slow conventional file downloads and/or file transfers.

The digital images obtained with the present invention can be utilized for any digital or  
15 projection application, including full screen display and/or projection applications.

While the present invention has been described and illustrated in various preferred embodiments, such descriptions are merely illustrative of the present invention and are not to be construed to be limitations thereof. In this regard, the present invention encompasses any and all modifications, variations, and/or alternate embodiments, with the scope of the present invention  
20 being limited only by the claims which follow.

CLAIMS

What Is Claimed Is:

1. An apparatus for producing a digital image, comprising:
  - a device for generating a digital signal file from a print film image; and
  - 5 a processor for processing said digital signal file and for generating an image file, wherein said processor generates a first signal file from said digital signal file, and further wherein said processor processes said first signal file and generates said image file.
  
2. The apparatus of claim 1, further comprising:
  - 10 a camera for obtaining a photographic representation of an image.
  
3. The apparatus of claim 2, further comprising:
  - a developing device for developing said photographic representation and for generating said print film image.
  
- 15 4. The apparatus of claim 3, further comprising:
  - an enlarging device for enlarging said print film image.
  
5. The apparatus of claim 4, further comprising:
  - 20 a scanning device for generating said digital signal file from said print film image.
  
6. The apparatus of claim 1, wherein said first signal file is a bitmap file.

7. The apparatus of claim 1, wherein said image file is a JPEG file.
8. An apparatus for producing a digital image, comprising:  
means for generating a digital signal file from a print film image file; and  
5 means for processing said digital signal file and for generating an image file,  
wherein said processing means generates a first signal file from said digital signal file,  
and further wherein said processing means processes said first signal file and generates said  
image file.
- 10 9. The apparatus of claim 8, further comprising:  
means for obtaining a photographic representation of an image.
10. The apparatus of claim 9, further comprising:  
means for developing said photographic representation and for generating said print film  
15 image.
11. The apparatus of claim 10, further comprising:  
means for enlarging said print film image.
- 20 12. The apparatus of claim 11, further comprising:  
means for generating said digital signal file from said print film image.
13. The apparatus of claim 8, wherein said image file is a bitmap file.

14. The apparatus of claim 8, wherein said image file is a JPEG file.
15. A method for producing a digital image, comprising:  
generating a digital signal file from a print film image;  
5 processing said digital signal file; and  
generating an image file, wherein said processing operation further comprises:  
generating a first signal file from said digital signal file; and  
processing said first signal file and generating said image file.
- 10 16. The method of claim 15, further comprising:  
obtaining a photographic representation of an image.
17. The method of claim 16, further comprising:  
developing said photographic representation; and  
15 generating said print film image.
18. The method of claim 18, further comprising:  
enlarging said print film image.
- 20 19. The method of claim 18, further comprising:  
generating said digital signal file from said print film image.
20. The apparatus of claim 15, wherein said first signal file is a bitmap file.

21. The apparatus of claim 15, wherein said image file is a JPEG file.

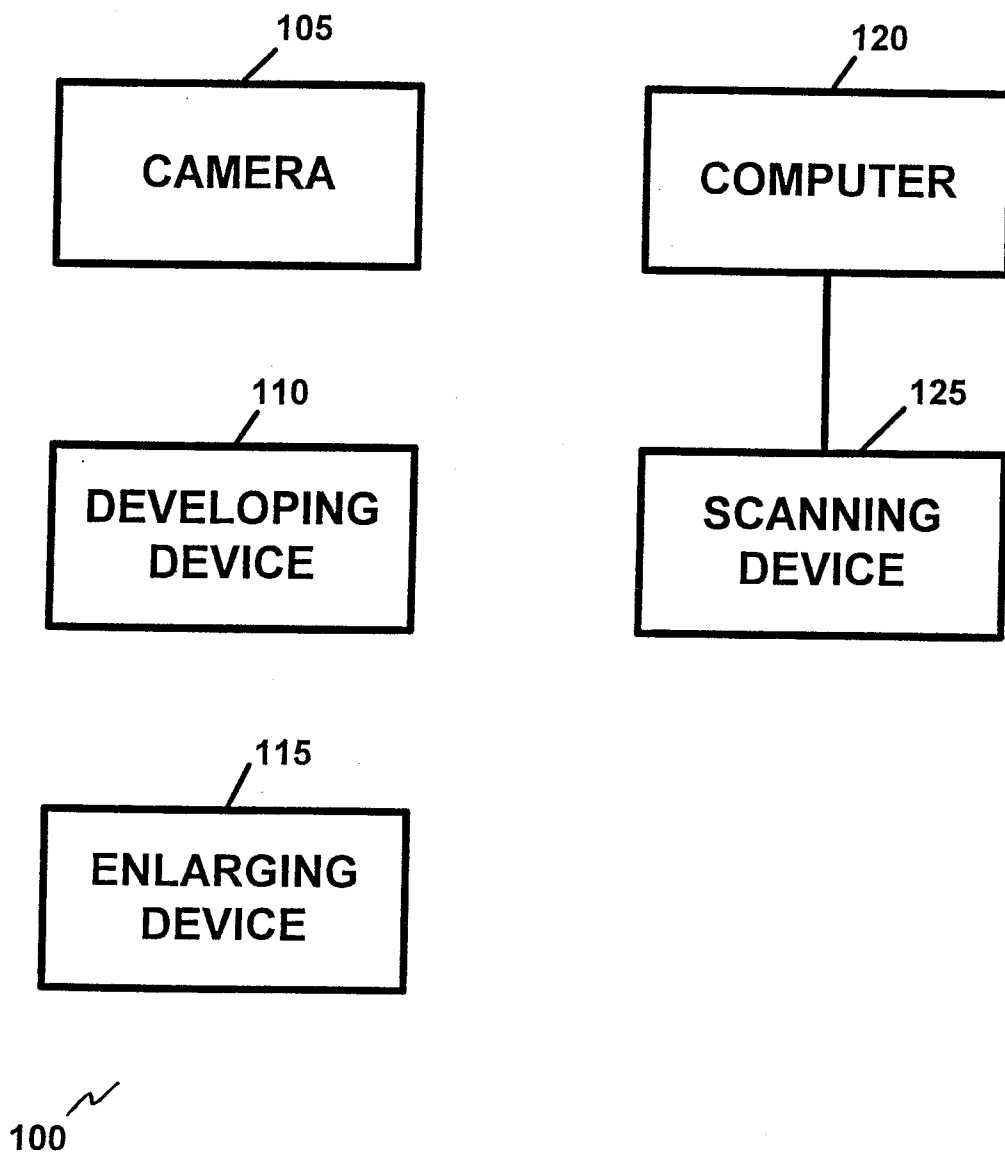


FIG. 1



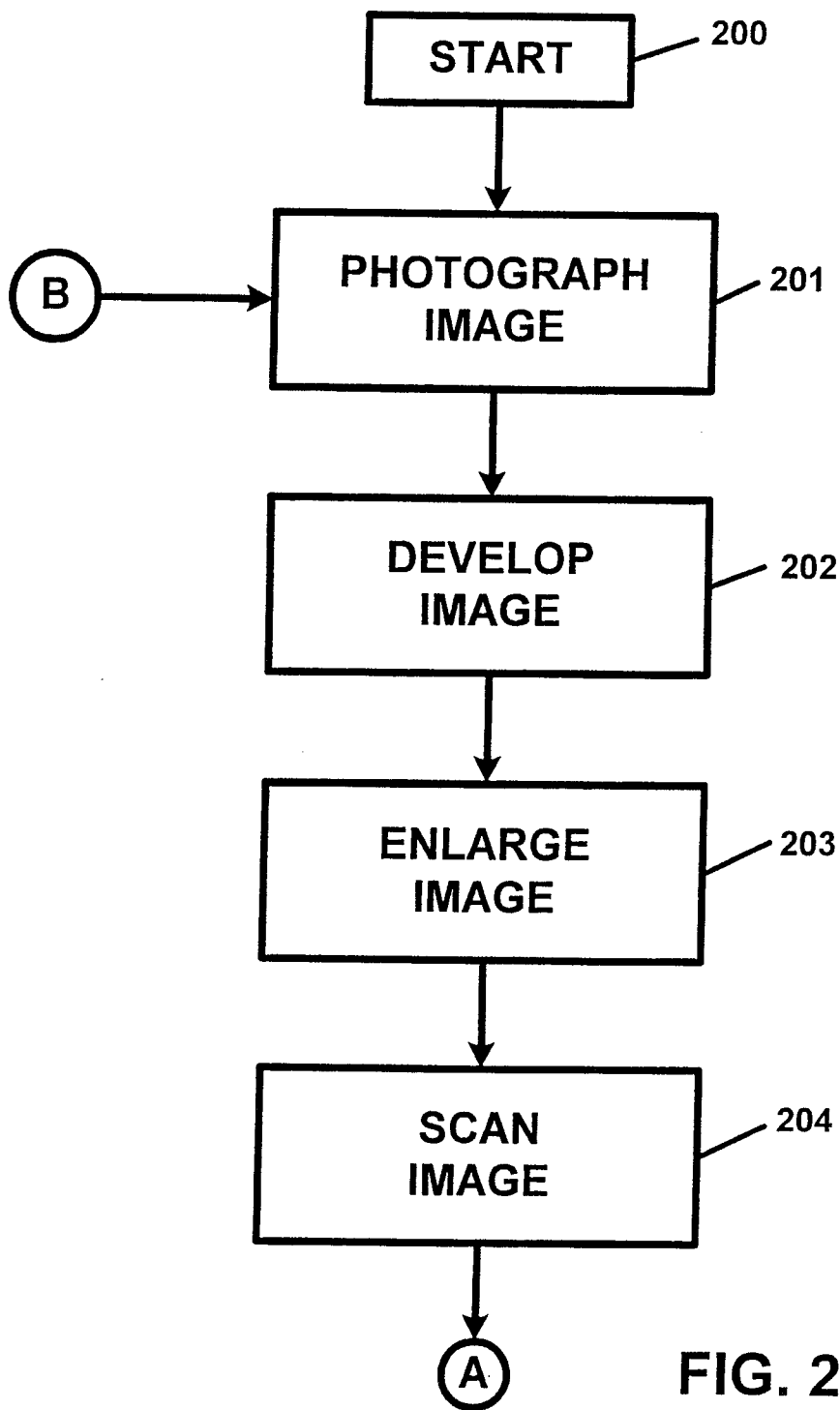


FIG. 2A

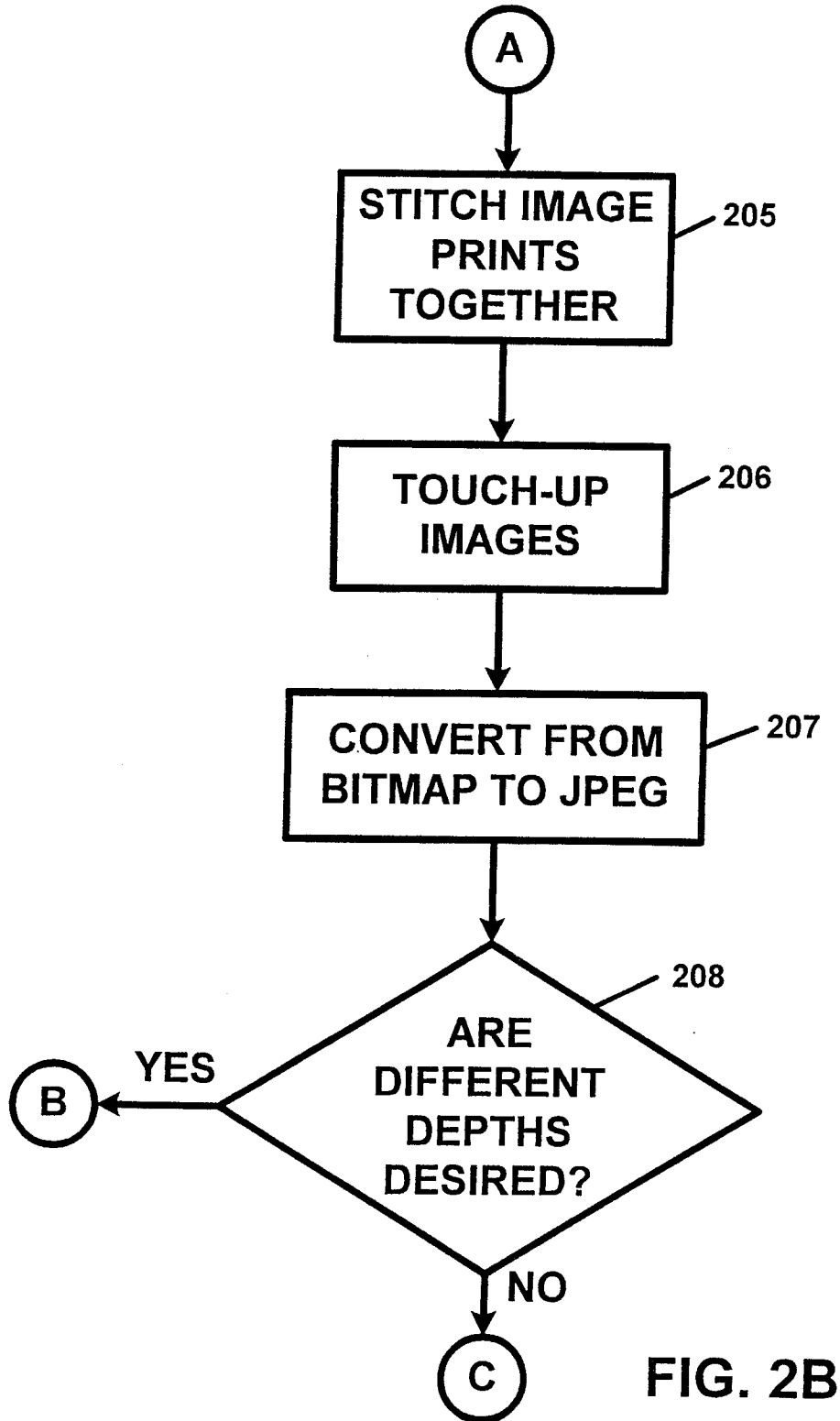


FIG. 2B

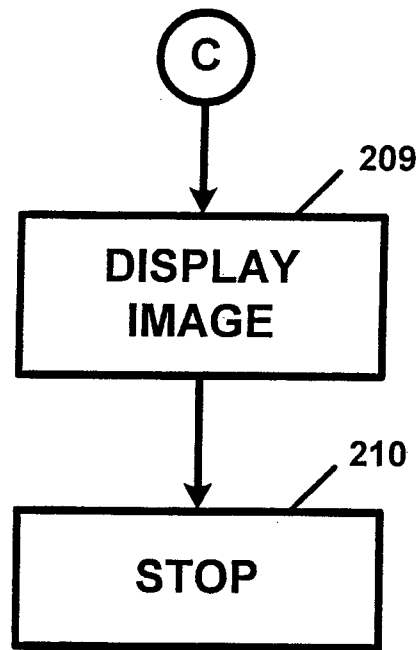


FIG. 2C