



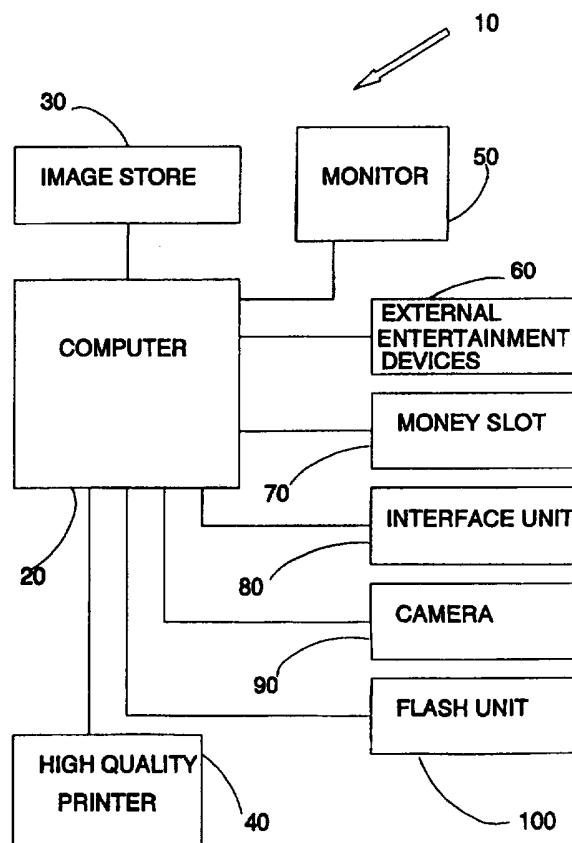
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: CAMERA SYSTEM WITH FLASH ILLUMINATION AND CHROMA-KEYING

## (57) Abstract

A camera system for generating a composite image of a subject superimposed on a background image, the system comprising: (a) a flash apparatus (100) operable to flash illuminate the subject; (b) image capture apparatus (90) for capturing a flash-illuminated image and a non-flash-illuminated image of the subject in front of a chromakey screen; (c) a matte generator for generating a matte from the non-flash-illuminated image; and (d) a chromakey image combiner for combining the background image with the flash-illuminated image in accordance with the matte to generate the composite image.



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## CAMERA SYSTEM WITH FLASH ILLUMINATION AND CHROMA-KEYING

This invention relates to camera systems.

5 There are currently a large number of different photo booths (employing camera systems) available for use by the public. Of these, most tend to operate in a similar manner. Typical photo booths comprise a cabinet within which is provided a light source for illuminating the subject, an adjustable stool for seating the subject and a variety of curtain-like cloth backdrops, may be selected by the user (subject) and physically dragged into place. These photo booths are typically used for taking  
10 passport photographs etc.

Once the user has paid, a sequence is initiated that starts a timer running. After a predetermined time, a flash is illuminated and a photograph is taken. The process repeats itself until all required photos have been taken. After a short period of time, typically around 5 minutes, the developed photographs are delivered from a  
15 slot in the front of the machine.

These systems suffer from a number of disadvantages in that the user is limited to a set number of plain backdrops, usually provided by curtains, and is required to wait around for the developing of the film. Similarly, as the device operates with photographic materials, the interior components of the machine are complex and  
20 expensive.

US-A-5,343,386 describes a system allowing more choice of image background.

This system incorporates so-called "chromakey" technology to superimpose an image of a subject over a computer generated backdrop. The particular chromakeying  
25 technology utilised by this machine is known from studio video production and will not be described here in detail.

In use, the subject selects a backdrop from a variety of different possibilities and then seats himself in front of a blue chromakey screen. A camera provided within the body of the machine then captures an image of the subject and electronically  
30 superimposes that image over the backdrop in accordance with a matte generated by conventional chromakeying techniques. The composite image of the subject and selected backdrop is then passed to a high quality printer that prints the composite

image onto a card.

However, this system exhibits a number of deficiencies that limit the quality of the produced image.

In particular, this system provides a single, continuous, light source to light the subject and to front-light the chromakey screen (in this case, a blue screen). If the light is set up to provide a good foreground image, it will tend to give a poor contrast between the subject image and the chromakey screen and so a reduction in the quality of the matte produced from that image. This reduction in contrast is due to the fact that the foreground and the background are both lit by similar quantities of light. Also, a large amount of the light tends to be reflected by the highly reflective chromakey screen and this again causes poor resolution between the image of the subject and the image of the background.

In summary, a machine of this kind needs to fulfil the apparently conflicting requirements of providing a good lighting environment for both the backdrop and the subject. However, this known system provides only a compromise between the two requirements - a compromise that can lead to an overall reduction in quality of the final composite image.

This invention provides a camera system for generating a composite image of a subject superimposed on a background image, the system comprising:

- (a) flash apparatus operable to flash illuminate the subject;
- (b) image capture apparatus for capturing a flash-illuminated image and a non-flash-illuminated image of the subject in front of a chromakey screen;
- (c) a matte generator for generating a matte from the non-flash-illuminated image; and
- (d) a chromakey image combiner for combining the background image with the flash-illuminated image in accordance with the matte to generate the composite image.

The invention addresses the apparently conflicting requirements of suitably lighting the subject to capture an image for use in matte generation and as the foreground material, by the elegantly simple step of capturing *two* images under different lighting conditions. One image is used for matte generation, and the other image is used as the foreground material.

In this way, the lighting arrangements can be varied between the two exposures, to provide a lighting arrangement particularly suitable for the respective use of each image. In this case, flash lighting is selected for use in capturing the foreground material, and non-flash illumination is selected for use in capturing the image for good discrimination between the subject and the chromakey screen in matte generation. The flash apparatus has the advantage that a very rapid change in light level can be achieved. This is important because, for a good quality overlay, it is desirable to capture the two images very close together in time.

The image capture apparatus could be, for example, a video camera (e.g. an analogue video camera) operable to capture successive video images in a synchronous manner, or an asynchronous image capture device operable to capture images asynchronously.

The matte and the foreground material are derived from different respective images, but these could be captured in either order.

In the case that a video camera is used, the successively generated images can be used to generate "trial views" of the subject on the background, so that the scene can be lined up correctly before the final composite image is generated. Preferably, therefore, the system comprises a display for displaying a trial view image of the subject in front of the chromakey screen, the trial view being generated from a non-flash-illuminated image superimposed on a background image using a matte generated from that or another non-flash-illuminated image. It is accepted that because the trial views are generated using mattes and foregrounds both derived from non-flash-illuminated images, their image quality will be lower. However, the trial view images may well be of sufficient quality for planning and alignment of the scene.

To improve further the discrimination between the chromakey screen and the subject, it is preferred that the chromakey screen is backlit. The screen can be distinguished by colour (e.g. a blue screen, although other colours may be used), by luminance, or both.

In order to match the response of the image capture apparatus to the two lighting levels used for the matte and foreground images, it is preferred that the system comprises control logic for controlling the gain of the image capture apparatus to be lower for the capture of the flash-illuminated image than for the capture of the non-

flash-illuminated image. Here, the gain represents the response of the system from light to electrical signal, and so could refer to an optical gain element (e.g. a filter), an electrical gain element (e.g. an amplifier) or a combination.

Alternatively, the elegantly straightforward step of changing the exposure (time, aperture or both) could be used, again so that the exposure of the image capture apparatus is lower for the capture of the flash-illuminated image than for the capture of the non-flash-illuminated image. Here, a mechanical or electronic shutter could be used (e.g. with a CCD (charge coupled device) image capture device).

This invention also provides a method of generating a composite image of a subject superimposed on a background image, the method comprising the steps of:

- (a) capturing a flash-illuminated image and a non-flash-illuminated image of the subject in front of a chromakey screen;
- (b) generating a matte from the non-flash-illuminated image; and
- (c) chromakey-combining the background image with the flash-illuminated image in accordance with the matte to generate the composite image.

Embodiments of the invention will now be described by way of example only and with reference to the appended drawings, in which:

Figure 1 is a schematic illustration of a known chromakey apparatus;

Figure 2 is a schematic illustration of the operating principles of the apparatus depicted in Figure 1;

Figure 3 is a general schematic illustration of a camera system;

Figure 4 is a schematic illustration of part of the camera system of Figure 3 when configured for use with an analogue video camera;

Figure 5 is a schematic representation of a number of video frames; and

Figures 6A and 6B are a flow chart depicting the various stages in the operation of the apparatus of Figure 4.

Figure 7 is a schematic illustration of part of the camera system of Figure 3 when configured for use with a digital camera.

Figure 1 shows a known chromakey arrangement to illustrate the basic principles of chromakey photography. A foreground camera 120 captures a real time image of a subject standing in front of a blue screen. A background camera 110 captures a real time image of a background scene in which it is desired to place the

subject. Signals from the cameras 110, 120 are passed to a background processor 130 and a foreground processor 140. These processors 130, 140 translate analogue signals from the cameras 110, 120 to digital signals for subsequent processing and mixing. Connected to the foreground processor 140 is a Matte Generator 150 that generates a  
5     matte. The matte is basically a map of the foreground image showing which parts of that image belong to the subject and which belong to the blue screen.

Digital signals from the processors 130, 140 are then passed to a switching unit 160 which combines the background and foreground signals in accordance with instructions provided by the matte that has been produced by the matte generator 150.  
10     A combined foreground/background composite chromakey image is outputted from the switch 160. These techniques have been employed for many years in the television field and have been commonly used to superimpose a weather reader, for example, on an image of a weather map.

Chromakey techniques were originally developed for use with analogue  
15     technology. The colour blue was found to be a particularly useful chromakey colour for use with analogue cameras. Digital systems, on the other hand, may use any colour as the chromakey colour. Alternatively, either analogue or digital systems could use the image luminance to distinguish between image areas belonging to the subject and areas of the chromakey screen.

Figure 2 illustrates schematically the known chromakey process. A foreground  
20     image FI is captured by the foreground camera 120. The foreground image comprises a subject image SI and a chromakey screen image CS. Similarly, a background image BI is captured by the background camera 110. A matte M is generated from the foreground image FI, and comprises a black area CS that corresponds to the  
25     chromakey screen and a white area SI that corresponds to the subject image. The foreground image FI is then combined with the background image BI by the switch 160 in accordance with the matte M. A final composite image showing the subject image superimposed on the background may then be outputted from the switch 160.

With reference to Figure 3, a camera system 10 according to an embodiment  
30     of the invention (for use in a photo booth) comprises a computer (control logic) 20, an image store 30, a high quality printer 40, a monitor 50, external entertainment devices generally referenced as 60, a money slot 70, an interface unit 80, a camera 90

and a flash unit 100. The booth also includes a blue screen (not shown) in front of which may be seated a subject who wishes to have his image reproduced.

The chromakey screen may be backlit to improve the contrast of the image from which the matte is to be generated.

5       The image store 30 may comprise, for example, a standard hard disk, a CD-ROM, other optical or magnetic medium or a solid state memory, internal or external to the computer 20. The image store is preloaded with a variety of different images, each of which may be used as a backdrop in the resulting image of the subject.

10       The booth is of a generally standard shape, having a large cabinet within which is provided an alcove housing a stool. Known booths typically provided a screw mounted stool that could be wound up and down to manually adjust the height of the subject prior to the taking of a photograph. As an advantageous alternative, however, the camera 90 may be mounted on a motor driven mount (not shown) that is adjustable by the user so that his image is placed in the centre of the final image.

15       The external entertainment devices 50 may comprise a television monitor and a pair of stereo loudspeakers so that a high quality movie or advertisement film may be displayed to passers-by. As an option, the external devices 50 may be configured to show an image of the person inside the booth when it is in use.

20       The interface unit 80 comprises a switching box that allows the user to position the camera 90, if that option is provided, and select the background against which he are to be depicted, and possibly other functions.

25       The monitor 50 is mounted within the booth and displays a real-time image of the subject placed within the selected background. The monitor is also used for display of messages to the subject which may prompt the subject to select a particular function or operation. These messages are preferably generated by the computer in response to instructions contained within a suitable computer program.

30       The camera 90 is either an analogue video camera (such as a CCD R-G-B (red, green, blue) camera) or a digital camera - such as a so-called asynchronous "frame grabber". The embodiment shown in Figure 4 uses an analogue camera and the embodiment shown in Figure 7 uses a digital camera. As shown, the embodiment of Figure 4 uses a foreground processor (partly) to digitise the image from the analogue camera, whereas the embodiment of Figure 7 does not require a stage of analogue to

digital conversion.

The blue screen mentioned above may be back lit by a suitable light source to provide an improved contrast for capturing the image of the subject for matte generation.

5           The flash unit 100 is under direct control of the computer 20 so that the flash 100 may accurately be fired at an appropriate point in the image-capturing process.

To avoid problems of reduced contrast and over exposure, the flash 100 is fired by the computer 20 and a foreground image is captured, either moments after or moments before a matte is stored, so that the flash does not affect the quality of the  
10           background/foreground discrimination in matte generation.

In the case that a video camera (generating successive images) is used, the successively generated images can be used to generate "trial views" of the subject on the background, so that the scene can be lined up correctly before the final composite image is generated. Embodiments of the camera system comprise a display within the  
15           booth (not shown) for displaying a trial view image of the subject in front of the chromakey screen, the trial view being generated from a non-flash-illuminated image superimposed on a background image using a matte generated from that or another non-flash-illuminated image. It is accepted that because the trial views are generated using mattes and foregrounds both derived from non-flash-illuminated images, their  
20           image quality will be lower. However, the trial view images may well be of sufficient quality for planning and alignment of the scene.

Figure 4 illustrates part of the camera system of Figure 3 when configured for use with an analogue video camera. Specifically, Figure 4 shows a chromakey apparatus comprising a foreground processor 170, a control unit 180, a matte generator  
25           190, a matte store 200 and a chromakey switch 210. Advantageously, all of these components may be provided on a single printed circuit board for use in the computer 20.

The user, when prompted for a response by the computer 20, presses a suitable button on the interface unit 80 to signify that he wishes a print to be taken of his  
30           combined image. This signal is transmitted to the control unit 180 which incorporates a synchronisation module. The control unit 180 synchronises an internal timer with the video signals received from the camera 90.

The matte generator generates mattes from each image output by the video camera. At a suitable time interval after the user has signified his wish to print a composite image, the control unit 180 instructs the matte generator 190 to cease generating mattes and to dump its last generated matte to a matte store 200. Simultaneously, the control unit 180 decreases the gain of the camera's built-in amplifier. The control unit 180 then fires the flash 100 and a flashed foreground image is recorded by the camera 90. This foreground image is processed and digitised by the foreground processor 170 and passed to the switch 210 in the normal way. The switch then combines the flashed image with an image from the image store under control of the matte that has been previously stored in the matte store 200.

In other embodiments, the matte generator could operate only when a matte is required for use in an output composite image.

The flashed foreground image is thus combined with a background image under control of a matte that is not generated from a flashed image and thus, the matte has an improved contrast with respect to a matte produced by a known arrangement. In this way, a final composite image is produced that alleviates the problems associated with the prior art.

Various methods may be adopted to vary the gain or exposure of the camera 90. If the camera 90 does not have an in-built amplifier (or even if it does), then a shutter or filter may be employed in front of the camera to reduce the quantity of light recorded by the camera. The shutter would, of course, be under the control of the control unit 180 for proper synchronisation. Alternatively, an aperture stop device or an electronic shutter could be used.

Figure 5 illustrates a schematic time representation of a video signal used with the apparatus of Figure 4. A series of video frames F1, F2, F3 etc. are shown separated over time. These frames have been generated by the analogue video camera 90. The user notifies the camera system, at some point before the first frame F1, that he requires a hard copy of any displayed combined image (generally indicated at "ACQUIRE IMAGE" in Figure 5). At a suitable juncture between frames, the control unit 180 instructs the matte generator 190 to store the most recent matte in the matte store 200 (indicated at point I in Figure 5). The control unit 180 then lowers the gain of the camera 90 by way of a shutter or otherwise (indicated at point II in Figure 5).

At the start of the next frame F2, the flash is fired (indicated at point III in Figure 5). The flashed image is then transferred to the switch 210 in the normal way (indicated at point IV in Figure 5). The system may then be reset, ready for a second and subsequent capture of the subject image (indicated at point V in Figure 5).

5           Figures 6A and 6B are a flow chart depicting the various stages of the present technique as described with reference to Figures 4 and 5.

          With reference to Figures 6A and 6B, upon powering up the camera system the money slot, external devices and interface unit are initialised and prepared for operation (as shown by a step 300). Then, as an option mentioned above, an external  
10       video programme may be played on the external devices 50 to attract potential customers (as shown by a step 310). The computer 20 interrogates the money slot 60 to ascertain whether a user has entered the booth and attempted to use it (as shown by a step 320).

          If the user has paid, the computer 20 instructs the camera system to allow the  
15       user to select a background by way of the interface unit 80 and its buttons (as shown by a step 330 and a step 340). Once a background is selected, that background image is loaded from the image store 30 (as shown by a step 350) and an image of the subject from the analogue video camera 90 is displayed superimposed upon the chosen background image (as shown by a step 360). The user is then prompted as to whether  
20       he is happy with the image and wishes to be provided with a hard copy (as shown by a step 370). If the user is not happy with the image, then he is provided with an option to return and select an alternative background image from the image store (as shown by a step 380).

          Once the user has selected a background, he signifies his desire to produce a  
25       hard copy by activating the interface unit 80 when prompted by the computer 20 (as shown by a step 370). The computer 20 then starts a timer and generates some graphic that is displayed on the monitor 50 and notifies the user that an image is soon to be captured (as shown by a step 380). A preferred graphic is in the form of a bar that decreases in length as it moves across the monitor 50. The computer then  
30       synchronises its timer with the frames of the video signal from the analogue video camera 90 (as shown in a step 390). As shown in Figure 4, a matte is generated and stored (as shown in a step 400), shortly after which the gain of the camera 90 is

reduced and the flash 100 is fired (as shown in a step 410). The flashed image of the subject is digitised and stored (as shown in a step 420) and may then be combined with the chosen background in accordance with the stored matte (as shown in a step 430). The composite image is displayed to the user, stored and the gain is reset (as shown in steps 440, 450).

The user is then prompted as to whether he requires the capture of another image (as shown in a step 460). If not, the stored composite image is printed via the printer 40 (as shown in a step 470). Printing may occur relatively swiftly, thereby alleviating one of the disadvantages of known photography based systems. The camera system then resets itself and returns to point B on Figure 6A.

If the user requires a second image, then the money slot 60 is activated again to sense whether the user has paid (a step 480). The user is then asked whether he wishes to be superimposed on the same background image or a different background image (as shown by a step 490). If he wishes to retain the same background, then the camera system is reset to point D on Figure 6A. If not, then the camera system is reset to point C on Figure 6A.

As an option, a further step may be provided that allows the user to adjust the attitude of the analogue video camera 90 to ensure that his image is correctly placed within the final image.

Figures 6A and 6B show an embodiment using an analogue camera 90 where, first, a matte is generated from an image that has not been illuminated by the flash and then, the flash is fired and an illuminated image of the subject is generated. Any movement of the subject in response to the flash would not affect the matte.

However, the above sequence of events could be reversed. In such a reversed sequence, a flash-illuminated image would be captured first and the matte would be generated from a subsequent non-flash-illuminated image. This "reversed" sequence would still allow the camera system to operate, but it may be sensitive to reflex movement of the subject in response to the flash.

The analogue video camera 90 may be replaced with a digital camera which exhibits a number of advantages over the analogue camera.

Firstly, as the digital camera outputs digital signals, a stage of analogue to digital conversion is not needed. Secondly, as the operation of the system does not

have to be synchronised with the camera (which is asynchronous), synchronisation circuits may not be needed.

Finally, as the digital camera is not tied to a particular frame rate, the time delay between capturing an illuminated image of the subject and capturing an unilluminated image of the subject (for generation of the matte) may be significantly reduced. The reduction of this time delay means that any movement of the subject in response to the flash would have a greatly reduced effect on the quality of the matte. In effect therefore, in digital systems, the matte may be generated either before or after the flash has been fired.

Figure 7 illustrates part of a camera system configured for use with a digital camera.

Specifically, Figure 7 shows a camera system 500 comprising a digital camera 510, a switch 520, a matte generator 530, a foreground image store 540, a background image store 550, a flash unit 560, a logic unit 570, a chromakey combiner 580, and an interface unit 590.

Instructions input into the user interface 590 by a subject causes the logic unit 570 to operate the camera system 500 to generate a composite image of the subject in front of a background of his choosing.

The logic unit 570 controls operation of the digital camera 510, the flash unit 560 and the switch 520. The switch 520 directs incoming image data to either the matte generator 530 or the chromakey switch 580.

The logic unit 570 may fire the flash to illuminate the subject and capture an image, either before or after a matte is generated by the matte generator 530. For the purposes of the discussion below, it will be assumed that the matte is generated from an image taken after the flash has been fired (and therefore after an illuminated image of the subject has been stored in the foreground image store 540).

When the user operates the interface unit 590, the logic unit 570 operates the camera 510 and flash unit 560 to generate a flashed foreground image that is passed via the switch 520 for temporary storage in the foreground image store 540.

The logic unit 570 then reduces the gain of the camera 510 (e.g. by way of mechanical or electronic shutter or by variation of software controls) and operates it to generate another image of the subject without firing the flash 560. The unflashed

image is then passed via the switch 520 to the matte generator for generation of a matte.

The matte is then used to control the chromakey switch 580 as it combines the flashed foreground image in the image store 540 with the background image stored in the background image store 550.

As with the other embodiments, the logic unit 570, switch 540, matte generator 530, chromakey switch 580 and foreground image store 540 may be provided on a single expansion board for insertion into a computer in a conventional manner.

Advantageously, this embodiment does not need to be synchronised with the signals from the camera 510. In view of this, the logic unit 570 does not need any synchronisation modules.

Furthermore, as the camera is not tied to a particular video rate, the time delay between generating an illuminated image of the subject and generating an unilluminated image of the subject (for generation of the matte) may be reduced. This means that any effect on the final image caused reflex movement of the subject in response to the flash is reduced.

Details of the embodiment described in relation to Figures 4, 5, 6A and 6B may also be utilised in the embodiment described in relation to Figure 7.

Various modifications of these embodiments may be made.

For example, the analogue system of Figure 4 may be yet further simplified by incorporating a time delay into the combination of the matte with the background and foreground images. In this way, a flashed foreground image would be combined with a matte that had not been subject to a flash, the matte having been generated some time prior to the flashed image. Whilst such an arrangement would be simpler than the technique described above, there would be a disadvantage in that the real time display, prior to any requested image capture, of the subject's image superimposed over the selected background would be subject to a dragging effect caused by the delayed matte.

Components of the camera system may be provided on an expansion card for insertion into a standard PC. It is also conceivable that some or all of the components could be implemented using one or more ASICs (Application Specific Integrated Circuits).

Although a booth has been described, the camera system could be employed in a photographic studio, for example. There, the camera system may be provided with a post-processor for processing the image signals to remove skin blemishes, change skin tones or the like.

5           Various other effects may also be employed in the camera system. For example, the chromakey switch could be forced to replace parts of the subject image with the background image to create perspective effects whereby the arms, for example, of a cartoon character may appear to envelop the subject in the final composite image.

10           The booth may be provided with wheels so that it can be wheeled to secure storage at night. The booth could require a human operator. This would be useful in countries where an automatic cash receiving device is not appropriate given the low quality of circulating currency.

CLAIMS

1. A camera system for generating a composite image of a subject superimposed on a background image, the system comprising:
  - 5 (a) flash apparatus operable to flash illuminate the subject;
  - (b) image capture apparatus for capturing a flash-illuminated image and a non-flash-illuminated image of the subject in front of a chromakey screen;
  - (c) a matte generator for generating a matte from the non-flash-illuminated image; and
  - 10 (d) a chromakey image combiner for combining the background image with the flash-illuminated image in accordance with the matte to generate the composite image.
2. A camera system according to claim 1, wherein the image capture apparatus  
15 is a video camera operable to capture successive video images.
3. A camera system according to claim 1, wherein the image capture apparatus is an asynchronous image capture device operable to capture images asynchronously.
- 20 4. A camera system according to any of claims 1 to 3, wherein the matte is generated from a non-flash-illuminated image captured before the flash-illuminated image is captured.
- 25 5. A camera system according to any of claims 1 to 3, wherein the matte is generated from a non-flash-illuminated image captured after the flash-illuminated image is captured.
- 30 6. A camera system according to any of claims 1 to 5, comprising a display for displaying a trial view image of the subject in front of the chromakey screen, the trial view being generated from a non-flash-illuminated image superimposed on a background image using a matte generated from that or another non-flash-illuminated image.

7. A camera system according to claim 2 and claim 6, wherein the matte generator is operable to generate respective mattes from each of the successive images captured by the image capture apparatus.

5 8. A camera system according to claim 7, comprising a matte store for storing at least a most recently generated matte.

9. A camera system according to claim 8, comprising matte generator control logic for controlling the matte generator to cease generating mattes prior to the capture  
10 of a flash-illuminated image.

10. A camera system according to claim 4 and claim 7, comprising a delay circuit for delaying mattes generated by the matte generator so that the composite image is derived using a current flash-illuminated image and a delayed matte generated from  
15 a previous, non-flash-illuminated image.

11. A camera system according to any preceding claim, wherein the chromakey screen is backlit.

20 12. A camera system according to any preceding claim, comprising:  
an image store for storing one or more background images; and  
a user operable background controller for selecting a background image for use in the composite image.

25 13. A camera system according to claim 12, wherein the image store comprises a hard disk data storage device.

14. A camera system according to claim 12, wherein the image store comprises a CD-ROM data storage device.

30

15. A camera system according to any preceding claim, comprising control logic for controlling the gain of the image capture apparatus to be lower for the capture of

the flash-illuminated image than for the capture of the non-flash-illuminated image.

16. A camera system according to any one of claims 1 to 14, comprising control logic for controlling the exposure of the image capture apparatus to be lower for the capture of the flash-illuminated image than for the capture of the non-flash-illuminated image.

17. A camera system according to any preceding claim, comprising a printer for printing the composite image.

18. A camera system according to any preceding claim, wherein the matte generator and chromakey image combiner are provided on a PC peripheral card.

19. A method of generating a composite image of a subject superimposed on a background image, the method comprising the steps of:

- (a) capturing a flash-illuminated image and a non-flash-illuminated image of the subject in front of a chromakey screen;
- (b) generating a matte from the non-flash-illuminated image; and
- (c) chromakey-combining the background image with the flash-illuminated image in accordance with the matte to generate the composite image.

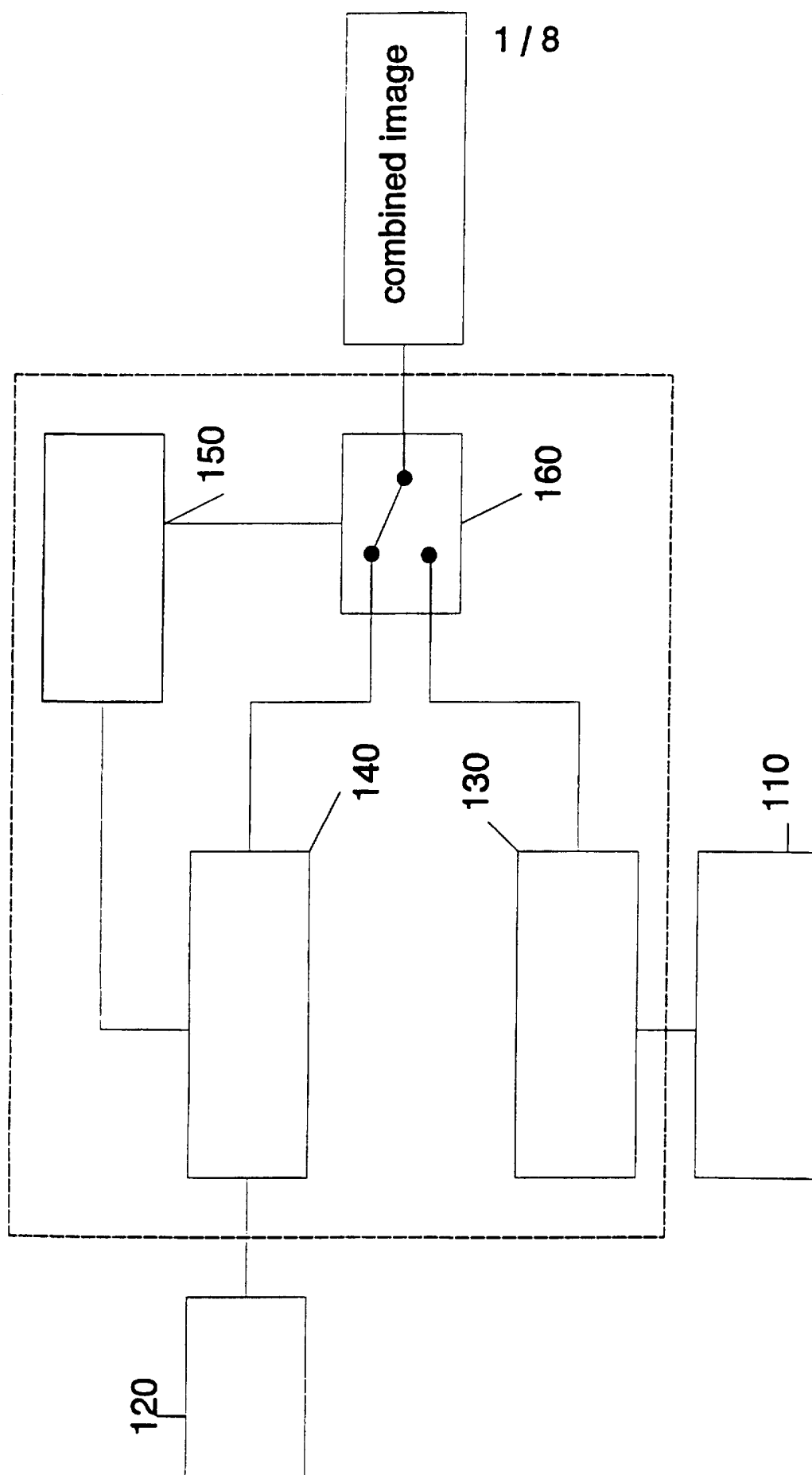


FIGURE 1

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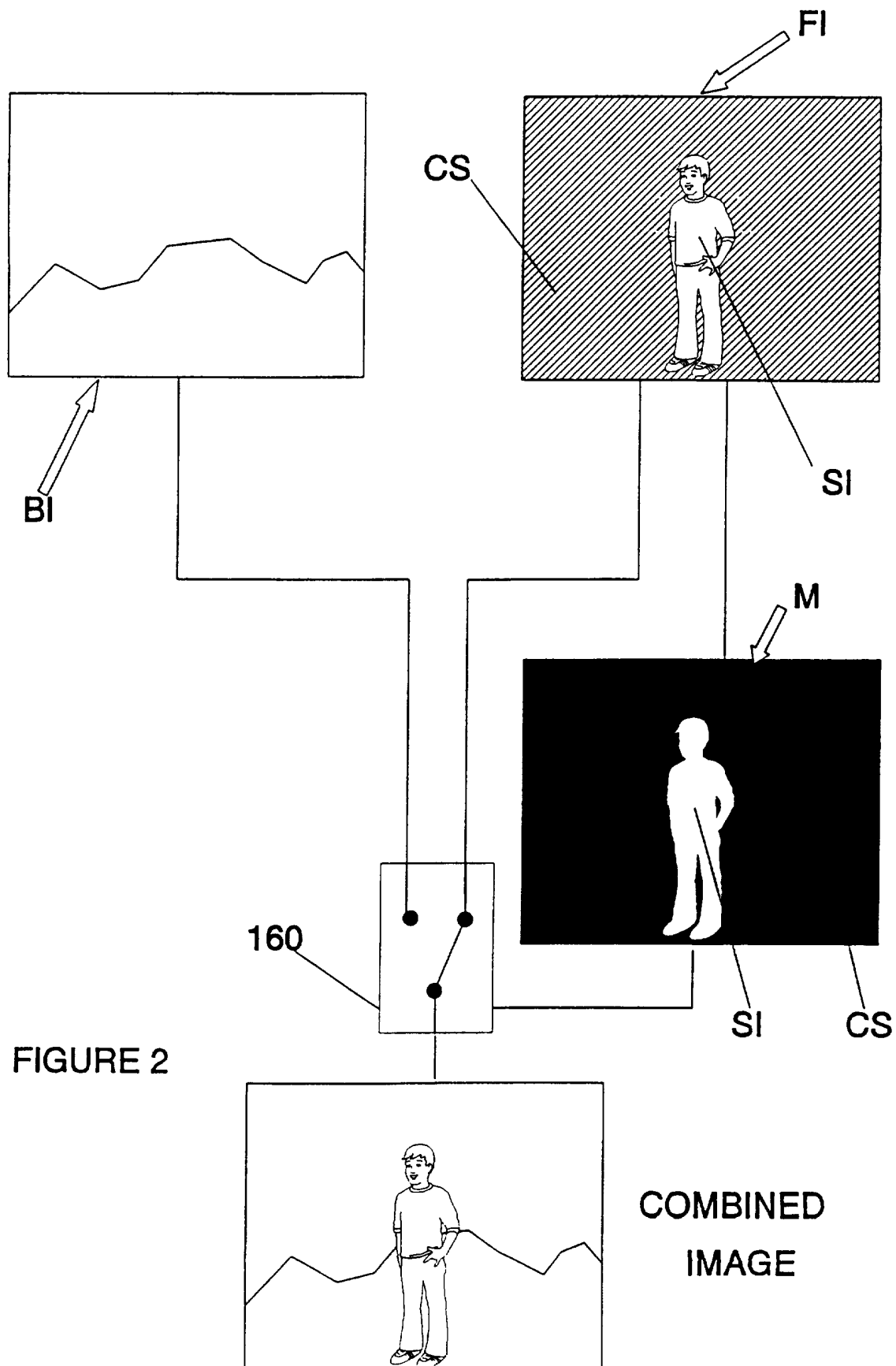
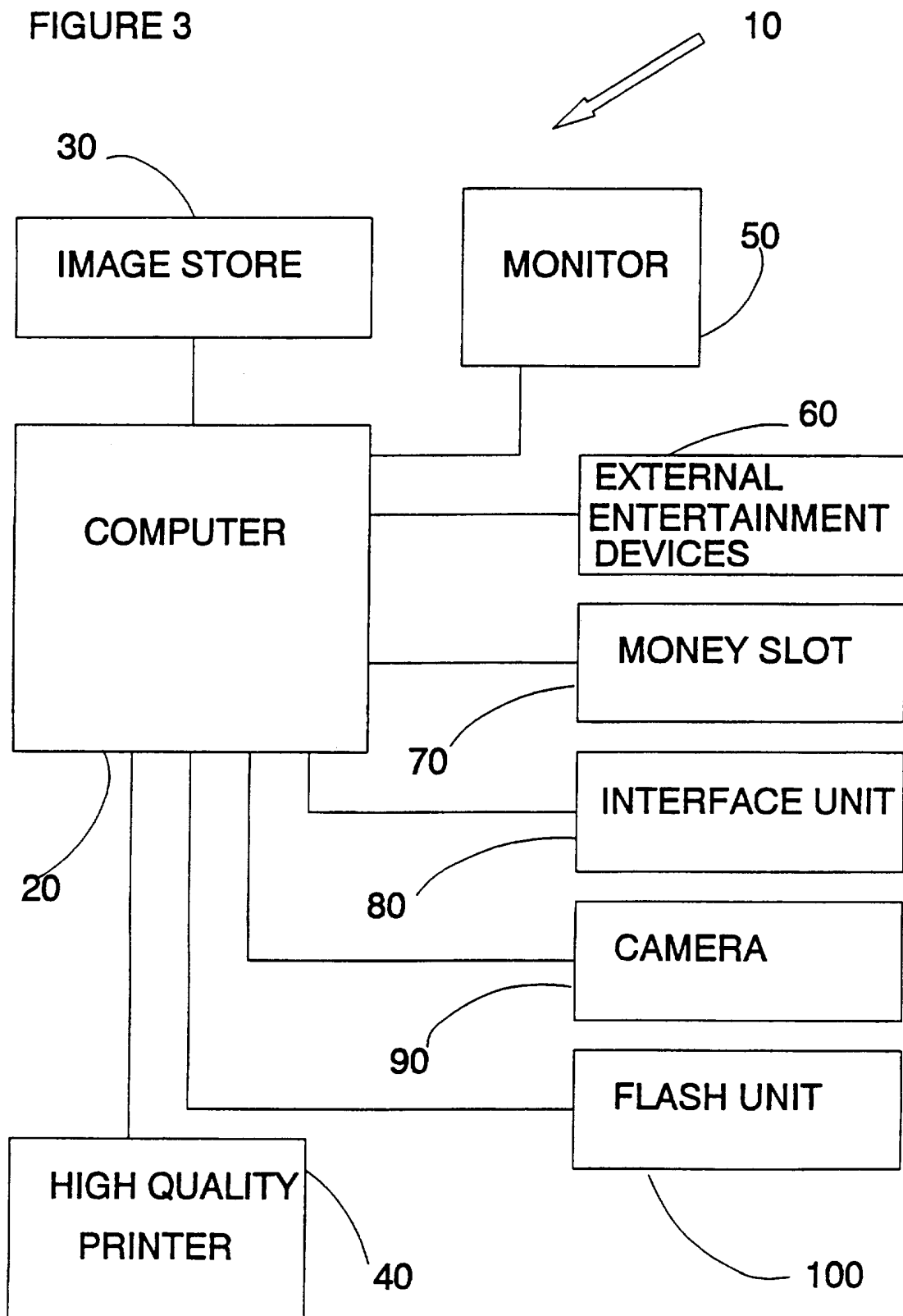


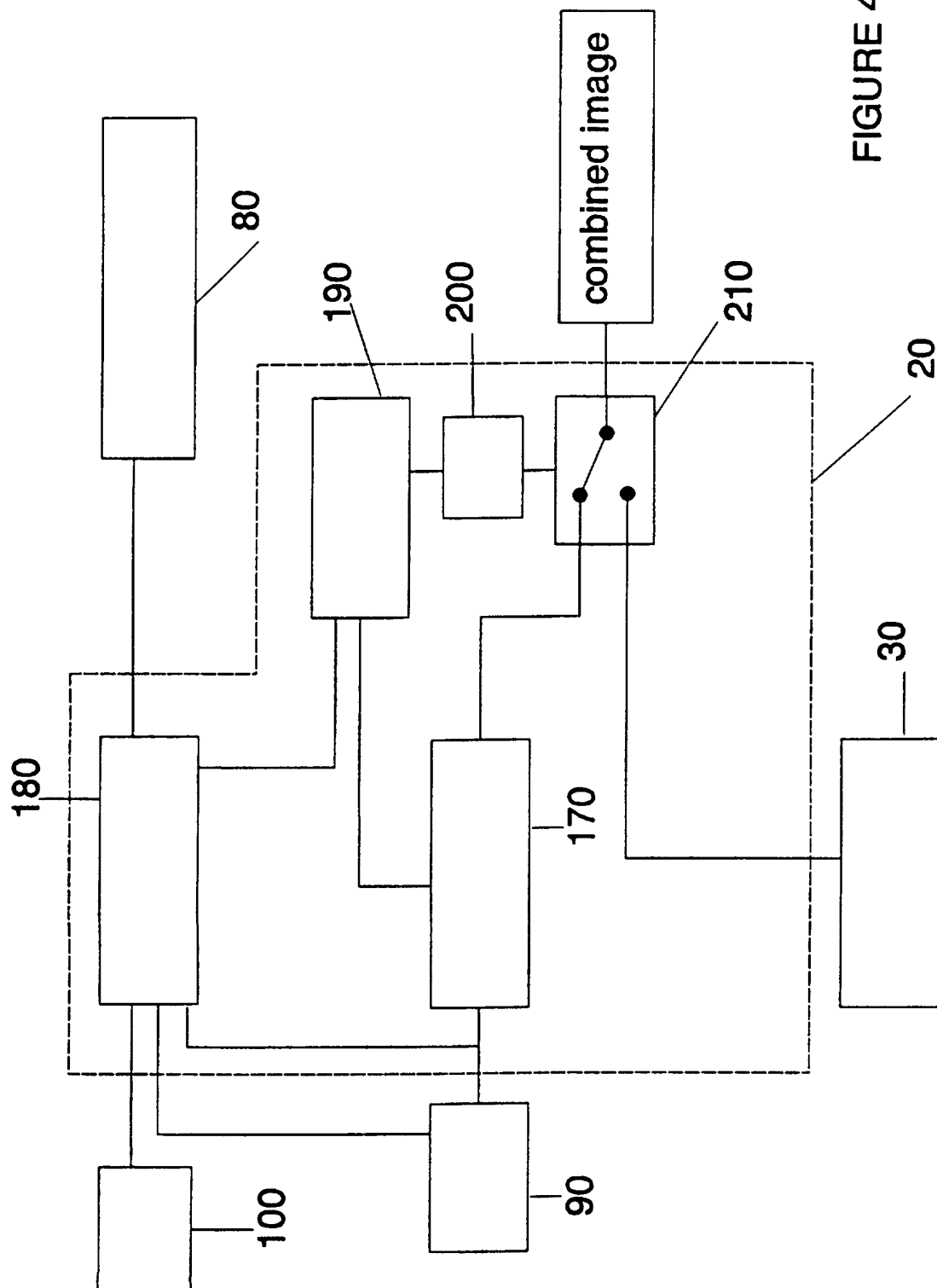
FIGURE 2

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FIGURE 3



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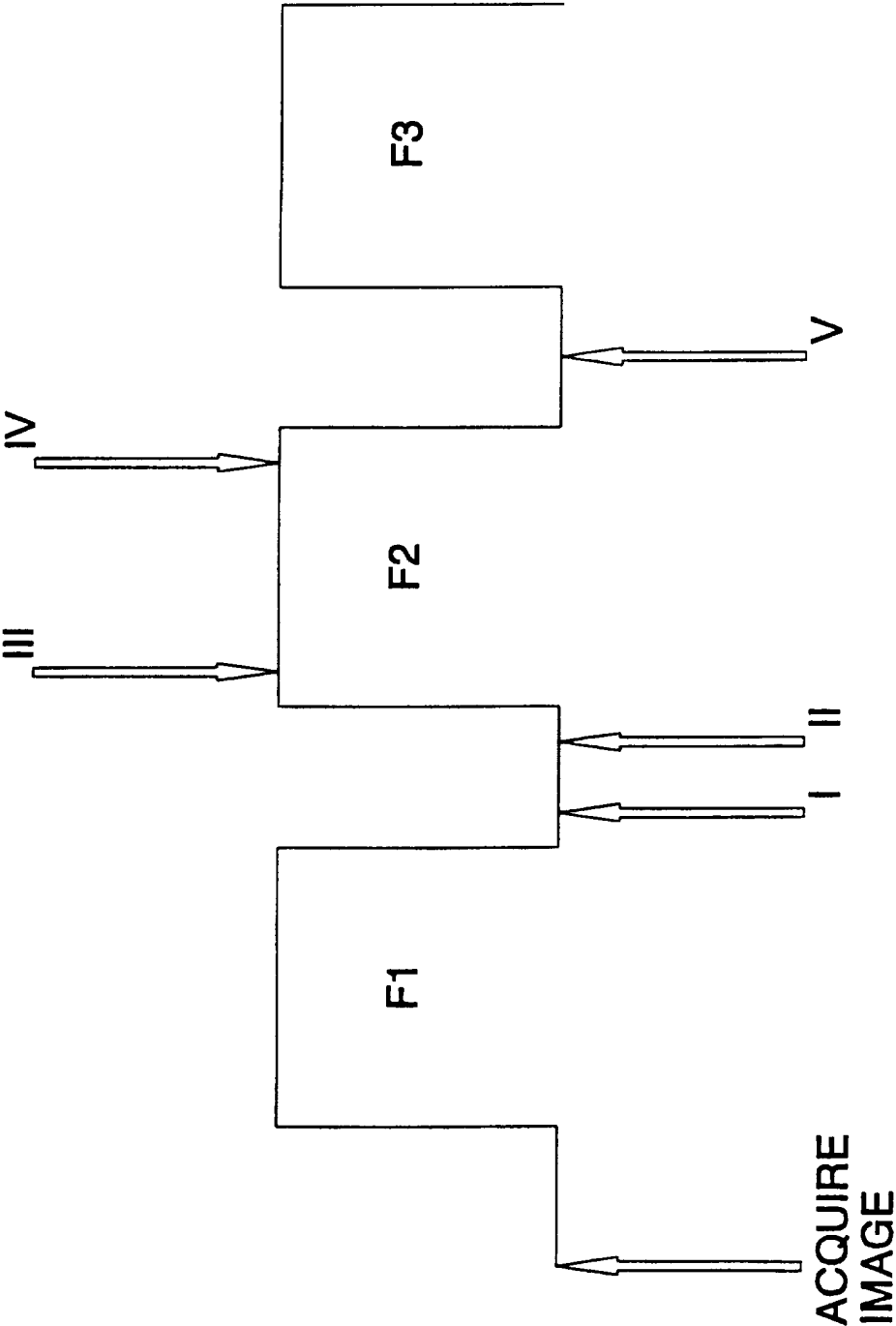


FIGURE 5

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FIGURE 6A

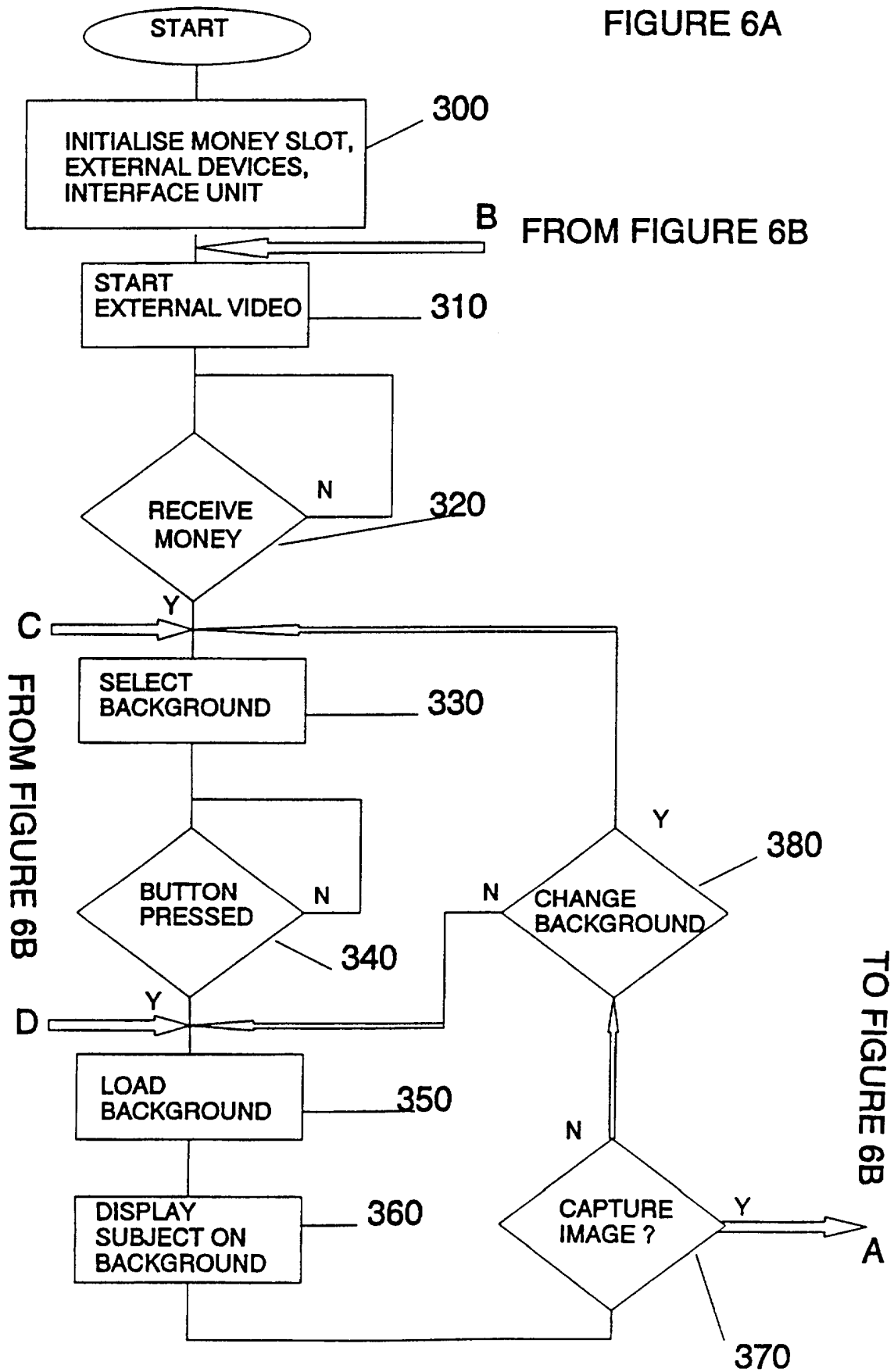

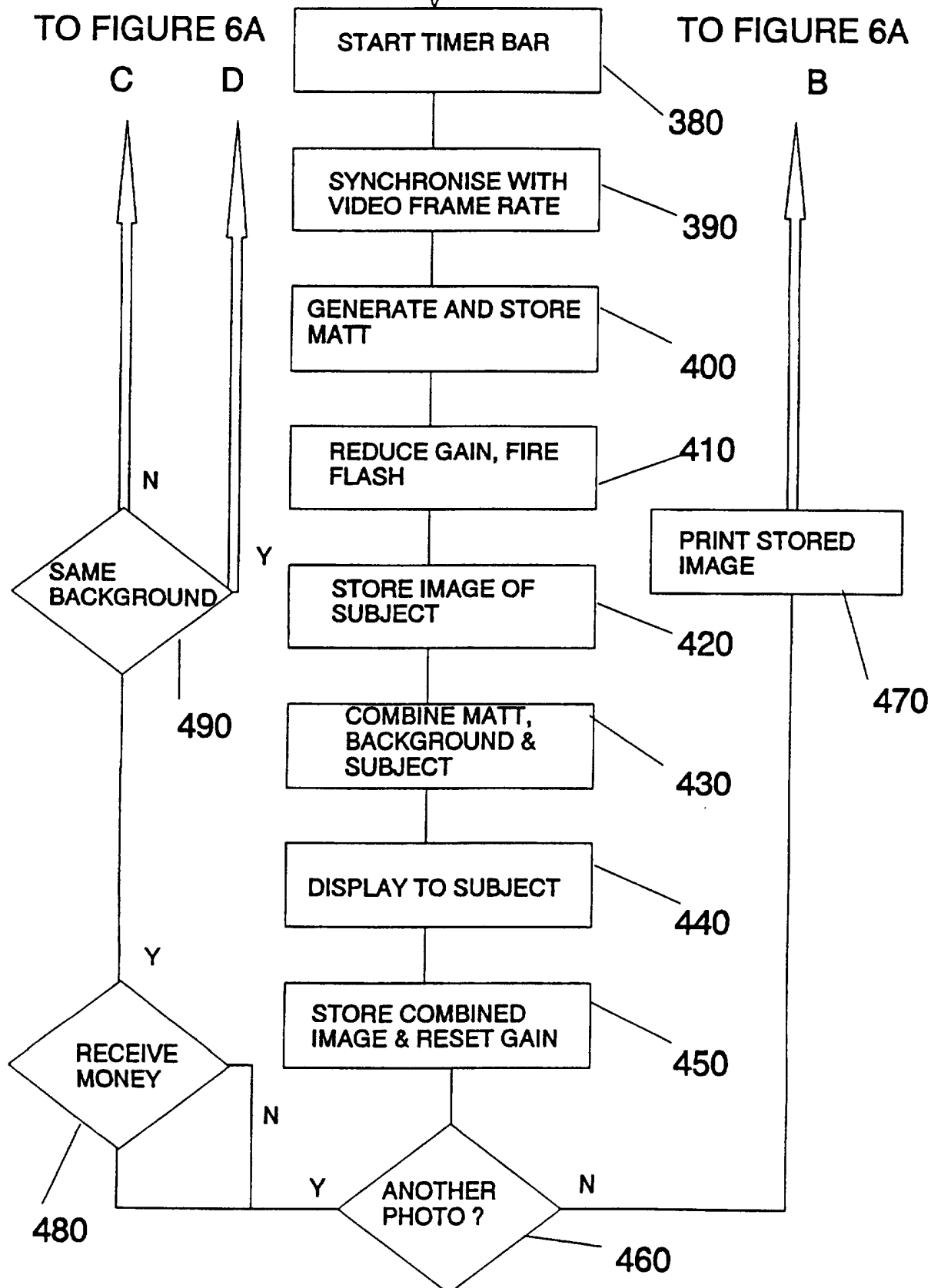


FIGURE 6B

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**A** 

FROM FIGURE 6A



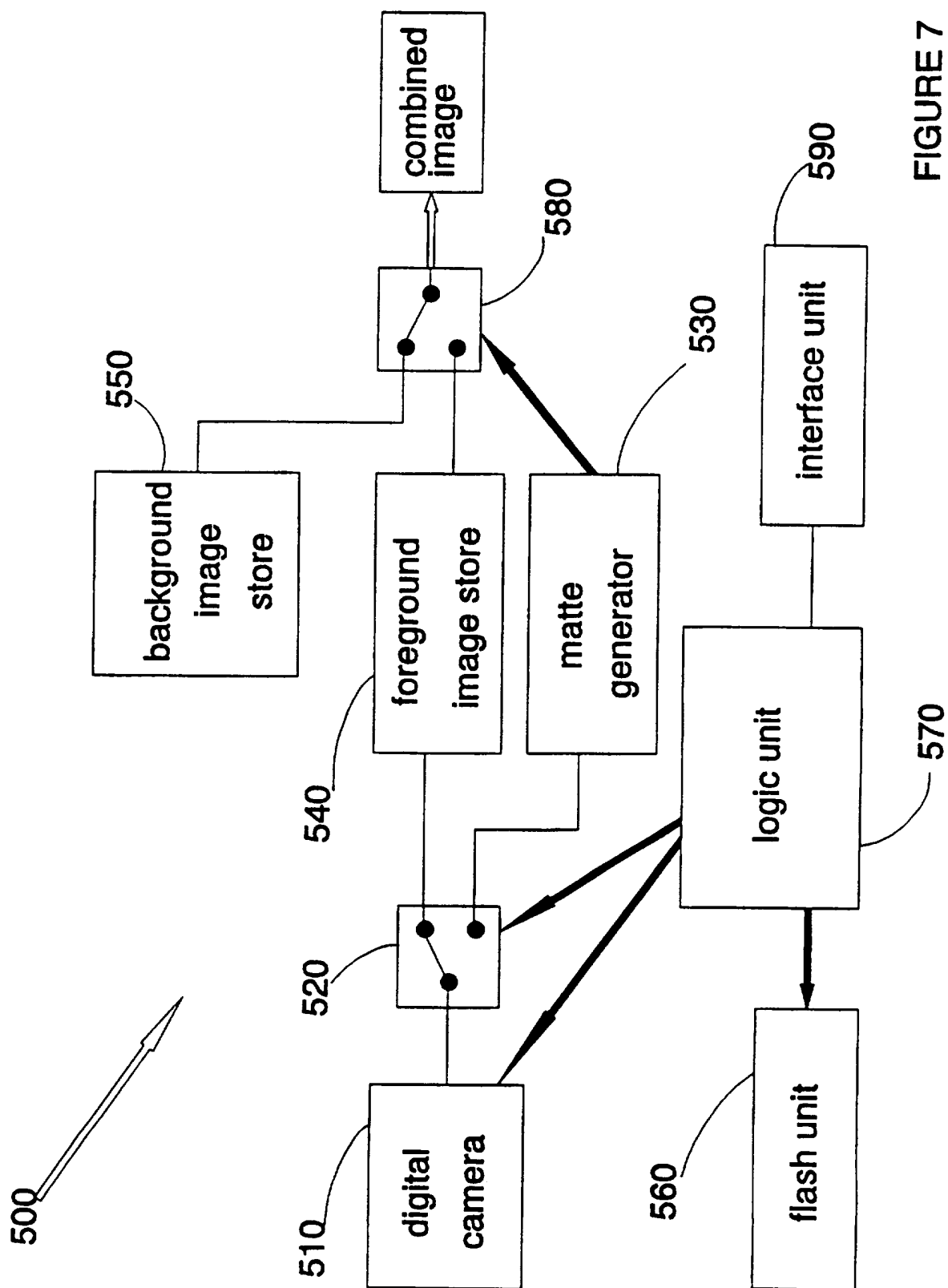


FIGURE 7

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 96/02726

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H04N5/272

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	WO 94 26057 A (SCIENT GENERICS LTD ;AGER COLIN DENNIS (GB); GREEN ALAN EDWARD (GB) 10 November 1994 see page 1, line 24 - page 5, line 19 see page 6, line 20 - page 7, line 7 see page 9, line 28 - page 10, line 23 see page 11, line 1 - line 20 see page 14, line 15 - line 30 ---	1-3,5, 11,17,19
A	US 5 117 283 A (KROOS DONNA S ET AL) 26 May 1992  see column 1, line 45 - column 3, line 63 see column 4, line 25 - column 6, line 51 --- -/--	1,2, 12-14, 17,19

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

3 March 1997

Date of mailing of the international search report

17.03.97

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WENTZEL, J

## INTERNATIONAL SEARCH REPORT

Inv. No. Application No

PCT/GB 96/02726

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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