(54) Title: A MACHINE AND METHOD FOR IMAGING DISPLAY OUTPUT ON A STANDARD LIGHT LENS OR DIGITAL COPIER, SCANNING DEVICE, OR FAX MACHINE

(57) Abstract: A machine and a method for imaging digital camera output on a standard light lens copier, the camera having a reflective display flush with the camera so that the display can lay flat on the copier platen without interference from any other portion of the camera.
A MACHINE AND METHOD FOR IMAGING DISPLAY OUTPUT ON A
STANDARD LIGHT LENS OR DIGITAL COPIER, SCANNING DEVICE, OR
FAX MACHINE

Field of the Invention

This invention relates to methods of generating printed images from reflective displays.

Background of the Invention

Up until recent years cameras used various types of film using chemical methods to produce images, usually on special photographic paper. Similarly, laptop and handheld computers have required dedicated printers with special interface connectors.

With the advent of the digital camera people have had the choice of using a variety of methods for printing images from their digital photographs, including dedicated printing modules designed for electronic cameras, or standard printers attached to personal computers onto which the digital images have been transferred.

The same is true of other devices using displays, such as laptop computers, personal digital assistants (PDA's), electronic games, portable televisions, and a whole host of devices that provide display imaging for human observation but do not facilitate copying on standard copying devices or facsimile machines.

The advent of digital cameras has created a need for improved methods of printing images. Today's digital cameras usually require a dedicated imaging module, or a connection to a personal computer that, in turn, is connected to a printer. This creates a need for additional, bulky, and expensive devices to facilitate imaging from the camera. There are a plethora of cameras, with many different electronic formats, connectors, pixel arrays, etc., and creating a great deal of complexity in going from an electronic image in a digital camera to a hard copy printout. The camera operator may be required to store images on memory cards and to wait until they return home where they may have specialized devices dedicated to imaging from their cameras, or where they may have a personal computer with special connectors and cables that allows them to move the image onto their computer, where they may need special software to collect and organize and select those images for printing, and are then limited to the type and quality of printer they have, and the paper type which that printer handles. If they have a black and white printer they would not be able to create color prints.

Many digital cameras come with a LCD for viewing the images. It is inherent in the operation of the standard liquid crystal display that their image, while superb for viewing by the human eye, does not contain the ability to
generate an image suitable to be used to make a good quality copy on a standard office or home copier. If one places the LCD on the copier and attempts to image it, the image will either not come out at all, or will be a very poor quality.

The desire to place the camera on the copier and copy the image on the LCD is defeated on the very first try, for those bold enough to bother. The relative abundance and availability of copiers, including color copiers, is negated with the advent of the digital camera, and a whole series of complex procedures and specialty equipment have to first be accessed in order to get the first set of prints from a digital camera.

The same is true of laptop and handheld computers, and PDA’s. Their displays do not create copies when they are placed on a copier.

Summary of the Invention

The primary object of the invention is enable one to use a digital camera or other electronic device having a flat display screen to print acceptable images on a standard office or home xerographic copier having a platen glass.

Another object of the invention is to retain the ordinary functioning, feature and benefits of standard digital camera.

Another object of the invention is to copy on an ordinary copier without modification, either color or black on white.

Another object of the invention is to enable flat panel displays to image on standard imaging surfaces without the use of specialty cables, adapters, etc.

Another object of the invention is to enable portable computers to be able to image onto a copier, without the use of specialty cables, adapters, etc. In this context a portable computer may embrace any portable electronic device which combines a reflective display with a memory feature including, but not limited to, a laptop or handheld computer, a personal digital assistant, a hand-held calculator, a paging device or a cell phone.

This invention relates generally to the field of digital cameras and personal, laptop and handheld computers, electronic books, and more particularly to a machine and method for imaging from a reflective display onto a standard light lens copier, digital copier, scanning device, or facsimile device.

Hereinafter, both in the detailed description and the claims, the term copier will be used to embrace any reproduction device that is currently capable of receiving an image from a paper or a book and copying it either locally or remotely, as either a hard copy or an electronic copy. Such devices include, but are not limited to, standard light lens or digital xerographic copiers, scanners, and fax machines.

Other objects and advantages of the present invention will become apparent from the following descriptions, taken in connection with the
accompanying drawings, wherein, by way of illustration and example, an
embodiment of the present invention is disclosed.

The invention includes a method for imaging digital camera output on a
standard light lens copier comprising a digital camera, a reflective display,
mounted flush, or adjustable to be flush, with at least one end of the camera, so
that the reflective display can lay flat on the copier platen, and all other buttons,
controls, etc., do not interfere with the reflective display.

The invention also includes a method for adapting the invention to
portable or handheld computing devices so that images from any of these devices
may be created with a standard light lens copier or other device capable of
scanning or reproducing a document.

The invention as taught herein has widespread applications and anticipates
many new developments. We expect reflective displays such as electrochromic as
taught by Doane, rotating balls as taught by Sheridan, and E-Ink as taught by
Jacobson et al (US 5,961,804) to be used in paging devices, portable telephones,
diaries and PDA devices, portable computers, electronic books, and many other
devices. With the teachings of this patent any device using a reflective display can
be configured to facilitate using a copier device to make a direct image from the
reflective display.

For example, a harried executive arriving off an airplane receives a dozen
messages on his or her PDA or paging device, and wants to make a permanent
recorded message of them, so as not to lose them. With our invention he need only
find any platen based copier, printer, scanner or fax machine with a platen glass,
and he can make a direct copy. He can also make multiple copies or fax the
information somewhere else. The executive can do all this without any cables or
electrical connections. This overcomes many of the technical interfacing problems
in the prior art.

We further anticipate the forward development of these reflective, bi-
stable displays to the point where they can be incorporated on the face of credit
cards, business cards, etc., and where they can even be configured to make up
what will appear to be the simulated pages of a book! Yet, they will in fact be
displays capable of reimagining and being used in such a fashion that a single
physical publication can contain a wealth of disparate publications. The harried
traveler today going on an airplane with a dozen books and magazines will be
able, in the anticipated future, to carry only a single book with a large selection of
titles on board in electronic form, and imageable on the display, even when it is
paper thin and stacked among a hundred additional pages.
With our invention the user can take any of these devices, put it on any standard or digital copier, or a copier of any other means, and make a copy or multiple copies.

The drawings constitute a part of this specification and include exemplary embodiments to the invention, which may be embodied in various forms. It is to be understood that in some instances various aspects of the invention may be shown exaggerated or enlarged to facilitate an understanding of the invention.

**Brief Description of the Drawings**

Figure 1 is a schematic perspective view of a digital camera seen from the front.

Figure 2 is a schematic perspective view of the camera of Figure 1, seen from the back and showing a reflective display with an image thereon.

Figure 3 is a schematic perspective view of a copier including a platen thereof.

Figure 4 is a schematic front elevation of the copier with a digital camera positioned on the platen, showing also a hard copy of the image.

Figure 5 is a schematic representation of a digital camera positioned on a scanner, showing also a computer, copy of the image on a monitor screen, and a second computer.

**Detailed Description of Preferred Embodiments**

Detailed descriptions of the preferred embodiment are provided herein. It is to be understood, however, that the present invention may be embodied in various forms. Therefore, specific details disclosed herein are not to be interpreted as limiting, but rather as a basis for the claims and as a representative basis for teaching one skilled in the art to employ the present invention in virtually any appropriately detailed system, structure or manner.

The invention disclosed herein replaces standard digital cameras and portable and handheld computer LCD displays with a reflective display having comparable features but having the unique attribute of reflecting ordinary light. This reflective display has been taught by William Doane of the Kent State Liquid Crystal Institute in his many papers and patents on reflective display technology.

A person wishing to generate printed images would first generate an image on the reflective display of Doane or an equivalent display. The reflective display will often be a part of some recording or generating device. These devices may be cameras, laptop screens, pager screens, etc. It is necessary for the reflective display on these devices to be located in a position such that it may lie flat on the platen glass of a copier. The reflective display should make smooth contact with the copier surface.
The imaging device has to be designed in such a manner as to allow for the selection and sequencing of images, and this sequencing may ideally be calibrated with the copier's copy cycle, so that the camera, if equipped with a sensor, can advance the image on the display to allow subsequent copying of additional images without having to lift the camera and review the image presented.

The process is further enhanced if the camera allows one to identify and select which of the photos are to be imaged, and further allows one to sequence and copy these images without having to lift the camera from the copier glass, a function which can be facilitated by advancing the desired photos in an automated fashion and making the desired number of copies, at which time the camera, when so programmed, will advance the image on the reflective display and leave it there for the desired number of copies to be made.

This process is not dependent, in any way, upon the type of copier used. A color copier would be able to produce full color reproductions of an image on a reflective display.

In summary, the invention provides for an image from an electronic imaging device to be displayed in a reflective display, the reflected light therefrom to be received and processed by a copier, and hard copies or electronic copies of the image to be produced and viewed either locally or remotely.

Referring now to the drawings, one embodiment of the invention is shown in Figures 1-4. Figure 1 represents a digital camera 10 viewed from the front and showing a lens 12. Figure 2 represents the same camera, viewed from the back and showing a planar reflective display 14, whereon is captured an image 16. The image 16 can be one of a series of images already stored in the camera. The camera is activated with an on-off switch 18, which may be optionally be configured to be activated manually or in conjunction with a lens cover or other enabling feature of the camera. The camera has a shutter release button 20 and two buttons 22 and 24 which can respectively be used to manually advance to a succeeding image or revert to a preceding image of the series. Another button 26 can be used to command the digital camera to initiate a series of images on the display in conjunction with a sensor 28, such as a light sensitive diode, for sensing the light from an external source. The working of the command button 26 and the sensor 28 will become apparent in further description. The camera is configured so that no portion thereof projects behind the plane of the display 14. For example, the sensor 28 is either coplanar with the plane of the display, or recessed into the camera 10.

Figure 3 is a schematic perspective representation of a xerographic copying machine 30, which can be either a standard light lens copier, or a digital
copier. On the top surface copier is a transparent platen 32, whereon normally a paper original is placed so that it can be copied to produce a hard copy. Figure 3 also shows a control panel 34 and paper trays 36 to supply paper for the copy.

The invention is practiced in the following manner. A picture or a series of pictures is taken with the digital camera 10 and stored therein for immediate or later retrieval. When the camera is activated, the previously stored image 16 will be present in the display 14. If it is desired to copy only this current image, the camera 10 is placed on the platen 32, and the copier 30 activated in the conventional manner. The copier illuminates the display 14, in the same manner as if it were paper, and the reflected light from the image 16 in the display is received and processed by the copier 30.

The distinguishing feature of the display is its superior reflective property, in contrast to prior art displays. The reflected light is processed by the copier 30 in the normal manner, to produce a hard copy 40 of the image 16, such as is seen having emerged from a copy-receiving tray 38 in Figure 4.

It may be desired to reproduce an image other than the current image in the display 14. In this event, either of the buttons 22 and 24 can be operated to advance or revert to another image. Alternatively, it may be desired to reproduce a series of consecutive images. The images may be manipulated manually using the buttons 22 and/or 24, or the command button 26 may be used to initiate the series at a selected current image. The command button 26 activates the sensor 28. The camera 10 is properly positioned on the platen 32 of the copier 30, and the copier activated from the control panel 34, being set for the number of copies required. Besides illuminating the image 16 for copying, light from the copier 30 causes the sensor 28 to advance from the current image to the next image of the series, while providing sufficient delay to allow the complete exposure of the current image. This cycle proceeds until all the images have been copied.

The immediately preceding description illustrates making a single copy of each member of a series of consecutive images. Obviously, the camera 10 could have the capability of being programmed to allow any of the stored images to be selected for copying in any order, and further to allow any number of copies to be made from each image.

Figure 5 illustrates another embodiment of the invention, wherein the camera 10 is used in conjunction with a scanner 50 which is connected in the normal manner to a computer 52 which has connections to a monitor 54 with a screen 56, and to command hardware such as a keyboard 58 and a mouse 60. The camera 10 is placed on the platen of the scanner 50, with the required image 16 in the display 14. After the scanner 50 is activated with appropriate commands, an electronic copy 62 appears on the screen 56. The electronic copy 62 can be filed
electronically and transmitted thereafter to a second computer 64 where the first
computer 52 is connected, whether through a local network or through the internet

One potential problem with our apparatus is that the display on LCD
screens is recessed beneath the surface of the display screen. There is a screen of
finite thickness between the actual display and the surface of the screen. Copiers
read what is directly above the platen. It is simple enough to adjust the target
depth for copiers that scan images with a laser beam. It is more difficult to
accomplish this with non-laser copiers that use ordinary light rather than lasers to
“read” an image. However, various methods could be used to overcome the
problem in either case. The platen could have an adjustable height. A lens or a
prism may also be used to focus the copier on the recessed image.

The invention can be practiced with a combination of any imaging device
which can deliver an image to a reflective display, and any copying device which
can optically copy the image therefrom as a hard copy or an electronic copy, the
copy being capable of being received either locally or remotely. The invention
can further be practiced in the case where the reflective display is electronic paper.

Therefore, while the invention has been described in connection with
preferred embodiments, it is not intended to limit the scope of the invention to the
particular form set forth, but on the contrary, it is intended to cover such
alternatives, modifications, and equivalents as may be included within the spirit
and scope of the invention as defined by the appended claims.
In the claims

1. An assembly for copying an image from a reflective display, comprising:
   (a) a reflective display;
   (b) a copier for reproducing an image from the display
2. The assembly of Claim 1, where the display is flexible.
3. The assembly of Claim 1, where the display is plastic.
4. An assembly for producing a copy of an image, comprising:
   (a) a reflective display wherein the image is capable of being electronically altered;
   (b) a copier, having a platen, upon which a face of the reflective display sits, there being no electronic connection between the display and the copier.
5. The assembly of Claim 4, where the display is flexible.
6. The assembly of Claim 4, where the display is plastic.
7. The assembly of claim 4, where the display is electronic paper.
8. The assembly of claim 4, where the display is an operable portion of one of a group consisting of digital camera and a portable computer.
9. The assembly of claim 4, where the copier is one of a group consisting of a scanner, a xerographic copier and a fax machine.
10. The assembly of Claim 4, where the copier is a color copier.
11. The assembly of Claim 4, further comprising a lens that is placed over the display.
12. The assembly of Claim 4, where it is possible to adjust the position of the copier platen position.
13. An assembly for producing a copy of an image from an electronic imaging device, comprising:
   (a) the imaging device;
   (b) a platen of a copier;
   (c) a reflective display that stores the image from the imaging device, the display mounted flush with a planar surface of the imaging device, and removably placed upon the platen.
14. The assembly of claim 13, wherein the copier is one of a group consisting of a standard light lens copier, a digital copier, a scanner and a fax machine.
15. The assembly of claim 13, wherein the electronic imaging device is one of a group consisting of a digital camera and a portable computer.
16. The assembly of claim 13, wherein the copy is an electronic copy which can be filed in a computer wherefrom it may be transmitted to a second computer.
17. The assembly of claim 13, wherein the copy is a hard copy which can be printed at one of a local and a remote location.

18. An electronic imaging device, comprising a reflective display, the device being configured so that the display can be placed flush on a platen of a copier without impediment from any portion of the device.

19. The imaging device of claim 18, further comprising a sensor which can cause the generation at the reflective display of a second image in response to the illumination of the first image.

20. A method for producing a copy of an image from a reflective display, comprising:
   (a) generating the image to be captured on the reflective display;
   (b) placing the reflective display face down flush with a platen of the copier;
   and
   (c) activating the copier.

21. The method of claim 20, wherein the step of activating the copier causes a copy to be made as an electronic copy which is saved as a file in a computer.

22. The method of claim 20, comprising the further step of transmitting the filed copy to a second computer.

23. The method of claim 20, wherein the step of activating the copier causes a hard copy to be made locally.

24. The method of claim 20, wherein the step of activating the copier causes a hard copy to be made at a remote location.

25. The method of Claim 20, further comprising placing a lens between the copier and the reflective display.

26. The method of Claim 20, further comprising lowering the position of the platen relative to the copier.