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Goldman et al.

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[54] **COPIER SYSTEM**

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[52] **U.S. Cl.** **95/12,** 346/33, 346/110

[51] **Int. Cl.**.....**G01d 9/42,** H01j 29/89

[58] **Field of Search** 95/1.1, 4.5, 12; 346/33, 110

[56] **References Cited**

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[57] **ABSTRACT**

This invention provides a unique system for capturing the image of a cathode ray tube (CRT) and transferring it to a copier machine. Cathode ray tubes have many uses, one being part of a terminal device for a computer, another being the screen of an oscilloscope and one other being part of a television set. Sometimes a permanent image is desired of what is displayed on a CRT. This is often referred to as a hard copy. This invention provides for the transfer of the image displayed on the CRT screen to a copier machine.

3 Claims, 2 Drawing Figures

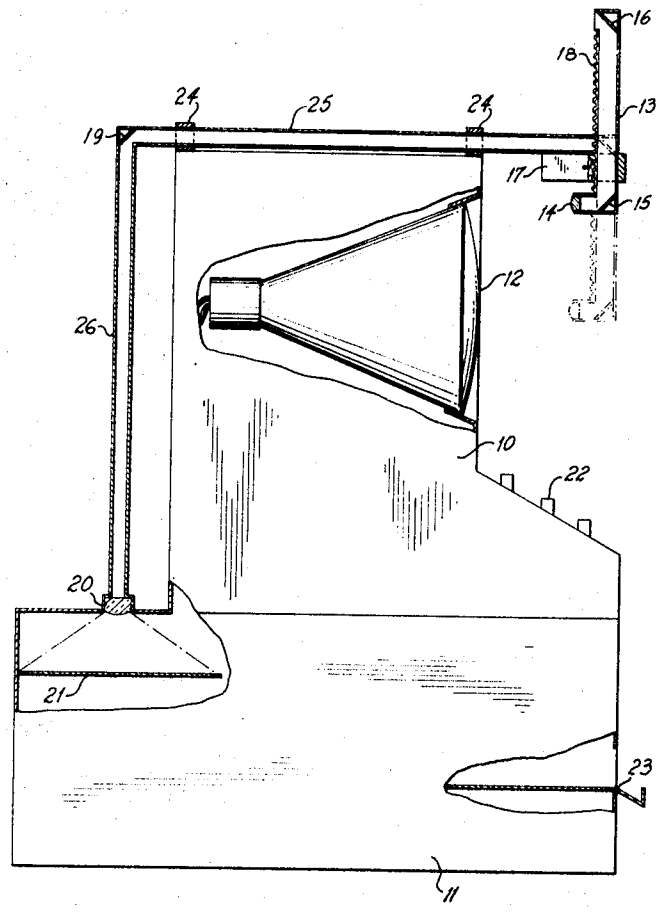
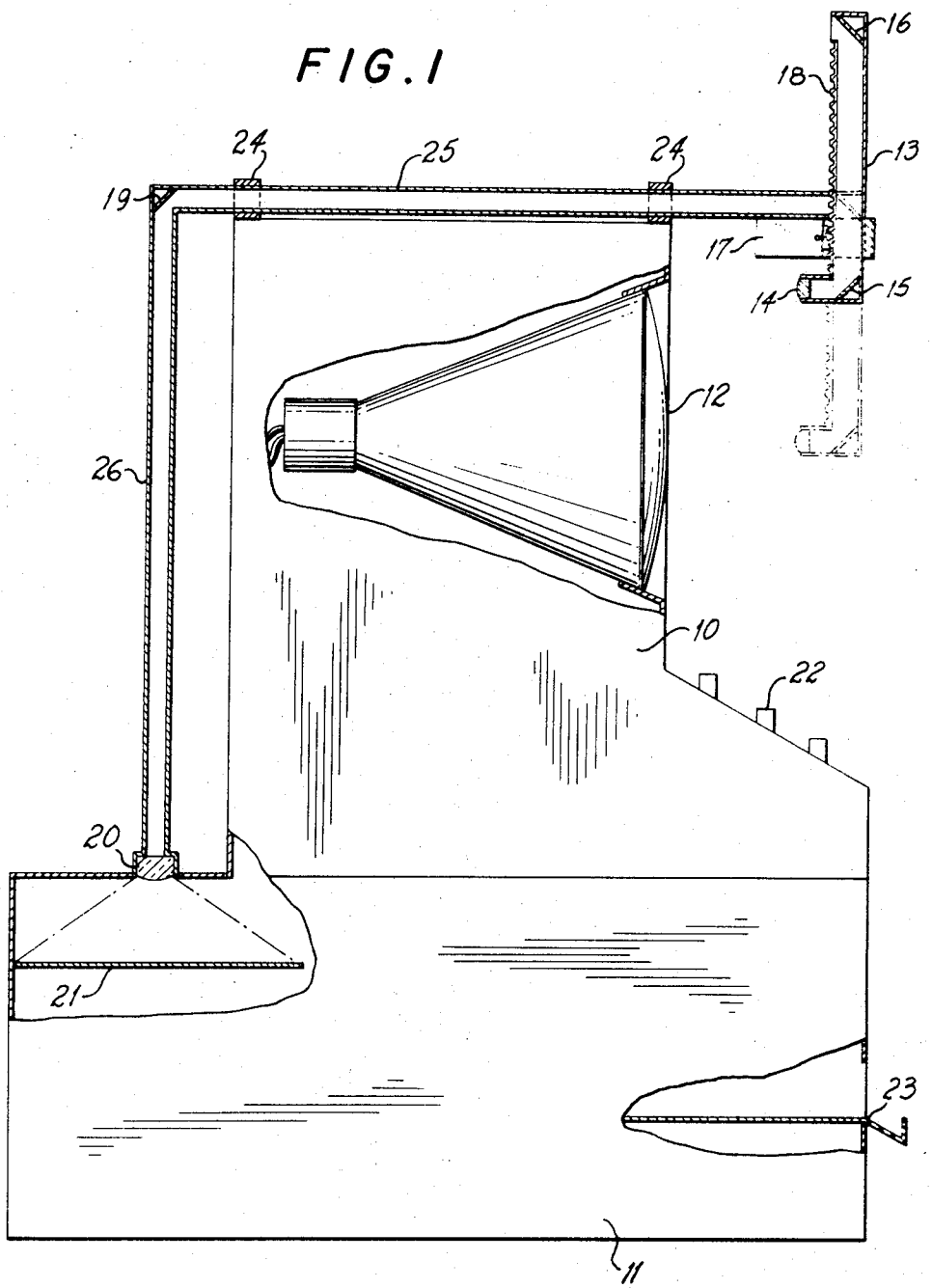


FIG. 1



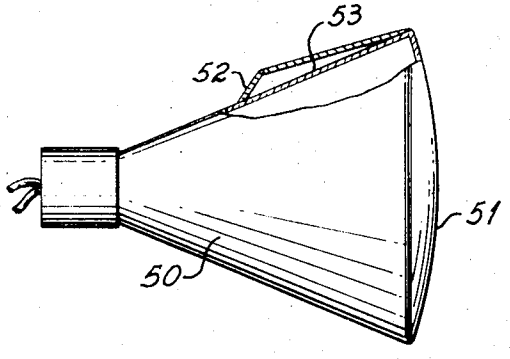


FIG. 2

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COPIER SYSTEM

The present invention relates to using a copier machine in conjunction with a cathode ray tube (CRT), and more particularly in transferring an image displayed on a CRT screen to a copier machine to obtain a hard copy.

Cathode ray tubes are in common use. Their uses are many and they are constructed for the specific function they are to serve. The best known use is for the screen of a television set. Other uses include screens for oscilloscopes and for terminal devices for computers where a visual display is required. CRT's are constructed to have different display characteristics depending on their use. Some screens are designed for extreme clarity (alpha-numeric displays), others with short image retention (television screens) and still others with long image retention (some oscilloscopes).

Copier machines are also in common use. There are wet (chemical solutions) and dry (electro-static) copier machines. The dry copiers tend to be quicker in operation and easier to use. Qualities of copies vary among the different machines. Some machines use bond paper while others require specially treated paper. Some machines supply copies identical in size to the original while others supply enlarged or reduced prints.

The most common means of obtaining hard copies of images from CRT's are by way of Read-Only Printers and X-Y Plotters. These units are relatively slow compared to the speed of a CRT, and are expensive compared to the cost of a copier. If the same buffer as the CRT is used by the Read-Only Printer, the CRT terminal is tied up for the duration needed to mechanically print out the information. The hard copies are used for permanent and semi-permanent use while an image on a screen is for momentary observation.

It has now been discovered that a CRT image can be directly and efficiently transferred to a copier through a unique optical arrangement with suitable mechanical support.

It is a primary object of this invention to provide an inexpensive means of capturing an image from a CRT screen to a hard copy.

It is another object of this invention to capture an image from the CRT screen onto a hard copy in a relatively short period of time, thereby releasing the CRT terminal for another inquiry.

It is still another object of this invention to provide optics that will produce a reduced, enlarged, or identical size hard copy of the image from the CRT screen.

It is one more object of this invention to provide for optical means to allow multiple sectional exposure on one document by the copier.

Another object of this invention is to provide for a camera unit replacing the copier to photograph the CRT screen.

One other object of this invention is to provide for a camera unit to be used in conjunction with the copier to have a film record of the hard copies.

It is but another object of this invention to provide for preprinted paper to be used in the copier machine to produce a final document.

One more object of this invention is to provide for a fast system for facsimile transmission.

The foregoing as well as other objects of this invention will become apparent with reference to the

detailed description below, taken in conjunction with the attached drawings in which:

FIG. 1 is a side view of a typical optical-mechanical arrangement capturing the image from the CRT screen onto a hard copy.

FIG. 2 is a side view of a specially constructed CRT screen so that the optics necessary to transmit the CRT image can be positioned or permanently mounted on it.

Generally speaking, the present invention contemplates the capture of a cathode ray tube image, transferring the image to a copier machine, and making at least one hard copy of said image.

This invention overcomes the short-comings of the present Read-Only Printers and X-Y Plotters that are attached to visual display units by providing for two seperate systems that work in conjunction with each other. The CRT screen displays the image, and on command, the copier is activated and an image on the screen is recorded by the copier. A small desk copier requires approximately 3 seconds to record the image from the screen. A few seconds more is required for the copier to fix the image on the paper. Hence, the CRT is tied up for only the initial three seconds to record the image and may then be used for another transaction. An X-Y Plotter is extremely slow (in the minutes range) while a Read-Only Printer can take as long as 1.33 minutes (assuming 960 characters on the CRT and the printer speed of 14.8 characters/second).

An inexpensive copier with the specifications required above rents in the range of $25 a month as compared to a Read-Only Printer and its Control Unit rental of approximately $100 a month plus communication line costs. An X-Y Plotter is even more expensive than a Read-Only Printer.

This invention provides for optical means that are suitably supported to transfer the image from a CRT screen to a copier machine without appreciably interfering with the vision of the CRT console operator. An image is projected on a CRT screen by command of an external device such as a computer or a transmission station. This image is transmitted through a lens-prism arrangement to a copier that can be situated anywhere near the CRT screen. The image from the CRT screen passes through a prefocused lens that has manual fine focusing capabilities, and is deflected by crystal wedges. The image is deflected as many times as is required. It then passes through another lens that fixes it on hard-copy material in the copier. This image can be anything from an engineering drawing to an alpha-numeric display, or even an electrical signal on an oscilloscope. The hard-copy can be a preprinted document with variable information in a fixed format transfixed to it by the copier. An airline ticket, an engineering drawing projected on a set of axes or a "mug" shot projected on a "wanted" poster, are examples. The activating means for the copier can be manually controlled or automatically activated.

Since the maximum amount of information that can be displayed on a CRT is limited by its design and buffer size, there are occasions where multiple images fixed on separate sections of the hard-copy are desirable to produce a complete document. There are also times where multiple images may be desired on a document for comparison purposes. This can be accomplished by shifting the optics either manually with a

vernier control, or automatically by a control on the CRT keyboard, copier, etc. Often, the operator works with the display on the CRT screen that is not in the format that would be desired on a hard-copy. In this case, once the information is verified visually, the operator would activate a control that would reformat the information on the CRT screen to that desired for the hard-copy and then the hard-copy control would be activated. The image size that is transferred to the hard-copy is determined by the optical arrangement.

This CRT copier system can be used for facsimile transmission. An image is sent from one point to another by closed circuit transmission. The image is displayed on the CRT screen at the output point and is copied either by manually or automatically controlled means. Commercial copiers operate at up to 2,400 copies per hour. A common facsimile transmission system operates at 10 copies per hour (one copy every 6 minutes). 2,400 images per hour is relatively simple to transmit and project on a CRT screen. The CRT copier system is 240 times as fast as the described facsimile transmission system above. The electro-mechanical unit to control the input and output document flow would have to be properly designed. If there is no need to view the CRT screen the CRT copier system can be designed to eliminate much of the optical system. In this case the units would be built solely for optimum performance rather than visual convenience and optimum performance.

A camera can replace or be used in conjunction with a copier having the proper optical arrangement for the making of permanent records. The film can be of the microfilm variety or the quick develop type.

The optics can also be attached to the side of a CRT tube that is manufactured for this purpose (see FIG. 2). Care must be taken when setting up the optics to be certain that a mirror image is not the final result on the hard-copy. Some CRT screens have light backgrounds with dark printing and others have the reverse. There are times when negative rather than positive hard copies are desired. The amount of light generated by the CRT screen is important when designing for the optical and copier characteristics as well as for those of the camera and film.

An automatic drive unit that positions the optics in front of the screen (for units with optics mounted outside the display) would be required in most instances to allow the operator an unobstructed view of the screen. This can be accomplished by an electrical drive unit or a manual or mechanized snapdown unit that reverts to its original position when released.

Now referring to FIG. **1**, a CRT terminal **10** with screen **12** and keyboard **22** is mounted on a copier **11**. A hollow tube **13** with image capturing means or suitable lens arrangement **14**, prisms **15** and **16** and threads **18** is held to tube **25** by an automatic drive **17**. Clamps **24** hold tube **25** to the CRT terminal. Tube **26** with prism **19** mounts on the copier to coincide with the lens **20**. The lens **20** projects the CRT screen image on plate **21** which is inside the copier **11**. The hard copy is delivered at **23**.

When the hard copy control is activated the automatic drive **17** positions the image capturing means **14** in front of the CRT screen so that prism **16** lines up with tube **25**. The CRT screen image is projected from capturing means **14** to prism **15**, and is further projected to prism **16** and then to prism **19** and lens **20**. Lens **20** projects the image to plate **21** or directly to the hard copy or film, whichever is the case. Of course, these lenses must be properly designed to be in focus. Lens **20** can also be a "zoom" type lens, thereby allowing the image projected on plate **21** to vary in size within the design range. A similar "zoom" type lens may be made part of element **14**. The image on plate **21** is transferred to a hard copy by the copier (depending on design). Plate **21** must be constructed of the proper material to transfer the image to the hard copy efficiently. Optical fiber means can be used in place of or in conjunction with the prisms and tubes.

Refering to FIG. **2**, CRT tube **50** with screen **51** has a built-in optically clear ridge **52** on which a similar optical arrangement can be mounted or positioned thereon to project the image directly from the inside of the screen (mirror image) to the copier. An optically transparent and electrically charge sensative screen **53** may be incorporated within the CRT to eliminate screen distortion that built-in ridge **52** may produce.

Although the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the scope and spirit of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview of the invention and appended claims.

Having thus described our invention,

We claim:

1. An image display and recording system comprising:

A. a terminal including a cathode ray tube adapted to display visual intelligence on the front face of a fluorescent screen which may be observed within a predetermined viewing area, said tube being provided with an envelope having an optical assembly thereon affording a view of the mirror image of the display appearing on the rear face of the screen,

B. a copier device for making copies of the mirror image without interfering with front face observation of the display, said device being installed at a position displaced from said viewing area; and

C. image-transmission means linking said optical assembly with said copier device to transfer said image thereto, whereby copies thereof may be made.

2. A system as set forth in claim **1**, wherein said copier device is an electrostatic dry copier machine.

3. A system as set forth in claim **1**, wherein said image-transmission means is constituted by an arrangement of crystal wedges to deflect the image along a path from the optical assembly to the copier device.

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