



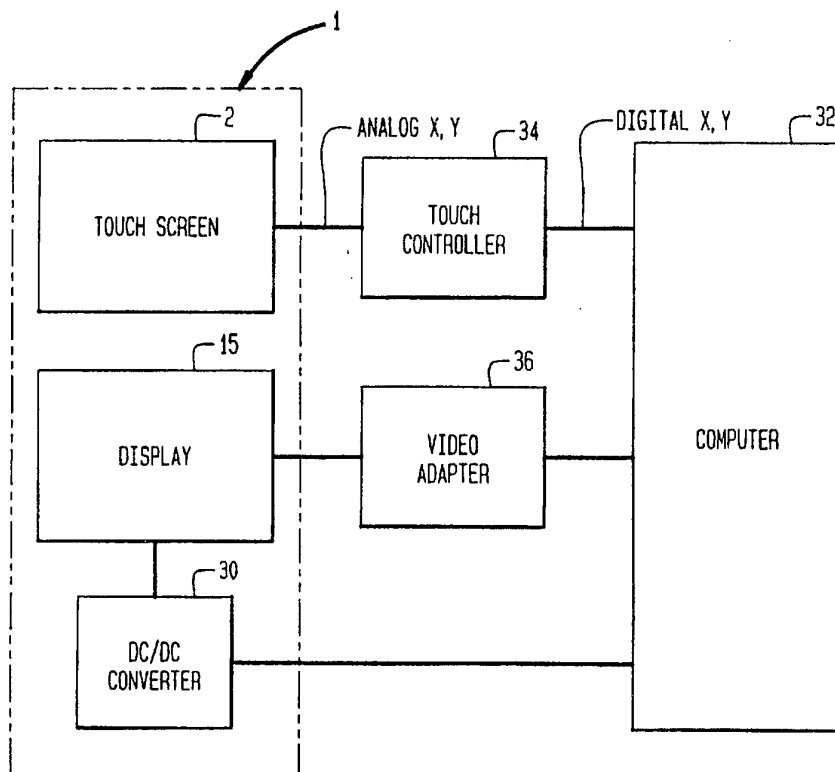
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: AN INTEGRATED TOUCH SCREEN INPUT DEVICE

## (57) Abstract

An integrated input device (1) which comprises: a contact sensor (2) capable of producing an analog signal indicative of the location of the position which is touched; and A/D converter (34) capable of receiving the analog signal output from the contact sensor (2) and converting it to a digital signal; a computer (32) capable of receiving the digital signal output from the converter (34), interpreting the digital signal and transmitting a digitized video signal in response to the digital signal; a video connector (36) capable of receiving the digitized video signal out from the computer (32); and a display (14) which is capable of receiving the output from the video connector (36).



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**AN INTEGRATED TOUCH SCREEN INPUT DEVICE**

The present invention relates generally to a horizontally disposed input device which is particularly useful in entering and retrieving trades or orders of tradable instruments, such as, government securities, equities, precious metals, currencies, commodities and futures, and options, securities and financial data from associated computers by the simple touch of a finger against a touch tablet including a contact sensor screen disposed on top of a flat medium display unit so as to give the user the impression that he is touching and changing objects that appear on the display.

**BACKGROUND OF THE INVENTION**

Most banks, securities firms and brokerage houses require traders to enter an impending trade on a paper ticket which is then physically delivered to back office data entry personnel for input into the firm's mainframe or personal computer upon receipt or after the trade. This ticketing system necessitates the use of position clerks and data entry personnel as intermediates between the trader and the data entry which substantially increases the cost and subjects the trade to human error. Moreover, the time lag between recording of the trade which establishes a firm

trading position can cost clients substantially amounts of money, especially when trading extremely volatile stocks and bonds.

Using the latest flat panel high resolution color  
5 liquid crystal display, plasma and touch screen  
technologies, the present invention provides an integrated  
input device which permits traders to quickly enter trades,  
retrieve trading data and call up on-line vendor services  
all at the touch of a finger. Traders benefit from the  
10 speed and ease-of-use. Management benefits from the  
enormous improvements in risk management and utilization of  
the firm's capital.

By connecting traders directly to the firm's back  
office computer systems, the present invention provides a  
15 true, "ticketless," single entry trading system that  
revolutionizes the economics of trading operations.  
Moreover, operation costs are substantially reduced by the  
elimination of position clerks and data entry personnel.

This unique input device provides for a more intuitive  
20 user interface, renders typing skills obsolete, fulfills the  
promise of the mouse by making pointing and executing  
commands a reality and its compact, ergonomic design is a  
pleasure to operate, even for prolonged periods.

This touch screen input device is designed to integrate with most mainframe computer configurations. All the industry standard networking protocols can be built in so as to make the system fully compatible with the full range of operating systems. As such, it gives traders and primary dealers, as well as financial management, real-time access to profit and loss information and monitor risk exposure as it changes minute to minute.

The present invention also provides many additional advantages which shall become apparent as described below.

#### **SUMMARY OF THE INVENTION**

An integrated input device which comprises: a contact sensor means capable of producing an analog signal indicative of the location of the position which is touched; a converter means capable of receiving the analog signal output from the contact sensor means and converting it to a digital signal; a computer means capable of receiving the digital signal output from the converter means, interpreting the digital signal and transmitting a digitized video signal in response to the digital signal; a video connector means capable of receiving the digitized video signal output from the computer means; and a display means which is capable of receiving the output from the video connector. The contact sensor means, e.g., a flat tablet, is preferably disposed

above a flat or substantially horizontally disposed flat display means.

It is preferable that the contact sensor means be a touch screen comprising a glass plate with a transparent,  
5 electrically resistive coating on a first side; a gas-tight electrical contact means disposed about the coating in such a manner as to permit it to be used as a highly stable linear voltage divider for both the X and Y axes; and a contact sheet with a transparent conductive coating on a  
10 second or opposite side disposed above glass plate, the contact sheet has separator points disposed about its inside surface such that the contact sheet is not in direct contact with the glass plate.

Furthermore, the present invention includes a  
15 controller circuit, normally incorporated together with the analog-to-digital converter, which is capable of impressing the voltage gradient across the resistive coating on the glass plate of the touch screen, alternating between the X and Y directions.

20 Still another object of the present invention is a touch screen input device which comprises: an upper housing portion; a lower housing portion; a contact sensor means disposed between the upper housing portion and the lower housing portion; a first insulator means disposed between

the upper surface of the contact sensor means and the inner surface of the upper housing portion; a lower support means disposed between the lower surface of the contact sensor means and the inner surface of the lower housing portion; a  
5 second insulator means disposed between the contact sensor means and the lower support means; a display means disposed between the lower support means and the lower housing portion; a first communication means capable of transmitting signals from the contact sensor means to an externally  
10 disposed computer means; and a second communication means capable of transmitting signals from the externally disposed computer means to the display means.

A further object of the present invention is a method of data entry or input which comprises: touching a contact  
15 sensor means to produce an analog signal indicative of the location of the position which is touched; converting the analog signal output from the contact sensor means to a digital signal; sending the digital signal to a computer means; interpreting the digital signal; sending a digitized  
20 video signal output from the computer means to a video connector means in response to the digital signal; and displaying the digitized video signal output on a display.

Other and further objects, advantages and features of the present invention will be understood by reference to the

following specification in conjunction with the annexed drawings, wherein like parts have been given like numbers.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Fig. 1 is a top-left side perspective view of the touch  
5 screen input device having a color liquid crystal display  
monitor in accordance with one embodiment of the present  
invention;

Fig. 2 is a rear side view of the touch screen input  
device of fig. 1;

10 Fig. 3 is an exploded view of the touch screen input  
device of fig. 1;

Fig. 4 is a top-left side perspective view of the touch  
screen input device having a monochrome gas plasma display  
monitor in accordance with another embodiment of the present  
15 invention;

Fig. 5 is a rear side view of the touch screen input  
device of fig. 4;

Fig. 6 is an exploded view of the touch screen input  
device of fig. 4;



Fig. 7 is a block diagram of the components of the touch screen input device according to the present invention;

Fig. 8 is a block diagram of the monochrome gas plasma display monitor;

Fig. 9 is a block diagram of the color liquid crystal display monitor; and

Fig. 10 is a block diagram of the back-light unit of the color liquid crystal display monitor.

#### 10 **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

This unique touch screen input device comprises three major components, i.e., a contact sensor or touch screen, a flat panel display unit and a computer. The system operates by having the user touch the touch screen with a finger or stylus. The touch of the finger or stylus creates an analog signal indicating the location of the position touched. This signal is then digitized by a separate controller circuit, and the digitized coordinates are transmitted to the host processor for interpretation by the computer's software. The host processor instantaneously returns a signal to the display panel to give the user the impression that he is touching objects directly on the display panel

itself. However, what is really occurring is that the computer is forwarding a feedback output to the display in response to the digitized signal received by the touching of the screen. This response may be in the form of changing  
5 color, shape, number, letter or other similar action. In the simplest sense, this system is designed to operate the computer by just touching symbols and objects displayed by the computer.

The touch screen or contact sensor is preferably a thin  
10 (i.e., approximately 0.125 inches), transparent, rigid glass plate or panel that is preferably flat, but could also be cylindrical or curved, to fit the face of the display panel to which it is mounted.

The display may be either a monochrome gas plasma  
15 display or a color liquid crystal display.

The computer preferably comprises an Intel 286®, Intel 386® or Intel 486® microprocessor having between 8-50Mhz, 1-24Mb of RAM, and 40-600Mb of hard drive.

The primary element of the touch screen is a glass  
20 plate with a transparent, electrically resistive coating on the first or upper side. Because it is fired onto the glass at high temperature, this coating is quite stable and durable. Gas-tight electrical contacts are then made to

this coating in such a manner as to permit it to be used as a highly stable linear voltage divider for both the X and Y axes.

A plastic contact sheet with a transparent conductive  
5 coating on the second or lower side is stretched tightly  
over the glass substrate. The contact sheet is held  
approximately 0.001 inches above the glass by small, clear  
separator points as discussed in U.S. Patent No. 3,911,215  
(Hurst et al.), which issued on October 7, 1975, and which  
10 is incorporated herein by reference, which are evenly  
distributed on the inside contact sheet surface. Fiber  
pressure causes the contact sheet to deform imperceptibly  
and make electrical contact with the resistive coating at  
the position of touch. The voltages picked off by the  
15 contact sheet at the point of contact are the analog  
representation of the position touched.

A controller circuit which is separate from the touch  
screen impresses the voltage gradient across the resistive  
coating on the glass, alternating between the X and Y  
20 directions. The analog signals picked up by the contact  
sheet are digitized by an analog-to-digital converter in the  
controller, and the digitized coordinate pair is then  
transmitted to the computer for processing.

The overall configuration of the touch screen input device 1 according to the present invention can best be understood by referring to Figs. 1-6, wherein a touch screen or glass 2 is between an aluminum upper housing portion 4 and an aluminum lower housing portion 6. Touch screen 2, which is preferably a transparent digitizer manufactured by Elographics, is connected to a computer by means of a five-pin ribbon cable 5 which is internally connected to port 7. A foam insulator 8, which is preferably a foam gasket such as that manufactured by Macklanburg-Duncan, is disposed between the upper surface of touch screen 2 and the inner surface of upper housing portion 4, whereby touch screen 2 does not come into contact with any hard objects so as to avoid cracking and other damage to touch screen 2. The bottom surface of touch screen 2 is removably secured to a support frame 10 by means of insulating tape 12, e.g., a foam adhesive tape manufactured by Archer. The bottom surface of support frame 10 is disposed against the upper surface of either monochrome gas plasma display unit 14 (e.g., a gas plasma display manufactured by Matsushita) or color liquid crystal display unit 16 (e.g., an active matrix LCD manufactured by Hitachi, Ltd. The display units are secured to support frame 10 by any suitable mechanical means, e.g., screws. The bottom surface of display unit 14 or 16 is disposed against lower housing portion 6 and secured to upper housing by any conventional mechanical means. Lower housing portion

6 includes an outer lip portion 20 when liquid crystal display unit 16 is incorporated therein due to its structural configuration. Display units 14 and 16 communicate with an associated computer via a ribbon cable (not shown) which is  
5 connected to port 7. Both upper and lower housing portions 4 and 6 include a plurality of vent holes 22 to permit the diffusion of heat from system 1.

It is critical according to the present invention to position touch screen 2 as close as possible to display unit  
10 14 or 16 without touching the display so as to reduce parallax. Otherwise the user would be touching what is incorrectly believed to be displayed.

Fig. 7 is a block diagram which underscores the interactive relationship between the individual components  
15 which make up touch screen input device 1. These components include touch screen or contact sensor 2, display 15, DC/DC converter 30 (optional) and computer 32. DC/DC converter 30 is typically used together to supply power to a gas plasma display.

20 When a user touches contact sensor or touch screen 2 it produces two analog voltage outputs corresponding to the X,Y coordinates representative of the position touched on the screen. The voltage from touch screen 2 travels through an internal cable which is disposed within the glass of touch

screen 2 to a connector disposed outside of the glass. External to the glass are converter units or touch controller 34 (i.e., the controller typically includes both analog-to-digital converters and controller circuitry) which generate a digital X,Y coordinate. The connector, not shown, has three functions, i.e., (1) it has a section to provide power to the glass, (2) it carries a digital video connection, and (3) it has an analog touch output from the glass. The digital X,Y coordinates generated from touch controller 34 are then communicated to computer 32 which reads the digital X,Y coordinate from touch controller 34 and produces a sequence of actions. Computer 32 is connected to a video adapter 36 which produces a digital video output in accordance with output signals received from computer 32 which are the direct results of actions taken by the computer in response to the digital X,Y coordinates received by computer 32 from touch controller 34. The display then reflects the change of video signaling by displaying a changed picture on display unit 15. The reaction caused by the touching of touch screen 2 on the video output exhibited on display unit 15 directly corresponds to the software used to run computer 32.

Fig. 8 depicts the preferred circuitry of monochrome gas plasma display 14 wherein data demultiplexer and data buffer unit 40, anode timing generator 42 and modulation clock generator 44 provide inputs to "Y" driver 46 which in

turn provides "Y" axis inputs to display panel 48. "X" axis inputs are provided to display panel 48 via "X" driver 50. "X" driver 50 receives inputs from cathode timing generator 52 and panel clock generator 54. As such, digitized X,Y  
5 signals are output from computer 32 through video adapter 36 and into their respective driver to provide the desired display which is caused by a corresponding touching of touch screen 2 by the user.

Fig. 9 depicts the preferred circuitry of color liquid  
10 crystal display unit 16 wherein an I/F connector 50 receives inputs from video adapter 36 such as timing signal display data mode set, viewing angle adjustments and power. I/F connector 50 then sends these inputs to timing converter 52 and power supply circuit 54. Both converter 52 and circuit  
15 54 are connected in parallel to upper driver 56, gate driver 58 and lower driver 60. Gate driver 58 sends inputs to liquid crystal display 62 via gates G1 through G480. Upper driver 56 sends inputs to liquid crystal display 62 via odd drains D1, D3 ... D919 and lower driver 60 sends inputs via  
20 even drains D2, D4 ... D920.

Fig. 10 depicts the preferred back-light unit 68 used in conjunction with the liquid crystal display unit 16 according to the present invention, wherein a brightness control circuit 70 is connected to a lamp driving circuit

72. The lamp driving circuit is thereafter connected in parallel to various lamps 74.

While we have shown and described several embodiments in accordance with our invention, it is to be clearly  
5 understood that the same are susceptible to numerous changes apparent to one skilled in the art. Therefore, we do not wish to be limited to the details shown and described but intend to show all changes and modifications which come within the scope of the appended claims.



**WHAT IS CLAIMED IS:**

1. An integrated input device which comprises:
  - a contact sensor means which is capable of producing an analog signal indicative of the location of the position which is touched;
  - a converter means which is capable of receiving said analog signal output from said contact sensor means and converting it to a digital signal;
  - a computer means which is capable of receiving said digital signal output from said converter means, interpreting said digital signal and sending a digitized video signal in response to said digital signal;
  - a video connector means which is capable of receiving said digitized video signal output from said computer means; and
  - a display means which is capable of receiving the output from said video connector.
2. The device according to claim 1 wherein said contact sensor means is a touch screen.

3. The device according to claim 2 wherein said touch screen comprises:

a glass plate with a transparent, electrically resistive coating on its first side;

5 a gas-tight electrical contact means disposed about said coating in such a manner as to permit it to be used as a highly stable linear voltage divider for both the X and Y axes; and

a contact sheet with a transparent conductive  
10 coating on the second side disposed above glass plate, said contact sheet has separator points disposed about its inside surface such that said contact sheet is not in direct contact with said glass plate.

4. The device according to claim 1 wherein said  
15 display means is a gas plasma display.

5. The device according to claim 4 wherein said display means is powered by a DC/DC converter.

6. The device according to claim 1 wherein said display means is a liquid crystal display.

20 7. The device according to claim 3 further comprising a controller circuit which is capable of impressing the voltage gradient across the resistive coating on said glass plate, alternating between the X and Y directions.

8. A touch screen input device which comprises:
- an upper housing portion;
  - a lower housing portion;
  - a contact sensor means disposed between said upper  
5 housing portion and said lower housing portion;
  - a first insulator means disposed between the upper  
surface of contact sensor means and the inner surface of  
said upper housing portion;
  - a lower support means disposed between the lower  
10 surface of said contact sensor means and the inner surface  
of said lower housing portion;
  - a second insulator means disposed between said  
contact sensor means and said lower support means;
  - a display means disposed between said lower  
15 support means and said lower housing portion;
  - a first communication means capable of sending  
signals from said contact sensor means to an externally  
disposed computer means; and
  - a second communication means capable of sending  
20 signals from said externally disposed computer means to said  
display means.

9. The device according to claim 8 wherein said  
contact sensor means is capable of producing an analog  
signal indicative of the location of the position which is  
25 touched.

10. The device according to claim 8 wherein said contact sensor means is a touch screen.

11. The device according to claim 10 wherein said touch screen comprises:

5           a glass plate with a transparent, electrically resistive coating on its first side;

          a gas-tight electrical contact means disposed about said coating in such a manner as to permit it to be used as a highly stable linear voltage divider for both the  
10   X and Y axes; and

          a contact sheet with a transparent conductive coating on the second side disposed above glass plate, said contact sheet has separator points disposed about its inside surface such that said contact sheet is not in direct  
15   contact with said glass plate.

12. The device according to claim 8 wherein said display means is a gas plasma display.

13. The device according to claim 12 wherein said display means is powered by a DC/DC converter.

20           14. The device according to claim 8 wherein said display means is a liquid crystal display.

15. A method of data input which comprises:

touching a contact sensor means to produce an analog signal indicative of the location of the position which is touched;

5           converting said analog signal output from said contact sensor means to a digital signal;

          sending said digital signal to a computer means;

          interpreting said digital signal;

          sending a digitized video signal output from said  
10 computer means in response to said digital signal to a video connector means; and

          displaying said digitized video signal output on a display.

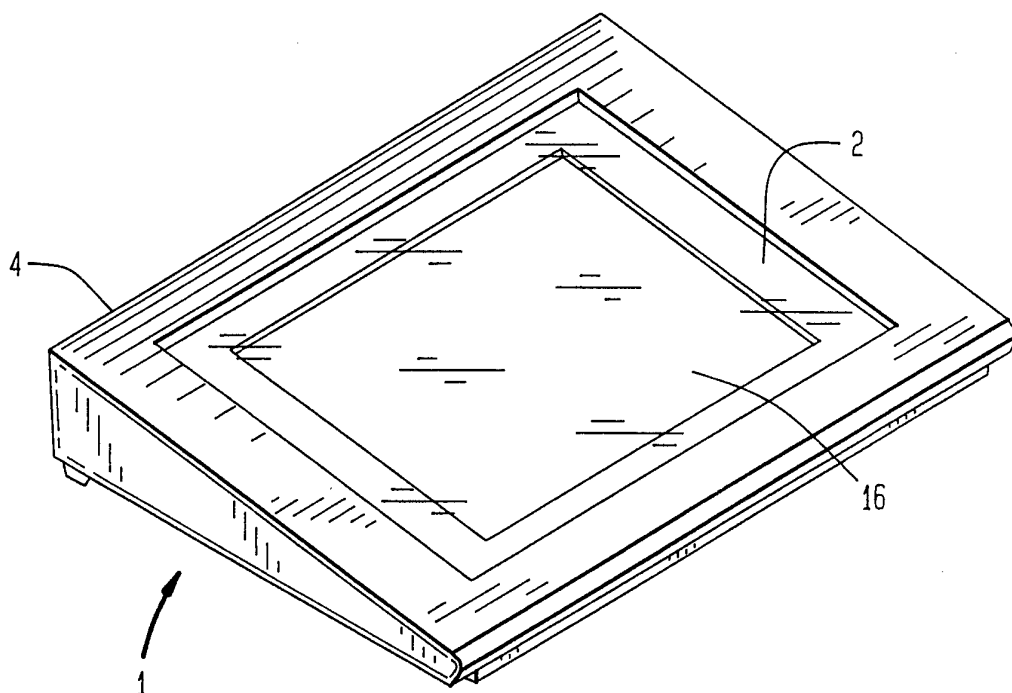
16. The method according to claim 15 wherein said  
15 contact sensor means is a touch screen.

17. The method according to claim 16 wherein said touch screen comprises:

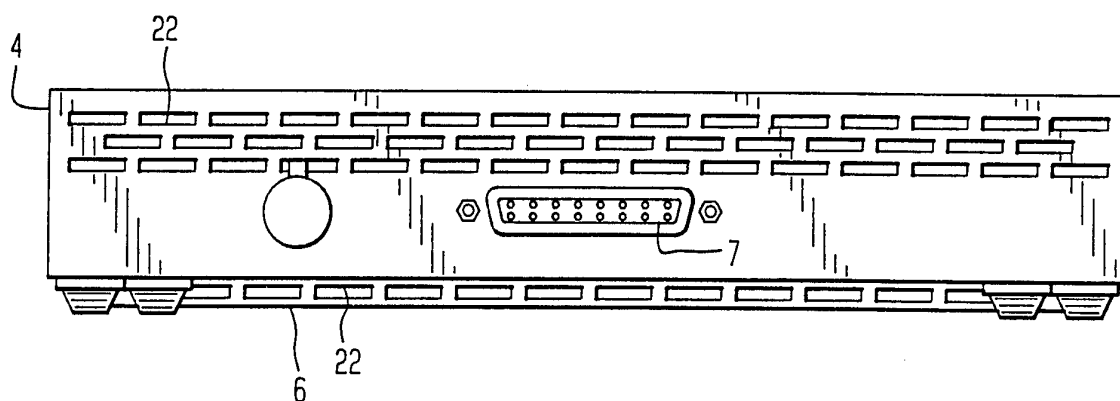
a glass plate with a transparent, electrically resistive coating on its first side;

5 a gas-tight electrical contact means disposed about said coating in such a manner as to permit it to be used as a highly stable linear voltage divider for both the X and Y axes; and

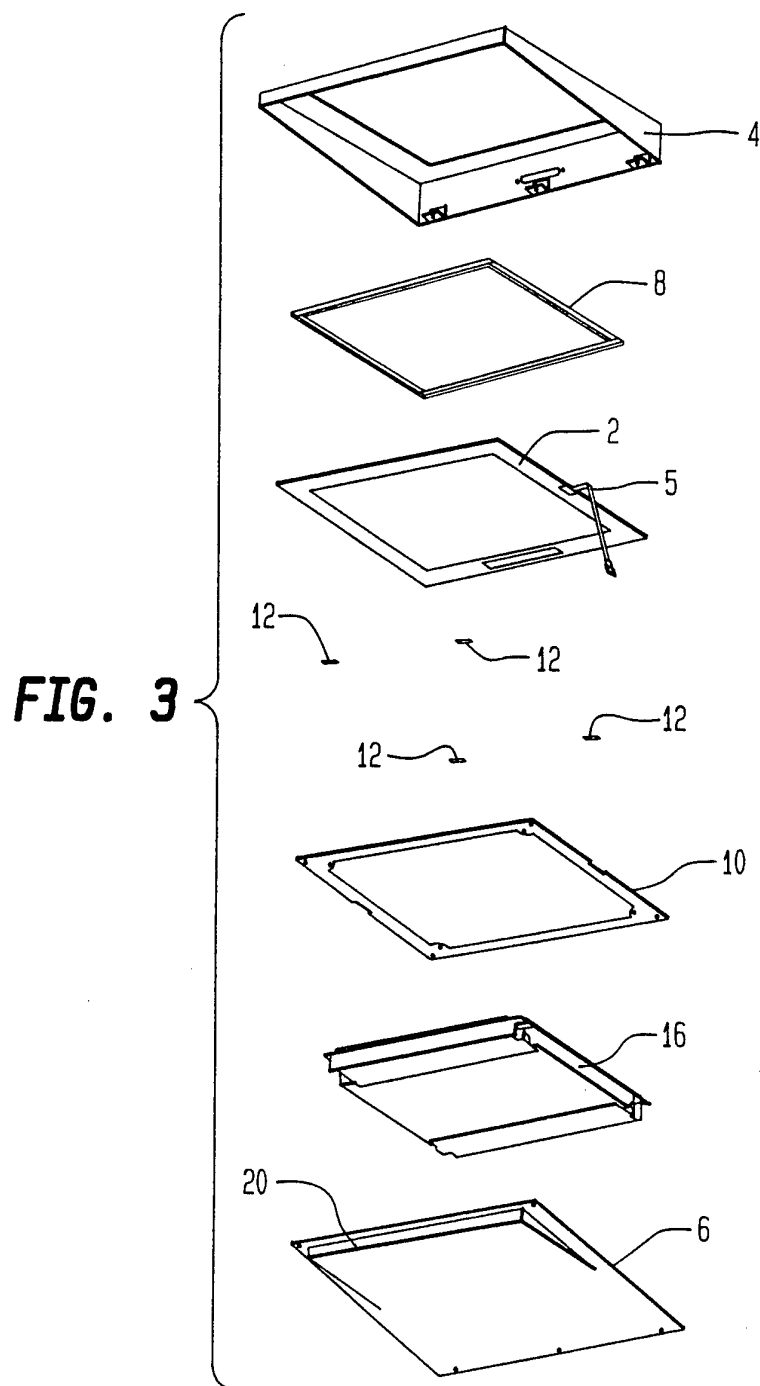
a contact sheet with a transparent conductive  
10 coating on the second side disposed above glass plate, said contact sheet has separator points disposed about its inside surface such that said contact sheet is not in direct contact with said glass plate.



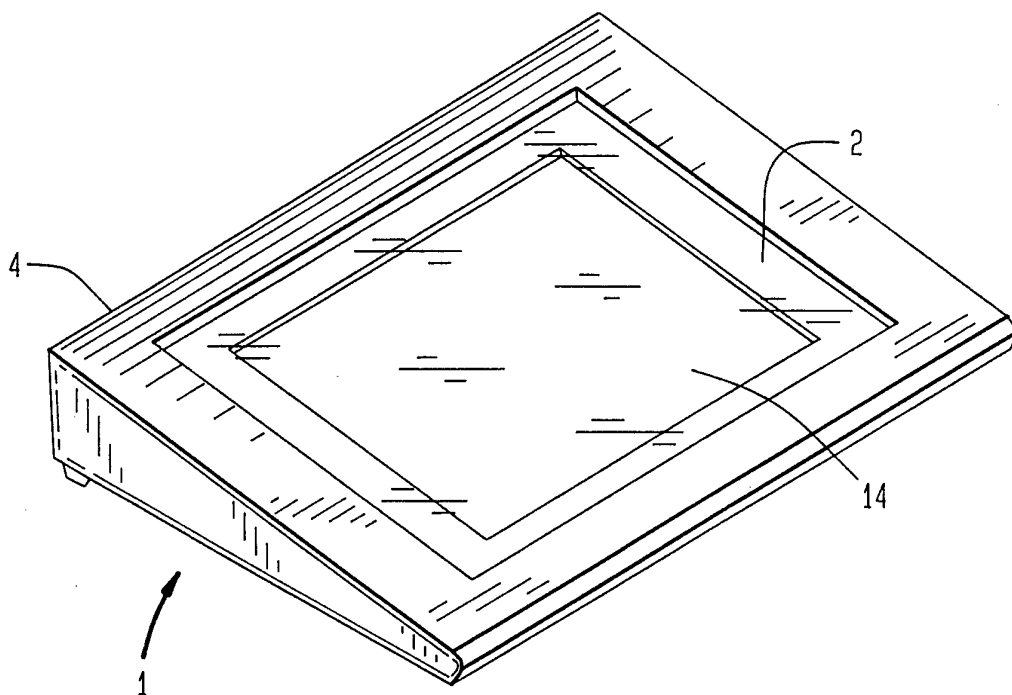
**FIG. 1**



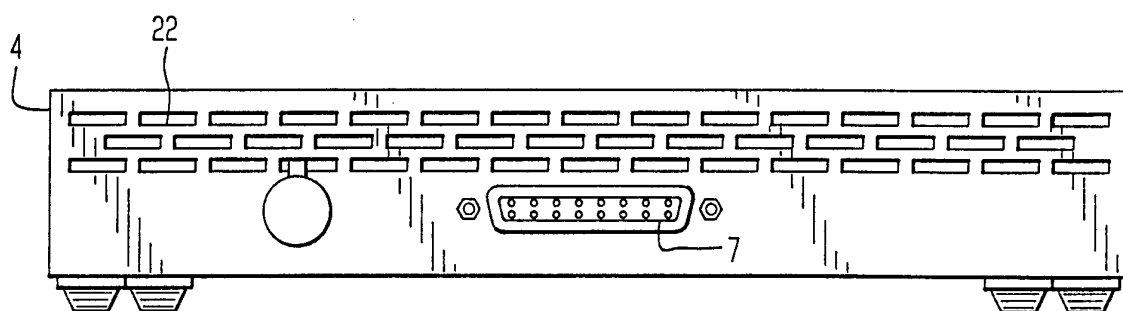
**FIG. 2**





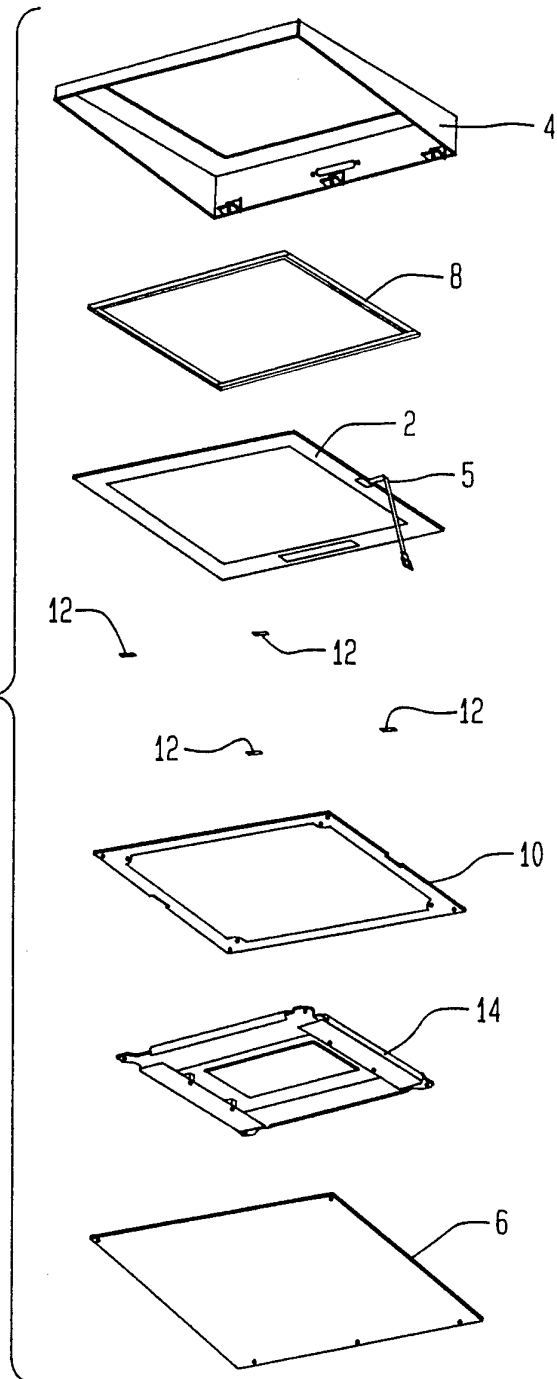


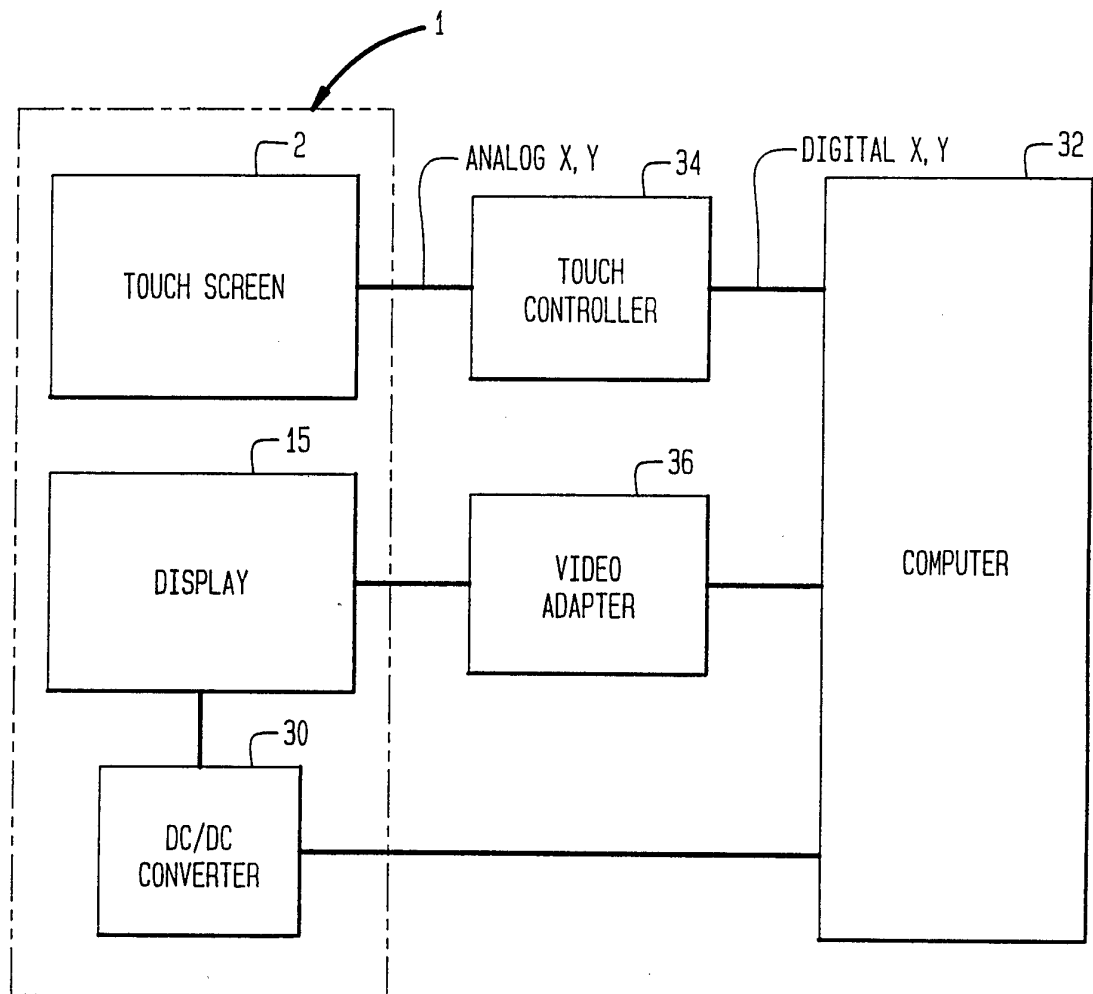
**FIG. 4**

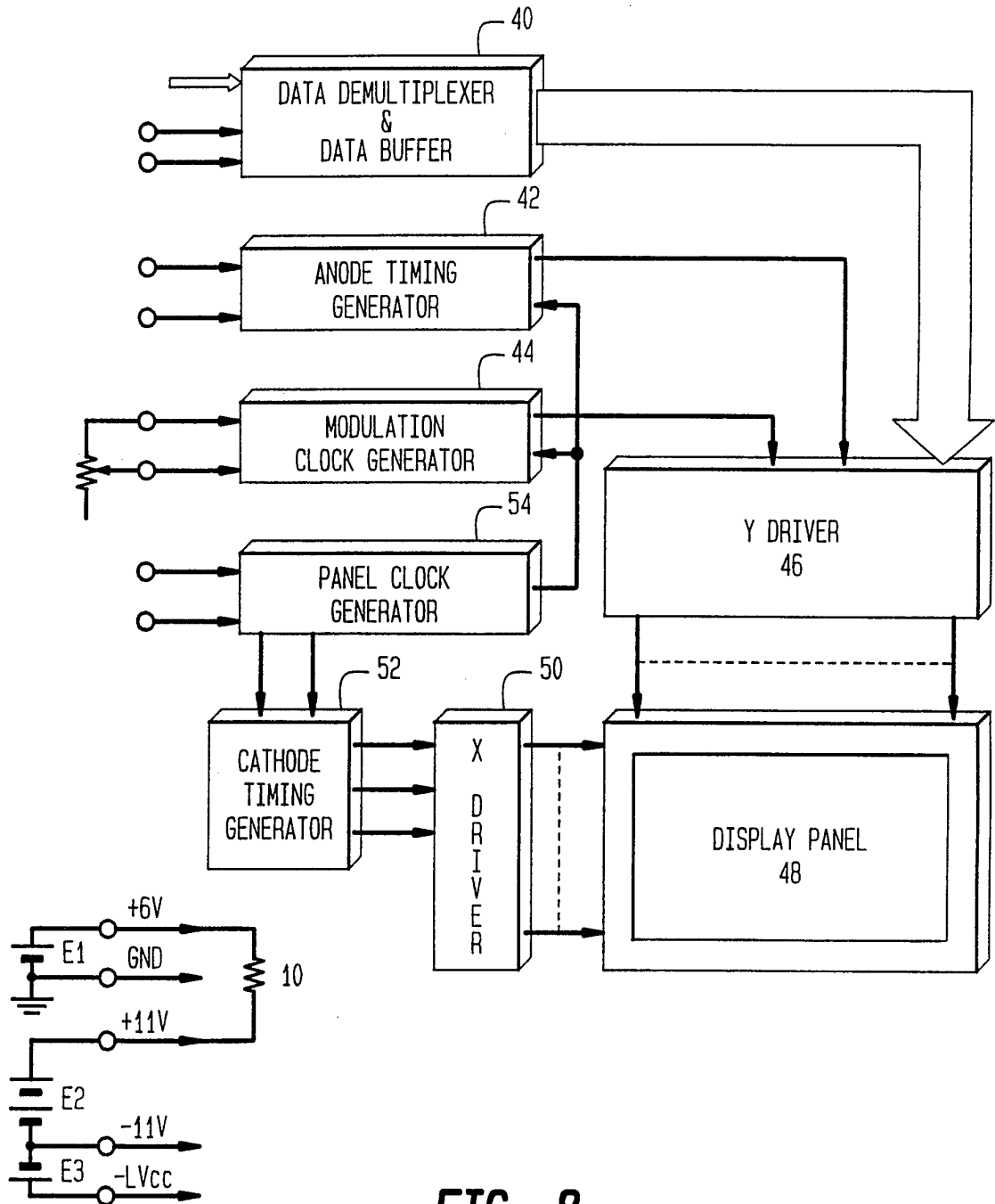


**FIG. 5**

**FIG. 6**



**FIG. 7**

**FIG. 8**

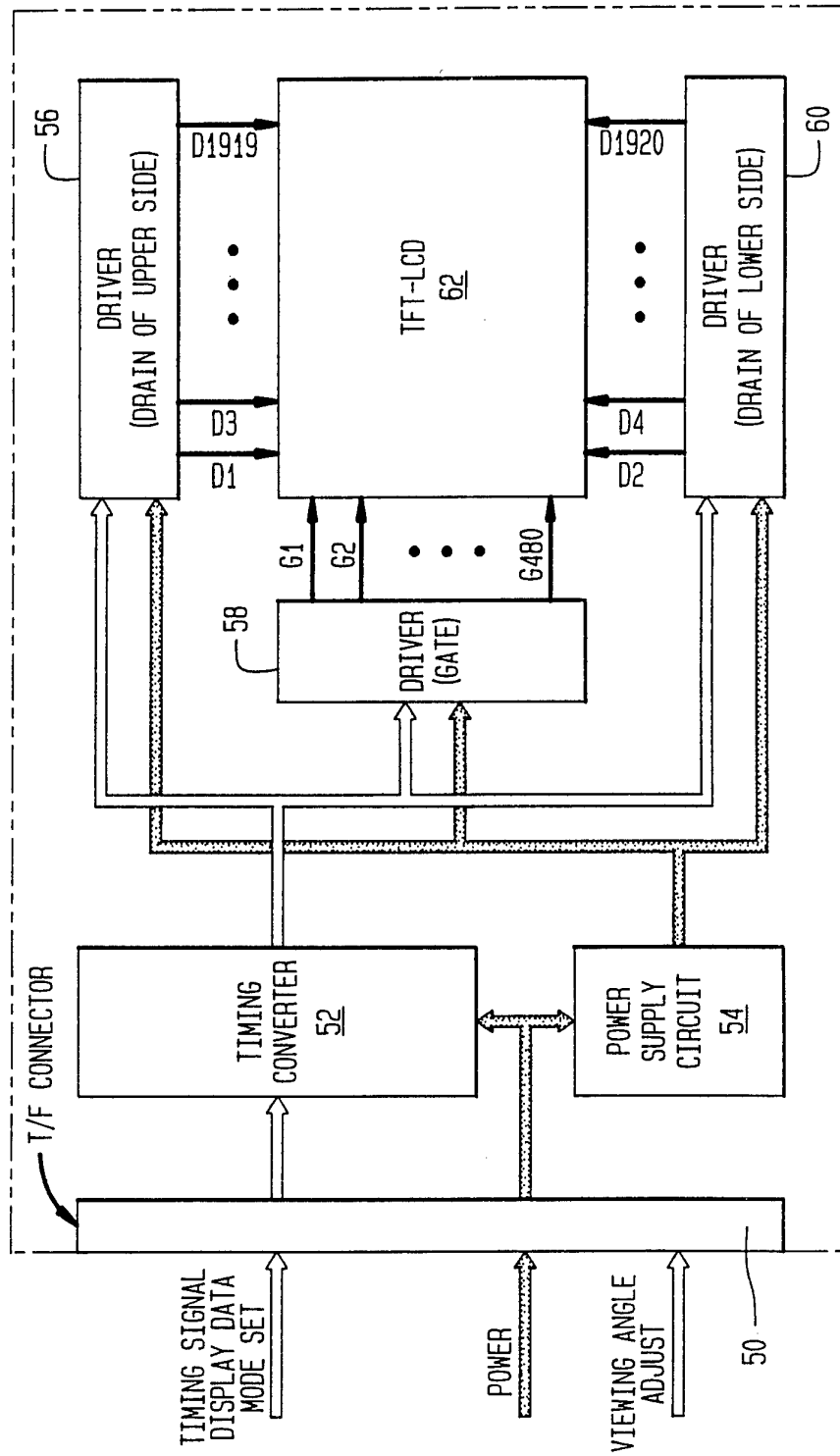


FIG. 9

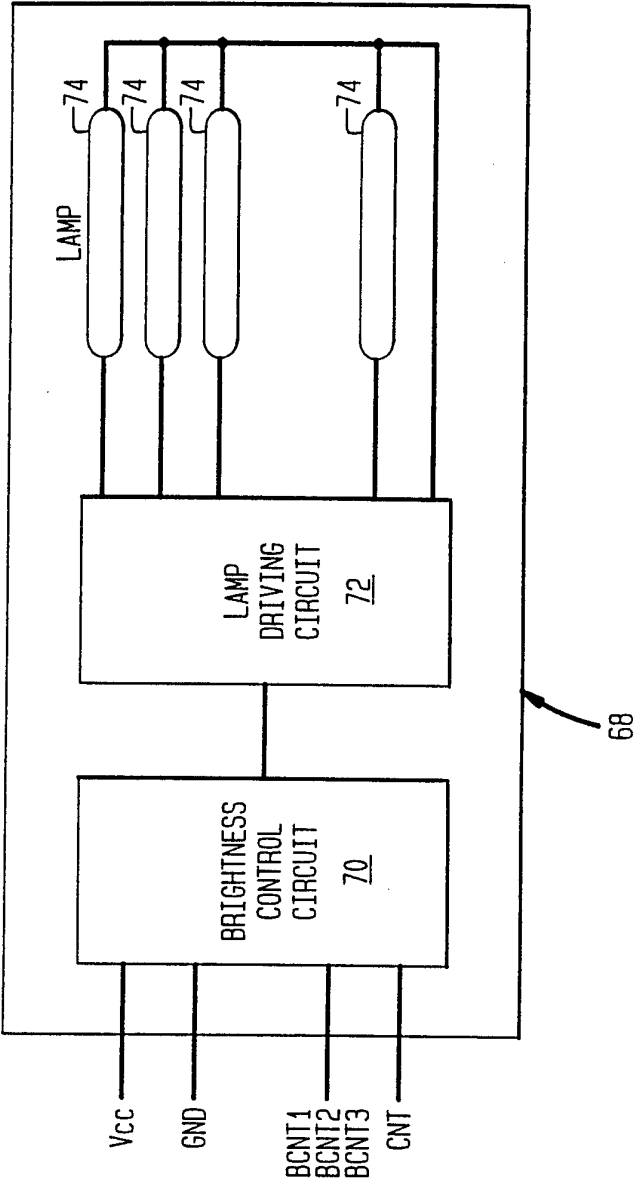


FIG. 10

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US94/01516**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) : G09G 9/02

US CL : 345/173, 156

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)

U.S. : 345/173, 174, 156; 178/18, 19

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 practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US,A, 4,821,029 (LOGAN ET AL.) 11 April 1989, see the entire document	1-2 and 15-16, ----- 3-7, 9, and 17
Y	US,A, 3,911,215 (HURST ET AL.) 07 October 1975, see the entire document	3, 7, 11, and 17
Y	US,A, 4,689,446 (HASEGAWA ET AL.) 25 August 1987, see the entire document	4-6, 12, and 14
Y	US,A, 4,848,876 (YAMAKAWA) 18 July 1989, see Figure 5	5 and 13

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search

28 MARCH 1994

Date of mailing of the international search report

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**INTERNATIONAL SEARCH REPORT**International application No.  
PCT/US94/01516**C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US,A, 4,812,830 (DOERING) 14 March 1989, see the entire document	8-14
Y	JP,A, 59-218541 (ARAKAWA) 08 December 1984, see Figure 2	8-14