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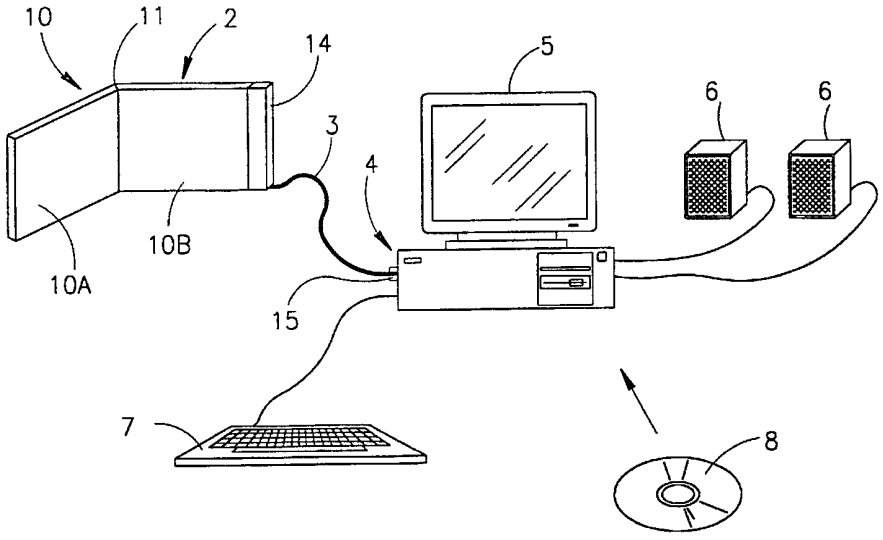
(54) Title: AN INTERACTIVE BOOK PARTICULARLY USEFUL WITH COMPUTERS



(57) Abstract: An interactive book (2), including a stiff backing panel (10) hinged along its center line to define front and back covers; a plurality of flexible book pages mounted along the center line between the inner faces of said front and back covers (10a and 10b); and a pressure-sensitive switching assembly carried on the inner face of one or both covers and defining a plurality of electrical switches adapted to be selectively actuated by the application of localized pressure to one of the pages. The switching assembly includes a pair of layers in overlying relation to each other, each layer carrying an electrically-conductive pattern normally spaced from the other. One of the layers is deformable such that its electrically-conductive pattern is engageable with that of the other layer at points thereof according to the localized pressure applied to one of the book pages and transmitted through the underlying pages to the switch assembly.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

AN INTERACTIVE BOOK PARTICULARLY USEFUL WITH COMPUTERS

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to an interactive book, and particularly to interactive books especially for use by children with computers for educational or amusement purposes.

Many types of interactive books are described in the patent literature. For example, Cummings U.S. Patent 4,990,092 describes a talking book which includes a line of pressure-sensitive switches and a speaker actuated to reproduce words or other sounds according to the switch depressed. A similar interactive book is described in Billings, et al. U.S. Patent 5,453,013 which includes a touch pad along one side of the book containing a plurality of electrical switches, and a digital sound generator responsive to actuation by one of the switches. McTaggart U.S. Patents 5,167,508, 5,417,575 and 5,609,488, disclose electronic books in which the electrical circuits, including the electrical switches, are formed in each leaf of the book. Jessop U.S. Patent 5,645,432 discloses a book in which the covers carry the electrical switches in the form of capacitive couplings such as to be responsive to the touch position of the user's finger.

OBJECTS AND BRIEF SUMMARY OF THE INVENTION

An object of the present invention is to provide an interactive book having a number of advantages, as will be described more particularly below, making the book especially useful with computers by children. Another object of the invention is to provide the combination of an interactive book with a computer to be used particularly by children.

According to a broad aspect of the present invention, there is provided an interactive book comprising: a stiff backing panel hinged along a center line thereof to define a front cover and a back cover for the book, with each cover having an outer face and an inner face; a plurality of flexible book pages mounted along the center line between the inner faces of the front and back covers, each of the book pages containing printed information at various locations thereon; and a pressure-sensitive switch assembly carried on the inner face of at least one cover and defining a plurality of electrical switches adapted to be selectively actuated by the application of localized pressure to one of the pages. The switching assembly includes a pair of layers in overlying relation to each other between the cover and the book pages, each layer carrying an electrically-conductive pattern normally spaced from the other. The layer adjacent the book pages is deformable such that its electrically-conductive pattern is engageable with that of the other layer at points thereof according to the localized pressure applied to one of the book pages and transmitted through the underlying pages to the switch assembly carried on the inner face of said cover.

According to further features in the described preferred embodiment, the electrically-conductive patterns are normally spaced from each other by localized deposits of an insulating material on one of the layers.

In the described preferred embodiment, the book pages contain printed information on both faces, and therefore there are a pair of the layers defining a pressure-sensitive switch assembly also on the inner face of the front cover.

As will be described more particularly below, such an interactive book is particularly useful with a programmable computer having a display screen and a speaker for producing displays and audio outputs according to the electrical switch actuated by the localized pressure applied to a book page. Thus, the user, such as a child, can apply pressure to a selected location on any of the pages, e.g., by the use of the child's finger, a pencil or stylus, whereupon a switch will be actuated according to the location of the pressure. The switch will then actuate the computer to display an animation clip or the like, and / or to produce an audio output, corresponding to the location of the pressure applied to the page. Such an interactive book could therefore include an electrical plug to be received in a port of a programmable computer for producing the display and / or audio output according to the selected program.

Further features and advantages of the invention will be apparent from the description below.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

FIG. 1 is a block diagram illustrating one form of apparatus constructed in accordance with the present invention;

FIG. 2 illustrates the interactive book included in the apparatus of FIG. 1;

FIGS. 3 and 4 illustrate the two layers of the pressure-sensitive switch assembly included in the book of FIG. 2.

FIG. 5 is a circuit diagram illustrating the electrical system included in the book of FIGS. 2 – 4;

FIG. 6a – 6e illustrate different ways of connecting the interactive book to a computer; and

FIG. 7 illustrates one program which the apparatus of FIG. 1 may execute.

DESCRIPTION OF A PREFERRED EMBODIMENT

The apparatus illustrated in FIG. 1 is designed particularly for children to provide an interactive system for educational or amusement purposes. It includes an interactive book, generally designated 2, adapted to be connected by cable 3 to a computer 4 having a display screen 5, speakers 6, and a keyboard 7. The computer 4 is adapted to be programmed by a data input device, such as a disc 8, for producing a visual output via screen 5, and / or an audio output via speakers 6, according to the specific pictures or other information selected by the child in the interactive book 2. The selection is made by the child applying the child's finger, or a pressing implement, such as a pencil or stylus, to a selected region on a selected page of the interactive book 2, which thereby actuates a switching assembly within the book according to the location of the page pressed by the child. The apparatus illustrated in FIG. 1 is particularly suitable for children of 2 – 6 years in age, and allows them to be active participants in an interactive story or game taking place on the screen.

The structure of the interactive book 2 is more particularly illustrated in FIGS. 2 – 5. It includes a stiff backing panel 10 of stiff sheet material and of rectangular configuration. Panel 10 is folded or hinged along its center line11, to define a front cover 10a and a back cover 10b. Preferably, the panel 10 is constituted of two rectangular cardboard sheets and a slim sheet spaced between them all joined together by a plastic sheet to define the two covers and the spring between them. The illustrated book further includes a plurality of flexible book pages 12 (FIG. 2) mounted along the center line 11 between the inner faces of the front cover 10a and back cover 10b. As shown in FIG. 2, each of the book

pages 12 contains printed information 13, such as pictures, instructions, etc., at various specific locations on both of its faces.

The interactive book 2 illustrated in FIG. 1 includes a housing 14 extending along one side of the back cover 10b, for housing the electrical components of the book. As will be described below, these electrical components are connected by cable 3 and plug 15 to the computer 4, and do not require a battery since the book may be powered by the computer 4.

The interactive book further includes a pressure-sensitive switch assembly carried on the inner face of both the front cover 10a and the back cover 10b. As shown in FIG. 2, the switch assembly includes an outer layer or membrane, generally designated 20, applied to the inner face of both covers 10a, 10b, and an inner layer or membrane 30 applied between membrane 20 and the book pages 12. Each of the two layers 20, 30 carries an electrically-conductive pattern which patterns are normally spaced from each other so as not to make electrical contact with each other. However, layer 30, directly underlying the book pages 12, is in the form a deformable membrane, or the portions thereof carrying the electrically-conducting pattern, such that its electrically conductive pattern is engageable with the electrically-conductive pattern of layer 20 at selected points of the two layers according to the localized pressure applied to one of the faces of the book page 12. It will thus be seen that when localized pressure is applied to the front face of a page 12, the pressure is transmitted through the underlying pages to the switch assembly carried by the back cover 10b; and when localized pressure is applied to the obverse face of a book page 12, the pressure is

transferred via the underlying pages to the switch assembly carried by the front cover 10a.

FIG. 3 more particularly illustrates the construction of layer 20, and FIG. 4 more particularly illustrates the construction of layer 30.

As shown in FIG. 3, the electrically-conductive pattern on the bottom layer 20 includes a plurality of fields 21 at different locations, corresponding to the different locations on the book pages 12. Each field 21 defines spaced, normally-open contacts of an electrical switch which contacts are bridgeable by the electrically conductive pattern of layer 30 upon the application of pressure to the respective location on a book page.

More particularly, as shown in FIG. 3, the electrically conductive pattern in each field 21 on layer 20 includes a plurality of electrically interconnected segments 22 defining the contacts on one side of an electrical circuit, and another plurality of electrically interconnected segments 23 spaced from segments 22 and defining the contacts on the opposite side of the electrical circuit. Since segments 23 are spaced from segments 22, the electrical switches defined by each of the fields 21 is normally open. The contacts of a selected field, however, are closed by the electrically-conductive pattern in the overlying layer 30 upon the application of localized pressure to a back page 12, as will be described more particularly below.

In the example illustrated in FIG. 3, there are 14 fields 21 on the front cover 10a, and 14 fields on the back cover 10b. Accordingly, such an arrangement is capable of selecting 14 different locations on each face of the book pages 12, or a total of 28 locations. Conductive pathways 24 extending

across the center hinge line or spine 11 interconnect the conductive fields 21 of the two covers 10a, 10b. Further conductive pathways 25 are provided at one side of the back cover 10b to serve as the input and output connections to the switch assembly defined by the conductive pathways in the two layers 20 and 30.

As shown in FIG. 4, layer 30 includes a plurality of conductive deposits 31, one for and overlying each of the fields 21 in layer 20. Conductive deposits 31 are configured to electrically bridge a segment 22 with an adjoining segment 23 wherever local pressure is applied to an overlying book page 12, to thereby actuate the switch corresponding to the location at which the pressure was applied. Thus, as shown in FIG. 4, since there are 14 fields 21 in each of the front and back covers 10a, 10b, layer 30 would be provided with 14 conductive deposits 31 for both covers, or a total of 28 such conductive deposits.

Layer 20 is preferably in the form a plastic membrane or sheet bonded to the inner face of back cover 10b. Layer 30 is also preferably in the form of a plastic membrane or sheet and is adhesively bonded to layer 20 at selected points in the spaces between the fields 21, so that the adhesive does not prevent the actuation of any of the switches defined by the fields. Preferably, the electrically-conductive patterns are normally spaced from each other by localized deposits of an insulating material, as shown at 26, on one of the two layers, preferably the outer layer 20 carrying the spaced contacts. That layer may also include an adhesive, such as shown at 27 in FIG. 3, in some of the spaces between the contact fields 21 for holding the two layers together.

FIG. 5 illustrates the electrical circuitry that may be included in housing 14 of the book 2. The switch assembly described above, defined by the

conductive segments in the two layers 20, 30, is schematically indicated by reference numeral 41 in FIG. 5. This switch assembly controls a microprocessor 42 within housing 14. The microprocessor is designed to perform cyclic scans of the switch assembly 41 and to transmit an electrical signal to the computer 4 to indicate the specific field 21 of the switch assembly 41 which has been actuated, and thereby to indicate to the computer which location of a book page 12 has been pressed by the user.

As indicated earlier, the interactive book 10 does not require a battery or other power supply. Rather, it includes an in circuit adapter, shown as 43 in FIG. 5, which is connected by the plug 15 to receive the power from the computer.

FIGS. 6a – 6e illustrate various ways in which the interactive book 2 may be connected to a computer via cables 3 and plug 15. Thus, it may be connected to the parallel port of a printer 50 (FIG. 6a), to one of the serial ports 51 of the computer (FIG. 6b), to the game / midi port 52 of the computer (FIG 6c), directly to the computer keyboard port 53 (FIG 6d), or to the computer keyboard port 53 via a keyboard input adapter 54 (FIG. 6e), which allows simultaneous and uninterrupted operation of the interactive book 2 and the keyboard 7.

FIG. 7 is a flow chart illustrating one example of a program for operating the interactive book 2 when plugged into the computer 4. In this example, the book is plugged into the exit port of the computer's sound card, Midi / Joy stick (block 60).

Disc 8 (FIG.1) is inserted into the CD-ROM drive of the computer 4 (block 61), whereupon the software incorporated in that disc installs the game

(block 62). The user may then select one of three game levels (box 63), and enables the book for play at the selected level (box 64).

In the example illustrated in FIG. 7, the book pages 12 include 23 pictures, instructions, etc. at various specific pages and locations, each of which may be selected by pressing the location of the respective picture or instruction. Pressing "PAUSE" (block 65) causes a game to be stopped in the middle of the current scene, until "PAUSE" is again pressed to restart the game.

Pressing a selected figure or number causes a short animation clip relating to the figure or number to be screened on the screen 5, and also to be explained via the speaker 6 (block 66). Pressing another location of a book page may cause a scene to be screened requiring some reaction or interactivity on the part of the viewer (block 67). Another possibility is to cause the pressing of a figure to move a scene to the scene of the selected figure (block 68). A further possibility is to press an arrow, which causes the scene to move forwards or backwards, according to the direction of the arrow, in the context of the story being screened.

In order to exit from the game, the user presses "ESC" (block 70).

Following is an example of an interactive application of the illustrated apparatus. After the book is connected to the computer and the software is made operational, a short clip is shown to the child, and the child may be asked questions with respect to what is shown on the screen. The child may answer the questions by pressing one of the digits in the book, and may also choose the display on the screen by pressing the appropriate picture in the book.

The book may be connected to a pre-programmed general purpose computer, to a dedicated computer, or to the internet for one-way or two-way communication with the internet. Pressing a spot on a book page to actuate a switch may be effective to produce a response from the computer or from an external device, e.g., a projector, a television set, etc. The book pages may be of paper, plastic or any other suitable material, preferably of non-tearable material.

Also, the circuitry or part of the circuitry within housing 14 may be placed externally of the book. Further, the communication between the book and the computer may be wireless, such as by IR, RF or acoustical. The cable connection may be detachable from the book so that the book will have the external appearance of a regular book; also the book pages could be detachable to permit the use of the cover with other book pages, in which case it would be preferable to have the conductive deposits of FIG. 4 printed on the book pages. Further, a family of books, each including its own covers, pages and switching assembly, could be individually connectable to a common controller and a common computer servicing each book as connected by the user. A sounding device could be included in the book actuated by the closing of a switch to inform the user that a switch has been closed.

Further, the electrically-conductive pattern shown in FIG. 3 may be in the form of a rectangular matrix of dots which, when bridged by the application of pressure, will inform the computer of the exact location of the pressure point.

It will be appreciated that the present invention is therefore described above merely for purposes of example, and that many variations, modifications, and other applications of the invention may be made.

CLAIMS

1. An interactive book, comprising:

a stiff backing panel hinged along a center line thereof to define a front cover and a back cover for the book, with each cover having an outer face and an inner face;

a plurality of flexible book pages mounted along said center line between the inner faces of said front and back covers, each of said book pages containing printed information at various locations thereon; and

a pressure-sensitive switch assembly carried on the inner face of at least one cover and defining a plurality of electrical switches adapted to be selectively actuated by the application of localized pressure to one of said pages;

said switch assembly including a pair of layers in overlying relation to each other between said cover and said book pages, each layer carrying an electrically-conductive pattern normally spaced from the other, the layer adjacent said book pages being deformable such that its electrically-conductive pattern is engageable with that of the other layer at points thereof according to the localized pressure applied to one of said book pages and transmitted through the underlying pages to the switch assembly carried on the inner face of said cover.

2. The book according to claim 1, wherein the electrically-conductive pattern on one of said layers includes a plurality of fields at different locations corresponding to the different locations on the book pages,

each field defining spaced, normally open contacts of an electrical switch which contacts are bridgeable by the electrically-conductive pattern of the other of said layers upon the application of pressure to the respective location on a book page.

3. The book according to claim 2, wherein the electrically-conductive pattern of said one layer includes, for each field, a first plurality of electrically interconnected segments defining one side of an electrical circuit, and a second plurality of electrically interconnected segments spaced from said first plurality of segments defining the opposite side of the electrical circuit; and

wherein the other of said layers includes a plurality of conductive deposits, one for each field, electrically separated from each other and configured to electrically bridge a segment of said first plurality with a segment of said second plurality when pressure is transferred to said switch assembly by the application of localized pressure to one of said book pages.

4. The book according to claim 3, wherein said one layer is carried by the inner face of said at least one cover, and said other layer is carried by a flexible diaphragm facing said one layer.

5. The book according to claim 4, wherein said flexible diaphragm is bonded to said one layer.

6. The book according to claim 1, wherein said electrically-conductive patterns are normally spaced from each other by localized deposits of an insulating material on one of said layers.

7. The book according to claim 1, wherein said book pages contain printed information on both of their faces, and wherein the pair of layers defining a pressure-sensitive switch assembly are also carried on the inner face of said front cover.

8. The book according to claim 1, wherein said switch assembly is connected to an electrical plug adapted to be received in a port of a programmable computer having a display screen for producing a display according to the electrical switch actuated by the localized pressure applied to a book page.

9. The combination of a book according to claim 8, with a programmable computer having a display screen for producing a display according to the electrical switch actuated by the localized pressure applied to a book page.

10. The combination according to claim 8, wherein said computer also includes a speaker for also producing an audio output according to the electrical switch actuated by the localized pressure applied to a book page.

11. An interactive book, comprising:

a stiff backing panel hinged along a center line thereof to define a front cover and a back cover for the book, with each cover having an outer face and an inner face;

a plurality of flexible book pages mounted along said center line between the inner faces of said front and back covers, each of said book pages containing printed information at various locations on both faces thereof; and

a pressure-sensitive switch assembly carried on the inner face of said front and back covers and defining a plurality of electrical switches adapted to be selectively actuated by the application of localized pressure to one of said pages;

said switch assembly including a pair of layers in overlying relation to each other between the book pages and the respective cover, each layer carrying an electrically-conductive pattern normally spaced from the other, the layers adjacent said book pages being deformable such that its electrically-conductive pattern is engageable with that of the other layer at points thereof according to the localized pressure applied to one of said book pages and transmitted through the underlying pages to the switch assembly carried on the inner face of the respective cover.

12. The book according to claim 11, wherein the electrically-conductive pattern on one of said layers includes a plurality of fields at different locations corresponding to the different locations on the book pages, each field defining spaced, normally open contacts of an electrical switch which contacts are bridgeable by the electrically-conductive

pattern of the other of said layers upon the application of pressure to the respective location on a book page.

13. The book according to claim 12, wherein the electrically-conductive pattern of said one layer includes for each field, a first plurality of electrically interconnected segments defining one side of an electrical circuit, and a second plurality of electrically interconnected segments spaced from said first plurality of segments defining the opposite side of the electrical circuit; and

wherein the other of said layers includes a plurality of conductive deposits, one for each field, electrically separated from each other and configured to electrically bridge a segment of said first plurality with a segment of said second plurality when pressure is transferred to said switch assembly by the application of localized pressure to one of said book pages.

14. The book according to claim 13, wherein said one layer is carried by the inner face of the back cover, and said other layer is carried by a flexible diaphragm facing said one layer.

15. The book according to claim 14, wherein said flexible diaphragm is bonded to said one layer.

16. The book according to claim 11, wherein said electrically-conductive patterns are normally spaced from each other by localized deposits of an insulating material on one of said layers.

17. The book according to claim 11, wherein said switch assembly is connected to an electrical plug adapted to be received in a port of a programmable computer having a display screen for producing a display according to the electrical switch actuated by the localized pressure applied to a book page.

18. The combination of a book according to claim 17, with a programmable computer having a display screen for producing a display according to the electrical switch actuated by the localized pressure applied to a book page.

19. The combination according to claim 18, wherein said computer also includes a speaker for also producing an audio output according to the electrical switch actuated by the localized pressure applied to a book page.

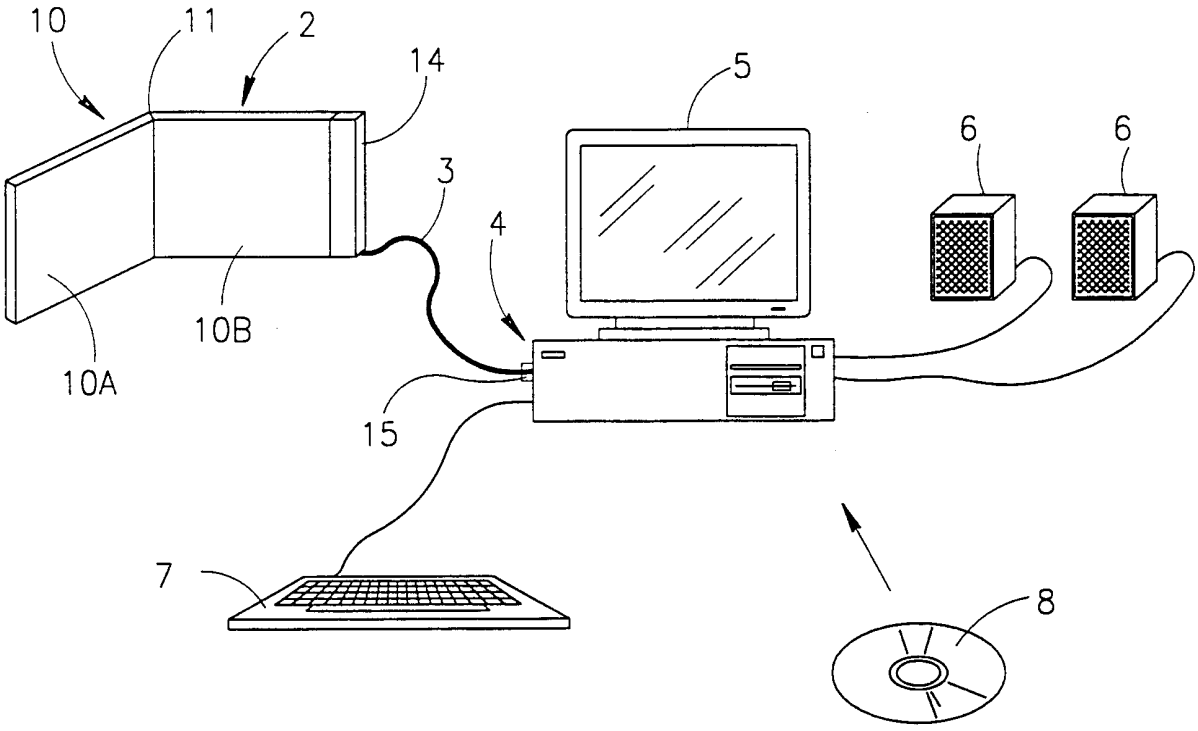

FIG.1

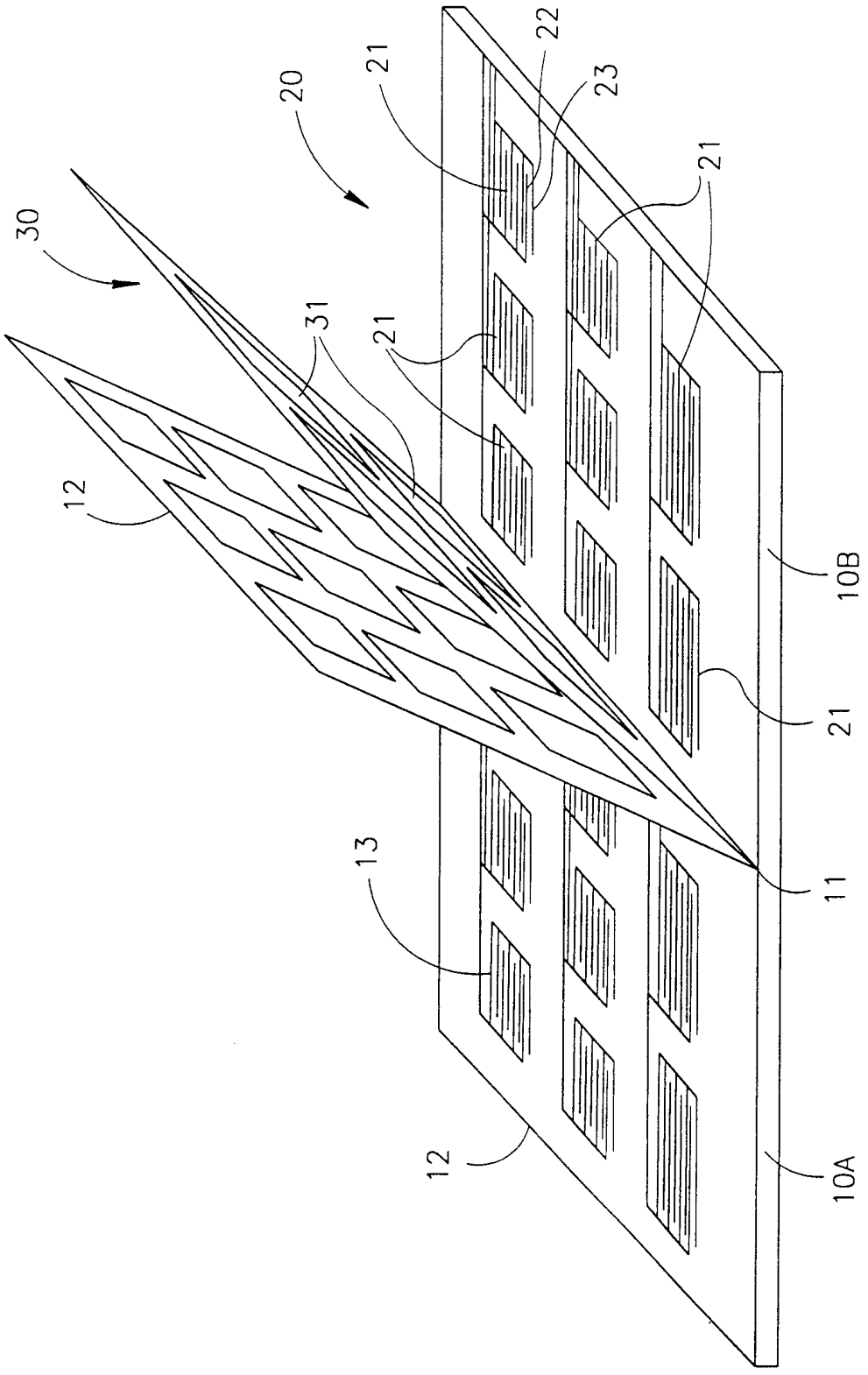

FIG.2

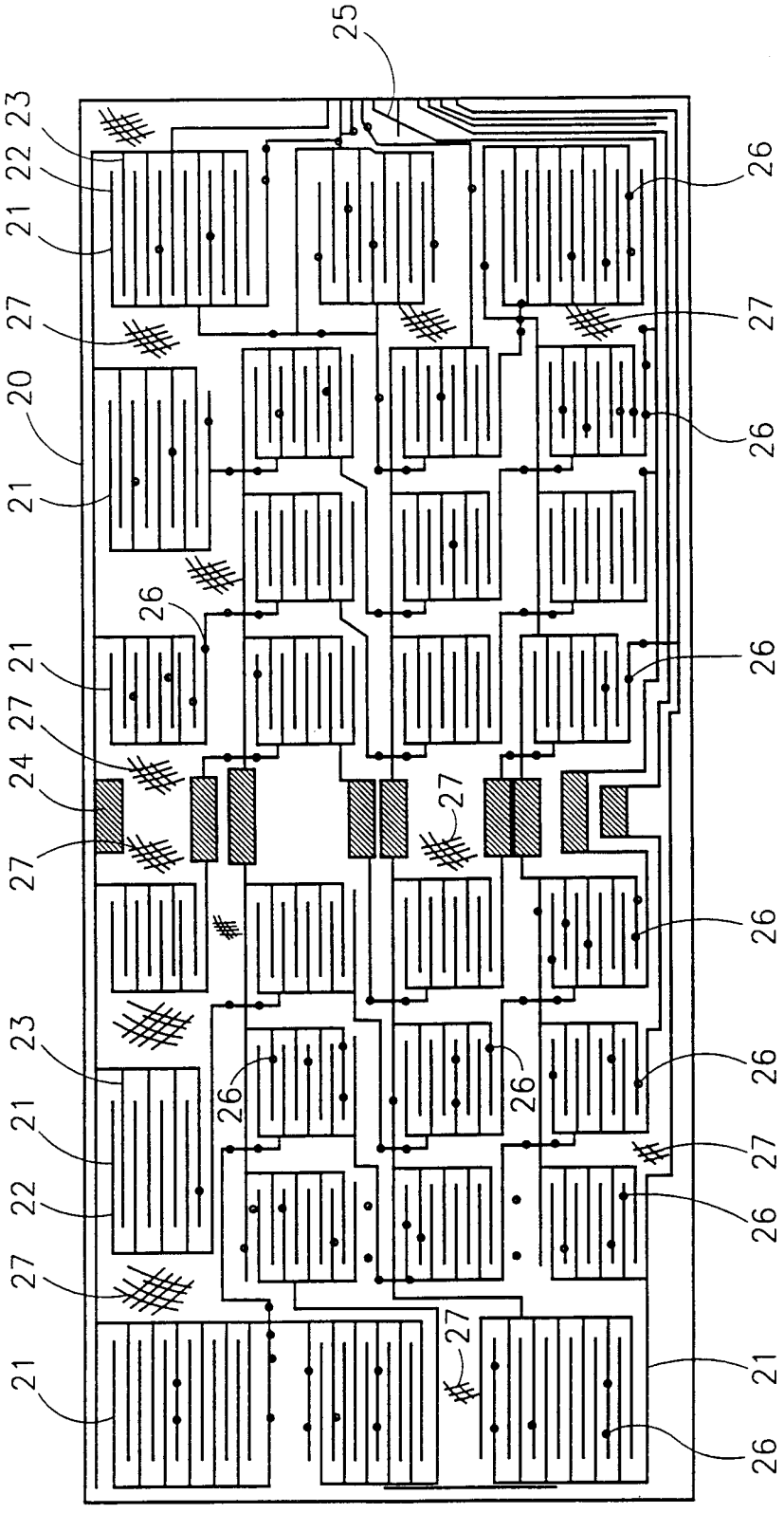
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FIG.3

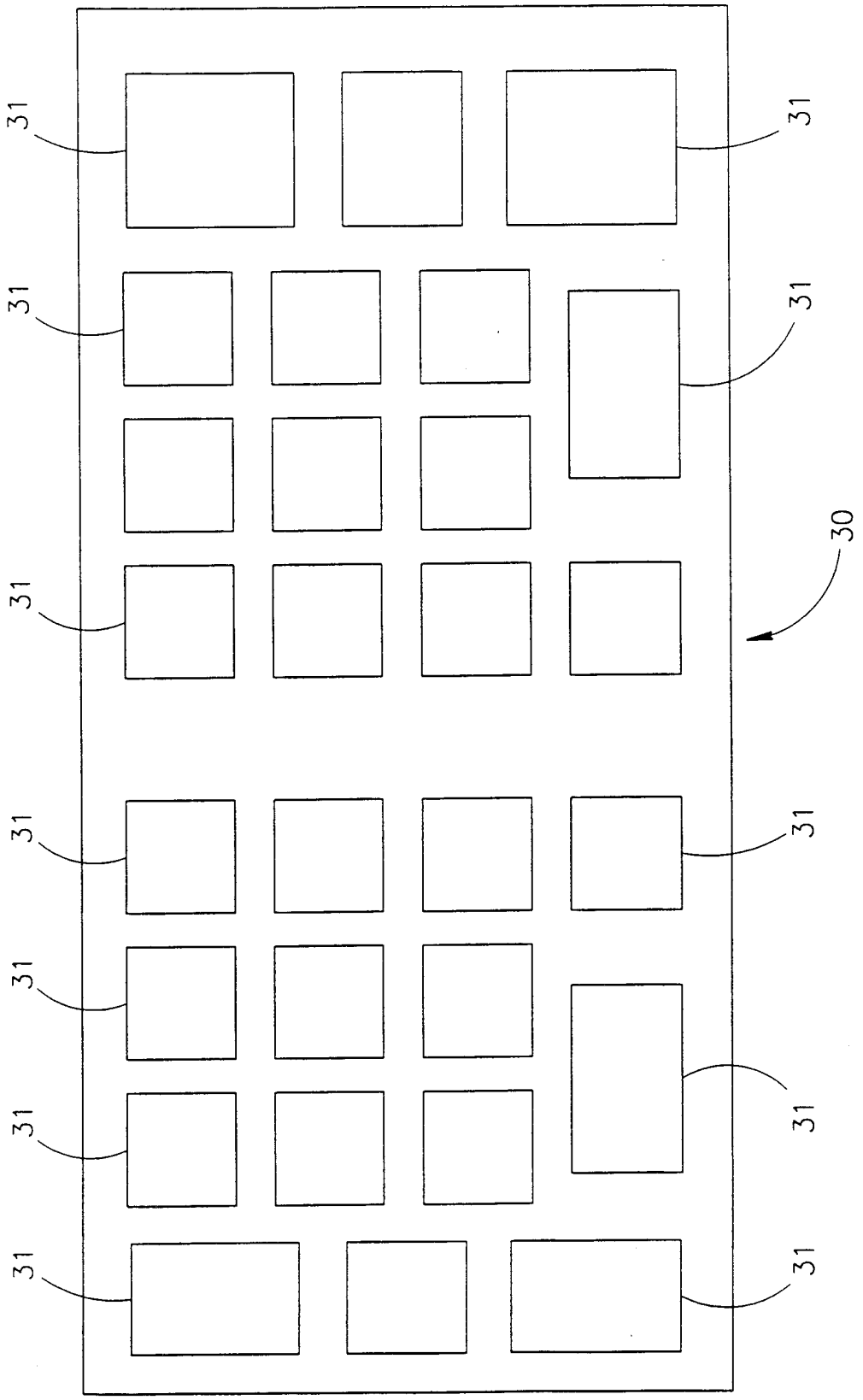

FIG.4

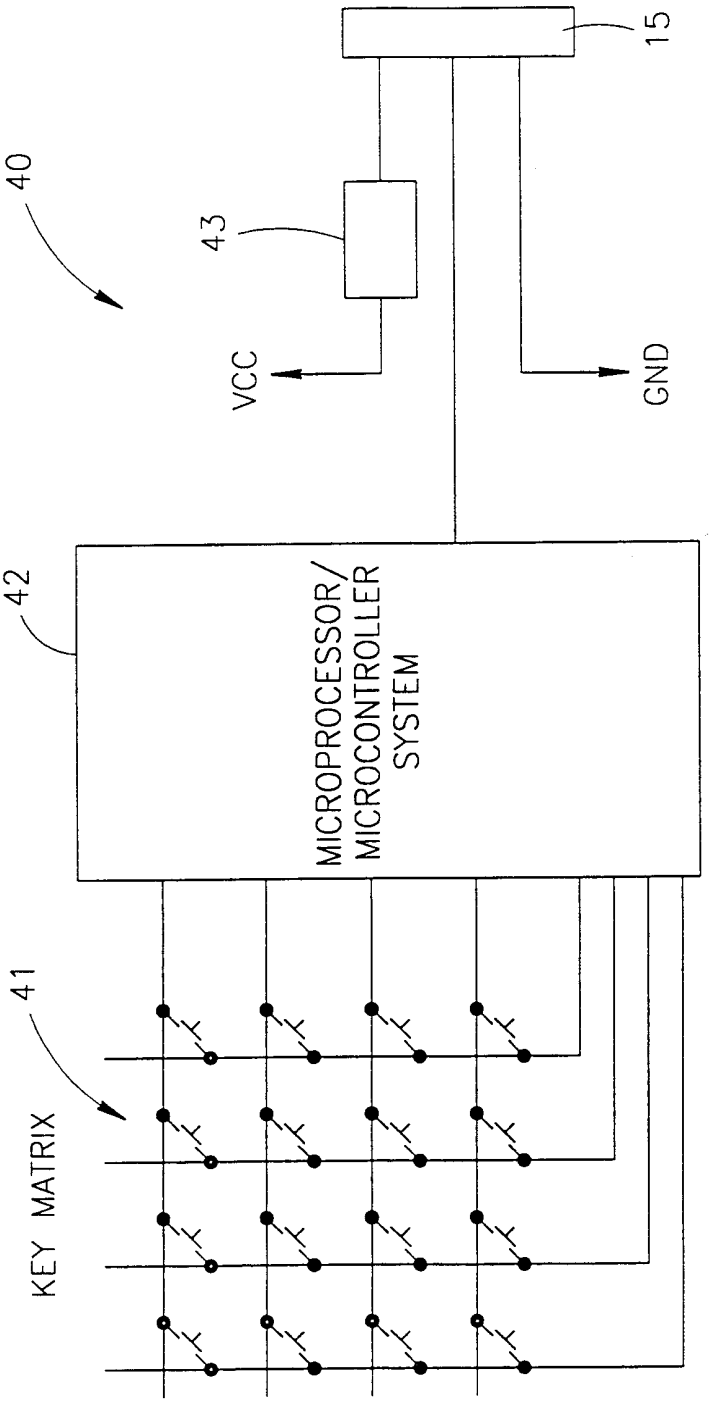
15
40
43
VCC
GND
42
MICROPROCESSOR/
MICROCONTROLLER
SYSTEM
41
KEY MATRIX

FIG.5

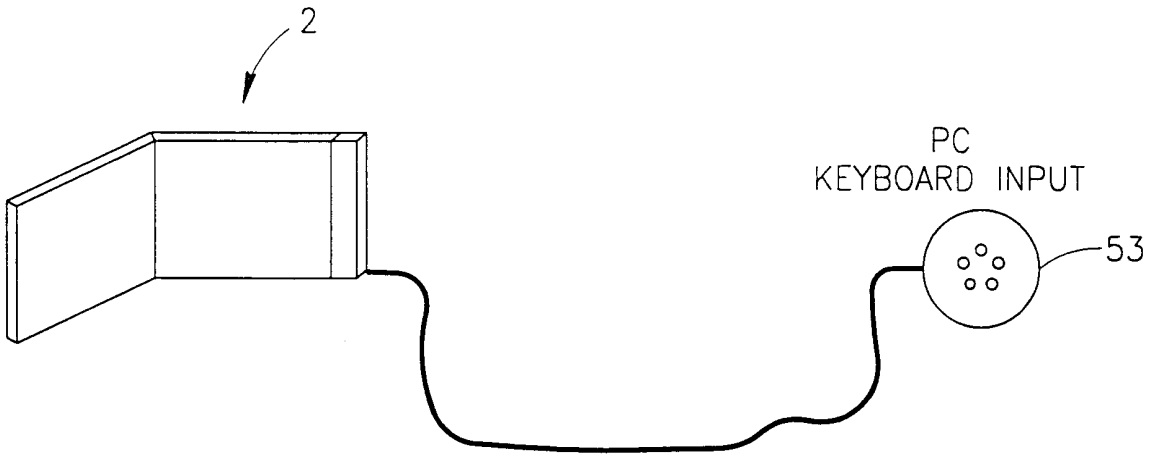
2
PC
KEYBOARD INPUT
53

FIG.6D

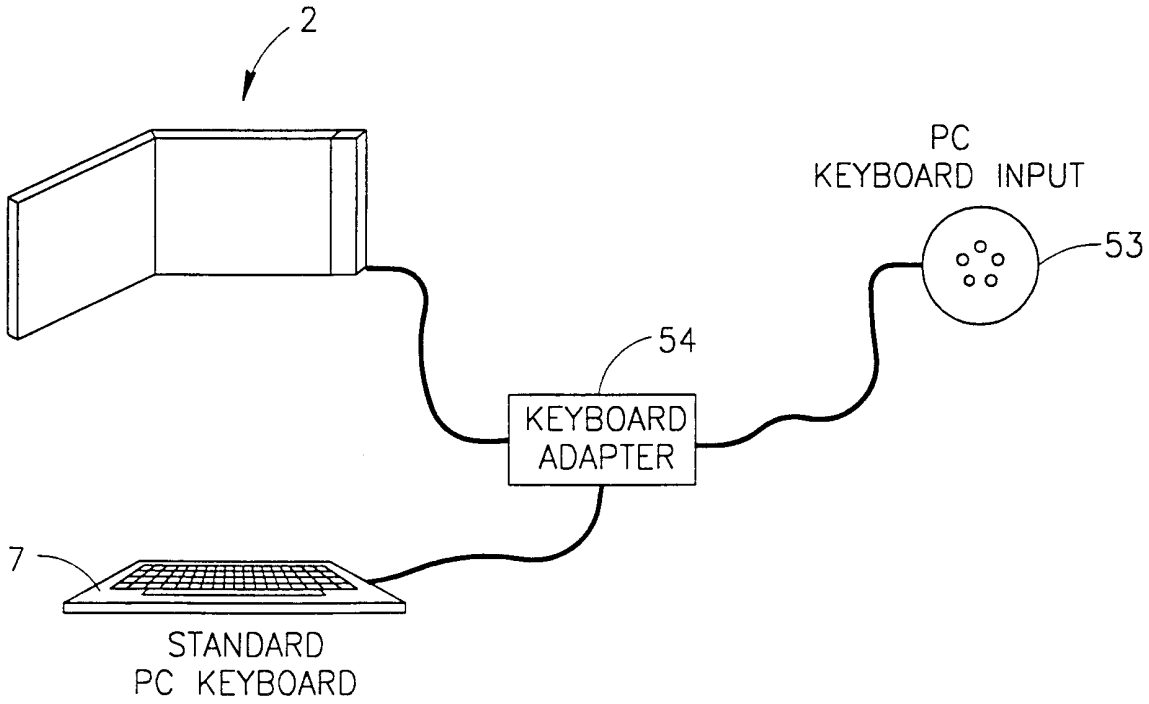
2
PC
KEYBOARD INPUT
53
54
KEYBOARD
ADAPTER
7
STANDARD
PC KEYBOARD

FIG.6E

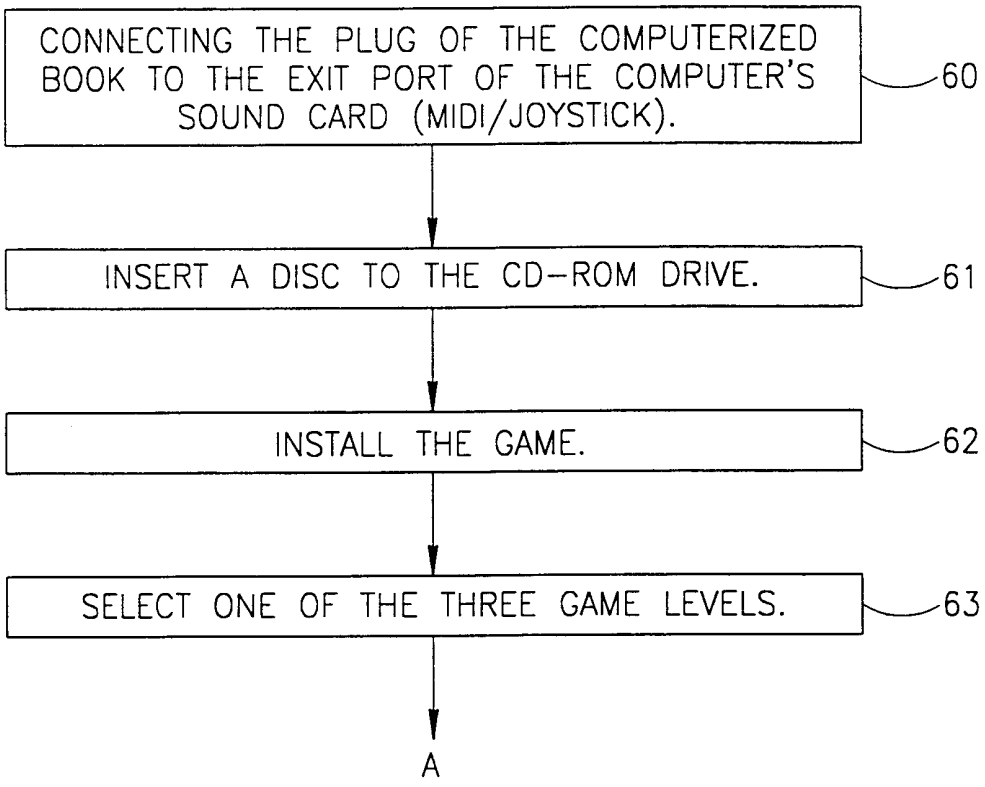
CONNECTING THE PLUG OF THE COMPUTERIZED BOOK TO THE EXIT PORT OF THE COMPUTER'S SOUND CARD (MIDI/JOYSTICK).
60
INSERT A DISC TO THE CD-ROM DRIVE.
61
INSTALL THE GAME.
62
SELECT ONE OF THE THREE GAME LEVELS.
63
A

FIG.7A

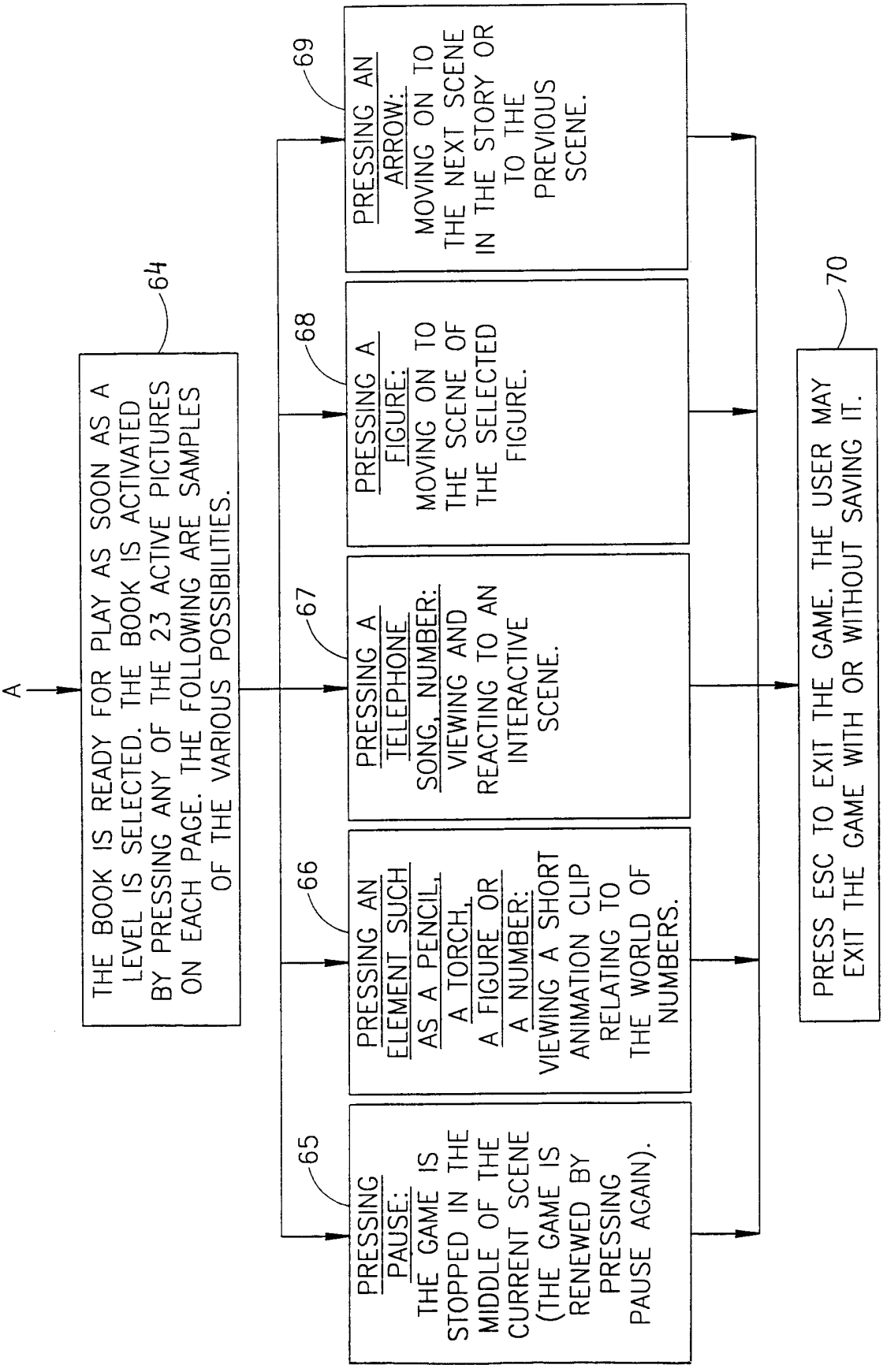
A
THE BOOK IS READY FOR PLAY AS SOON AS A LEVEL IS SELECTED. THE BOOK IS ACTIVATED BY PRESSING ANY OF THE 23 ACTIVE PICTURES ON EACH PAGE. THE FOLLOWING ARE SAMPLES OF THE VARIOUS POSSIBILITIES.
64
PRESSING PAUSE: THE GAME IS STOPPED IN THE MIDDLE OF THE CURRENT SCENE (THE GAME IS RENEWED BY PRESSING PAUSE AGAIN).
65
PRESSING AN ELEMENT SUCH AS A PENCIL, A TORCH, A FIGURE OR A NUMBER: VIEWING A SHORT ANIMATION CLIP RELATING TO THE WORLD OF NUMBERS.
66
PRESSING A TELEPHONE SONG, NUMBER: VIEWING AND REACTING TO AN INTERACTIVE SCENE.
67
PRESSING A FIGURE: MOVING ON TO THE SCENE OF THE SELECTED FIGURE.
68
PRESSING AN ARROW: MOVING ON TO THE NEXT SCENE IN THE STORY OR TO THE PREVIOUS SCENE.
69
PRESS ESC TO EXIT THE GAME. THE USER MAY EXIT THE GAME WITH OR WITHOUT SAVING IT.
70

FIG. 7B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL00/00297

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G09B 5/00
US CL :434/317, 307R, 308

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. : 434/317, 307R, 308, 309, 310, 311, 339, 156, 159, 178; 462/2, 7, 8, 17

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)

EAST

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 5,810,604 A (KOPP) 22 September 1998, col. 4, line 17 to col. 9, line 39.	1-7, 11-16 -------- 8-10, 17-19
Y	US 5,645,432 A (JESSOP) 08 July 1997, col. 6, lines 10-35.	1-19
Y	US 4,990,092 A (CUMMINGS) 05 February 1991, col. 2, line 11 to col. 3, line 61.	1-19
Y	US 5,453,013 A (BILLINGS) 26 September 1995, col. 2, line 34 to col. 8, line 7.	1-19
Y	US 5,167,508 A (MC TAGGART) 01 December 1992, col. 4, line 26 to col. 10, line 35.	1-19
Y	US 5,417,575 A (MCTAGGART) 23 May 1995, col. 5, line 4 to col. 17, line 25.	1-19

[X] 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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL00/00297

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 5,897,324 A (TAN) 27 April 1999, col 3, line 46 to col. 6, line 55.	1-19
A	US 5,845,160 A (PATTON) 1 December 1998, col. 2, line 43 to col. 9, line 50	1-19
A	US 5,851,119 A (SHARPE, III ET AL.) 22 Deceember 1998, col. 2, line 51 to col. 8, line 58.	1-19
Y	US 5,803,748 A (MADDRELL) 08 September 1998, col. 6, line 46 to col. 13, line 28.	1-19
A	US 5,631,883 A (LI) 20 May 1997, col. 2, line 62 to col. 4, line 63.	1-19
Y	US 5,413,486 A (BURROWS) 09 May 1995, col. 2, line 42 to col. 7, line 18.	1-19
Y	US 5,466,158 A (SMITH, III) 14 November 1995, col. 4, line 42 to col. 11, line 44.	1-19