

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
11 May 2006 (11.05.2006)

PCT

(10) International Publication Number
WO 2006/048384 A1

(51) International Patent Classification:
G06F 13/38 (2006.01)

(21) International Application Number:
PCT/EP2005/055450

(22) International Filing Date: 21 October 2005 (21.10.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
04300760.8 4 November 2004 (04.11.2004) EP

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

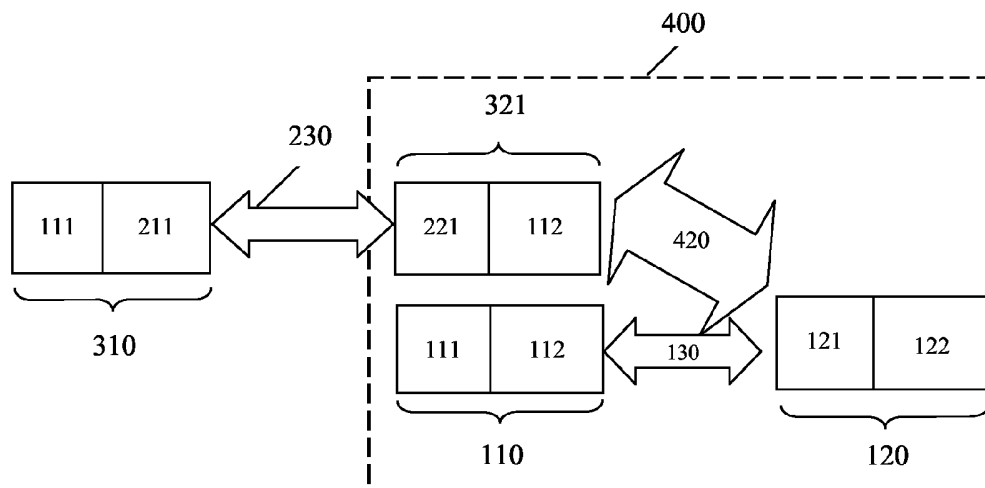
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

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.

(54) Title: CONVERTING UNIT AND SYSTEM CONTAINING THE SAME



(57) Abstract: A converting unit and a system containing the same is disclosed. The converting unit is for converting a USB unadapted host apparatus into a USB-adapted host apparatus, the converting unit including a unit non-USB interface connected to the host apparatus interface, a unit output terminal connected to the host apparatus input terminal, a unit input terminal connected to the unit output terminal, a unit USB interface for connecting the USB interface, a converting circuit for carrying out an interface conversion between the unit non-USB interface and the unit USB interface, and a unit power supply input terminal for inputting the power supply.

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Converting Unit and System containing the sameFIELD OF THE INVENTION

5

The present invention relates to a converting unit and a system containing the same, and particularly to a converting unit structured of IDE peripheral interface adjoining to the USB host interface, which enables the main
10 host system to enjoy the advantages both of USB connection and of the IDE interface.

BACKGROUND OF THE INVENTION

15

In the age of content sharing, different devices/systems can share the contents with each other through connections. Intelligent Drive Electronics (IDE) interface is one of these connections, which has been used for more than two decades. The IDE interface is commonly used
20 to connect the mass storage such as hard disk drive. And the IDE interface is known by the skilled in the art for the following characteristics:

1. IDE is standard electrical interface for high-speed data transfer.
- 25 2. ATA/ATAPI is standard command set for the IDE devices such as Hard Disk, CD-ROM, DVD-ROM, etc.
3. Its variants are CFA and PCMCIA interfaces. Doing a small circuit change can make them communicate with IDE interface.
- 30 4. There are many different types of device using that interface (and its variants), e.g., mass/flash storage, Ethernet, Modem, GPS, picture/movie camera, bluetooth, IrDa, WiFi, etc.

However, it is not possible to perform functions of hot-swap and plug and use so that the power of the computer has to be shut down before the IDE storage device such as the hard disk in the computer being able to be replaced. In view of the bandwidth for communication, it will be more favourable to stream the content from the content storage device system to the player system than entirely downloading the content to the player system side before playback. On the other hand, it will be more beneficial for the player system to decide whether the content is playable or not. To fill these needs, the USB connection emerged in the market for several years ago and it has the following advantages:

1. hot plug and use;
2. commonness of interface for various devices;
3. expandable Bus topology and up to 127 devices running at the same time depending on bandwidth available;
4. unified resource in the system controlling many devices; and
5. power supply and management through the bus for the small devices.

Despite of these, the above-mentioned application of USB connection only concentrated on communication between the personal computer system and the USB client device systems but seldom exchanged content among device systems. Therefore, the USB host implementation embedded in the system is provided for this purpose. As known by the skilled in the art, re-implementation based on the USB host interface is needed for the main host system to enjoy the benefits of the USB connection, such as a build-in software. Moreover, the existing USB host implementation requires copying the content into the player before playback, which is very inconvenient and also intervenes with personal computer and ROM burner.

Accordingly, there remains a need for playback the content, especially the compressed content, directly from the external media, such as external flash memory or hard disc.

5 SUMMARY OF THE INVENTION

According to the present invention, a converting unit is suggested to meet this need. The proposed approach is to build a functional hardware block that converts the interface
10 from USB Host to IDE Peripheral to let the existing system with IDE Master Interface enjoy the USB connection advantage.

In one aspect of the invention, a converting unit for converting a universal serial bus (USB) unadapted host
15 apparatus into a USB-adapted host apparatus is provided, the USB-unadapted host apparatus having a host apparatus interface for connecting a non-USB interface, a host apparatus input terminal for inputting a signal, and a host apparatus power supply input terminal for inputting a power
20 supply, the converting unit including a unit non-USB interface connected to the host apparatus interface, a unit output terminal connected to the host apparatus input terminal, a unit input terminal connected to the unit output terminal, a unit USB interface for connecting a USB
25 interface, a converting circuit for carrying out an interface conversion between the unit non-USB interface and the unit USB interface, and a unit power supply input terminal for inputting the power supply.

30 According to the invention, the host apparatus interface could be any one of intelligent drive electronics (IDE) interface, small computer system (SCSI) interface, CFA interface, or PCMCIA interface.

According to the invention, the USB-unadapted host apparatus could be any one of hard disk drive, CD-ROM, DVD-ROM, CD-R, DVD-R, CD-RW, or DVD-RW.

5 According to the invention, the unit non-USB interface could be any one of IDE interface, SCSI interface, CFA interface, or PCMCIA interface.

10 In the best mode of implementation, the converting circuit is an IDE peripheral interface circuit adjoining to a USB host interface circuit.

15 In another aspect of the invention, a system is provided. The system includes a USB-unadapted host apparatus, at least one converting unit, and at least one connector, the USB-unadapted host apparatus connected to the at least one converting unit via the at least one connector, the USB-unadapted host apparatus having at least one host apparatus interface for connecting at least one non-USB interface, at least one host apparatus input terminal for inputting a signal, and a host apparatus power supply input terminal for inputting a power supply, the converting unit including a unit non-USB interface connected to the host apparatus interface, a unit output terminal connected to the host apparatus input terminal, a unit input terminal connected to the unit output terminal, a unit USB interface for connecting the USB interface, a converting circuit for carrying out an interface conversion between the unit non-USB interface and the unit USB interface, and a unit power supply input terminal for inputting the power supply.

25 According to the invention, the system is a CD player or a DVD player.

According to the invention, the system may further include an internal storage device.

5 According to the invention, the above internal storage device in the system could be a hard disk, a ZIP floppy disk, a Magneto-Optical (MO), a magnetic tape or a flash memory card reader.

10 According to the invention, the host apparatus interface in the system could be any one of IDE interface, SCSI interface, CFA interface, or PCMCIA interface.

15 According to the invention, the USB-unadapted host apparatus in the system could be any one of hard disk drive, CD-ROM, DVD-ROM, CD-R, DVD-R, CD-RW, or DVD-RW.

20 According to the invention, the unit non-USB interface in the system could be any one of IDE interface, SCSI interface, CFA interface, or PCMCIA interface.

According to the invention, the converting circuit in the system is a IDE peripheral interface circuit adjoining to a USB host interface circuit.

25 In one embodiment of the invention, the connector in the system is IDE cable.

30 Other objects, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the topology of IDE interface for Storage device in the prior art;

Fig. 2 is a block diagram showing the topology of USB
5 connection in the prior art;

Fig. 3 is a block diagram showing the topology of
from USB Host to IDE Peripheral to let the existing system
with IDE Master Interface enjoy the USB connection advantage;
10

Fig. 4 is a block diagram of the complete
implementation of the invention; and

Fig. 5 is a schematic diagram showing the internal
15 structure of the converting unit.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The technical features of the present invention will be described further with reference to the embodiments. The
5 embodiments are only preferable examples without limiting to the present invention. It will be well understood by the following detail description in conjunction with the accompanying drawings.

10 The Fig. 1 and 2 illustrate the conventional IDE connection and USB connection respectively. The conventional system topology of IDE interface for Mass Storage Media is shown in the Fig. 1. The Mass Storage Media **111** is connected to the Play **122** through the IDE cable **130**, also the IDE
15 Peripheral Interface **112** at the end of the Mass Storage Media side and the IDE Master Interface **121** at the other end of the Player side. As known by the skilled in the art, the Storage Device System **110** is a slave under control from the Main Host System **120**. As for the USB host, the system topology of USB
20 connection is directly cloned from the PC architecture and as shown in the Fig. 2. The Mass Storage Media **111** is connected to the Play **122** through the USB cable **230**, also the USB Client Interface **211** at the end of the Mass Storage Media side and the USB Host Interface **221** at the other end of the
25 Player side. The IDE is connected and located inside the USB Storage Device System **210** (as indicated by the parallel lines).

The Fig. 3 is the schematic drawing of the proposed
30 solution for letting the existing system with IDE Master Interface **121** enjoy the advantages of USB connection. The Mass Storage Media **111** is connected to the Play **122** through the USB cable **230**, also the USB Client Interface **211** at the end of the Mass Storage Media side and the USB Host Interface

221 at the other end of the Player side. The USB Host Interface 221 is adjoining to the IDE Peripheral Interface 112 and then connected to the IDE Master Interface 121 at the end of the Player side. The IDE is connected and located
5 inside the Main Storage System 320 (as indicated by the parallel lines). It could be understood by the skilled in the art, the USB Device System 310 in the Fig. 3 can be any device integrated with USB Client Interface such as mass/flash storage, Ethernet, Modem, GPS, picture/movie
10 camera, bluetooth, IrDa, WiFi, etc. The IDE interface is versatile and capable to communicate effectively with many different types of devices or those devices coming from the USB interface. In a system-wise view, the Player system is like in the Figure 1 to handle the USB connected device as
15 IDE Peripheral device or its variants.

The advantages of the proposed approach are:

1. Fast time-to-market, using the traditional concepts, reorganizing the existing hardware and software
20 architecture for system integration.
2. No special or new knowledge required for USB and IDE connections, and make things transparent in the system design.
3. Versatile and full-ranged applications in all platforms,
25 using IDE connection inside the system is more effective to handle USB, IDE, CFA and PCMCIA interfaces.
4. The burden of re-implementation in the conventional Main Host System is released by the proposed hardware block.

30 More preferably, the Main Host System includes one or more internal storage media such as CD, DVD, Hard Disk, etc. In such a system, the music or video can be ripped into the Hard Disc through multi-media jukebox. To connect outside storage, a compact flash storage device is a good choice to

share the IDE interface to transfer the content from the Hard Disc to compact flash storage device or encode the optical disc content into compact flash storage device. Of course, it can playback the content from the compact flash storage device directly.

Referring to Fig. 4, the Mass Storage Media **111** is connected to the Play **122** through the USB cable **230**, also the USB Client Interface **211** at the end of the USB device **310** side and the USB Host Interface **221** at the other end of the System **400** side. The USB Host Interface **221** is adjoining to the IDE Peripheral Interface **112** and then connected to the IDE Master Interface **121** at the end of the Player **122** side via the IDE cable or other wire connection **420**. As discussed above, the system **400** may further comprise one or more internal storage device **110**. With the complete implementation shown in the Fig. 4, the system architecture can connect to different mass storage type such as USB mass storage device implemented in the mp3 player, Digital camera, PDA, Cellular Phone, PC flash thumb drive, etc.

In order to take both advantages as the easy implementation and USB connectivity, the hardware sub-system shown in the Fig. 4 is provided to convert USB connectivity into IDE interface as a bridge. Obviously, this system architecture will take the proposed sub-system as a virtual removable Hard Disc device in an application-wise view.

Refer to the Fig. 5 for the internal structure of the proposed converting unit. As shown in the Fig. 5, along the direction of the outgoing signal from the system to the external USB device, the proposed converting unit may contain IDE Bus **500**, which connects to IDE peripheral interface & emulate logic; the IDE peripheral interface & emulate logic

510, which create the interface and the mass storage operation logic; Data Buffer 520, which used in the data transfer; Registers 530, which used as IDE command and control registers; Mass storage Device Logic 540, which provides the data exchange mechanism for configuration and state management and presents to its clients; USB System Control Logic 550, which is responsible for managing USB bandwidth, power supply, device attachment and detachment; Host Controller 560, which manages the data transfer between host and clients using the protocol and interconnection; Serial Interface Engine 570, which handles the serial data input and output including data error correction and detection; PHY 580, which is the electrical interface of the converting unit; USB bus 590, which connects to external USB device.

The above internal structure should be taken as a preferable example and should not be the limitation to the invention.

20

As for USB 1.1 version, the converting unit could be either build-in the housing of the system or outside the housing to be an independent unit. Preferably, the outside independent unit is more cost efficient and is conformed with minimization of the system size.

25

As for USB 2.0 version, the converting unit could also be implemented either as an in-jack chip or an out-jack chip. More advantageously, the in-jack chip helps to simplify the architecture of the system.

30

CLAIMS

1. A converting unit (321) for converting a
5 universal serial bus (USB) unadapted host apparatus
(120) into a plug-and-play USB-adapted host apparatus,
said USB-unadapted host apparatus having a host
apparatus interface (121) for connecting a non-USB
10 interface, a host apparatus input terminal for inputting
a signal, and a host apparatus power supply input
terminal for inputting a power supply,

said converting unit (321) including a unit non-
USB interface (112) connected to said host apparatus
interface (121), a unit output terminal connected to
15 said host apparatus input terminal, a unit input
terminal connected to said unit output terminal, a unit
USB interface (221) for connecting a USB interface, a
converting circuit for carrying out an interface
conversion between said unit non-USB interface and said
20 unit USB interface, and a unit power supply input
terminal for inputting the power supply.

2. The converting unit (321) according to claim
1, wherein said converting circuit is an IDE peripheral
25 interface circuit adjoining to a USB host interface
circuit.

3. A system (400), including a USB-unadapted
host apparatus (120), at least one converting unit
30 (321), and at least one connector (420),

said USB-unadapted host apparatus (120) connected
to said at least one converting unit (321) via said at
least one connector (420),

said USB-unadapted host apparatus (120) having at least one host apparatus interface (121) for connecting at least one non-USB interface, at least one host apparatus input terminal for inputting a signal, and a host apparatus power supply input terminal for inputting a power supply,

said converting unit (321) for converting a universal serial bus (USB) unadapted host apparatus (120) into a plug-and-play USB-adapted host apparatus, said USB-unadapted host apparatus (120) including a unit non-USB interface (112) connected to said host apparatus interface (121), a unit output terminal connected to said host apparatus input terminal, a unit input terminal connected to said unit output terminal, a unit USB interface (221) for connecting a USB interface, a converting circuit for carrying out an interface conversion between said unit non-USB interface and said unit USB interface, and a unit power supply input terminal for inputting the power supply.

4. The system (400) according to claim 3, wherein said converting circuit is a IDE peripheral interface circuit adjoining to a USB host interface circuit.

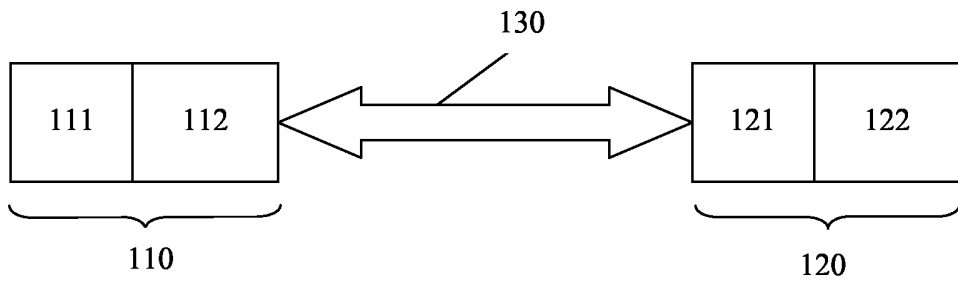


Fig. 1

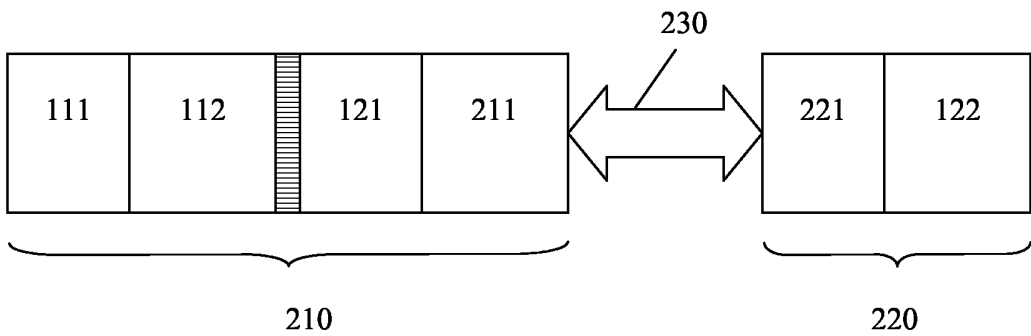


Fig. 2

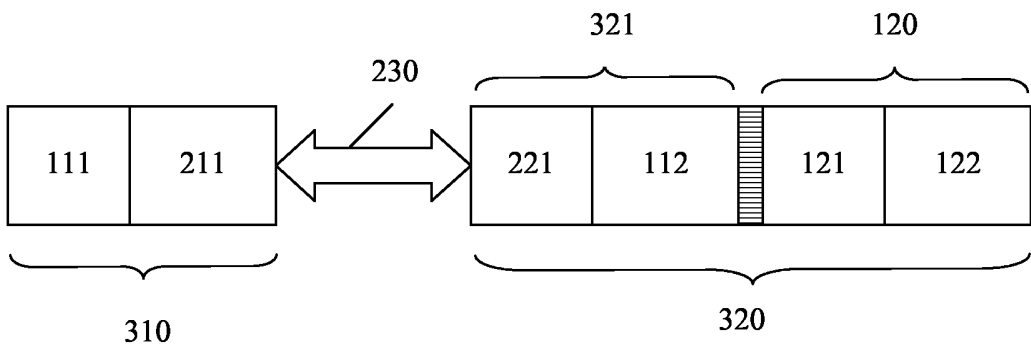


Fig. 3

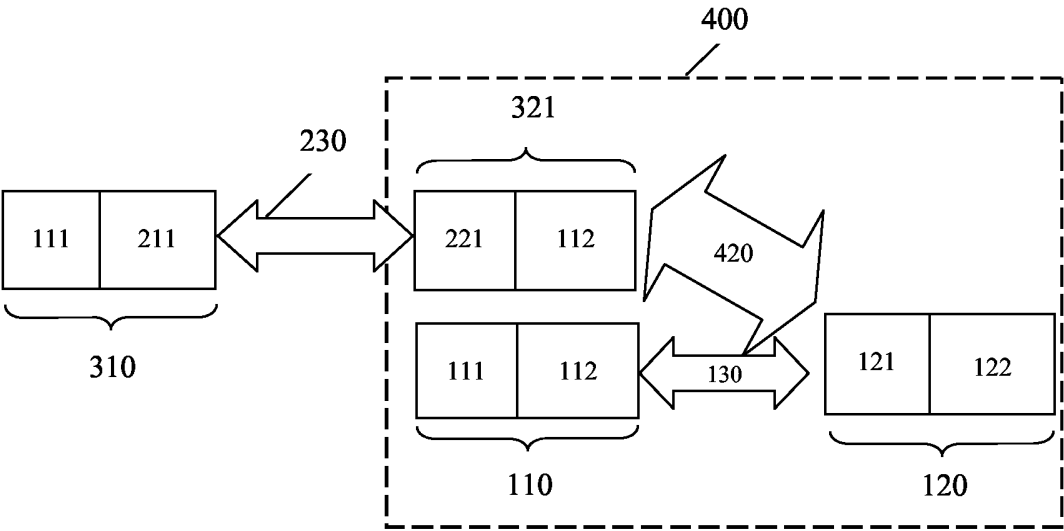


Fig. 4

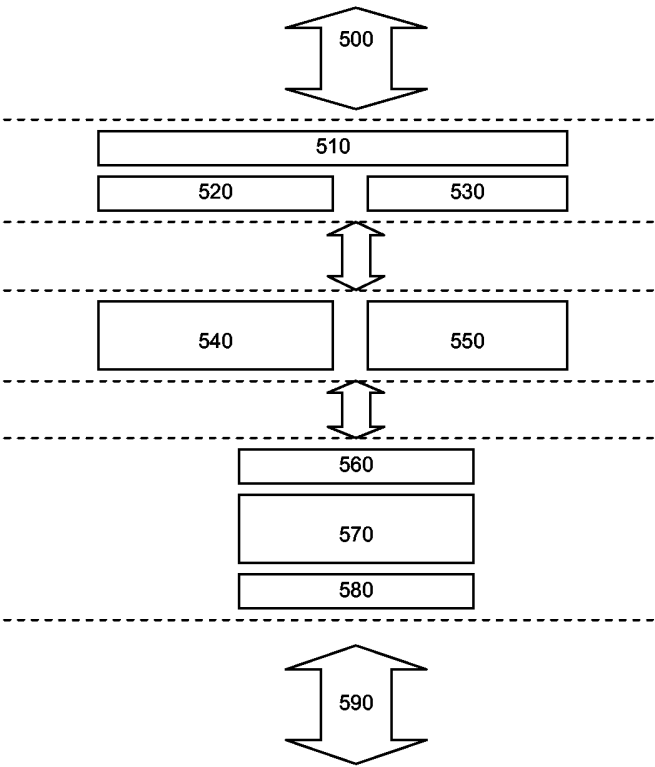


Fig. 5

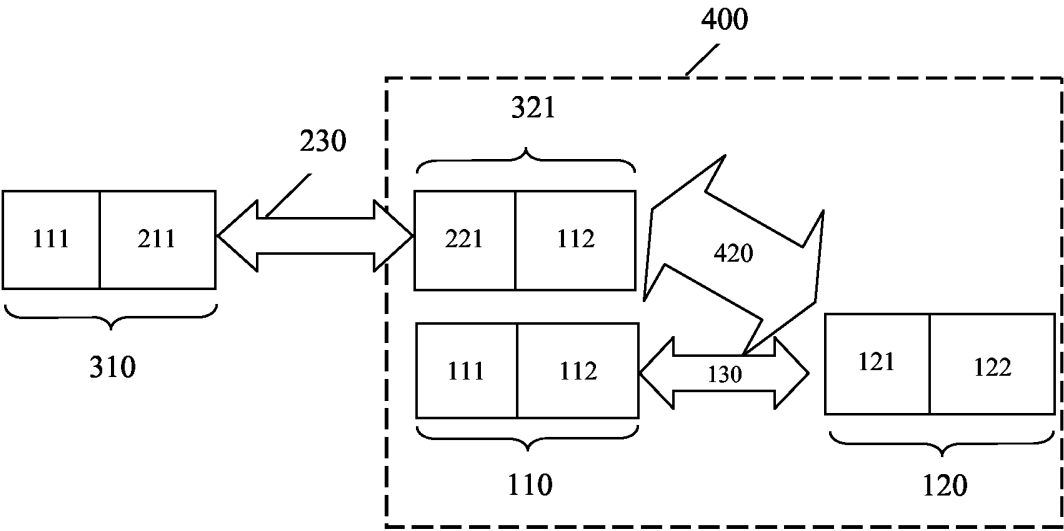


Fig. 4

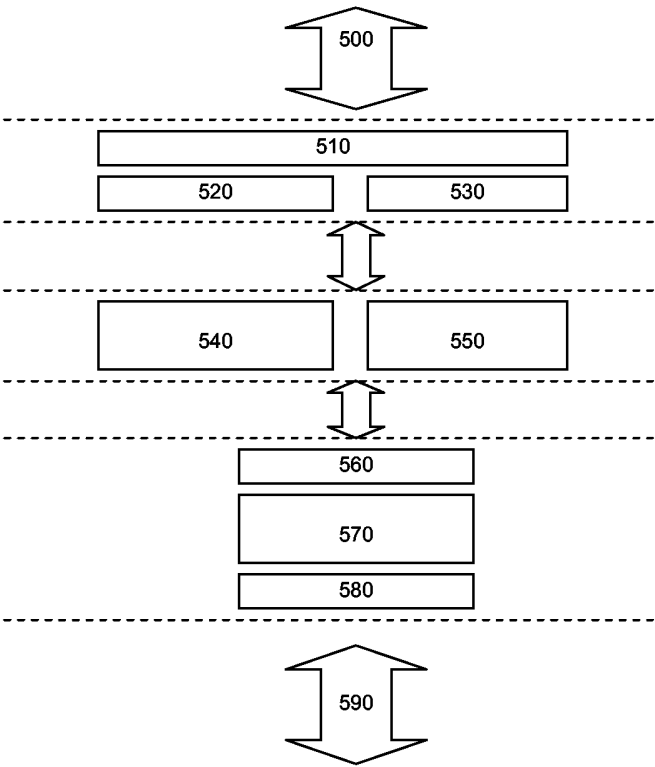


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2005/055450

A. CLASSIFICATION OF SUBJECT MATTER

G06F13/38

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)
G06F

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 131 134 A (HUANG ET AL) 10 October 2000 (2000-10-10) the whole document	1-4
X	DE 196 31 050 A1 (BERGLER, FRANK, 75223 NIEFERN-OESCHELBRONN, DE; KAEUFFERT, UWE, 75180) 5 February 1998 (1998-02-05) the whole document	1-4
X	US 2001/013079 A1 (LUKE DAVID D ET AL) 9 August 2001 (2001-08-09) the whole document	1-4
X	US 5 935 224 A (SVANCAREK ET AL) 10 August 1999 (1999-08-10) the whole document	1-4

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

13 February 2006

Date of mailing of the international search report

03/03/2006

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2005/055450

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
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