

**CIVIL COVER SHEET**

JS 44 - CAND (Rev. 11/04)

The JS-44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON PAGE TWO)

**I. (a) PLAINTIFFS**

Hitachi, Ltd., a Japanese corporation

**DEFENDANTS**

Proview International Holdings, Ltd., a Bermuda corporation; Proview Electronics Co., Ltd., a Taiwanese corporation; and Proview Technology, Inc., a California Corporation

(b) COUNTY OF RESIDENCE OF FIRST LISTED PLAINTIFF \_\_\_\_\_  
(EXCEPT IN U.S. PLAINTIFF CASES)

COUNTY OF RESIDENCE OF FIRST LISTED DEFENDANT \_\_\_\_\_  
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE TRACT OF LAND INVOLVED.

(c) ATTORNEYS (FIRM NAME, ADDRESS, AND TELEPHONE NUMBER)

Stephen J. Akerley  
McDermott Will & Emery LLP  
3150 Porter Drive  
Palo Alto, CA 94304-1212  
650.813.5000

ATTORNEYS (IF KNOWN)

**II. BASIS OF JURISDICTION** (PLACE AN 'X' IN ONE BOX ONLY)

- 1 U.S. Government Plaintiff  
 2 U.S. Government Defendant  
 3 Federal Question (U.S. Government Not a Party)  
 4 Diversity (Indicate Citizenship of Parties in Item III)

**III. CITIZENSHIP OF PRINCIPAL PARTIES** (PLACE AN 'X' IN ONE BOX FOR PLAINTIFF AND ONE BOX FOR DEFENDANT)

	PTF	DEF		PTF	DEF
Citizen of This State	<input type="checkbox"/> 1	<input type="checkbox"/> 1	Incorporated or Principal Place of Business In This State	<input type="checkbox"/> 4	<input type="checkbox"/> 4
Citizen of Another State	<input type="checkbox"/> 2	<input type="checkbox"/> 2	Incorporated and Principal Place of Business In Another State	<input type="checkbox"/> 5	<input type="checkbox"/> 5
Citizen or Subject of a Foreign Country	<input type="checkbox"/> 3	<input type="checkbox"/> 3	Foreign Nation	<input type="checkbox"/> 6	<input type="checkbox"/> 6

**IV. ORIGIN**

(PLACE AN "X" IN ONE BOX ONLY)

- Original Proceeding  
 Removed from State Court  
 Remanded from Appellate Court  
 Reinstated or Reopened  
 Transferred from Another district (specify)  
 Multidistrict Litigation  
 Appeal to District Judge from Magistrate Judgment

**V. NATURE OF SUIT** (PLACE AN "X" IN ONE BOX ONLY)

CONTRACT	TORTS		FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES
<input type="checkbox"/> 110 Insurance	<input type="checkbox"/> 310 Airplane	<input type="checkbox"/> 362 Personal Injury	<input type="checkbox"/> 610 Agriculture	<input type="checkbox"/> 422 Appeal 28 USC 158	<input type="checkbox"/> 400 State Reapportionment
<input type="checkbox"/> 120 Marine	<input type="checkbox"/> 315 Airplane Product Liability	<input type="checkbox"/> 365 Personal Injury Med. Malpractice	<input type="checkbox"/> 620 Other Food & Drug	<input type="checkbox"/> 423 Withdrawal 28 USC 157	<input type="checkbox"/> 410 Antitrust
<input type="checkbox"/> 130 Miller Act	<input type="checkbox"/> 320 Assault Libel & Slander	<input type="checkbox"/> 366 Personal Injury Product Liability	<input type="checkbox"/> 625 Drug Related Seizure of Property 21 USC 881	<b>PROPERTY RIGHTS</b>	<input type="checkbox"/> 430 Banks and Banking
<input type="checkbox"/> 140 Negotiable Instrument	<input type="checkbox"/> 330 Federal Employers Liability	<input type="checkbox"/> 368 Asbestos Personal Injury Product Liability	<input type="checkbox"/> 630 Liquor Laws	<input type="checkbox"/> 820 Copyrights	<input type="checkbox"/> 450 Commerce/ICC Rates/etc.
<input type="checkbox"/> 150 Recovery of Overpayment & Enforcement of Judgment	<input type="checkbox"/> 340 Marine	<b>PERSONAL PROPERTY</b>	<input type="checkbox"/> 640 RR & Truck	<input checked="" type="checkbox"/> 830 Patent	<input type="checkbox"/> 460 Deportation
<input type="checkbox"/> 151 Medicare Act	<input type="checkbox"/> 345 Marine Product Liability	<input type="checkbox"/> 370 Other Fraud	<input type="checkbox"/> 650 Airline Regs.	<input type="checkbox"/> 840 Trademark	<input type="checkbox"/> 470 Racketeer Influenced and Corrupt Organizations
<input type="checkbox"/> 152 Recovery of Defaulted Student Loans (Excl Veterans)	<input type="checkbox"/> 350 Motor Vehicle	<input type="checkbox"/> 371 Truth in Lending	<input type="checkbox"/> 660 Occupational Safety/Health	<b>SOCIAL SECURITY</b>	<input type="checkbox"/> 810 Selective Service
<input type="checkbox"/> 153 Recovery of Overpayment of Veteran's Benefits	<input type="checkbox"/> 355 Motor Vehicle Product Liability	<input type="checkbox"/> 380 Other Personal Property Damage	<input type="checkbox"/> 690 Other	<input type="checkbox"/> 861 HIA (1395ff)	<input type="checkbox"/> 850 Securities/Commodities/Exchange
<input type="checkbox"/> 160 Stockholders Suits	<input type="checkbox"/> 360 Other Personal Injury	<input type="checkbox"/> 385 Property Damage Product Liability	<b>LABOR</b>	<input type="checkbox"/> 862 Black Lung (923)	<input type="checkbox"/> 875 Customer Challenge 12 USC 3410
<input type="checkbox"/> 190 Other Contract			<input type="checkbox"/> 710 Fair Labor Standards Act	<input type="checkbox"/> 863 DIWC/DIWW (405(g))	<input type="checkbox"/> 891 Agricultural Acts
<input type="checkbox"/> 195 Contract Product Liability			<input type="checkbox"/> 720 Labor/Mgmt Relations	<input type="checkbox"/> 864 SSID Title XVI	<input type="checkbox"/> 892 Economic Stabilization Act
<input type="checkbox"/> 196 Franchise			<input type="checkbox"/> 730 Labor/Mgmt Reporting & Disclosure Act	<input type="checkbox"/> 865 RSI (405(g))	<input type="checkbox"/> 893 Environmental Matters
<b>REAL PROPERTY</b>	<b>CIVIL RIGHTS</b>	<b>PRISONER PETITIONS</b>	<input type="checkbox"/> 740 Railway Labor Act	<b>FEDERAL TAX SUITS</b>	<input type="checkbox"/> 894 Energy Allocation Act
<input type="checkbox"/> 210 Land Condemnation	<input type="checkbox"/> 441 Voting	<input type="checkbox"/> 510 Motion to Vacate Sentence Habeas Corpus:	<input type="checkbox"/> 790 Other Labor Litigation	<input type="checkbox"/> 870 Taxes (U.S. Plaintiff or Defendant)	<input type="checkbox"/> 895 Freedom of Information Act
<input type="checkbox"/> 220 Foreclosure	<input type="checkbox"/> 442 Employment	<input type="checkbox"/> 530 General	<input type="checkbox"/> 791 Empl. Ret. Inc. Security Act	<input type="checkbox"/> 871 IRS - Third Party 26 USC 7609	<input type="checkbox"/> 900 Appeal of Fee Determination Under Equal Access to Justice
<input type="checkbox"/> 230 Rent Lease & Ejectment	<input type="checkbox"/> 443 Housing	<input type="checkbox"/> 535 Death Penalty			<input type="checkbox"/> 950 Constitutionality of State Statutes
<input type="checkbox"/> 240 Torts to Land	<input type="checkbox"/> 444 Welfare	<input type="checkbox"/> 540 Mandamus & Other			<input type="checkbox"/> 890 Other Statutory Actions
<input type="checkbox"/> 245 Tort Product Liability	<input type="checkbox"/> 440 Other Civil Rights	<input type="checkbox"/> 550 Civil Rights			
<input type="checkbox"/> 290 All Other Real Property	<input type="checkbox"/> 445 Amer w/disab - Empl	<input type="checkbox"/> 555 Prison Condition			
	<input type="checkbox"/> 446 Amer w/ disab - Other				
	<input type="checkbox"/> 448 Consumer Credit				
	<input type="checkbox"/> 490 Cable/Satellite TV				

**VI. CAUSE OF ACTION** (CITE THE US CIVIL STATUTE UNDER WHICH YOU ARE FILING AND WRITE A BRIEF STATEMENT OF CAUSE. DO NOT CITE JURISDICTIONAL STATUTES UNLESS DIVERSITY)

**VII. REQUESTED IN COMPLAINT:**  CHECK IF THIS IS A CLASS ACTION DEMAND \$ 0.00 UNDER F.R.C.P. 23  CHECK YES only if demanded in complaint: JURY DEMAND:  YES  NO

**VIII. RELATED CASE(S) IF ANY** PLEASE REFER TO CIVIL L.R. 3-12 CONCERNING REQUIREMENT TO FILE "NOTICE OF RELATED CASE".

**IX. DIVISIONAL ASSIGNMENT** (CIVIL L.R. 3-2) (PLACE AN "X" IN ONE BOX ONLY)  SAN FRANCISCO/OAKLAND  SAN JOSE

DATE SIGNATURE OF ATTORNEY OF RECORD

June 6, 2005

*Elaine M. Heal*  
Elaine M. Heal

UNITED STATES DISTRICT COURT  
NORTHERN DISTRICT OF CALIFORNIA

Hitachi, Ltd., a Japanese corporation

SUMMONS IN A CIVIL CASE

v.

CASE NUMBER:

Proview International Holdings, Ltd., a  
Bermuda corporation; Proview Electronics  
Co., Ltd., a Taiwanese corporation; and  
Proview Technology, Inc., a California  
Corporation

**C 05 02305**

**PVT**

TO:

Proview Technology, Inc.,  
a California corporation

**YOU ARE HEREBY SUMMONED** and required to serve upon PLAINTIFF'S ATTORNEY

Stephen J. Akerley  
Elaine M. Heal  
McDermott Will & Emery LLP  
3150 Porter Drive  
Palo Alto, CA 94304-1212  
Telephone: 650.813.5000  
Facsimile: 650.813.5100

an answer to the complaint which is herewith served upon you, within 20 days after service of this summons upon you, exclusive of the day of service. If you fail to do so, judgement by default will be taken against you for the relief demanded in the complaint. You must also file your answer with the Clerk of this Court within a reasonable period of time after service.

**RICHARD W. WIEKING**

**JUN - 6 2005**

CLERK

DATE

(BY) DEPUTY CLERK

MARY ANN BUCKLEY

1 McDERMOTT WILL & EMERY LLP  
Stephen J. Akerley (State Bar No. 160757)  
2 [sakerley@mwe.com](mailto:sakerley@mwe.com)  
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ORIGINAL  
FILED

JUN - 6 2005

RICHARD W. WIERKING  
CLERK, U.S. DISTRICT COURT,  
NORTHERN DISTRICT OF CALIFORNIA

6 Attorneys for Plaintiff, HITACHI, LTD.,  
7 a Japanese corporation

8 UNITED STATES DISTRICT COURT  
9 NORTHERN DISTRICT OF CALIFORNIA

10 SAN FRANCISCO DIVISION

11 HITACHI, LTD., a Japanese corporation

**C 05 02305**  
Case No.

**PVT**

12 Plaintiff,

ELECTRONIC CASE FILING

13 v.

COMPLAINT

14 PROVIEW INTERNATIONAL HOLDINGS,  
15 LTD., a Bermuda corporation; PROVIEW  
16 ELECTRONICS CO., LTD., a Taiwanese  
17 corporation; and PROVIEW  
TECHNOLOGY, INC., a California  
18 corporation,

DEMAND FOR JURY TRIAL

18 Defendants.

19  
20 Plaintiff HITACHI, LTD. ("Hitachi"), alleges by and through its attorneys the following  
21 Complaint against defendants Proview International Holdings Ltd. ("Proview Hong Kong");  
22 Proview Electronics Co., Ltd. ("Proview Taiwan"); and Proview Technology, Inc. ("Proview  
23 USA"); (collectively "Defendants"):

24 **PARTIES**

- 25 1. Plaintiff Hitachi is a Japanese corporation.  
26 2. On information and belief, Defendant Proview Hong Kong is a Bermuda  
27 corporation, with a regular and established place of business located Unit 1901 19th Fl Tower 1  
28 Enterprise Square, 9 Sheung Yuet Road Kowloon Bay, Kowloon, China (Hong Kong).

COMPLAINT AND DEMAND FOR JURY TRIAL

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ATTORNEYS AT LAW  
PALO ALTO

1           3.       On information and belief, Defendant Proview Taiwan is a Taiwanese corporation  
2 with a regular and established place of business located at 6F, No. 1, Pau-Sheng Road, Yung Ho  
3 City, Taipei County, Taiwan.

4           4.       On information and belief, Defendant Proview USA is a corporation organized  
5 under the laws of the State of California with a regular and established place of business located  
6 at 7373 Hunt Avenue, Garden Grove, California, 92841.

7                               **JURISDICTION AND VENUE**

8           5.       The court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and  
9 1338(a) because this action arises under the patent laws of the United States, 35 U.S.C. §§ 1 *et*  
10 *seq.*

11          6.       Defendants are subject to personal jurisdiction in this District because they each  
12 regularly conduct business in this District and each purposefully ships products, including  
13 products at issue in this case, into this District through an established distribution channel.

14          7.       Venue is proper in this federal district pursuant to 28 U.S.C. §§ 1391(b)-(c) and  
15 1400(b) on information and belief that Defendants have done business in this District, have  
16 committed acts of infringement in this District, and continue to commit acts of infringement in  
17 this District, entitling Hitachi to relief.

18                               **INTRADISTRICT ASSIGNMENT**

19          8.       This is an Intellectual Property Action and shall therefore be assigned on a district-  
20 wide basis in accordance with Local Rule 3-2(c).

21                               **GENERAL ALLEGATIONS**

22          9.       Hitachi is the sole and exclusive owner of United States Patent No. 6,247,090  
23 (“the ‘090 patent”), a true and correct copy of which is attached hereto as Exhibit A, which was  
24 duly and legally issued on June 12, 2001 and is entitled “Display Apparatus Enabled to Control  
25 Communicatability With An External Computer Using Identification Information.”

26          10.       Hitachi is the sole and exclusive owner of United States Patent No. 6,549,970  
27 (“the ‘970 patent”), a true and correct copy of which is attached hereto as Exhibit B, which was  
28



1 duly and legally issued on April 15, 2003 and is entitled "Display Unit With Controller Enabling  
2 Bi-directional Communication With Computer."

3 11. Hitachi is the sole and exclusive owner of United States Patent No. 6,513,088  
4 ("the '088 patent"), a true and correct copy of which is attached hereto as Exhibit C, which was  
5 duly and legally issued on January 28, 2003 and is entitled "Display Unit and Method Enabling  
6 Bi-Directional Communication With Video Source."

7 12. On information and belief, each Defendant makes, uses, imports, distributes, offers  
8 for sale and/or sells certain computer monitor products ("Accused Products") in the United States  
9 which infringe the '090 patent, the '970 patent, and/or the '088 patent.

10 13. Hitachi has complied with the requirements of 35 U.S.C. § 287(a) and is entitled to  
11 collect damages for infringement occurring prior to suit with respect to the '090 patent, the '970  
12 patent and/or the '088 patent.

13 **COUNT I**

14 **Infringement of the '090 Patent**

15 14. Hitachi incorporates by reference paragraphs 1- 13 of this Complaint as though  
16 fully and completely set forth herein.

17 15. Defendants, in violation of 35 U.S.C. § 271(a), have been and are currently  
18 infringing, directly and/or indirectly, the '090 patent by, among other things, making, using,  
19 importing, distributing, offering for sale and/or selling the Accused Products without authority or  
20 license from Hitachi.

21 16. Defendants have actively induced and are currently actively inducing infringement  
22 of the '090 patent, in violation of 35 U.S.C. § 271(b), by knowingly and intentionally  
23 encouraging or aiding third parties to infringe the '090 patent, without authority or license from  
24 Hitachi.

25 17. Defendants have contributorily infringed and are contributorily infringing the '090  
26 patent, in violation of 35 U.S.C. § 271(c), by selling, or offering for sale to third parties, the  
27 Accused Products especially adapted for use in an infringement of the '090 patent, without  
28 authority or license from Hitachi.

1 18. Defendants' infringement of the '090 patent has been and continues to be willful.

2 19. Unless enjoined, Defendants will continue to infringe the '090 patent, and Hitachi  
3 will suffer irreparable injury as a direct and proximate result of the conduct of Defendants.

4 20. Hitachi has been damaged by Defendants' infringing conduct and Defendants are  
5 therefore liable to Hitachi for actual damages suffered by Hitachi, and in no event less than a  
6 reasonable royalty, as well as treble damages.

7 WHEREFORE, Hitachi seeks relief as set forth in the Request for Relief, below.

8 **COUNT II**

9 **Infringement of the '970 Patent**

10 21. Hitachi incorporates by reference paragraphs 1-13 of this Complaint as though  
11 fully and completely set forth herein.

12 22. Defendants, in violation of 35 U.S.C. § 271(a), have been and are currently  
13 infringing, directly and/or indirectly, the '970 patent by, among other things, making, using,  
14 importing, distributing, offering for sale and/or selling the Accused Products without authority or  
15 license from Hitachi.

16 23. Defendants have actively induced and are currently actively inducing infringement  
17 of the '970 patent, in violation of 35 U.S.C. § 271(b), by knowingly and intentionally  
18 encouraging or aiding third parties to infringe the '970 patent, without authority or license from  
19 Hitachi.

20 24. Defendants have contributorily infringed and are contributorily infringing the '970  
21 patent, in violation of 35 U.S.C. § 271(c), by selling, or offering for sale to third parties, the  
22 Accused Products especially adapted for use in an infringement of the '970 patent, without  
23 authority or license from Hitachi.

24 25. Defendants' infringement of the '970 patent has been and continues to be willful.

25 26. Unless enjoined, Defendants will continue to infringe the '970 patent, and Hitachi  
26 will suffer irreparable injury as a direct and proximate result of the conduct of Defendants.

27 27. Hitachi has been damaged by Defendants' infringing conduct and Defendants are  
28 therefore liable to Hitachi for actual damages suffered by Hitachi, and in no event less than a

1 reasonable royalty, as well as treble damages.

2 WHEREFORE, Hitachi seeks relief as set forth in the Request for Relief, below.

3 **COUNT III**

4 **Infringement of the '088 Patent**

5 28. Hitachi incorporates by reference paragraphs 1- 13 of these Complaint as though  
6 fully and completely set forth herein.

7 29. Defendants, in violation of 35 U.S.C. § 271(a), have been and are currently  
8 infringing, directly and/or indirectly, the '088 patent by, among other things, making, using,  
9 importing, distributing, offering for sale and/or selling the Accused Products without authority or  
10 license from Hitachi.

11 30. Defendants have actively induced and are currently actively inducing infringement  
12 of the '088 patent, in violation of 35 U.S.C. § 271(b), by knowingly and intentionally  
13 encouraging or aiding third parties to infringe the '088 patent, without authority or license from  
14 Hitachi.

15 31. Defendants have contributorily infringed and are contributorily infringing the '088  
16 patent, in violation of 35 U.S.C. § 271(c), by selling, or offering for sale to third parties, the  
17 Accused Products especially adapted for use in an infringement of the '088 patent, without  
18 authority or license from Hitachi.

19 32. Defendants' infringement of the '088 patent has been and continues to be willful.

20 33. Unless enjoined, Defendants will continue to infringe the '088 patent, and Hitachi  
21 will suffer irreparable injury as a direct and proximate result of the conduct of Defendants.

22 34. Hitachi has been damaged by Defendants' infringing conduct and Defendants are  
23 therefore liable to Hitachi for actual damages suffered by Hitachi, and in no event less than a  
24 reasonable royalty, as well as treble damages.

25 WHEREFORE, Hitachi seeks relief as set forth in the Request for Relief, below.

26 **REQUEST FOR RELIEF**

27 Wherefore, Hitachi prays that the Court enter judgment as follows:

28 1. For a judicial determination and declaration that the patents in suit are valid and

MCDERMOTT WILL & EMERY LLP  
ATTORNEYS AT LAW  
PALO ALTO

1 enforceable;

2 2. For a judicial determination and a declaration that the patents in suit are infringed  
3 by Defendants and that said infringement is and has been willful;

4 3. For an order permanently enjoining Defendants, their directors, employees,  
5 attorneys, agents, parties in privity with and all persons in active concert or participation with any  
6 of the foregoing from further acts of infringement, contributory infringement, or inducing  
7 infringement of the patents in suit;

8 4. For damages resulting from Defendants' infringement of the patents in suit and the  
9 trebling of such damages due to the willful nature of said infringement;

10 5. For an award of interest on damages;

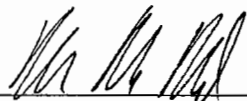
11 6. For a declaration that this case is exceptional pursuant to 35 U.S.C. § 285,  
12 including an award of attorneys fees; and

13 7. For an award of such other and further relief as the Court deems just and proper.

14 Dated: June 6, 2005

15 Respectfully submitted,

16 McDERMOTT WILL & EMERY LLP

17  
18 By:   
19 Stephen J. Akerley  
Elaine M. Heal

20 McDermott Will & Emery LLP  
21 3150 Porter Drive  
22 Palo Alto, CA 94304  
Telephone: 650.813.5000  
Facsimile: 650.813.5100

23 Attorneys for Plaintiff, HITACHI, LTD.,  
24 a Japanese corporation  
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26  
27  
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McDERMOTT WILL & EMERY LLP  
ATTORNEYS AT LAW  
PALO ALTO



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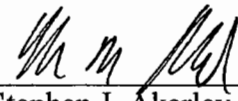
**DEMAND FOR JURY TRIAL**

Plaintiff HITACHI, LTD. hereby demands a trial by jury on all issues properly triable to a jury in this action.

Dated: June 6, 2005

Respectfully submitted,

McDERMOTT WILL & EMERY LLP

By:   
\_\_\_\_\_  
Stephen J. Akerley  
Elaine M. Heal

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Palo Alto, CA 94304  
Telephone: 650.813.5000  
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Attorneys for Plaintiff, HITACHI, LTD.,  
a Japanese corporation

MPK 92256-1.017575.0688

McDERMOTT WILL & EMERY LLP  
ATTORNEYS AT LAW  
PALO ALTO

# **Exhibit A**



US006247090B1

(12) **United States Patent**  
**Arai et al.**

(10) **Patent No.:** US 6,247,090 B1  
 (45) **Date of Patent:** Jun. 12, 2001

(54) **DISPLAY APPARATUS ENABLED TO CONTROL COMMUNICABILITY WITH AN EXTERNAL COMPUTER USING IDENTIFICATION INFORMATION**

(75) Inventors: **Ikuya Arai; Kouji Kitou**, both of Yokohama (JP)

(73) Assignee: **Hitachi, Ltd.**, Tokyo (JP)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/265,363**

(22) Filed: **Mar. 10, 1999**

**Related U.S. Application Data**

(63) Continuation of application No. 08/833,346, filed on Apr. 4, 1997, now Pat. No. 5,887,147, which is a continuation of application No. 08/598,903, filed on Feb. 9, 1996, now Pat. No. 5,652,845, which is a continuation of application No. 08/190,848, filed on Feb. 3, 1994, now abandoned.

(30) **Foreign Application Priority Data**

Feb. 10, 1993 (JP) ..... 5-022212

(51) **Int. Cl.<sup>7</sup>** ..... **G06F 13/38**

(52) **U.S. Cl.** ..... **710/129; 710/62; 710/64; 345/99; 345/132**

(58) **Field of Search** ..... **710/101-103, 710/129, 62, 63, 64, 65, 72, 8-11, 14, 15-17, 2; 395/186, 187.01, 188.01; 345/58, 98-100, 132, 204; 709/236, 237, 249, 250**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,047,158 9/1977 Jennings .  
 4,169,262 9/1979 Schwartz et al. .... 340/744  
 4,177,462 12/1979 Chung ..... 340/703

(List continued on next page.)

**FOREIGN PATENT DOCUMENTS**

37 22 169 A1 1/1989 (DE) .

43 36 116 A1 5/1994 (DE) .  
 0 456 923 A1 11/1991 (EP) .  
 0612053A1 8/1994 (EP) .  
 61-84688 4/1986 (JP) .  
 1-321475 12/1989 (JP) .  
 2-250576 10/1990 (JP) .  
 3-56931 3/1991 (JP) .  
 3-116093 5/1991 (JP) .  
 3-261995 11/1991 (JP) .  
 5-46106 2/1993 (JP) .  
 5-232918 9/1993 (JP) .

**OTHER PUBLICATIONS**

"Display Function Identification", IBM Technical Disclosure Bulletin, vol. 25, No. 12, pp. 5568-5579, May 1980.

"Monitor Identification Technique", IBM Technical Disclosure Bulletin, vol. 30, No. 2, pp. 839-840, Jul. 1990.

"Display Controller Set up as a Function of Display Monitor type, Display Jumper Settings and Amount of Vram", IBM Technical Disclosure Bulletin, vol. 30, No. 2, pp. 352-353, Jul. 1990.

"Improved Method of Monitor Identification and Mode Control", IBM Technical Disclosure Bulletin, vol. 33, No. 5, pp. 289-291, Oct. 1990.

(List continued on next page.)

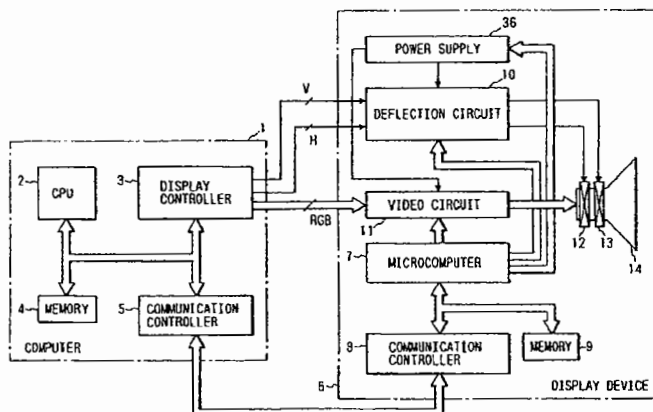
*Primary Examiner*—Robert Beausoleil  
*Assistant Examiner*—Raymond N Phan

(74) *Attorney, Agent, or Firm*—Antonelli, Terry, Stout & Kraus, LLP

(57) **ABSTRACT**

In the computer, the control information for screen display incorporated in the keyboard and software is processed by CPU2 and sent to the display device via the communication controller. The microcomputer in the display device fetches the control information from the communication controller and controls a predetermined part of the video circuit or deflection circuit. In this case, identification information is sent to the display device from the computer first and when it matches with the identification information stored in the memory, the above control is permitted.

**4 Claims, 12 Drawing Sheets**



## US 6,247,090 B1

Page 2

## U.S. PATENT DOCUMENTS

4,197,590	4/1980	Sukonick et al. ....	364/900	5,457,473	* 10/1995	Arai et al. ....	345/10
4,342,029	7/1982	Hofmanis et al. ....	340/703	5,483,255	* 1/1996	Numao ....	345/98
4,450,535	* 5/1984	De Pommery et al. ....	395/186	5,550,966	* 8/1996	Drake et al. ....	395/154
4,747,041	5/1988	Engel et al. .		5,599,231	* 2/1997	Hibino et al. ....	463/29
4,800,376	1/1989	Suga et al. .		5,887,147	* 3/1999	Arai et al. ....	710/106
4,882,687	11/1989	Gordon ....	364/518	5,896,546	* 4/1999	Monahan et al. ....	710/10
4,893,248	* 1/1990	Pitts et al. ....	364/464.01	5,909,592	* 6/1999	Shipman ....	710/10
4,922,448	5/1990	Kunieda et al. .		5,948,091	* 9/1999	Kerigan et al. ....	710/129
4,991,023	* 2/1991	Nicols ....	358/242	6,012,103	* 1/2000	Sartore et al. ....	710/8
5,010,238	4/1991	Kadono et al. .					
5,276,458	* 1/1994	Sawdon ....	345/132				
5,276,875	1/1994	Satoh .					
5,282,247	* 1/1994	McLean et al. ....	380/4				
5,309,504	* 5/1994	Morganstein ....	379/67				
5,317,691	5/1994	Traeger .					
5,353,423	10/1994	Hamid et al. .					
5,375,210	* 12/1994	Monnes et al. ....	710/1				

## OTHER PUBLICATIONS

"Improvements to Display Identification", IBM Technical Disclosure Bulletin, vol. 33, No. 6B, pp. 83-85.  
 "Self-Identification Protocol Initialization", IBM Technical Disclosure Bulletin, vol. 33, No. 10 A, pp. 406-407, Mar. 1991.

\* cited by examiner



FIG. 1

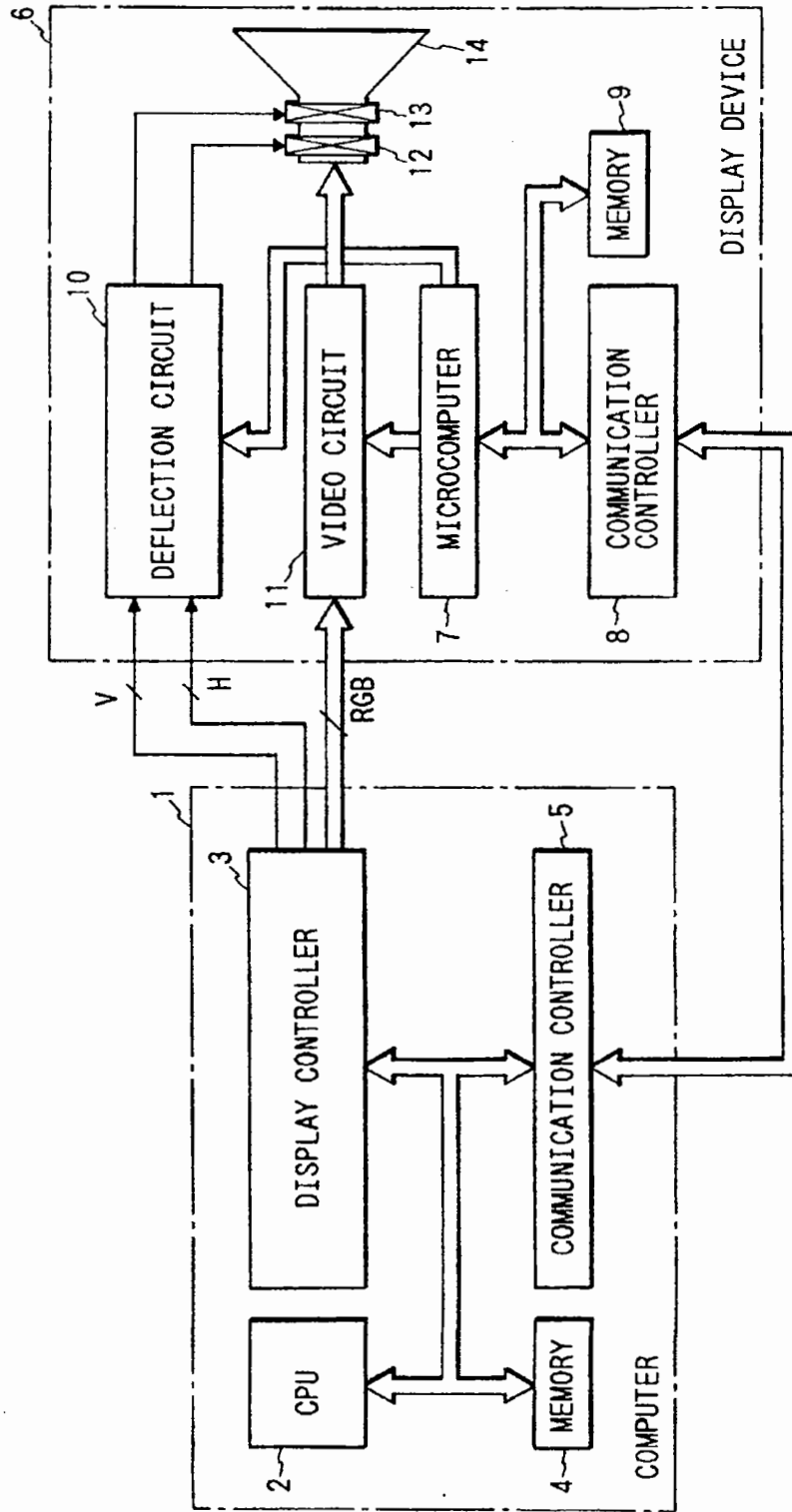


FIG. 2

ADDRESS 1	NUMBER OF DATA SET	REGISTERED ID NUMBERS
ADDRESS 2	DATA AREA 1 FOR DELIVERY ADJUSTMENT	
ADDRESS 3	DATA AREA 2 FOR DELIVERY ADJUSTMENT	
⋮	⋮	
ADDRESS i	ADJUSTMENT DATA AREA 1 FOR USER	
ADDRESS i+1	ADJUSTMENT DATA AREA 2 FOR USER	
⋮	⋮	

FIG. 3

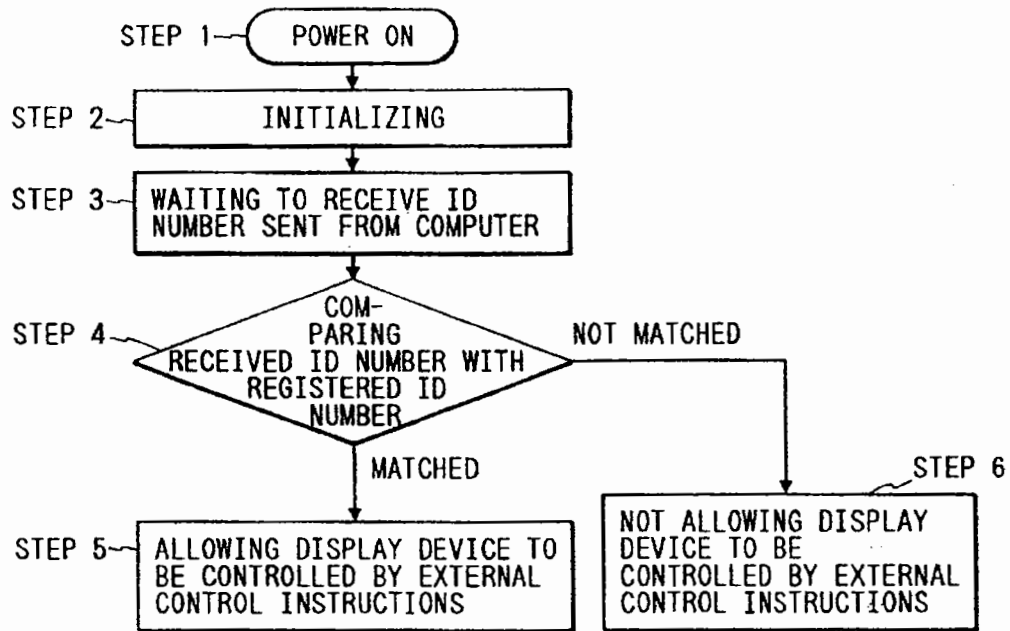


FIG. 4

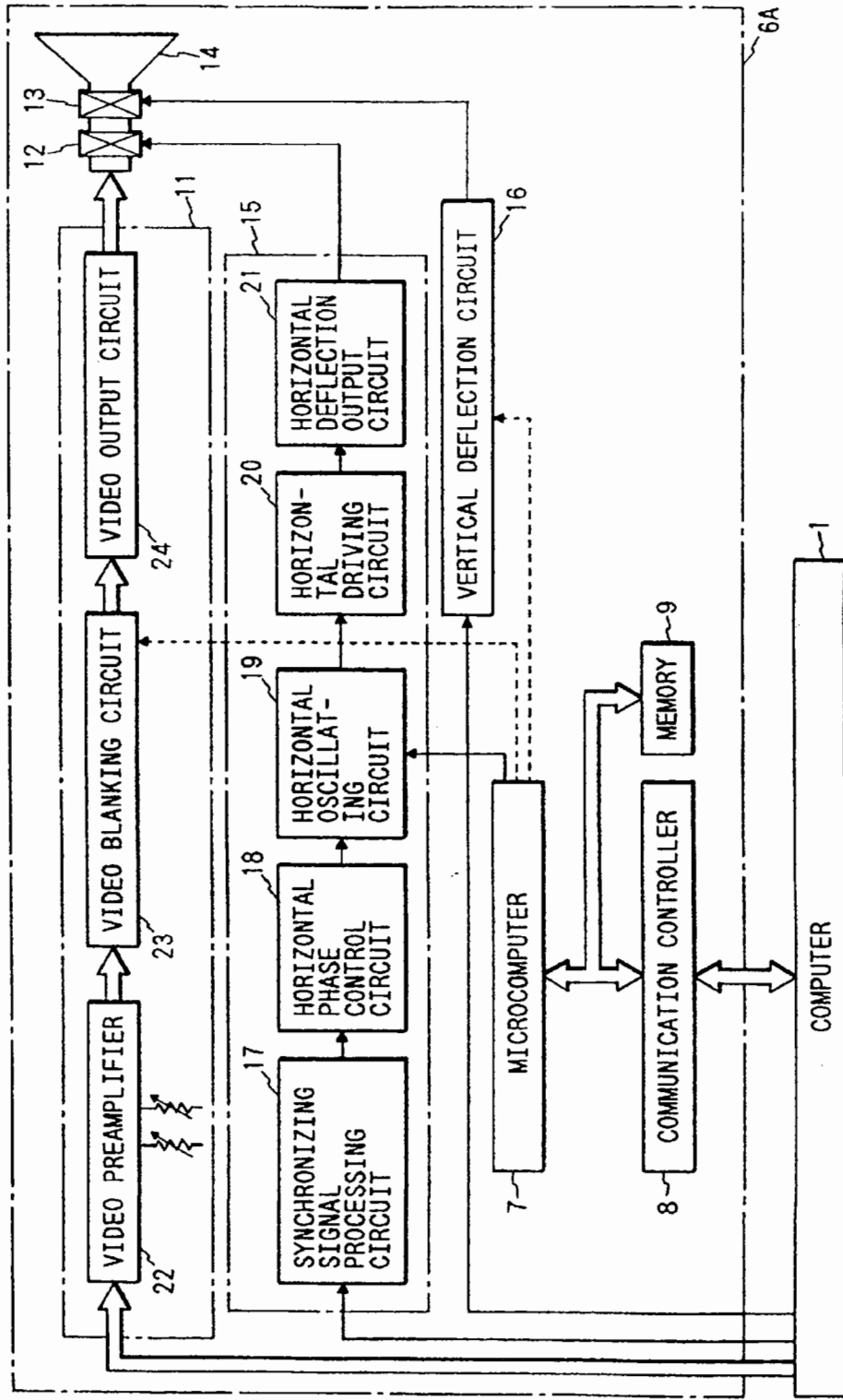




FIG. 5

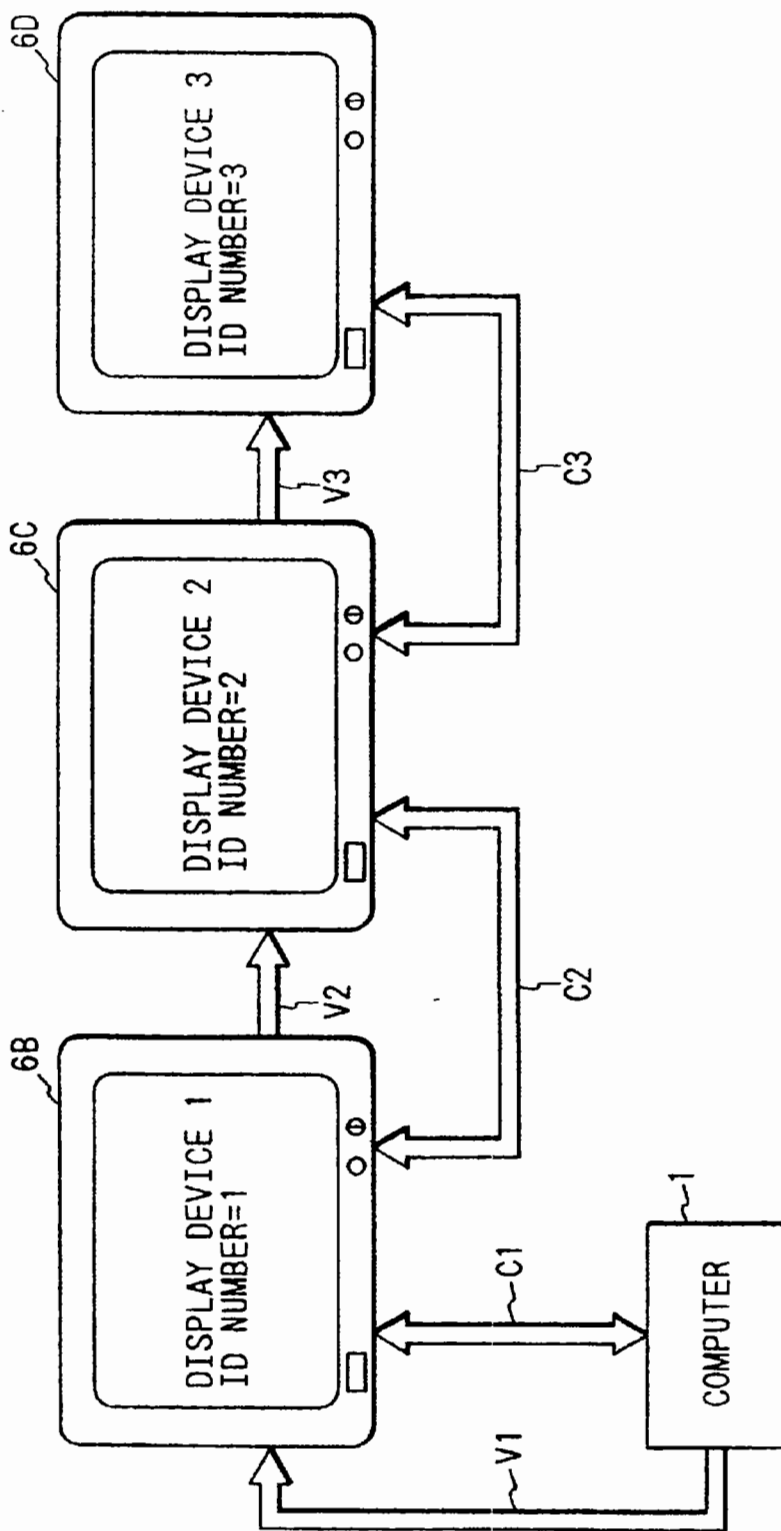


FIG. 6

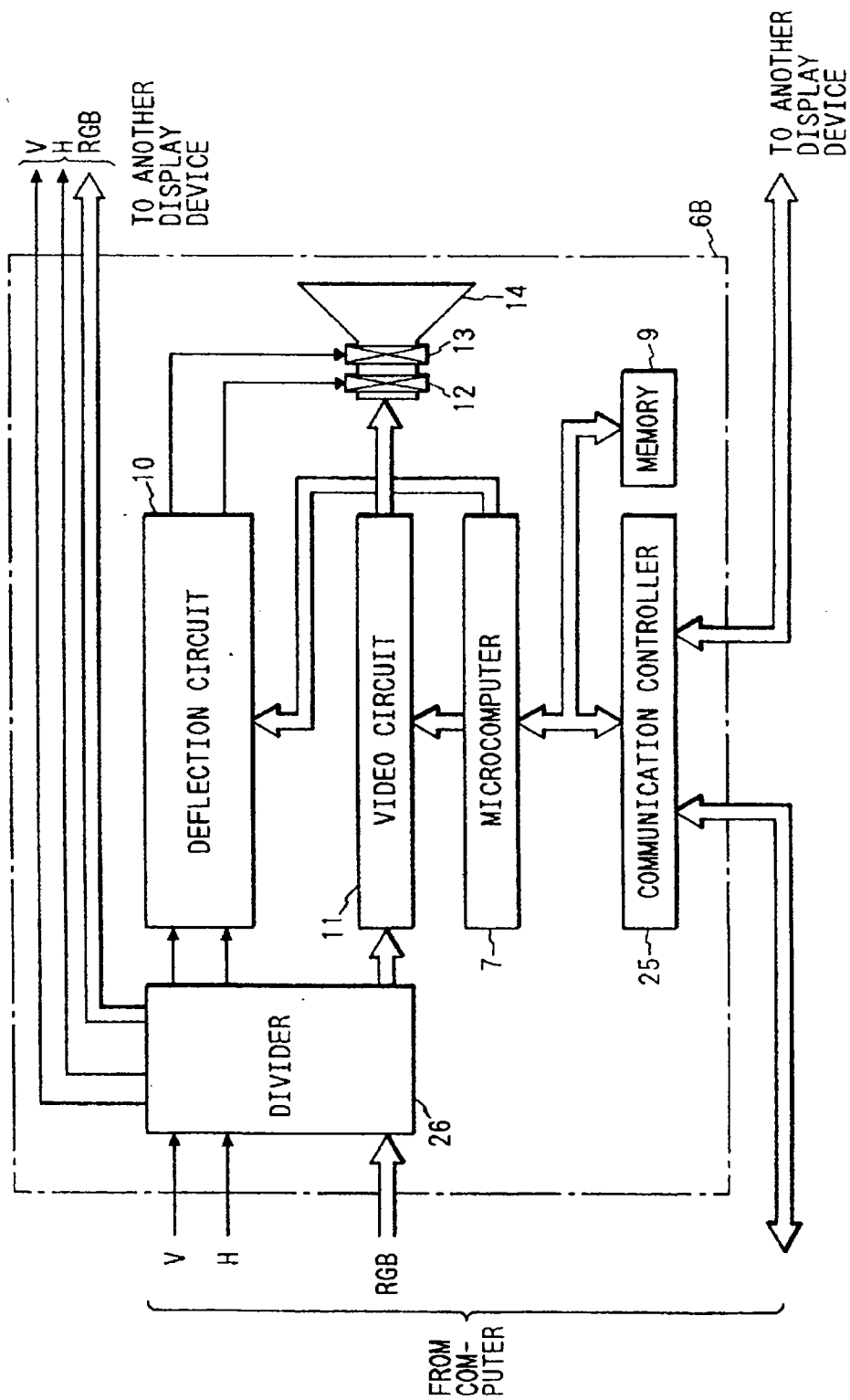


FIG. 7

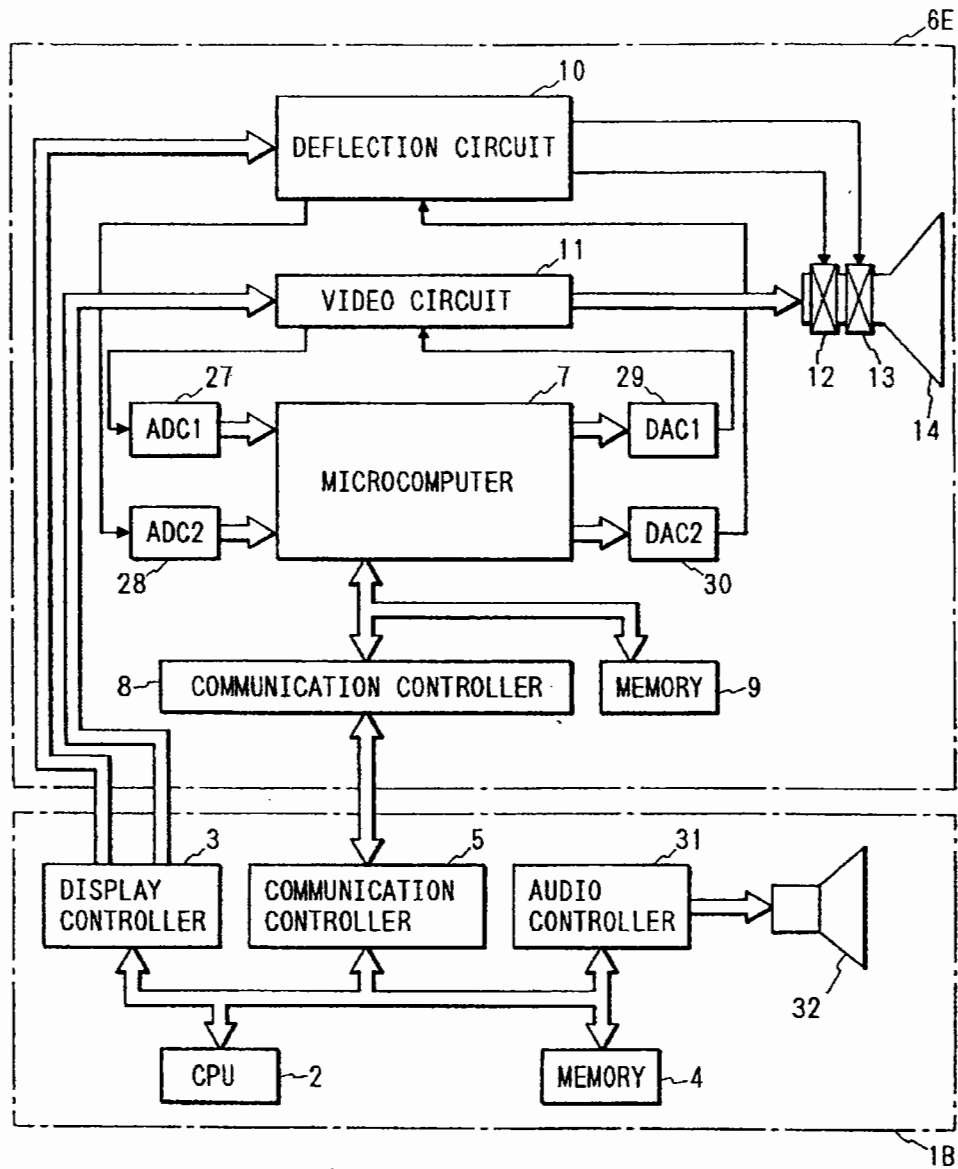


FIG. 8

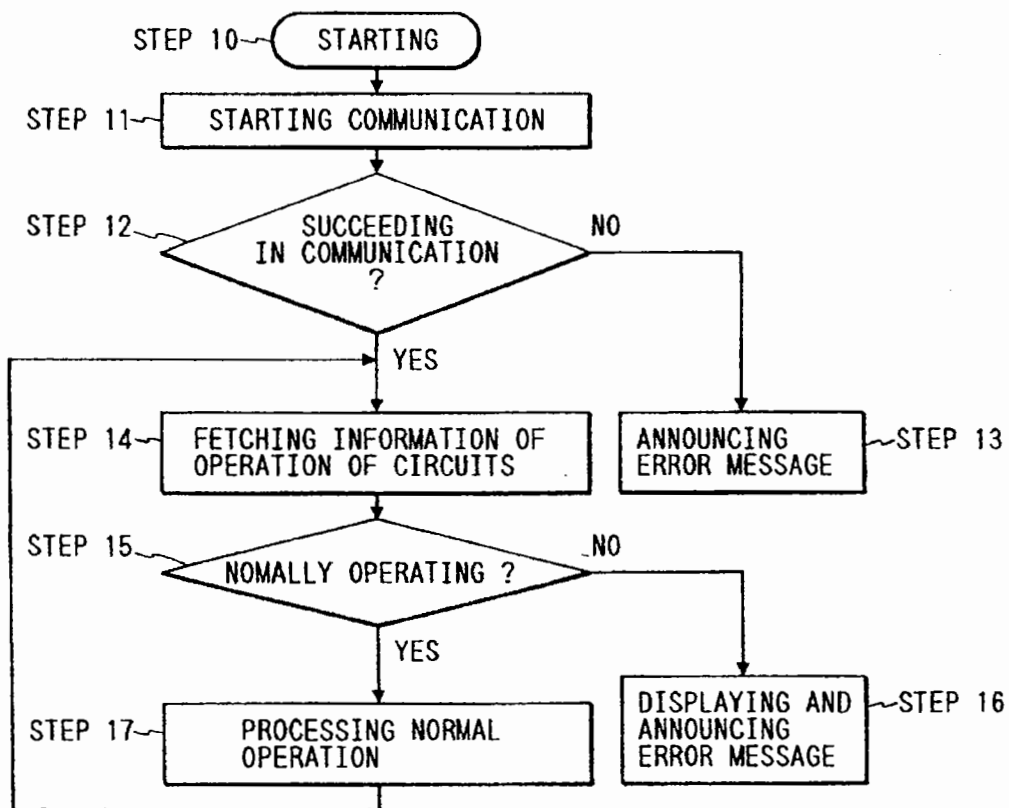




FIG. 9

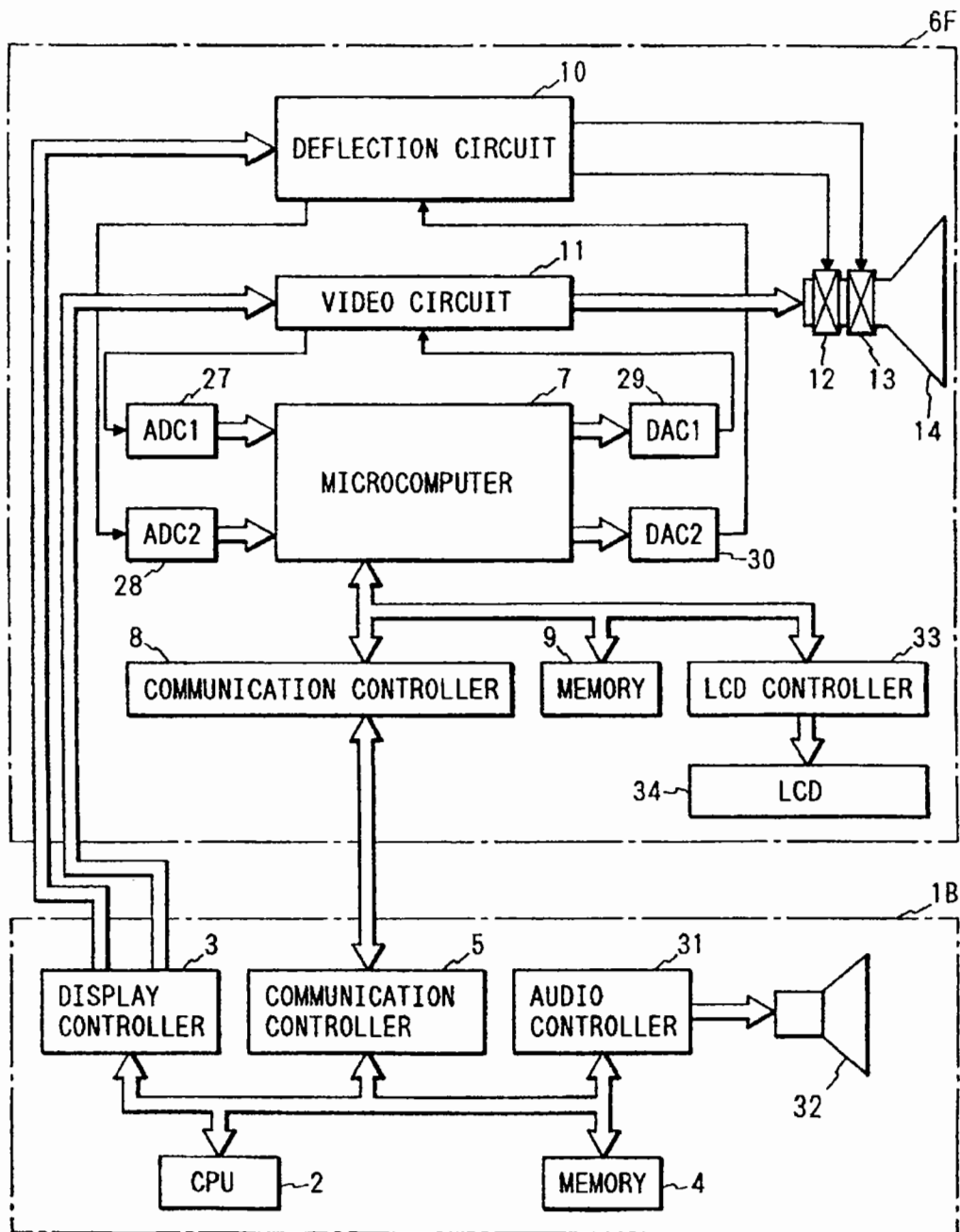


FIG. 10

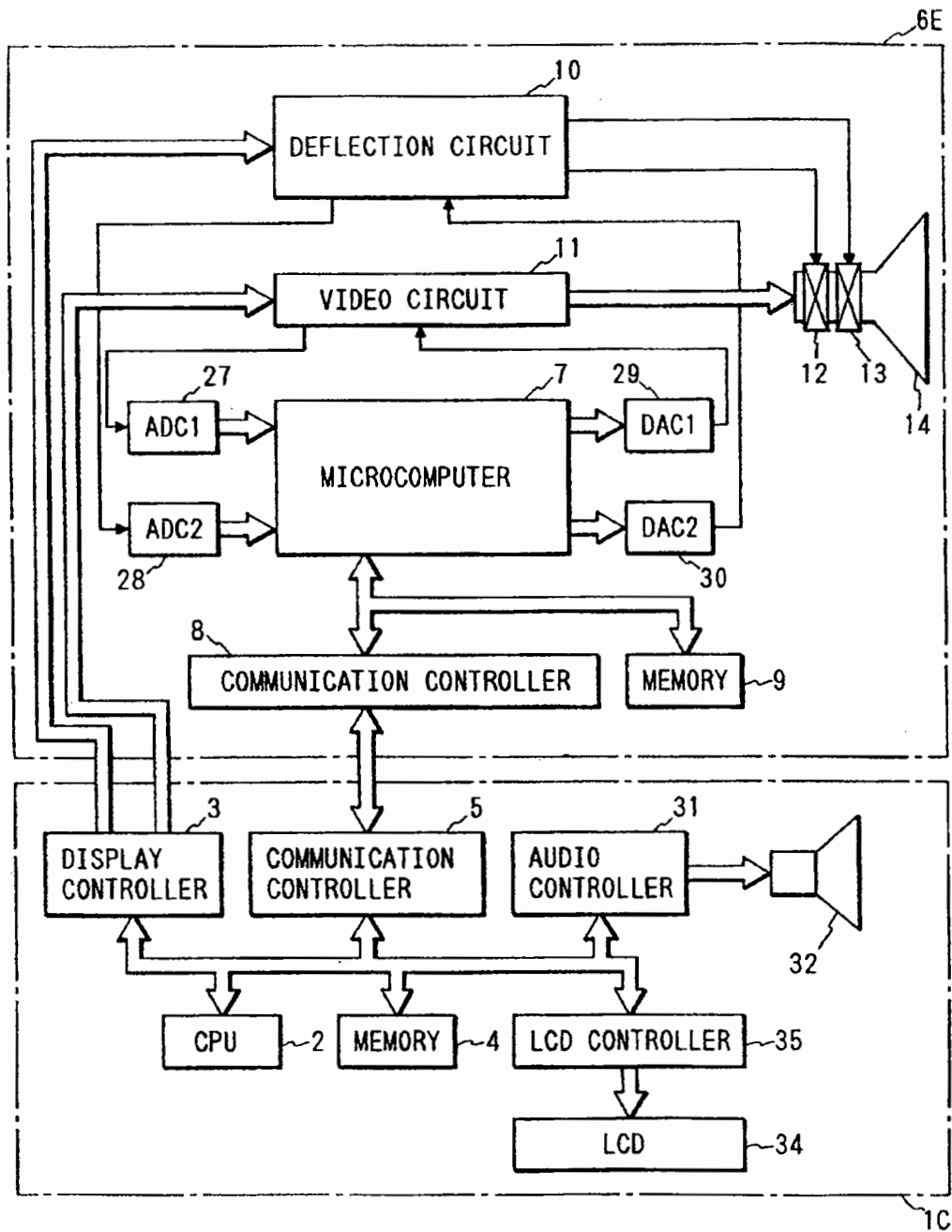


FIG. 11

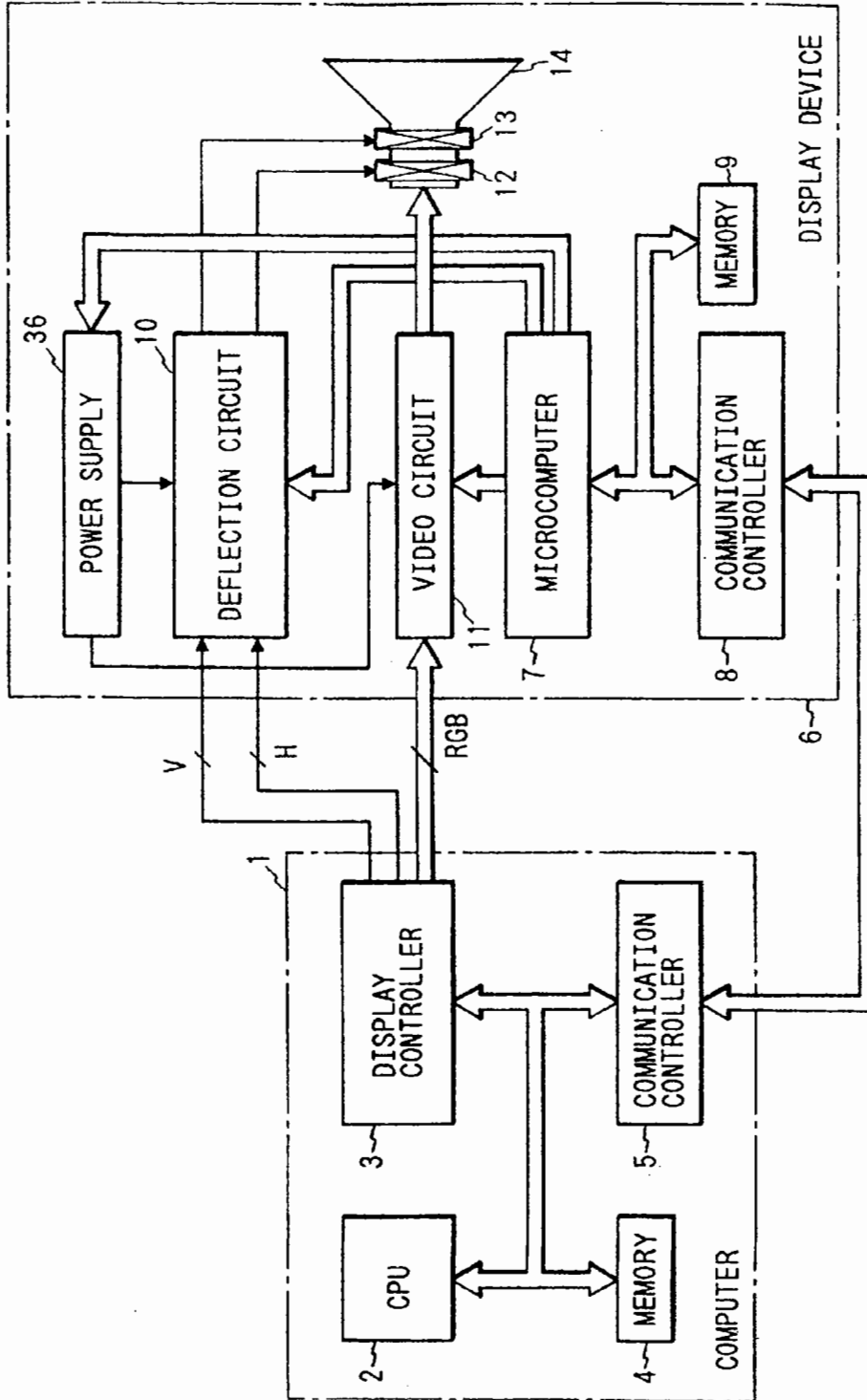
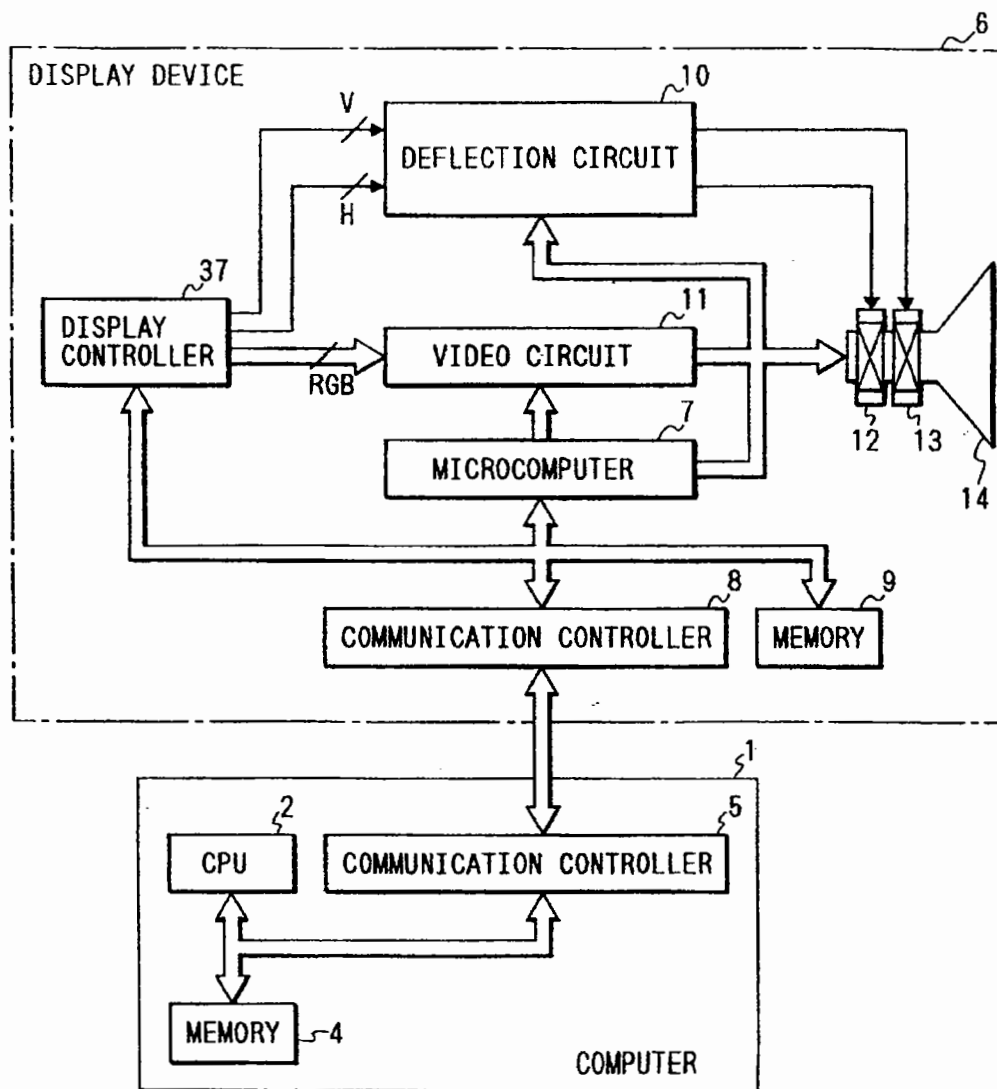


FIG. 12





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**DISPLAY APPARATUS ENABLED TO  
CONTROL COMMUNICABILITY WITH  
AN EXTERNAL COMPUTER USING  
IDENTIFICATION INFORMATION**

**CROSS REFERENCE TO RELATED  
APPLICATION**

This is a continuation of U.S. application Serial No. 08/833,346, filed Apr. 4, 1997, now U.S. Pat. No. 5,887,147, issued Mar. 23, 1999, which is a continuation of U.S. application Ser. No. 08/598,903, filed Feb. 9, 1996, now U.S. Pat. No. 5,652,845, issued Jul. 29, 1997, which is a continuation of U.S. application Ser. No. 08/190,848, filed Feb. 3, 1994, now abandoned, the subject matter of which is incorporated by reference herein.

**BACKGROUND OF THE INVENTION**

The present invention relates to an information output system or display apparatus including a computer and an information output device such as a display device or a printer as a computer terminal and more particularly to an information output system or display apparatus for performing various types of control such as the information output method and allowing or not allowing of information output from the computer connected to the above information output device via a communication interface.

In current display devices as computer terminals, a wide variety of display positions and sizes on the screen and video signal frequencies to be displayed are used depending on video signals to be inputted. Therefore, a display or a so-called multi-scan display has been used so that a display device can handle various video signals.

A microcomputer or a memory LSI is used to provide a most suitable display image for each video signal as this type of display device. Such a prior art is indicated in Japanese Patent Application Laid-Open No. 1-321475.

According to this prior art, the microcomputer controls the memory which stores information of the display position and size on the screen for each video signal beforehand and reads the information of the most suitable display position and size on the screen depending on the input video signal from the memory. The microcomputer outputs a control signal on the basis of the read information. This control signal is applied to the deflection circuit as a control voltage or control current through a D-A converter so as to control the voltage or current at a predetermined part of the deflection circuit. By doing this, the display size and position of the display device can be adjusted. When a video signal inputted to the display device is not a known signal, no corresponding information is kept in the above memory. Therefore, the switch mounted on the front of the display device is operated so as to input the adjustment information of the display position and size on the screen. The control circuit of the above microcomputer creates deflection control information on the basis of the above input information and adjusts the display position and size.

According to the aforementioned prior art, the display device obtains a most suitable screen display according to the input video signal. However, according to another prior art, the computer controls and changes the display status. Such a prior art is indicated in Japanese Patent Application Laid-Open No. 61-84688. According to this prior art, a discrimination pulse is superimposed at the blanking interval of a video signal outputted from the computer and the deflection frequency of the display device is changed on the basis of this discrimination pulse.

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According to the former prior art among the aforementioned prior arts, the control of the display position and size on the screen is managed by the display device. Therefore, when adjustment is required or requested from the user of display device, it is necessary to perform manual adjustment using the adjustment switch of the display device each time and it is rather troublesome to operate the system.

According to the latter prior art among the aforementioned prior arts, the control can be operated by the computer. However, since the operation is such that the deflection frequency is simply changed on the basis of the discrimination pulse superimposed on the video signal, an image cannot be adjusted to the display image (display position and size) which is required by a user of the computer. Namely, there is a problem imposed that the status which is simply desired by the user cannot be obtained. Furthermore, no consideration is given to prevention of display (indication) of careless images (information) and restraining of unnecessary power consumption. Even if the discrimination pulse is superimposed at the blanking interval of the video signal, the video blanking level is generally shallow in the case of the display device, so that the discrimination pulse is displayed. Furthermore, the control is applied only in one direction from the computer to the display device and no information is sent in the reverse direction, so that there is another problem imposed that a malfunction cannot be avoided.

**SUMMARY OF THE INVENTION**

An object of the present invention is to provide an information output system wherein a computer can exercise various types of control of an information output device such as a display device. Another object of the present invention is to provide an information output system for maintaining secrecy of information and for restraining power consumption. A further object of the present invention is to provide an information output system for informing the computer of the operation status of the information output device so as to allow easy maintenance.

To accomplish the above objects, according to the present invention, in an information output system consisting of at least a computer and an information output device, the computer is equipped with a first communication means and the information output device is equipped with a second communication means. Furthermore, a control processing means and a memory means for storing the identification number of the computer beforehand are added to the information output device, or a memory means for storing the identification number of the information output device beforehand is mounted in the computer in addition to the first communication means. The above second communication means has a plurality of communication interfaces. Furthermore, a detection means for detecting the internal operation status and a control processing means for judging the detection result are added to the information output device and an audio output means for outputting the operation status in voice is added to the computer. A second display means for displaying the operation status is mounted in the information output device. Or, a display means for displaying the operation status of the information output device is mounted in the computer.

The first communication means in the computer controls communication with the information output device and the second communication means in the information output device controls communication with the computer. The control processing means operates and generates control

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signals for exercising various types of control for the information output device on the basis of control instructions from the second communication means and compares the identification number of the computer stored in the memory means with the identification number sent from the computer via the first and second communication means. When a comparison result match occurs, the control processing means controls a predetermined part in the information output device.

In the memory means mounted in the computer, the identification number for identifying the information output device is stored beforehand. When the identification number which is sent from the information output device via the second and first communication means matches with the identification number which is stored in the memory means beforehand, the computer communicates with the information output device.

When no comparison result match occurs, the above control processing means controls so that information which is sent from the computer to the information output device is not normally outputted from the information output device. By doing this, information of a computer user will not be indicated carelessly.

When the second communication means has a plurality of communication interfaces, it can communicate with another plurality of information output devices and the computer and in the state that a plurality of similar information output devices are connected to the computer, it can exercise various types of control for the information output devices and can inform the computer of the status of each information output device.

The detection means detects the internal operation status of the information output device and the control processing means judges the detection result. The audio output means indicates the operation status of the information output device in voice on the basis of the judgment result which is sent from the information output device to the computer via the second and first communication means. Furthermore, the display means mounted in the information output device displays the above operation status. The display means mounted in the computer performs the same operation as that of the display means mounted in the information output device. In this case, information which is sent to the computer via the second and first communication means is used as display information.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing the first embodiment of the present invention.

FIG. 2 is a memory map showing the contents of the memory in the display device shown in FIG. 1.

FIG. 3 is a flow chart showing the operation of the essential section shown in FIG. 1.

FIG. 4 is a block diagram showing the second embodiment of the present invention.

FIG. 5 is a block diagram showing the third embodiment of the present invention.

FIG. 6 is a block diagram showing the internal structure of the display device 6B shown in FIG. 5.

FIG. 7 is a block diagram showing the fourth embodiment of the present invention.

FIG. 8 is a flow chart showing the operation outline shown in FIG. 7.

FIG. 9 is a block diagram showing the fifth embodiment of the present invention.

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FIG. 10 is a block diagram showing the sixth embodiment of the present invention.

FIG. 11 is a block diagram showing the seventh embodiment of the present invention.

FIG. 12 is a block diagram showing the eighth embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments of the present invention will be explained with reference to the accompanying drawings hereunder.

FIG. 1 is a block diagram showing the first embodiment of the present invention. In the drawing, a section 1 enclosed by a chained line indicates a computer. In the section 1, a reference numeral 2 indicates a CPU (central processing unit), 3 a display controller for generating various signals for video display, 4 a memory, and 5 a communication controller for communicating with peripheral devices. In addition, a magnetic recording unit is mounted as a data storage device which is not shown in the drawing.

A section 6 enclosed by another chained line indicates a so-called multi-scan display device which can be applied to various video signal specifications. In the section 6, a reference numeral 7 indicates a microcomputer for controlling display of the display device 6, 8 a second communication controller for communicating with the above communication controller 5, 9 a second memory, 10 a general deflection circuit of the display device, 11 a video circuit of the display device, 12 a horizontal deflection yoke, 13 a vertical deflection yoke, and 14 a color cathode-ray tube (hereinafter called a CDT (color display tube)) for displaying color images.

The operation shown in FIG. 1 is as shown below. The computer 1 has a structure which is the same as the general structure of a conventional personal computer or work station and the communication controller 5 controls a communication interface such as RS-232C which is installed in the standard type. When a control instruction of the display device 6 is inputted firstly by a user of the computer from a general keyboard which is not shown in the drawing of the computer 1, it is coded digitally by a keyboard controller which is neither shown in the drawing and CPU 2 identifies the instruction and controls the communication controller 5. The communication controller 5 sends the control instruction of the display device to the display device 6. When a control instruction of the display device 6 which is included in the software for allowing the computer 1 to operate is read from the external storage device such as a floppy disk drive or hard disk drive which is not shown in the drawing, CPU 2 identifies the instruction and controls the communication controller 5. The communication controller 5 also sends the control instruction of the display device to the display device 6.

Next, the display device 6 sends the control instruction from the computer 1 which is received by the communication controller 8 to the microcomputer 7. The microcomputer 7 identifies this control instruction and generates control signals to the relevant portions to be adjusted in the deflection circuit 10 or video circuit 11. The aforementioned deflection circuit 10 and video circuit 11 can be adjusted in the same way as with a conventional multiscan display and the adjustment means has a structure which is the same as that of a conventional multiscan display. By doing this, the display size and position, brightness, contrast, and hue of images displayed on the CDT 14 are made most suitable to a user of the computer system.



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Furthermore, WYSIWYG (what you see is what you get) control which makes an image displayed on the display device 6 similar to print output of an output device other than the display, for example, a printer can be realized only by sending a control instruction for changing the display position and size to the display device 6 instead of operating and generating display data by the computer 1. The interface part of the above display device 6 such as the communication control terminal is mounted on the back or side of the display device from a viewpoint of easy connection to the computer 1 and appearance.

Furthermore, the aforementioned communication function is used for adjustment at a factory. In this case, necessary information is all written into the memory 9 in the display device 6. FIG. 2 is a memory map showing the contents of the memory 9 in the display device 6. For adjustment at factory, data to be written can be all set. In a case other than factory adjustment, namely, for adjustment in a system as shown in FIG. 1, to prevent data requiring no rewriting, namely, preset values at factory such as, for example, the number of all data or the data within the corresponding frequency range from being erased by mistake or rewritten, the computer 1 sends the ID number and the microcomputer 7 in the display device 6 checks the ID number with the registered ID number stored in the memory 9.

A flow chart of this check is shown in FIG. 3. As shown in the drawing, when the computer 1 and display device 6 are turned on at Step 1, each device is initialized at Step 2. Concretely, CPU 2 and the microcomputer 7 read the starting system software and put the peripheral circuit to be connected to the CPU into the active state so that the next operation can be performed. Then, at Step 3, the microcomputer 7 in the display device 6 waits for sending of the identification number assigned to the computer 1, that is, the so-called ID number from the computer 1. Next, at Step 4, the microcomputer 7 receives the ID number which is sent from the computer 1 and checks whether the received ID number is registered in the registered ID number list which is stored in the memory 9 in the display device 6.

When it is registered, at Step 5, the computer 1 is allowed to control the display device 6 by external control instructions so that the user control of the display size, position, brightness, and contrast can be performed by control instructions sent from the computer 1 thereafter. On the other hand, when the received ID number is not registered in the memory 9, at Step 6, the display device 6 is not allowed to be controlled by external control instructions thereafter. Therefore, even if any control instruction is sent from the computer 1, the display device 6 will not accept it.

Or, at Step 5, the computer 1 may be allowed to perform all the adjustments which can be performed by the display device 6, that is, the same control as that for adjustment at factory and at Step 6, a part of the control of the display device 6 such as display control may be allowed.

By doing this, the display device 6 can be prevented from careless control.

The above is an example that an ID number is sent to the display device 6 from the computer 1. However, needless to say, the reverse case of the above is possible. Namely, an ID number is sent to the computer 1 from the display device 6 so that the computer 1 identifies that the display device 6 having a communication function is connected and the computer 1 compares the ID number with the ID number registered in the computer 1. When the corresponding ID number is registered, the computer 1 controls the display

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device 6 by a predetermined control instruction. When it is not registered, the computer 1 judges that it cannot control the display device 6 and will not control the display device 6.

By doing this, the computer 1 communicates with a specific display device 6 and can exercise control such as changing the color temperature of an image displayed on the display device 6 or changing the display size depending on the application software.

According to this embodiment, RS-232C is used as a communication interface. However, a general-purpose interface such as RS-422, RS-423, SCSI or GP-IB, or network interface may be used. Furthermore, the embodiment may be applied to an interface using optical signals instead of electric signals. The above interface may be installed in the neighborhood of the rear cabinet or lower pedestal of the display device 6 for convenience of a user.

FIG. 4 is a block diagram showing the second embodiment of the present invention. According to this embodiment, when the ID number sent from the computer to the display device is not registered in the memory 9, another operation which is different from the operation shown in the first embodiment is performed. Namely, according to this embodiment, when the ID numbers do not match with each other, nothing is displayed on the display device so as to enhance the secrecy of information.

Next, the structure of FIG. 4 will be explained. In the drawing, a reference numeral 6A indicates another display device which is different from the display device 6 shown in FIG. 1, 15 a horizontal deflection circuit, 16 a vertical deflection circuit, 17 a synchronizing signal processing circuit, 18 a horizontal phase control circuit, 19 a horizontal oscillating circuit, 20 a horizontal driving circuit, 21 a horizontal deflection output circuit, 22 a video pre-amplifier circuit, 23 a video blanking circuit, and 24 a video output circuit. The other reference numerals which are the same as those shown in FIG. 1 indicate the same functions. The video circuit 11 is a general video circuit consisting of the video pre-amplifier circuit 22, video blanking circuit 23, and video output circuit 24. The horizontal deflection circuit 15 is a general deflection circuit consisting of the synchronizing signal processing circuit 17, horizontal phase control circuit 18, horizontal oscillating circuit 19, horizontal driving circuit 20, and horizontal deflection output circuit 21. The vertical deflection circuit 16 is also a general circuit which has a structure similar to that of the horizontal deflection circuit 15.

Next, the operation shown in FIG. 4 will be explained. In the drawing, an ID number sent from the computer 1 is inputted into the microcomputer 7 via the communication controller 8. The microcomputer 7 checks the above ID number with the ID number stored in the memory 9. When the ID number stored in the memory 9 matches with the ID number sent from the computer 1, the microcomputer 7 receives the control from the computer 1.

On the other hand, when the check results do not match with each other, the microcomputer 7 controls the horizontal oscillating circuit 19, fixes the oscillation frequency to a predetermined value, and allows the display device 6A to perform a horizontal deflection operation at a value different from the horizontal frequencies of the video signal and synchronizing signal which are sent from the computer. Therefore, the image displayed on the CDT 14 is not synchronized horizontally in this case and the screen content cannot be judged. When the vertical deflection circuit 16 is controlled in the same way, the image displayed on the CDT

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14 is not synchronized vertically on the screen. By controlling the video blanking circuit 23 of the video circuit 11, the video display period may be blanked so that no image is displayed on the CDT 14.

By using the aforementioned methods independently or combined, only when a user of the computer system enters a predetermined ID number from the keyboard, it is displayed correctly on the display device 6A and information displayed on the CDT 14 can be prevented from careless indication.

FIG. 5 is a block diagram of the third embodiment of the present invention. According to this embodiment, the display device is provided with a plurality of communication functions and a plurality of display devices can be connected with the communication interface. In the drawing, reference numerals 6B, 6C, and 6D indicate display devices having the same structure, V1, V2, and V3 lines for video signals and synchronizing signals, C1, C2, and C3 communication lines for, for example, RS-232C, and 1 the aforementioned computer. Each of the display devices 6B, 6C, and 6D has a plurality of video signal I/O terminals and communication interface I/O terminals and a registered ID number. According to this embodiment, as shown in FIG. 5, 1 is assigned to the display device 6B as an ID number, 2 to the display device 6C as an ID number, and 3 to the display device 6D as an ID number.

Next, the operation shown in FIG. 5 will be explained. In the drawing, for example, when controlling the display device 6B from the computer 1, the ID number 1 is sent to the line C1 and the display device 6B is controlled appropriately from the computer 1. Next, when controlling the display device 6C, the ID number 2 is sent from the computer 1 in the same way. Then, the ID number is received by the display device 6C via the lines C1 and C2 and the display device 6C can be controlled appropriately from the computer 1.

Since a plurality of display devices can be controlled by a computer in this way, a plurality of display devices can be adjusted at a time, for example, at the time of delivery adjustment at a factory. Furthermore, by using a multi-display system for displaying an image by assembling a plurality of display devices and for displaying various images on each screen, the display devices can be hued and adjusted in brightness simply.

FIG. 6 is a block diagram showing the internal structure of the display device 6B shown in FIG. 5. In the drawing, a reference numeral 25 indicates a communication controller having two communication ports and 26 a divider of video signals and synchronizing signals. The communication controller 25 sends or receives data to or from the computer 1 in the same way as the communication controller 8 of the display device 6 shown in FIG. 1 and also divides the communication lines and relays other display devices. On the other hand, the divider 26 divides video signals or synchronizing signals sent from the computer 1 or signal source to other display devices. By using such a structure, a plurality of display devices can be connected to a computer as shown in FIG. 5.

Next, the fourth embodiment of the present invention will be described. FIG. 7 is a block diagram showing the fourth embodiment of the present invention. In the drawing, a reference numeral 1B indicates a computer, 31 an audio control circuit for producing a sound, 32 a speaker, 6E a display device, 27 and 28 analog-digital converters (hereinafter abbreviated to ADC), and 29 and 30 digital-analog converters (hereinafter abbreviated to DAC). The

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other reference numerals which are the same as those shown in FIG. 1 indicate the same functions. The operation of FIG. 7 will be explained hereunder with reference to the operation flow chart shown in FIG. 8.

When the computer 1B and display device 6E are started at Step 10 as shown in FIG. 8, they start communication with each other via the communication controllers 5 and 8 at Step 11 next. Then, at Step 12, the computer 1B calls the display device 6E. When no response is received, the computer 1B judges that the display device 6E is faulty, starts the audio control circuit 31 at Step 13, and informs the user of the computer 1B that the display device 6E is faulty from the speaker.

When the communication succeeds, at Step 14, the microcomputer 7 fetches information of the operation status of the deflection circuit 10 or video circuit 11 in the display device 6E from the voltage at a predetermined part in the circuit as digital information via the ADCs 27 and 28. Next, at Step 15, the microcomputer 7 judges whether the value which is fetched at Step 14 is a value in the normal operation status. When the microcomputer 7 judges it as an error, it informs the computer 1B of the faulty value via the communication controller 8 and CPU 2 of the computer 1B allows the audio control circuit 31 to operate and generates a message informing an error of the display device 6E from the speaker 32. Furthermore, CPU 2 allows the display controller 3 to operate and displays also a message informing an error on the CDT 14 via the video circuit 11.

In this case, when an indication code informing the faulty part is sent to the computer 1B from the display device 6E simultaneously, the computer 1B judges the indication code and can inform the user or a customer engineer of the display device 6E of the faulty part by sound or display.

When the display device 6E is normal at Step 15, the computer 1B can exercise the communication control such as the display size, hue, and brightness of the display device 6E at Step 17. At this step, when a control instruction is sent to the display device 6E from the computer 1B, the microcomputer 7 decodes the instruction and outputs the control code to the corresponding DAC 29 or 30. The DAC 29 or 30 controls a predetermined control part at the DC control voltage corresponding to the above control code and controls the display size, position, and hue of the image displayed on the CDT 14. When the above series of operations ends, the computer 1B returns to Step 14 and repeats the operations from the monitor mode of a faulty operation of the display device 6E to the normal operation at Step 17.

As mentioned above, the computer 1B can be informed of a faulty operation by using the communication function of the display device 6E. Therefore, the user can judge the faulty part and can maintain the system easily.

FIG. 9 is a block diagram showing the fifth embodiment of the present invention. This embodiment obtains the same effect as that of the embodiment shown in FIG. 7. In FIG. 9, a reference numeral 6F indicates a display device, 33 a liquid crystal display controller in the display device 6F, and 34 a liquid crystal display panel mounted in the display device 6F. The other reference numerals which are the same as those shown in FIGS. 1 and 7 indicate the same functions.

The operation shown in FIG. 9 is basically the same as that shown in FIG. 7. The operation of the deflection circuit 10 or video circuit 11 is monitored by the microcomputer 7 via the ADC 27 or 28. When an error occurs, the microcomputer 7 transmits an indication code informing the occurrence of an error to the computer 1B via the communication line and informs the user of it by voice from the speaker 32.



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Furthermore, the microcomputer 7 allows the liquid crystal display controller 33 in the display device 6F to operate and displays information of the occurrence of the fault and faulty part on the liquid crystal display panel 34. By doing this, information when an error occurs in the display device 6F can be obtained more surely.

FIG. 10 is a block diagram showing the sixth embodiment of the present invention. This embodiment obtains the same effect as that of the embodiment shown in FIG. 9. In FIG. 10, a reference numeral 1C indicates a computer and 35 a liquid crystal display controller in the computer 1C. The other reference numerals which are the same as those shown in FIGS. 1 and 9 indicate the same functions. In FIG. 10, the display function for a fault and faulty operation of the display device shown in FIG. 9 is mounted in the computer 1C.

Namely, when an error occurs in the internal circuit of the display device 6E, the voltage detected by the ADC 27 or 28 is digitized and processed by the microcomputer 7 as faulty voltage occurrence information and information informing an error is transmitted to the computer 1C via the communication controller 8. In the computer 1C, CPU 2 decodes the transmitted faulty information. When CPU 2 identifies the faulty part of the display device 6E, it allows the audio control circuit 31 to operate as an audio signal and informs the user of the fault by an audio message from the speaker 32 on one hand. On the other hand, CPU 2 controls the liquid crystal display controller 35 so as to display characters or graphics on the liquid crystal display panel 34. By doing this, the user of the display device 6E can be informed of an error or fault of the display device 6E and can maintain the system easily.

FIG. 11 is a block diagram showing the seventh embodiment of the present invention. In the drawing, a reference numeral 36 indicates a power supply of the deflection circuit 10 and video circuit 11. The other reference numerals which are the same as those shown in FIG. 1 indicate the same functions.

Next, the operation shown in FIG. 11 will be explained. In FIG. 11, when a control instruction to the display device 6 is issued from CPU 2 of the computer 1, the communication controller 5 changes the control instruction to a one in the signal format suited to communication and sends it to the display device 6. The display device 6 returns the signal received by the communication controller 8 to the control instruction which can be identified by the microcomputer 7 and sends it to the microcomputer 7. The microcomputer 7 judges the control instruction and decides the part of a predetermined section in the display device 6 to be controlled.

When the control instruction relates to control of the power supply 36 and is an instruction for stopping power supply from the power supply 36 to the deflection circuit 10, or video circuit 11, or both circuits, the microcomputer 7 controls the power supply 36 so as to stop the above power supply. Therefore, the image display on the CDT 14 is also stopped.

By doing this, for example, when the computer 1 is not in operation for a predetermined period, the operation power supply for the display device 6 can be automatically put into the off state. Therefore, unnecessary power consumption can be restrained and the life span of the display device can be lengthened. The aforementioned is power supply off control. However, needless to say, power supply on control is also possible. Namely, in this case, when the computer 1 is turned on or the computer 1 is changed from the function stop state

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to the active state, the microcomputer 7, power supply 36, deflection circuit 10, and video circuit 11 perform the reverse operation of the aforementioned so that the display device automatically starts to display.

FIG. 12 is a block diagram showing the eighth embodiment of the present invention. In the drawing, a reference numeral 37 indicates a display controller and the other numerals which are the same as those shown in FIG. 1 indicate units performing the same functions as those shown in FIG. 1.

Next, the operation of FIG. 12 will be explained. In FIG. 12, video information is sent to the display device 6 from the communication controller 5 in addition to a control instruction of the display device 6 which is explained in the embodiment shown in FIG. 1. This video information is a digital signal in the same way as a signal which is inputted to the display controller 3 in the embodiment shown in FIG. 1. The communication controller 8 of the display device 6 sends video information among the received signals to the display controller 37. The display controller 37 performs an operation which is the same as that of the display controller shown in FIG. 1 and generates a video signal to be inputted to a general display. By doing this, also in the embodiment shown in FIG. 12, an effect which is the same as that shown in FIG. 1 can be obtained. Furthermore, in FIG. 12, since video information is transmitted via a communication interface which is connected between the computer 1 and display device 6, a video signal line which is conventionally necessary is not necessary.

According to the present invention, a user of a computer can exercise various types of control for an information output device such as a display device from the keyboard of the computer or by the software incorporated in the computer. Therefore, the operability of the computer system is improved so that the system can be used easily and the user can obtain a desired information output status easily.

When an identification number is set to each device, a value which is set by the above control will not be lost by a careless operation of a user. By setting an identification number for a specific user, the secret of information can be protected inversely. Since the power supply for the information output device can be controlled by the computer when necessary, unnecessary power consumption can be restrained.

Since the status of the information output device can be monitored simply, the system can be protected against a malfunction and maintained easily. Furthermore, the aforementioned control hardware can be realized in a minimum structure.

What is claimed is:

1. A display unit comprising:

means for receiving video signals for video display from a video source;

memory means for storing at least display unit information, wherein said display unit information includes an identification number for uniquely identifying the display unit; and

a communication controller capable of bi-directionally communicating with the video source;

wherein said communication controller communicates the display unit information to the video source and the display unit receives a signal from the video source that is generated based on the display unit information.

2. A display unit according to claim 1, wherein the video source is a computer.

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**3.** A display unit comprising:  
a video circuit adapted to display video signals sent by a video source;  
a memory in which at least display unit information is stored, wherein said display unit information includes an identification number for uniquely identifying the display unit; and  
a communication controller capable of bi-directionally communicating with the video source;

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wherein said communication controller communicates the display unit information from the display unit to the video source and said display unit receives a signal from said video source that is generated based on the display unit information.  
**4.** A display unit according to claim 3, wherein the video source is a computer.

\* \* \* \* \*

# **Exhibit B**





(12) **United States Patent**  
**Arai et al.**

(10) **Patent No.:** US 6,549,970 B2  
 (45) **Date of Patent:** Apr. 15, 2003

(54) **DISPLAY UNIT WITH CONTROLLER  
 ENABLING BI-DIRECTIONAL  
 COMMUNICATION WITH COMPUTER**

4,169,262 A 9/1979 Schwartz et al. .... 340/744

(List continued on next page.)

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**FOREIGN PATENT DOCUMENTS**

DE 37 22 169 A1 1/1989  
 DE 4025295 2/1991  
 DE 43 36 116 A1 5/1994

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(List continued on next page.)

(\* ) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

**OTHER PUBLICATIONS**

(21) **Appl. No.:** 09/732,291

Barco n. v. Video & Communications, The Calibrator Explained, Part 1, Apr. 1990, pp. 1-40.

(22) **Filed:** Dec. 8, 2000

NASA Tech Brief, "Interface for Color-Video Monitor", Apr. 1988, pp. 246-247.

(65) **Prior Publication Data**

"Display Function Identification", IBM Technical Disclosure Bulletin, vol. 28, No. 12, pp. 5568-5579, May 1980.

US 2001/0002474 A1 May 31, 2001

(List continued on next page.)

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 09/265,363, filed on Mar. 10, 1999, now Pat. No. 6,247,090, which is a continuation of application No. 08/833,346, filed on Apr. 4, 1997, now Pat. No. 5,887,147, which is a continuation of application No. 08/598,903, filed on Feb. 9, 1996, now Pat. No. 5,652,845, which is a continuation of application No. 08/190,848, filed on Feb. 3, 1994, now abandoned.

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*Assistant Examiner*—Raymond N Phan

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**Foreign Application Priority Data**

Feb. 10, 1993 (JP) ..... 5-022212

**ABSTRACT**

A display unit having a communication control circuit for communicating with an externally connected computer and which enables bi-directional communication with the display unit and the computer. The communication control circuit includes a comparator for comparing first identification information which is previously stored in said display unit and second identification information which is previously stored in the computer and is sent from the computer. The communication control circuit further includes at least one of a communication prohibitor for prohibiting communication between the computer with respect to display control of the display unit, when the first and second identification information do not match as a result of the comparison by the comparator or communication permitter for enabling communication for display control as a result of a match.

(51) **Int. Cl.<sup>7</sup>** ..... G06F 13/28

(52) **U.S. Cl.** ..... 710/305; 710/62; 710/64; 345/99; 345/132

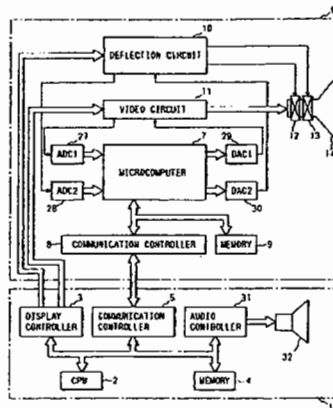
(58) **Field of Search** ..... 710/101-103, 710/129, 62, 63-65, 72, 8-11, 14-15; 345/58, 98-100, 132, 204; 709/236, 237, 249-250

**References Cited**

**U.S. PATENT DOCUMENTS**

4,007,443 A 2/1977 Bromberg et al.  
 4,047,158 A 9/1977 Jennings  
 4,159,480 A 6/1979 Tachi

**29 Claims, 12 Drawing Sheets**



## US 6,549,970 B2

Page 2

## U.S. PATENT DOCUMENTS

4,177,462 A 12/1979 Chung ..... 340/703  
 4,197,590 A 4/1980 Sukonick et al. .... 364/900  
 4,342,029 A 7/1982 Hofmanis et al. .... 340/703  
 4,415,985 A 11/1983 McDaniel et al.  
 4,450,535 A 5/1984 De Pommery et al.  
 4,574,279 A 3/1986 Roberts  
 4,589,063 A \* 5/1986 Shah et al.  
 4,626,892 A 12/1986 Nortrup et al.  
 4,641,262 A \* 2/1987 Bryan et al.  
 4,680,647 A 7/1987 Moriyama  
 4,727,947 A 3/1988 Naito  
 4,736,324 A 4/1988 Sainen et al.  
 4,743,968 A 5/1988 Mogi et al.  
 4,747,041 A 5/1988 Engel et al.  
 4,775,857 A 10/1988 Staggs  
 4,800,376 A 1/1989 Suga et al.  
 4,882,687 A 11/1989 Gordon ..... 364/518  
 4,893,248 A 1/1990 Pitts et al.  
 4,922,448 A 5/1990 Kunieda et al.  
 4,970,655 A \* 11/1990 Winn et al.  
 4,990,904 A 2/1991 Zenda  
 4,991,023 A \* 2/1991 Nicols ..... 358/242  
 5,010,238 A 4/1991 Kadono et al.  
 5,012,339 A 4/1991 Kurata et al.  
 5,068,732 A 11/1991 Satoh  
 5,138,305 A 8/1992 Tomiyasu  
 5,150,109 A 9/1992 Berry  
 5,159,683 A 10/1992 Lvovsky et al.  
 5,227,881 A 7/1993 Wess et al.  
 5,241,281 A 8/1993 Wilkes et al.  
 5,251,031 A 10/1993 Tagami  
 5,257,350 A 10/1993 Howard et al.  
 5,270,821 A 12/1993 Samuels  
 5,276,458 A \* 1/1994 Sawdon ..... 345/132  
 5,276,875 A 1/1994 Satoh  
 5,282,247 A 1/1994 McLean et al.  
 5,309,174 A \* 5/1994 Minkus  
 5,309,504 A 5/1994 Morganstein  
 5,315,695 A 5/1994 Saito et al.  
 5,317,691 A 5/1994 Traeger  
 5,353,423 A 10/1994 Hamid et al.  
 5,375,210 A 12/1994 Monnes et al.  
 5,396,593 A 3/1995 Mori et al.  
 5,457,473 A 10/1995 Arai et al.  
 5,483,255 A 1/1996 Numao  
 5,506,602 A \* 4/1996 Yokoyama  
 5,550,966 A 8/1996 Drake et al.  
 5,576,735 A \* 11/1996 Kikuchi et al.

5,599,231 A \* 2/1997 Hibino et al. .... 43/29  
 5,887,147 A 3/1999 Arai et al.  
 5,896,546 A 4/1999 Monahan et al.  
 5,909,592 A 6/1999 Shipman  
 5,948,091 A 9/1999 Kerigan et al.  
 6,012,103 A 1/2000 Sartore et al.  
 6,057,812 A 5/2000 Arai et al.

## FOREIGN PATENT DOCUMENTS

EP 456923 A1 \* 11/1991  
 EP 0612053 A1 8/1994  
 JP 61-16643 \* 1/1986  
 JP 61-84688 4/1986  
 JP 1-321475 12/1989  
 JP 2-103592 4/1990  
 JP 2-127688 5/1990  
 JP 2-250576 10/1990  
 JP 2-257196 10/1990  
 JP 3-56931 3/1991  
 JP 3-56993 3/1991  
 JP 3-116093 5/1991  
 JP 3-118595 5/1991  
 JP 3-148697 6/1991  
 JP 3-160494 7/1991  
 JP 3-261995 11/1991  
 JP 4-21024 1/1992  
 JP 5-46106 2/1993  
 JP 5-232918 9/1993

## OTHER PUBLICATIONS

"Monitor Identification Technique", IBM Technical Disclosure Bulletin, vol. 30, No. 2, pp. 839-840, Jul. 1987.

"Display Controller Set up as a Function of Display Monitor Type, Display Jumper Settings and Amount of Vram", IBM Technical Disclosure Bulletin, vol. 33, No. 2, pp. 352-353, Jul. 1990.

"Improved Method of Monitor Identification and Mode Control", IBM Technical Disclosure Bulletin, vol. 33, No. 5, pp. 289-291, Oct. 1990.

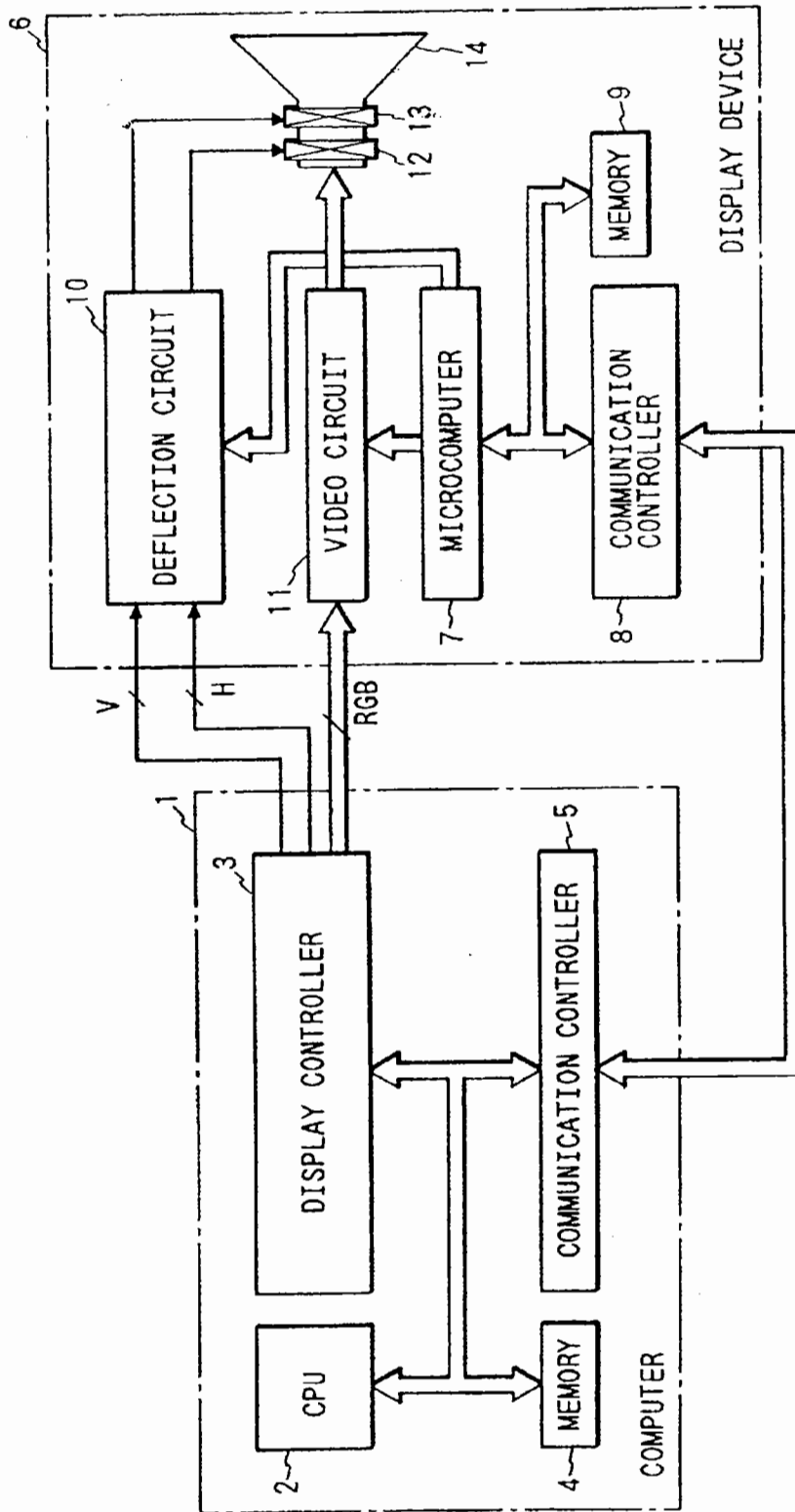
"Improvements to Display Identification", IBM Technical Disclosure Bulletin, vol. 33, No. 6B, pp. 83-85, pp. 83-85.

"Self-Identification Protocol Initialization", IBM Technical Disclosure Bulletin, vol. 33, No. 10A, pp. 406-407, Mar. 1991.

"ACCESS.bus, an Open Desktop Bus", Peter A. Sichel, Digital Technical Journal, vol. 3, No. 4, Fall 1991.

\* cited by examiner

FIG. 1



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FIG. 2

ADDRESS 1	NUMBER OF DATA SET	REGISTERED ID NUMBERS
ADDRESS 2	DATA AREA 1 FOR DELIVERY ADJUSTMENT	
ADDRESS 3	DATA AREA 2 FOR DELIVERY ADJUSTMENT	
⋮	⋮	
ADDRESS i	ADJUSTMENT DATA AREA 1 FOR USER	
ADDRESS i+1	ADJUSTMENT DATA AREA 2 FOR USER	
⋮	⋮	

FIG. 3

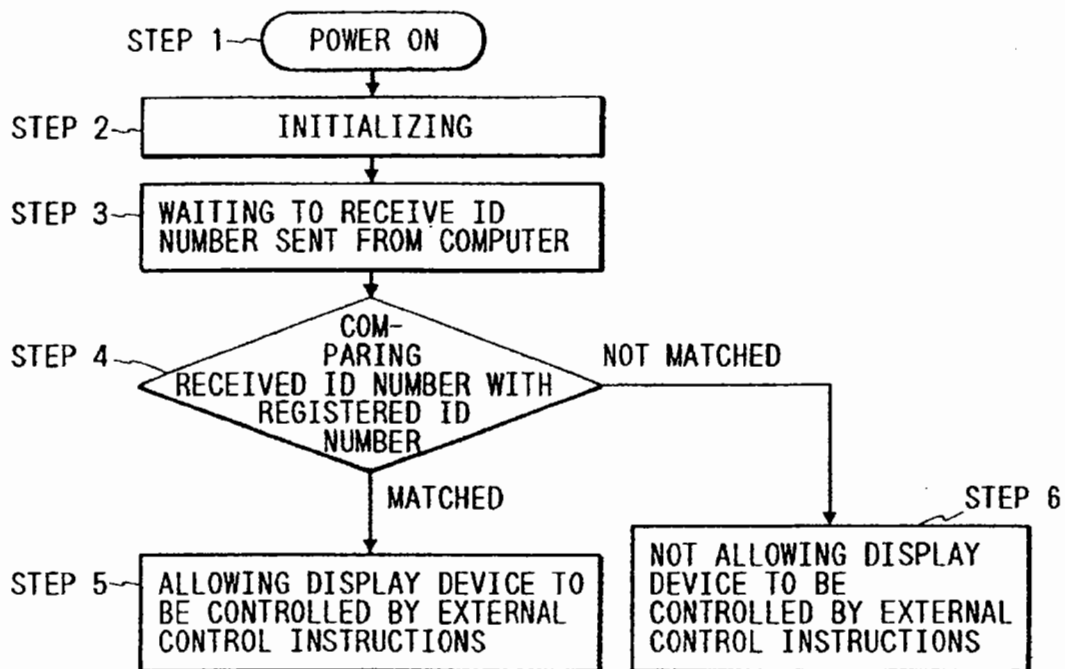


FIG. 4

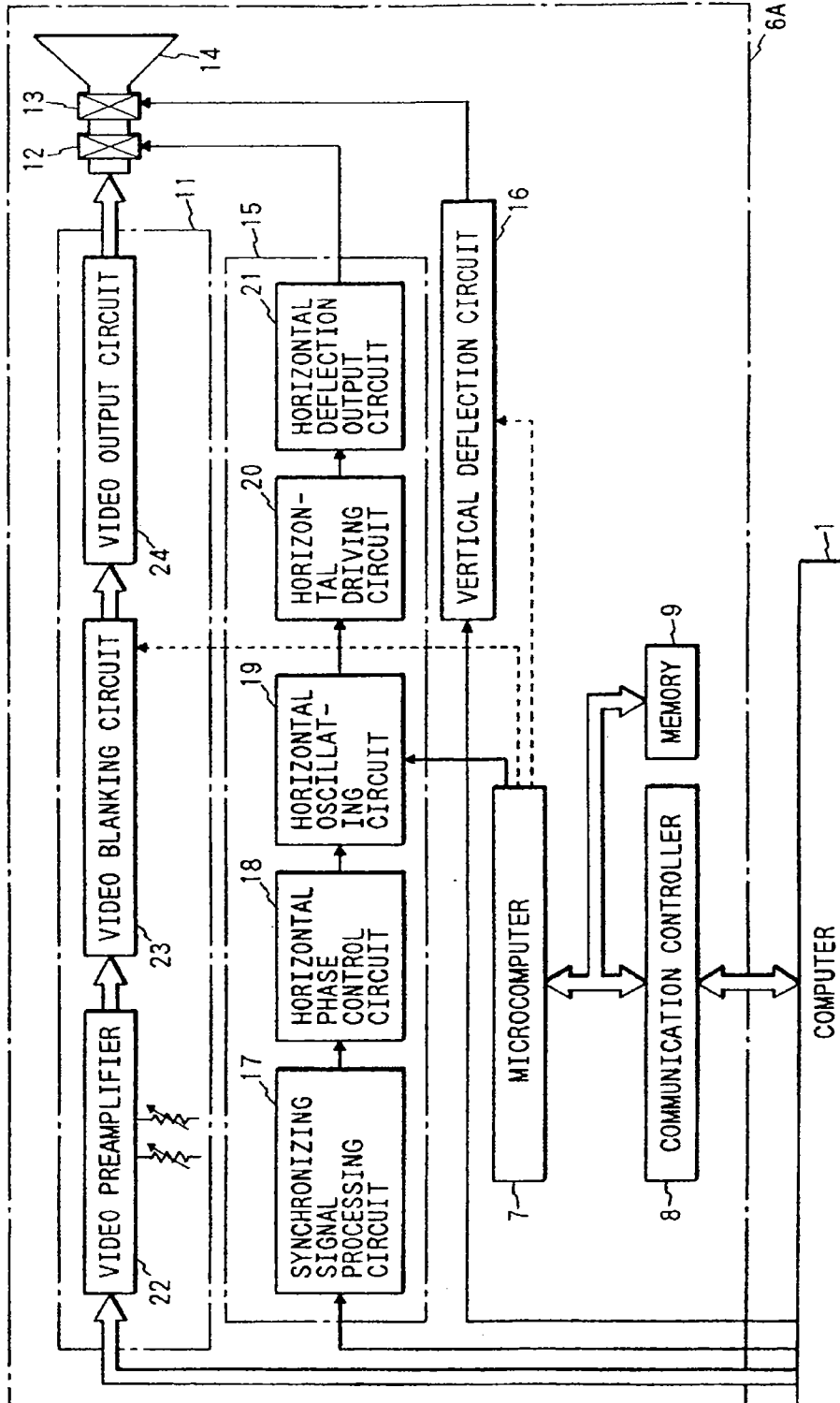


FIG. 5

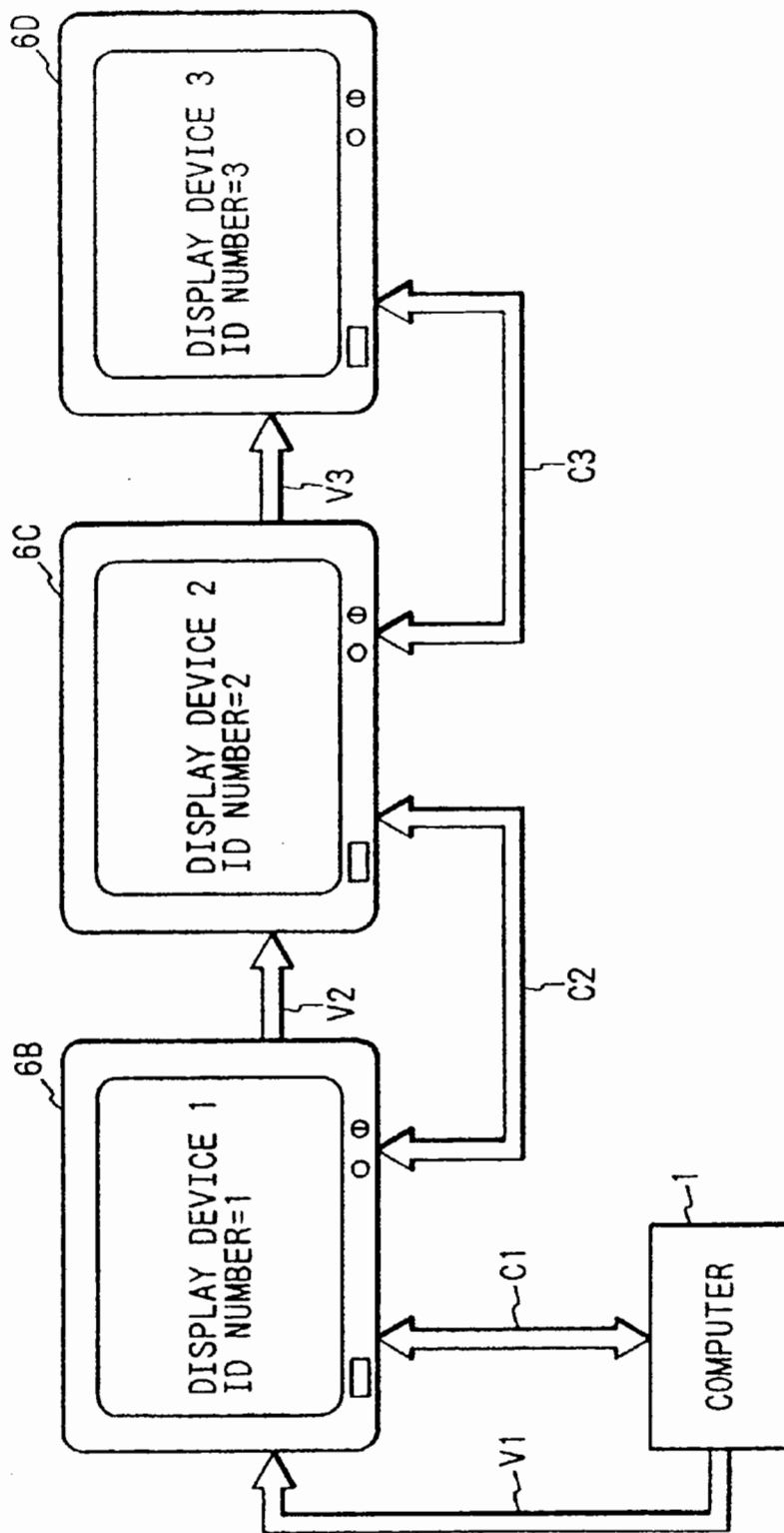




FIG. 6

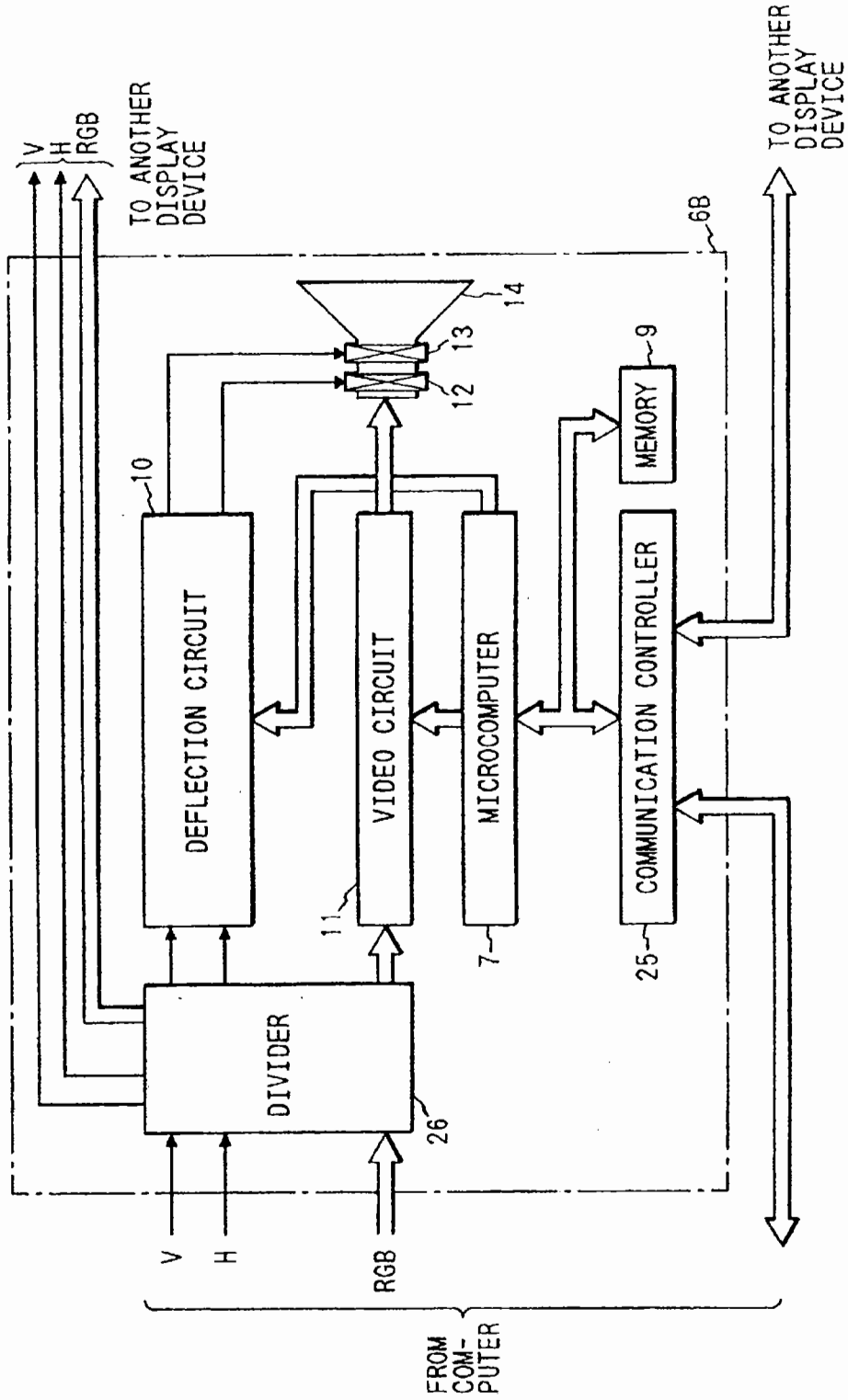


FIG. 7

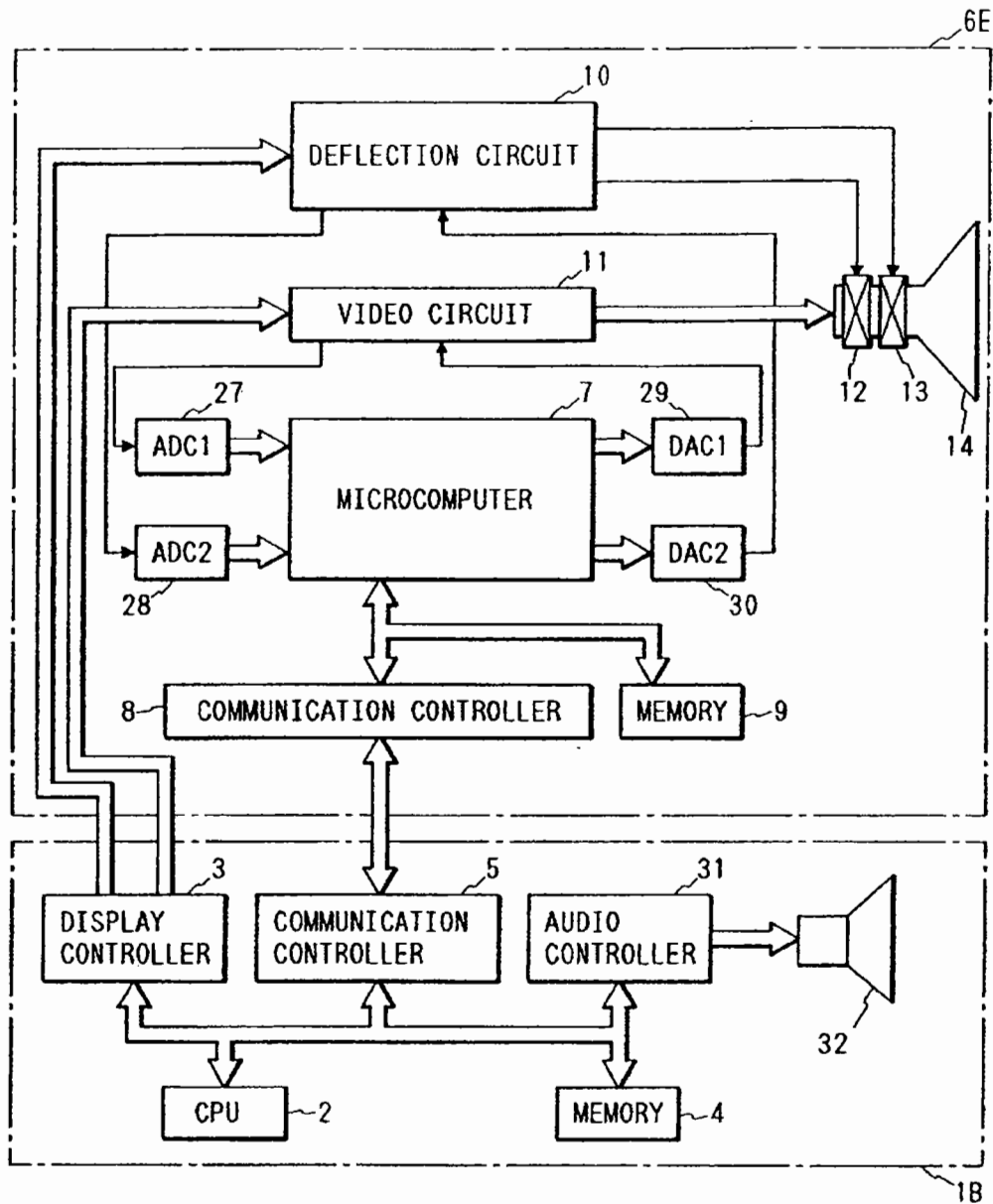


FIG. 8

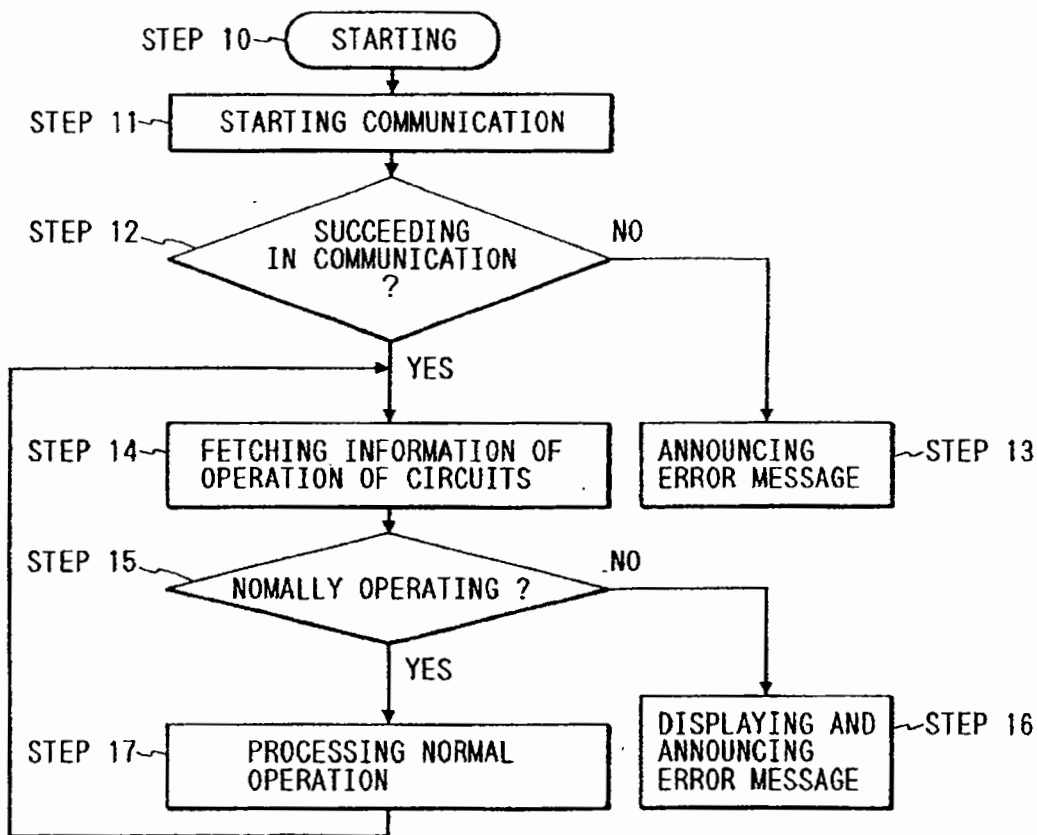


FIG. 9

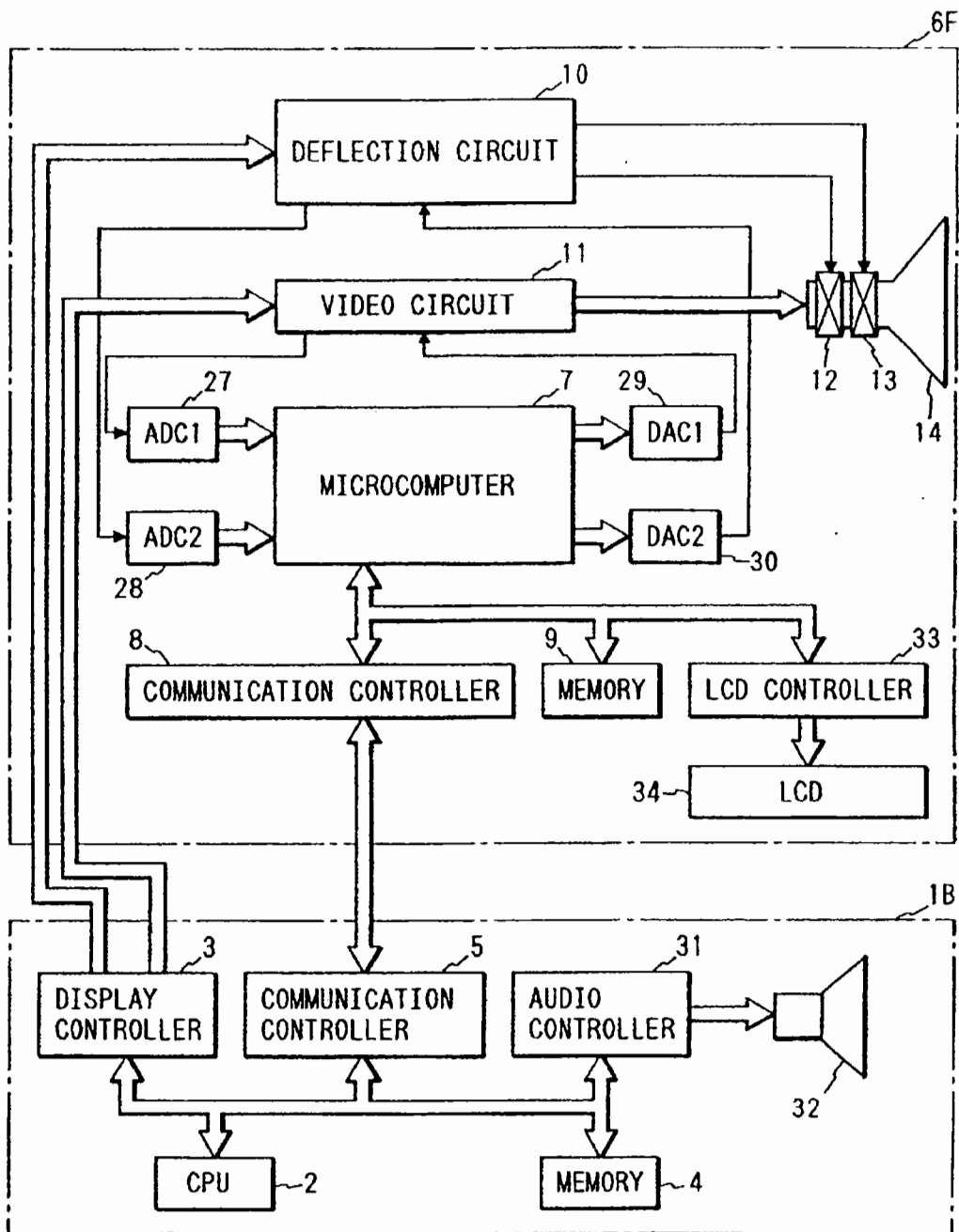


FIG. 10

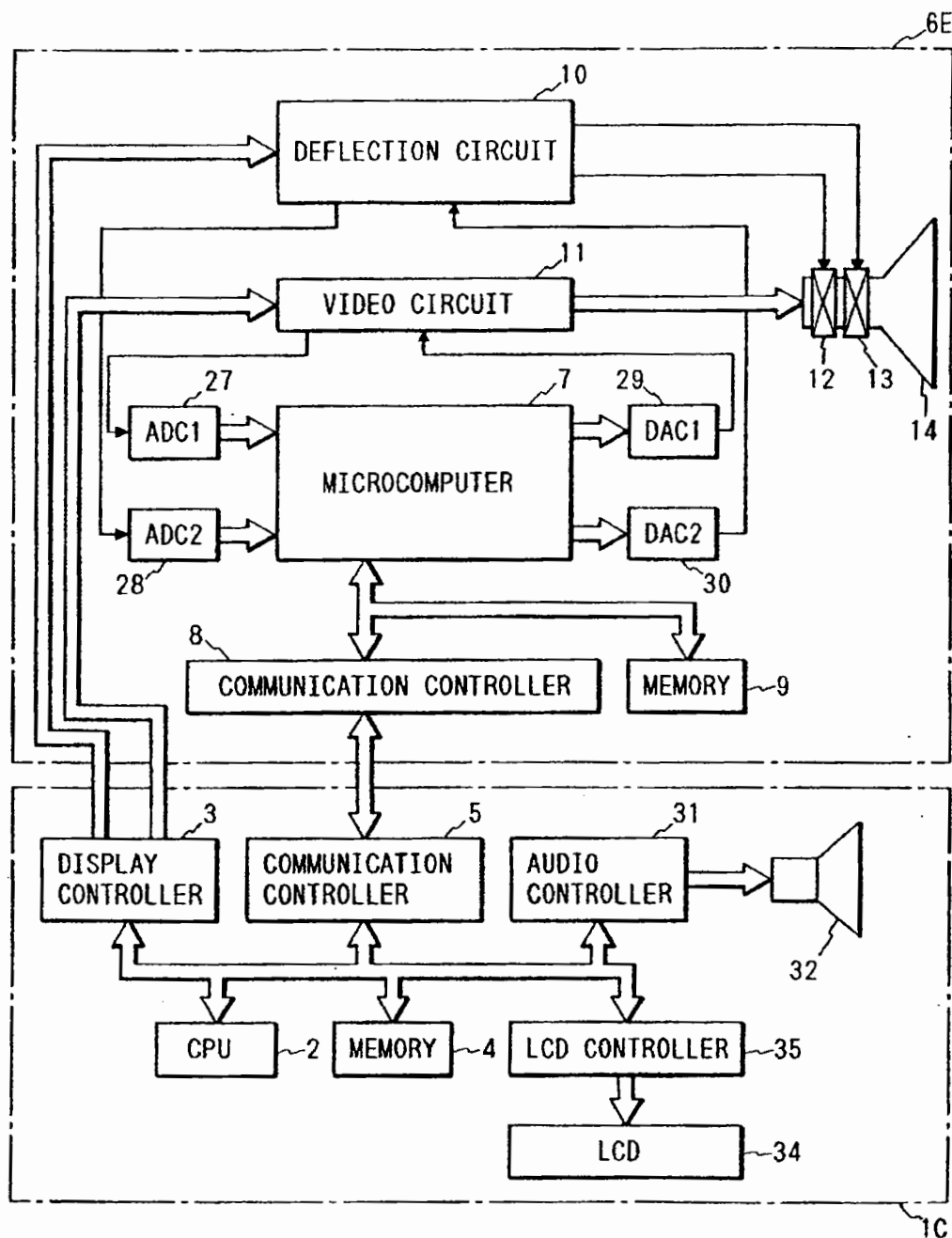


FIG. 11

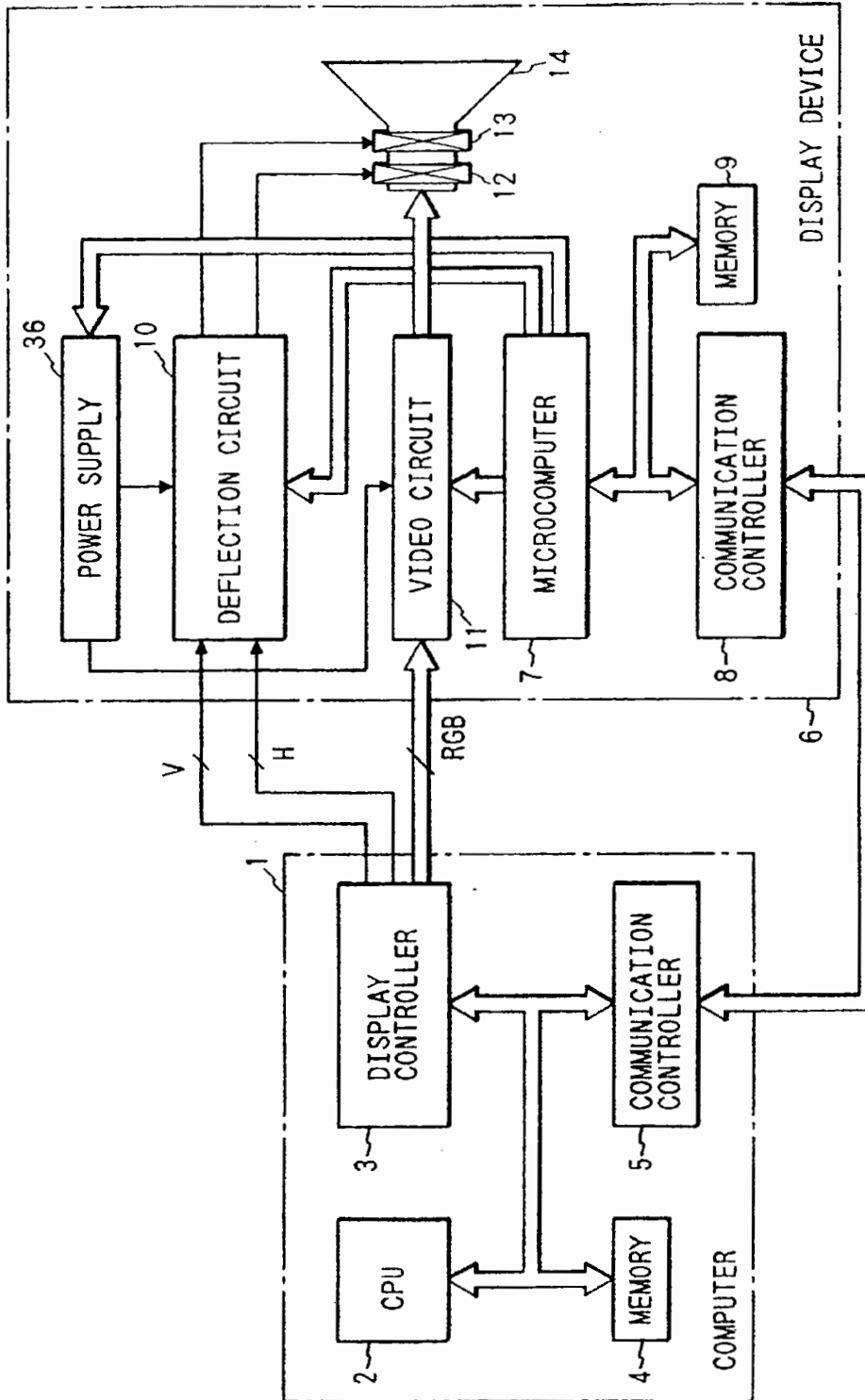
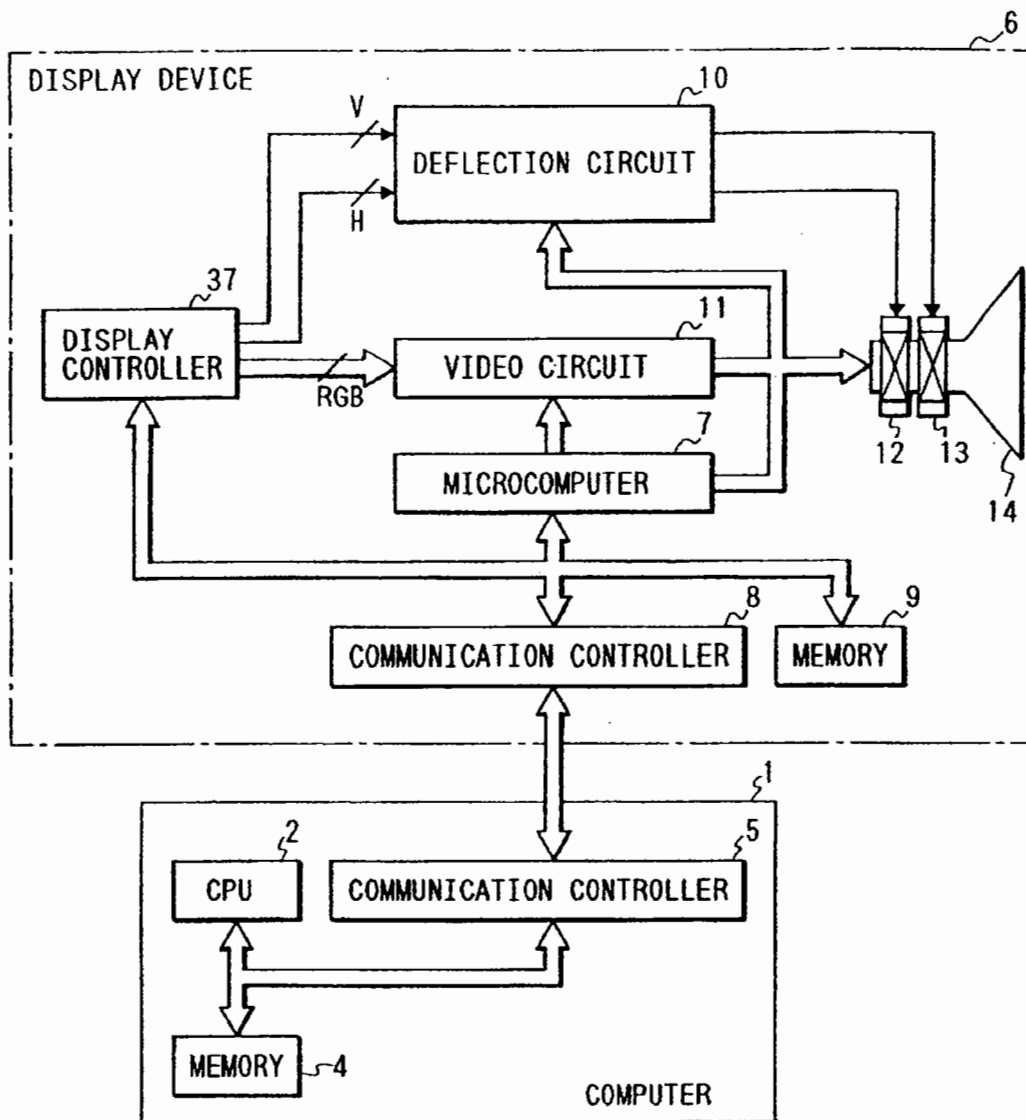


FIG. 12





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**DISPLAY UNIT WITH CONTROLLER  
ENABLING BI-DIRECTIONAL  
COMMUNICATION WITH COMPUTER**

**CROSS REFERENCE TO RELATED  
APPLICATION**

This application is related to U.S. application Ser. No. 09/732,292, filed on the same date, and is a continuation of U.S. application Ser. No. 09/265,363, filed Mar. 10, 1999, now U.S. Pat. No. 6,247,090 which is a continuation of U.S. application Ser. No. 08/833,346, filed Apr. 4, 1997, now U.S. Pat. No. 5,887,147, issued Mar. 23, 1999, which is a continuation of U.S. application Ser. No. 08/598,903, filed Feb. 9, 1996, now U.S. Pat. No. 5,652,845, issued Jul. 29, 1997, which is a continuation of U.S. application Ser. No. 08/190,848, filed Feb. 3, 1994, now abandoned, the subject matter of which is incorporated by reference herein.

**BACKGROUND OF THE INVENTION**

The present invention relates to an information output system or display apparatus including a computer and an information output device such as a display device or a printer as a computer terminal and more particularly to an information output system or display apparatus for performing various types of control such as the information output method and allowing or not allowing of information output from the computer connected to the above information output device via a communication interface.

In current display devices as computer terminals, a wide variety of display positions and sizes on the screen and video signal frequencies to be displayed are used depending on video signals to be inputted. Therefore, a display or a so-called multi-scan display has been used so that a display device can handle various video signals.

A microcomputer or a memory LSI is used to provide a most suitable display image for each video signal as this type of display device. Such a prior art is indicated in Japanese Patent Application Laid-Open No. 1-321475.

According to this prior art, the microcomputer controls the memory which stores information of the display position and size on the screen for each video signal beforehand and reads the information of the most suitable display position and size on the screen depending on the input video signal from the memory. The microcomputer outputs a control signal on the basis of the read information. This control signal is applied to the deflection circuit as a control voltage or control current through a D-A converter so as to control the voltage or current at a predetermined part of the deflection circuit. By doing this, the display size and position of the display device can be adjusted. When a video signal inputted to the display device is not a known signal, no corresponding information is kept in the above memory. Therefore, the switch mounted on the front of the display device is operated so as to input the adjustment information of the display position and size on the screen. The control circuit of the above microcomputer creates deflection control information on the basis of the above input information and adjusts the display position and size.

According to the aforementioned prior art, the display device obtains a most suitable screen display according to the input video signal. However, according to another prior art, the computer controls and changes the display status. Such a prior art is indicated in Japanese Patent Application Laid-Open No. 61-84688. According to this prior art, a discrimination pulse is superimposed at the blanking interval of a video signal outputted from the computer and the

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deflection frequency of the display device is changed on the basis of this discrimination pulse.

According to the former prior art among the aforementioned prior arts, the control of the display position and size on the screen is managed by the display device. Therefore, when adjustment is required or requested from the user of display device, it is necessary to perform manual adjustment using the adjustment switch of the display device each time and it is rather troublesome to operate the system.

According to the latter prior art among the aforementioned prior arts, the control can be operated by the computer. However, since the operation is such that the deflection frequency is simply changed on the basis of the discrimination pulse superimposed on the video signal, an image cannot be adjusted to the display image (display position and size) which is required by a user of the computer. Namely, there is a problem imposed that the status which is simply desired by the user cannot be obtained. Furthermore, no consideration is given to prevention of display (indication) of careless images (information) and restraining of unnecessary power consumption. Even if the discrimination pulse is superimposed at the blanking interval of the video signal, the video blanking level is generally shallow in the case of the display device, so that the discrimination pulse is displayed. Furthermore, the control is applied only in one direction from the computer to the display device and no information is sent in the reverse direction, so that there is another problem imposed that a malfunction cannot be avoided.

**SUMMARY OF THE INVENTION**

An object of the present invention is to provide an information output system wherein a computer can exercise various types of control of an information output device such as a display device. Another object of the present invention is to provide an information output system for maintaining secrecy of information and for restraining power consumption. A further object of the present invention is to provide an information output system for informing the computer of the operation status of the information output device so as to allow easy maintenance.

To accomplish the above objects, according to the present invention, in an information output system consisting of at least a computer and an information output device, the computer is equipped with a first communication means and the information output device is equipped with a second communication means. Furthermore, a control processing means and a memory means for storing the identification number of the computer beforehand are added to the information output device, or a memory means for storing the identification number of the information output device beforehand is mounted in the computer in addition to the first communication means. The above second communication means has a plurality of communication interfaces. Furthermore, a detection means for detecting the internal operation status and a control processing means for judging the detection result are added to the information output device and an audio output means for outputting the operation status in voice is added to the computer. A second display means for displaying the operation status is mounted in the information output device. Or, a display means for displaying the operation status of the information output device is mounted in the computer.

The first communication means in the computer controls communication with the information output device and the second communication means in the information output

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device controls communication with the computer. The control processing means operates and generates control signals for exercising various types of control for the information output device on the basis of control instructions from the second communication means and compares the identification number of the computer stored in the memory means with the identification number sent from the computer via the first and second communication means. When a comparison result match occurs, the control processing means controls a predetermined part in the information output device.

In the memory means mounted in the computer, the identification number for identifying the information output device is stored beforehand. When the identification number which is sent from the information output device via the second and first communication means matches with the identification number which is stored in the memory means beforehand, the computer communicates with the information output device.

When no comparison result match occurs, the above control processing means controls so that information which is sent from the computer to the information output device is not normally outputted from the information output device. By doing this, information of a computer user will not be indicated carelessly.

When the second communication means has a plurality of communication interfaces, it can communicate with another plurality of information output devices and the computer and in the state that a plurality of similar information output devices are connected to the computer, it can exercise various types of control for the information output devices and can inform the computer of the status of each information output device.

The detection means detects the internal operation status of the information output device and the control processing means judges the detection result. The audio output means indicates the operation status of the information output device in voice on the basis of the judgment result which is sent from the information output device to the computer via the second and first communication means. Furthermore, the display means mounted in the information output device displays the above operation status. The display means mounted in the computer performs the same operation as that of the display means mounted in the information output device. In this case, information which is sent to the computer via the second and first communication means is used as display information.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing the first embodiment of the present invention.

FIG. 2 is a memory map showing the contents of the memory in the display device shown in FIG. 1.

FIG. 3 is a flow chart showing the operation of the essential section shown in FIG. 1.

FIG. 4 is a block diagram showing the second embodiment of the present invention.

FIG. 5 is a block diagram showing the third embodiment of the present invention.

FIG. 6 is a block diagram showing the internal structure of the display device 6B shown in FIG. 5.

FIG. 7 is a block diagram showing the fourth embodiment of the present invention.

FIG. 8 is a flow chart showing the operation outline shown in FIG. 7.

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FIG. 9 is a block diagram showing the fifth embodiment of the present invention.

FIG. 10 is a block diagram showing the sixth embodiment of the present invention.

FIG. 11 is a block diagram showing the seventh embodiment of the present invention.

FIG. 12 is a block diagram showing the eighth embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments of the present invention will be explained with reference to the accompanying drawings hereunder.

FIG. 1 is a block diagram showing the first embodiment of the present invention. In the drawing, a section 1 enclosed by a chained line indicates a computer. In the section 1, a reference numeral 2 indicates a CPU (central processing unit), 3 a display controller for generating various signals for video display, 4 a memory, and 5 a communication controller for communicating with peripheral devices. In addition, a magnetic recording unit is mounted as a data storage device which is not shown in the drawing.

A section 6 enclosed by another chained line indicates a so-called multi-scan display device which can be applied to various video signal specifications. In the section 6, a reference numeral 7 indicates a microcomputer for controlling display of the display device 6, 8 a second communication controller for communicating with the above communication controller 5, 9 a second memory, 10 a general deflection circuit of the display device, 11 a video circuit of the display device, 12 a horizontal deflection yoke, 13 a vertical deflection yoke, and 14 a color cathode-ray tube (hereinafter called a CDT (color display tube)) for displaying color images.

The operation shown in FIG. 1 is as shown below. The computer 1 has a structure which is the same as the general structure of a conventional personal computer or workstation and the communication controller 5 controls a communication interface such as RS-232C which is installed in the standard type. When a control instruction of the display device 6 is inputted firstly by a user of the computer from a general keyboard which is not shown in the drawing of the computer 1, it is coded digitally by a keyboard controller which is neither shown in the drawing and CPU 2 identifies the instruction and controls the communication controller 5. The communication controller 5 sends the control instruction of the display device to the display device 6. When a control instruction of the display device 6 which is included in the software for allowing the computer 1 to operate is read from the external storage device such as a floppy disk drive or hard disk drive which is not shown in the drawing, CPU 2 identifies the instruction and controls the communication controller 5. The communication controller 5 also sends the control instruction of the display device to the display device 6.

Next, the display device 6 sends the control instruction from the computer 1 which is received by the communication controller 8 to the microcomputer 7. The microcomputer 7 identifies this control instruction and generates control signals to the relevant portions to be adjusted in the deflection circuit 10 or video circuit 11. The aforementioned deflection circuit 10 and video circuit 11 can be adjusted in the same way as with a conventional multiscan display and the adjustment means has a structure which is the same as that of a conventional multiscan display. By doing this, the

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display size and position, brightness, contrast, and hue of images displayed on the CDT 14 are made most suitable to a user of the computer system.

Furthermore, WYSIWYG (what you see is what you get) control which makes an image displayed on the display device 6 similar to print output of an output device other than the display, for example, a printer can be realized only by sending a control instruction for changing the display position and size to the display device 6 instead of operating and generating display data by the computer 1. The interface part of the above display device 6 such as the communication control terminal is mounted on the back or side of the display device from a viewpoint of easy connection to the computer 1 and appearance.

Furthermore, the aforementioned communication function is used for adjustment at a factory. In this case, necessary information is all written into the memory 9 in the display device 6. FIG. 2 is a memory map showing the contents of the memory 9 in the display device 6. For adjustment at factory, data to be written can be all set. In a case other than factory adjustment, namely, for adjustment in a system as shown in FIG. 1, to prevent data requiring no rewriting, namely, preset values at factory such as, for example, the number of all data or the data within the corresponding frequency range from being erased by mistake or rewritten, the computer 1 sends the ID number and the microcomputer 7 in the display device 6 checks the ID number with the registered ID number stored in the memory 9.

A flow chart of this check is shown in FIG. 3. As shown in the drawing, when the computer 1 and display device 6 are turned on at Step 1, each device is initialized at Step 2. Concretely, CPU 2 and the microcomputer 7 read the starting system software and put the peripheral circuit to be connected to the CPU into the active state so that the next operation can be performed. Then, at Step 3, the microcomputer 7 in the display device 6 waits for sending of the identification number assigned to the computer 1, that is, the so-called ID number from the computer 1. Next, at Step 4, the microcomputer 7 receives the ID number which is sent from the computer 1 and checks whether the received ID number is registered in the registered ID number list which is stored in the memory 9 in the display device 6.

When it is registered, at Step 5, the computer 1 is allowed to control the display device 6 by external control instructions so that the user control of the display size, position, brightness, and contrast can be performed by control instructions sent from the computer 1 thereafter. On the other hand, when the received ID number is not registered in the memory 9, at Step 6, the display device 6 is not allowed to be controlled by external control instructions thereafter. Therefore, even if any control instruction is sent from the computer 1, the display device 6 will not accept it.

Or, at Step 5, the computer 1 may be allowed to perform all the adjustments which can be performed by the display device 6, that is, the same control as that for adjustment at factory and at Step 6, a part of the control of the display device 6 such as display control may be allowed.

By doing this, the display device 6 can be prevented from careless control.

The above is an example that an ID number is sent to the display device 6 from the computer 1. However, needless to say, the reverse case of the above is possible. Namely, an ID number is sent to the computer 1 from the display device 6 so that the computer 1 identifies that the display device 6 having a communication function is connected and the

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computer 1 compares the ID number with the ID number registered in the computer 1. When the corresponding ID number is registered, the computer 1 controls the display device 6 by a predetermined control instruction. When it is not registered, the computer 1 judges that it cannot control the display device 6 and will not control the display device 6.

By doing this, the computer 1 communicates with a specific display device 6 and can exercise control such as changing the color temperature of an image displayed on the display device 6 or changing the display size depending on the application software.

According to this embodiment, RS-232C is used as a communication interface. However, a general-purpose interface such as RS-422, RS-423, SCSI or GP-IB, or network interface may be used. Furthermore, the embodiment may be applied to an interface using optical signals instead of electric signals. The above interface may be installed in the neighborhood of the rear cabinet or lower pedestal of the display device 6 for convenience of a user.

FIG. 4 is a block diagram showing the second embodiment of the present invention. According to this embodiment, when the ID number sent from the computer to the display device is not registered in the memory 9, another operation which is different from the operation shown in the first embodiment is performed. Namely, according to this embodiment, when the ID numbers do not match with each other, nothing is displayed on the display device so as to enhance the secrecy of information.

Next, the structure of FIG. 4 will be explained. In the drawing, a reference numeral 6A indicates another display device which is different from the display device 6 shown in FIG. 1, 15 a horizontal deflection circuit, 16 a vertical deflection circuit, 17 a synchronizing signal processing circuit, 18 a horizontal phase control circuit, 19 a horizontal oscillating circuit, 20 a horizontal driving circuit, 21 a horizontal deflection output circuit, 22 a video pre-amplifier circuit, 23 a video blanking circuit, and 24 a video output circuit. The other reference numerals which are the same as those shown in FIG. 1 indicate the same functions. The video circuit 11 is a general video circuit consisting of the video pre-amplifier circuit 22, video blanking circuit 23, and video output circuit 24. The horizontal deflection circuit 15 is a general deflection circuit consisting of the synchronizing signal processing circuit 17, horizontal phase control circuit 18, horizontal oscillating circuit 19, horizontal driving circuit 20, and horizontal deflection output circuit 21. The vertical deflection circuit 16 is also a general circuit which has a structure similar to that of the horizontal deflection circuit 15.

Next, the operation shown in FIG. 4 will be explained. In the drawing, an ID number sent from the computer 1 is inputted into the microcomputer 7 via the communication controller 8. The microcomputer 7 checks the above ID number with the ID number stored in the memory 9. When the ID number stored in the memory 9 matches with the ID number sent from the computer 1, the microcomputer 7 receives the control from the computer 1.

On the other hand, when the check results do not match with each other, the microcomputer 7 controls the horizontal oscillating circuit 19, fixes the oscillation frequency to a predetermined value, and allows the display device 6A to perform a horizontal deflection operation at a value different from the horizontal frequencies of the video signal and synchronizing signal which are sent from the computer. Therefore, the image displayed on the CDT 14 is not



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synchronized horizontally in this case and the screen content cannot be judged. When the vertical deflection circuit 16 is controlled in the same way, the image displayed on the CDT 14 is not synchronized vertically on the screen. By controlling the video blanking circuit 23 of the video circuit 11, the video display period may be blanked so that no image is displayed on the CDT 14.

By using the aforementioned methods independently or combined, only when a user of the computer system enters a predetermined ID number from the keyboard, it is displayed correctly on the display device 6A and information displayed on the CDT 14 can be prevented from careless indication.

FIG. 5 is a block diagram of the third embodiment of the present invention. According to this embodiment, the display device is provided with a plurality of communication functions and a plurality of display devices can be connected with the communication interface. In the drawing, reference numerals 6B, 6C, and 6D indicate display devices having the same structure, V1, V2, and V3 lines for video signals and synchronizing signals, C1, C2, and C3 communication lines for, for example, RS-232C, and 1 the aforementioned computer. Each of the display devices 6B, 6C, and 6D has a plurality of video signal I/O terminals and communication interface I/O terminals and a registered ID number. According to this embodiment, as shown in FIG. 5, 1 is assigned to the display device 6B as an ID number, 2 to the display device 6C as an ID number, and 3 to the display device 6D as an ID number.

Next, the operation shown in FIG. 5 will be explained. In the drawing, for example, when controlling the display device 6B from the computer 1, the ID number 1 is sent to the line C1 and the display device 6B is controlled appropriately from the computer 1. Next, when controlling the display device 6C, the ID number 2 is sent from the computer 1 in the same way. Then, the ID number is received by the display device 6C via the lines C1 and C2 and the display device 6C can be controlled appropriately from the computer 1.

Since a plurality of display devices can be controlled by a computer in this way, a plurality of display devices can be adjusted at a time, for example, at the time of delivery adjustment at a factory. Furthermore, by using a multi-display system for displaying an image by assembling a plurality of display devices and for displaying various images on each screen, the display devices can be hued and adjusted in brightness simply.

FIG. 6 is a block diagram showing the internal structure of the display device 6B shown in FIG. 5. In the drawing, a reference numeral 25 indicates a communication controller having two communication ports and 26 a divider of video signals and synchronizing signals. The communication controller 25 sends or receives data to or from the computer 1 in the same way as the communication controller 8 of the display device 6 shown in FIG. 1 and also divides the communication lines and relays other display devices. On the other hand, the divider 26 divides video signals or synchronizing signals sent from the computer 1 or signal source to other display devices. By using such a structure, a plurality of display devices can be connected to a computer as shown in FIG. 5.

Next, the fourth embodiment of the present invention will be described. FIG. 7 is a block diagram showing the fourth embodiment of the present invention. In the drawing, a reference numeral 1B indicates a computer, 31 an audio control circuit for producing a sound, 32 a speaker, 6E a

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display device, 27 and 28 analog-digital converters (hereinafter abbreviated to ADC), and 29 and 30 digital-analog converters (hereinafter abbreviated to DAC). The other reference numerals which are the same as those shown in FIG. 1 indicate the same functions. The operation of FIG. 7 will be explained hereunder with reference to the operation flow chart shown in FIG. 8.

When the computer 1B and display device 6E are started at Step 10 as shown in FIG. 8, they start communication with each other via the communication controllers 5 and 8 at Step 11 next. Then, at Step 12, the computer 1B calls the display device 6E. When no response is received, the computer 1B judges that the display device 6E is faulty, starts the audio control circuit 31 at Step 13, and informs the user of the computer 1B that the display device 6E is faulty from the speaker.

When the communication succeeds, at Step 14, the microcomputer 7 fetches information of the operation status of the deflection circuit 10 or video circuit 11 in the display device 6E from the voltage at a predetermined part in the circuit as digital information via the ADCs 27 and 28. Next, at Step 15, the microcomputer 7 judges whether the value which is fetched at Step 14 is a value in the normal operation status. When the microcomputer 7 judges it as an error, it informs the computer 1B of the faulty value via the communication controller 8 and CPU 2 of the computer 1B allows the audio control circuit 31 to operate and generates a message informing an error of the display device 6E from the speaker 32. Furthermore, CPU 2 allows the display controller 3 to operate and displays also a message informing an error on the CDT 14 via the video circuit 11.

In this case, when an indication code informing the faulty part is sent to the computer 1B from the display device 6E simultaneously, the computer 1B judges the indication code and can inform the user or a customer engineer of the display device 6E of the faulty part by sound or display.

When the display device 6E is normal at Step 15, the computer 1B can exercise the communication control such as the display size, hue, and brightness of the display device 6E at Step 17. At this step, when a control instruction is sent to the display device 6E from the computer 1B, the microcomputer 7 decodes the instruction and outputs the control code to the corresponding DAC 29 or 30. The DAC 29 or 30 controls a predetermined control part at the DC control voltage corresponding to the above control code and controls the display size, position, and hue of the image displayed on the CDT 14. When the above series of operations ends, the computer 1B returns to Step 14 and repeats the operations from the monitor mode of a faulty operation of the display device 6E to the normal operation at Step 17.

As mentioned above, the computer 1B can be informed of a faulty operation by using the communication function of the display device 6E. Therefore, the user can judge the faulty part and can maintain the system easily.

FIG. 9 is a block diagram showing the fifth embodiment of the present invention. This embodiment obtains the same effect as that of the embodiment shown in FIG. 7. In FIG. 9, a reference numeral 6F indicates a display device, 33 a liquid crystal display controller in the display device 6F, and 34 a liquid crystal display panel mounted in the display device 6F. The other reference numerals which are the same as those shown in FIGS. 1 and 7 indicate the same functions.

The operation shown in FIG. 9 is basically the same as that shown in FIG. 7. The operation of the deflection circuit 10 or video circuit 11 is monitored by the microcomputer 7 via the ADC 27 or 28. When an error occurs, the micro-

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computer 7 transmits an indication code informing the occurrence of an error to the computer 1B via the communication line and informs the user of it by voice from the speaker 32.

Furthermore, the microcomputer 7 allows the liquid crystal display controller 33 in the display device 6F to operate and displays information of the occurrence of the fault and faulty part on the liquid crystal display panel 34. By doing this, information when an error occurs in the display device 6F can be obtained more surely.

FIG. 10 is a block diagram showing the sixth embodiment of the present invention. This embodiment obtains the same effect as that of the embodiment shown in FIG. 9. In FIG. 10, a reference numeral 1C indicates a computer and 35 a liquid crystal display controller in the computer 1C. The other reference numerals which are the same as those shown in FIGS. 1 and 9 indicate the same functions. In FIG. 10, the display function for a fault and faulty operation of the display device shown in FIG. 9 is mounted in the computer 1C.

Namely, when an error occurs in the internal circuit of the display device 6E, the voltage detected by the ADC 27 or 28 is digitized and processed by the microcomputer 7 as faulty voltage occurrence information and information informing an error is transmitted to the computer 1C via the communication controller 8. In the computer 1C, CPU 2 decodes the transmitted faulty information. When CPU 2 identifies the faulty part of the display device 6E, it allows the audio control circuit 31 to operate as an audio signal and informs the user of the fault by an audio message from the speaker 32 on one hand. On the other hand, CPU 2 controls the liquid crystal display controller 35 so as to display characters or graphics on the liquid crystal display panel 34. By doing this, the user of the display device 6E can be informed of an error or fault of the display device 6E and can maintain the system easily.

FIG. 11 is a block diagram showing the seventh embodiment of the present invention. In the drawing, a reference numeral 36 indicates a power supply of the deflection circuit 10 and video circuit 11. The other reference numerals which are the same as those shown in FIG. 1 indicate the same functions.

Next, the operation shown in FIG. 11 will be explained. In FIG. 11, when a control instruction to the display device 6 is issued from CPU 2 of the computer 1, the communication controller 5 changes the control instruction to a one in the signal format suited to communication and sends it to the display device 6. The display device 6 returns the signal received by the communication controller 8 to the control instruction which can be identified by the microcomputer 7 and sends it to the microcomputer 7. The microcomputer 7 judges the control instruction and decides the part of a predetermined section in the display device 6 to be controlled.

When the control instruction relates to control of the power supply 36 and is an instruction for stopping power supply from the power supply 36 to the deflection circuit 10, or video circuit 11, or both circuits, the microcomputer 7 controls the power supply 36 so as to stop the above power supply. Therefore, the image display on the CDT 14 is also stopped.

By doing this, for example, when the computer 1 is not in operation for a predetermined period, the operation power supply for the display device 6 can be automatically put into the off state. Therefore, unnecessary power consumption can be restrained and the life span of the display device can be

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lengthened. The aforementioned is power supply off control. However, needless to say, power supply on control is also possible. Namely, in this case, when the computer 1 is turned on or the computer 1 is changed from the function stop state to the active state, the microcomputer 7, power supply 36, deflection circuit 10, and video circuit 11 perform the reverse operation of the aforementioned so that the display device automatically starts to display.

FIG. 12 is a block diagram showing the eighth embodiment of the present invention. In the drawing, a reference numeral 37 indicates a display controller and the other numerals which are the same as those shown in FIG. 1 indicate units performing the same functions as those shown in FIG. 1.

Next, the operation of FIG. 12 will be explained. In FIG. 12, video information is sent to the display device 6 from the communication controller 5 in addition to a control instruction of the display device 6 which is explained in the embodiment shown in FIG. 1. This video information is a digital signal in the same way as a signal which is inputted to the display controller 3 in the embodiment shown in FIG. 1. The communication controller 8 of the display device 6 sends video information among the received signals to the display controller 37. The display controller 37 performs an operation which is the same as that of the display controller shown in FIG. 1 and generates a video signal to be inputted to a general display. By doing this, also in the embodiment shown in FIG. 12, an effect which is the same as that shown in FIG. 1 can be obtained. Furthermore, in FIG. 12, since video information is transmitted via a communication interface which is connected between the computer 1 and display device 6, a video signal line which is conventionally necessary is not necessary.

According to the present invention, a user of a computer can exercise various types of control for an information output device such as a display device from the keyboard of the computer or by the software incorporated in the computer. Therefore, the operability of the computer system is improved so that the system can be used easily and the user can obtain a desired information output status easily.

When an identification number is set to each device, a value which is set by the above control will not be lost by a careless operation of a user. By setting an identification number for a specific user, the secret of information can be protected inversely. Since the power supply for the information output device can be controlled by the computer when necessary, unnecessary power consumption can be restrained.

Since the status of the information output device can be monitored simply, the system can be protected against a malfunction and maintained easily. Furthermore, the aforementioned control hardware can be realized in a minimum structure.

What is claimed is:

1. A display unit having a communication control circuit for communicating with an externally connected computer, wherein said communication control circuit comprises:

comparing means for comparing a first identification information which is previously stored in said display unit and a second identification information which is previously stored in said computer and is sent from said computer; and

a communication prohibition means for prohibiting communication between said computer with respect to display control of said display unit, when said first and second identification information do not match as a result of the comparison by said comparing means;



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wherein said communication control circuit enables bi-directional communication with said display unit and said computer.

2. A display unit according to claim 1, wherein said first and second identification information include an identification number.

3. A display unit having a communication control circuit for communicating with an externally connected computer, wherein said communication control circuit comprises:

comparing means for comparing a first identification information which is previously stored in said display unit, and a second identification information which is previously stored in said computer and is sent from said computer; and

a reception prohibition means for prohibiting reception of a control command from said computer, for controlling at least one of a display size, a display position, a brightness, and a contrast of said display unit, when said first and second identification information do not match as a result of the comparison by said comparing means;

wherein said communication control circuit enables bi-directional communication with said display unit and said computer.

4. A display unit according to claim 3, wherein said first and second identification information include an identification number.

5. A display unit having a communication control circuit for communicating with an externally connected computer, wherein said communication control circuit comprises:

memory means for storing at least data of a frequency range to which said display unit is operable;

comparing means for comparing a first identification information which is previously stored in said display unit, and a second identification information which is previously stored in said computer and is sent from said computer; and

a communication permission means for permitting communication between said computer, at least with respect to said data of a frequency range stored in said memory means, when said first and second identification information match as a result of the comparison by said comparing means;

wherein said communication control circuit enables bi-directional communication with said display unit and said computer.

6. A display unit according to claim 5, wherein said first identification information is stored in said memory means.

7. A display unit according to claim 5, wherein said data relating at least to a display specification of said display unit stored in said memory means, includes data of a frequency range to which said display unit is operable.

8. A display unit according to claim 5, wherein said first and second identification information include an identification number.

9. A display unit having a communication control circuit for communicating with an externally connected computer, wherein said communication control circuit comprises:

memory means for storing at least data of a frequency range for which said display unit is operable;

comparing means for comparing a first identification information which is previously stored in said display unit in advance, and a second identification information which is previously stored in said computer and is sent from said computer; and

a communication prohibition means for prohibiting communication between said computer, at least with respect to said data of a frequency range stored in said memory means, when said first and second identification infor-

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mation do not match as a result of the comparison by said comparing means;

wherein said communication control circuit enables bi-directional communication with said display unit and said computer.

10. A display unit according to claim 9, wherein the control of said memory means includes rewriting or writing control of said data in said memory means.

11. A display unit according to claim 9, wherein said first identification information is stored in said memory means.

12. A display unit according to claim 9, wherein said data relating at least to a display specification of said display unit stored in said memory means, includes data of a frequency range to which said display unit is operable.

13. A display unit according to claim 9, wherein said first and second identification information include an identification number.

14. A display unit having a communication control circuit for communicating with an externally connected computer, wherein said communication control circuit comprises:

comparing means for comparing a first identification information which is previously stored in said display unit, and a second identification information which is previously stored in said computer and is sent from said computer; and

a communication permission means for enabling display control by said computer and permitting communication between said computer and said display unit with respect to display control of said display unit, when said first and second identification information match as a result of the comparison by said comparing means, wherein said communication control circuit enables bi-directional communication with said display unit and said computer.

15. A display unit having a communication control circuit for communicating with an externally connected computer, wherein said communication control circuit comprises:

comparing means for comparing a first identification information which is previously stored in said display unit, and a second identification information which is previously stored in said computer and is sent from said computer; and

a reception permission means for enabling control of a display size/position of said display unit by said computer and permitting reception of a control command from said computer for controlling at least the display size/position of said display unit, when said first and second identification information match as a result of the comparison by said comparing means,

wherein said communication control circuit enables bi-directional communication with said display unit and said computer.

16. A display unit for displaying an image based upon a digital image information signal, inputting said digital image information signal from an externally connected computer, comprising:

comparing means for comparing a first identification information which is previously stored in said display unit, and a second identification information which is previously stored in said computer and is sent from said computer; and

a communication permission means for enabling display control by said computer and permitting communication between said computer and said display unit with respect to display control of said display unit, when said first and second identification information match as a result of the comparison by said comparing means, further comprising a communication controller which enables bi-directional communication with said display unit and said computer.

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17. A display unit for displaying an image based upon a digital image information signal, inputting said digital image information signal from an externally connected computer, comprising:

comparing means for comparing a first identification information which is previously stored in said display unit, and a second identification information which is previously stored in said computer and is sent from said computer; and

a communication prohibition means for disabling control of said memory means by said computer and prohibiting communication between said computer and said memory means of said display unit, when said first and second identification information do not match as a result of the comparison by said comparing means, further comprising a communication controller which enables bi-directional communication with said display unit and said computer.

18. A display unit for displaying an image based upon an image signal inputted from an externally connected computer, comprising:

memory means for storing an identification number for making said computer recognize that said display unit is communicatable with said computer; and

a communication control means for sending said identification number stored in said memory means to said computer, wherein said communication control means enables bi-directional communication with said display unit and said computer.

19. A display unit for displaying an image based upon an image signal inputted from an externally connected computer, comprising:

memory means for storing an identification number for making said computer recognize that said display unit is communicatable with said computer; and

a communication control means for sending said identification number stored in said memory means to said computer in response to power on of at least one said display unit and said computer,

wherein said communication control means enables bi-directional communication with said display unit and said computer.

20. A display unit for displaying an image based upon an image signal inputted from an externally connected computer, comprising:

a memory which stores an identification number for making said computer recognize that said display unit is communicatable with said computer; and

a communication controller connected to said memory which sends said identification number stored in said memory to said computer,

wherein said communication controller enables bi-directional communication with said display unit and said computer.

21. A display unit for displaying an image based upon an image signal inputted from an externally connected computer, comprising:

a memory which stores an identification number for making said computer recognize that said display unit is communicatable with said computer; and

a communication controller which sends said identification number stored in said memory to said computer in response to power on of at least one of said display unit and said computer,

wherein said communication controller enables bi-directional communication with said display unit and said computer.

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22. A method of communicating between a display unit and a video source from which video signals are sent to the display unit for display, the method comprising the steps of:

communicating display unit information stored in a memory of the display unit from the display unit to the video source, wherein said display unit information includes an identification number for uniquely identifying the display unit; and

sending a signal from the video source to the display unit, wherein said signal is generated based on the display unit information,

wherein information is bi-directionally communicated with the video source and the display unit.

23. A display unit for displaying an image based on an image signal inputted from an externally connected computer, comprising:

a processor adapted to control display of the display unit; a memory which stores an identification number; and

a communication controller which sends the identification number stored in said memory to said computer; wherein said communication controller enables bi-directional communication between said display and said computer.

24. A display unit according to claim 23, further comprising a deflection circuit, wherein the processor generates control signals for the deflection circuit.

25. A display unit for displaying an image based on an image signal inputted from an externally connected computer, comprising:

a processor adapted to control display of the display unit; a memory which stores identification information; and

a communication controller which sends the identification information stored in said memory to said computer in response to power on of at least one of said display unit and said computer;

wherein said communication controller enables bi-directional communication between said display and said computer.

26. A display unit according to claim 25, further comprising a deflection circuit, wherein the processor generates control signals for the deflection circuit.

27. A display unit for displaying an image based on an image signal inputted from an externally connected video source, comprising:

a processor adapted to control display of the display unit; a memory in which at least display unit information is stored, wherein the display unit information includes an identification number for identifying the display unit; and

a communication controller capable of bi-directionally communicating with the video source;

wherein the communication controller communicates the display unit information from the display unit to the video source and the display unit receives a signal from the video source that is generated based on the display unit information.

28. A display unit according to claim 27, wherein the video source is a computer.

29. A display unit according to claim 28, further comprising a deflection circuit, wherein the processor generates control signals for the deflection circuit.

\* \* \* \* \*



# **Exhibit C**



US006513088B2

(12) **United States Patent**  
**Arai et al.**

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 (45) **Date of Patent:** \*Jan. 28, 2003

(54) **DISPLAY UNIT AND METHOD ENABLING BI-DIRECTIONAL COMMUNICATION WITH VIDEO SOURCE**

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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**Related U.S. Application Data**

(63) Continuation of application No. 09/265,363, filed on Mar. 10, 1999, now Pat. No. 6,247,090, which is a continuation of application No. 08/833,346, filed on Apr. 4, 1997, now Pat. No. 5,887,147, which is a continuation of application No. 08/598,903, filed on Feb. 9, 1996, now Pat. No. 5,652,845, which is a continuation of application No. 08/190,848, filed on Feb. 3, 1994, now abandoned.

(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**<sup>7</sup> ..... **G06F 13/68**

(52) **U.S. Cl.** ..... **710/305; 710/62; 710/64; 345/99; 345/132**

(58) **Field of Search** ..... **710/129, 101-103, 710/62-65, 14-15, 52, 69, 72; 345/58, 98-100, 132, 204; 709/236, 237, 249**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,007,443 A 2/1977 Bromberg et al.  
 4,047,158 A 9/1977 Jennings  
 4,159,480 A 6/1979 Tachi

(List continued on next page.)

**FOREIGN PATENT DOCUMENTS**

DE 3722169 A1 1/1989  
 DE 37 22 169 A1 1/1989  
 DE 4025295 A1 2/1991  
 DE 43 36 116 A1 5/1994

(List continued on next page.)

**OTHER PUBLICATIONS**

Barco n.v. Video & Communications, The Calibrator Explained, Part 1, Apr. 1990, pp. 1-40.

NASA Tech Brief, "Interface for Color-Video Monitor", Apr. 1988, pp. 246-247.

(List continued on next page.)

*Primary Examiner*—Peter Wong

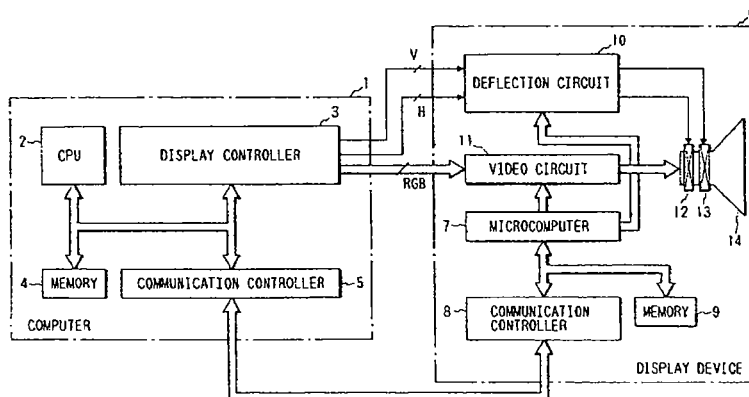
*Assistant Examiner*—Raymond N Phan

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(57) **ABSTRACT**

A display unit and method having a communication controller which is capable of bi-directionally communication with a video source. Video signals for video display are received from the video source and a memory stores at least display unit information, wherein the display unit information includes identifying information of the display unit. The communication controller communicates the display unit information to the video source and the display unit receives a signal from the video source that is generated based on at least a portion of the display unit information.

**33 Claims, 12 Drawing Sheets**



## US 6,513,088 B2

Page 2

## U.S. PATENT DOCUMENTS

4,169,262 A 9/1979 Schwartz et al. .... 340/744  
 4,177,462 A 12/1979 Chung ..... 340/703  
 4,197,590 A 4/1980 Sukonick et al. .... 364/900  
 4,342,029 A 7/1982 Hofmanis et al. .... 340/703  
 4,415,985 A 11/1983 McDaniel et al.  
 4,450,535 A 5/1984 De Pommery et al.  
 4,574,279 A 3/1986 Roberts  
 4,589,063 A 5/1986 Shah et al.  
 4,626,892 A 12/1986 Nortrup et al.  
 4,641,262 A 2/1987 Bryan et al.  
 4,680,647 A 7/1987 Moriyama  
 4,727,947 A 3/1988 Naito  
 4,736,324 A 4/1988 Sainen et al.  
 4,743,968 A 5/1988 Mogi et al.  
 4,747,041 A 5/1988 Engel et al.  
 4,775,857 A 10/1988 Staggs  
 4,800,376 A 1/1989 Suga et al.  
 4,882,687 A 11/1989 Gordon ..... 364/518  
 4,893,248 A 1/1990 Pitts et al.  
 4,922,448 A 5/1990 Kunieda et al.  
 4,970,655 A 11/1990 Winn et al.  
 4,990,904 A 2/1991 Zenda  
 4,991,023 A \* 2/1991 Nicols ..... 348/554  
 5,010,238 A 4/1991 Kadono et al.  
 5,012,339 A 4/1991 Kurata et al.  
 5,038,301 A \* 8/1991 Thoma, III ..... 345/3.3  
 5,068,732 A 11/1991 Satoh  
 5,138,305 A 8/1992 Tomiyasu  
 5,150,109 A 9/1992 Berry  
 5,159,683 A 10/1992 Lvovsky et al.  
 5,227,881 A 7/1993 Wess et al.  
 5,241,281 A 8/1993 Wilkes et al.  
 5,247,090 A \* 9/1993 Arai et al. .... 710/129  
 5,251,031 A 10/1993 Tagami  
 5,257,350 A \* 10/1993 Howard et al. .... 345/501  
 5,270,821 A 12/1993 Samuels  
 5,276,458 A 1/1994 Sawdon  
 5,276,875 A 1/1994 Satoh  
 5,282,247 A 1/1994 McLean et al.  
 5,309,174 A 5/1994 Minkus  
 5,309,504 A 5/1994 Morganstein  
 5,315,695 A 5/1994 Saito et al.  
 5,317,691 A 5/1994 Traeger  
 5,353,423 A 10/1994 Hamid et al.  
 5,375,210 A \* 12/1994 Monnes et al. .... 710/10  
 5,396,593 A 3/1995 Mori et al.  
 5,457,473 A 10/1995 Arai et al.  
 5,483,255 A 1/1996 Numao  
 5,506,602 A 4/1996 Yokoyama  
 5,550,966 A 8/1996 Drake et al.  
 5,576,735 A 11/1996 Kikuchi et al.

5,599,231 A 2/1997 Hibino et al.  
 5,602,567 A \* 2/1997 Kanno ..... 345/698  
 5,887,147 A 3/1999 Arai et al.  
 5,896,546 A 4/1999 Monaban et al.  
 5,909,592 A 6/1999 Shipman  
 5,948,091 A 9/1999 Kerigan et al.  
 6,012,103 A 1/2000 Sartore et al.  
 6,057,812 A 5/2000 Arai et al.

## FOREIGN PATENT DOCUMENTS

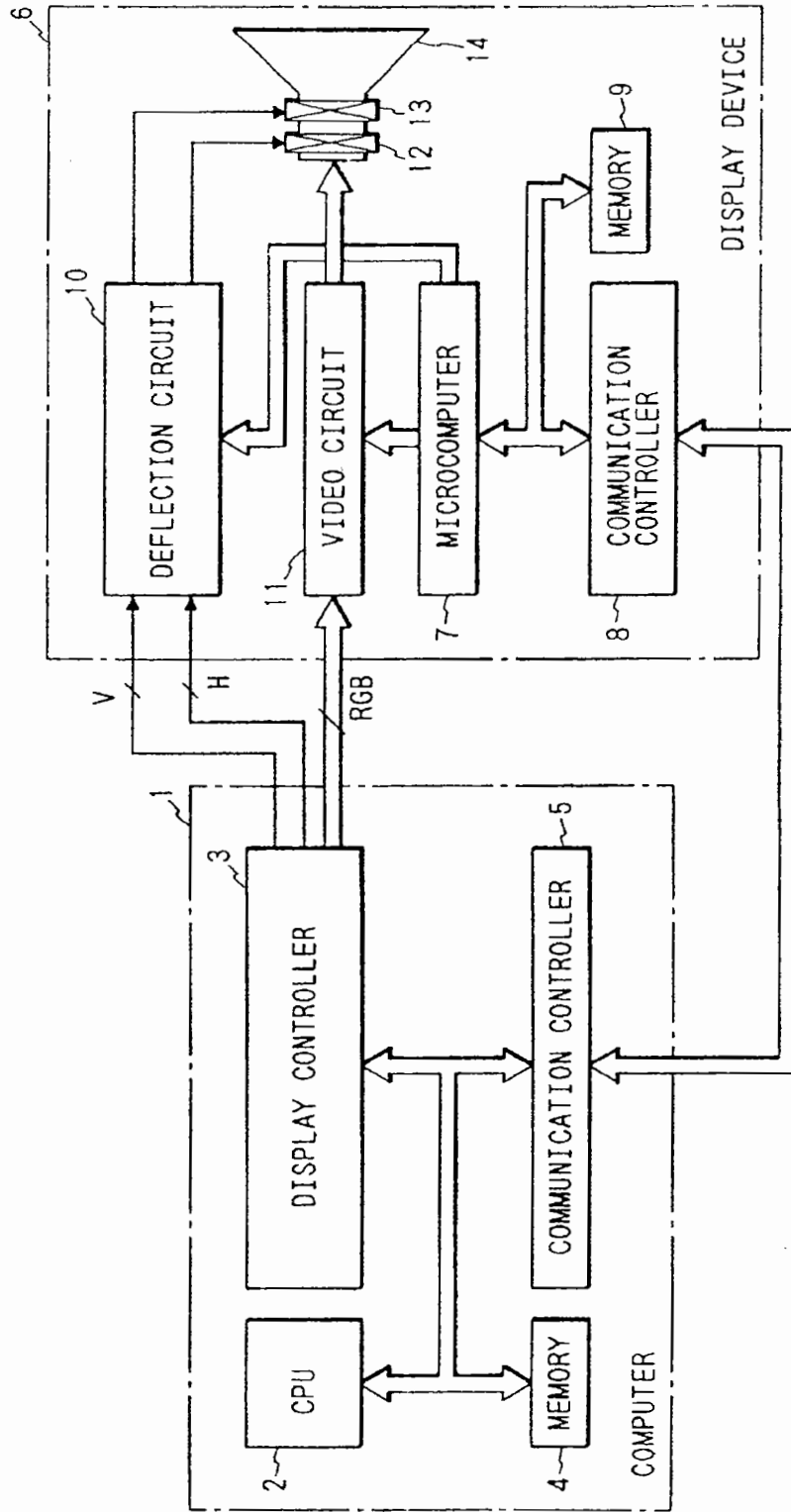
EP 456923 A1 11/1991  
 EP 0 456 923 A1 11/1991  
 EP 0456923 A1 11/1991  
 EP 0612053 A1 8/1994  
 JP 61-16643 1/1986  
 JP 61-84688 4/1986  
 JP 1-321475 12/1989  
 JP 2-103592 4/1990  
 JP 2-127688 5/1990  
 JP 2-250576 10/1990  
 JP 2-257196 10/1990  
 JP 3-56931 3/1991  
 JP 3-56993 3/1991  
 JP 3-116093 5/1991  
 JP 3-118595 5/1991  
 JP 3-148697 6/1991  
 JP 3-160494 7/1991  
 JP 3-261995 11/1991  
 JP 4-21024 1/1992  
 JP 5-46106 2/1993  
 JP 5-232918 9/1993

## OTHER PUBLICATIONS

"Display Function Identification", IBM Technical Disclosure Bulletin, vol. 28, No. 12, pp. 5568-5579, May 1980.  
 "Monitor Identification Technique", IBM Technical Disclosure Bulletin, vol. 30, No. 2, pp. 839-840, Jul. 1987.  
 "Display Controller Set up as a Function of Display Monitor Type, Display Jumper Settings and Amount of Vram", IBM Technical Disclosure Bulletin, vol. 33, No. 2, pp. 352-353, Jul. 1990.  
 "Improved Method of Monitor Identification and Mode Control", IBM Technical Disclosure Bulletin, vol. 33, No. 5, pp. 289-291, Oct. 1990.  
 "Improvements to Display Identification", IBM Technical Disclosure Bulletin, vol. 33, No. 6B, pp. 83-85.  
 "Self-Identification Protocol Initialization", IBM Technical Disclosure Bulletin, vol. 33, No. 10A, pp. 406-407, Mar. 1991.

\* cited by examiner

FIG. 1



*FIG. 2*

ADDRESS 1	NUMBER OF DATA SET	REGISTERED ID NUMBERS
ADDRESS 2	DATA AREA 1 FOR DELIVERY ADJUSTMENT	
ADDRESS 3	DATA AREA 2 FOR DELIVERY ADJUSTMENT	
⋮	⋮	
ADDRESS <i>i</i>	ADJUSTMENT DATA AREA 1 FOR USER	
ADDRESS <i>i</i> +1	ADJUSTMENT DATA AREA 2 FOR USER	
⋮	⋮	

FIG. 3

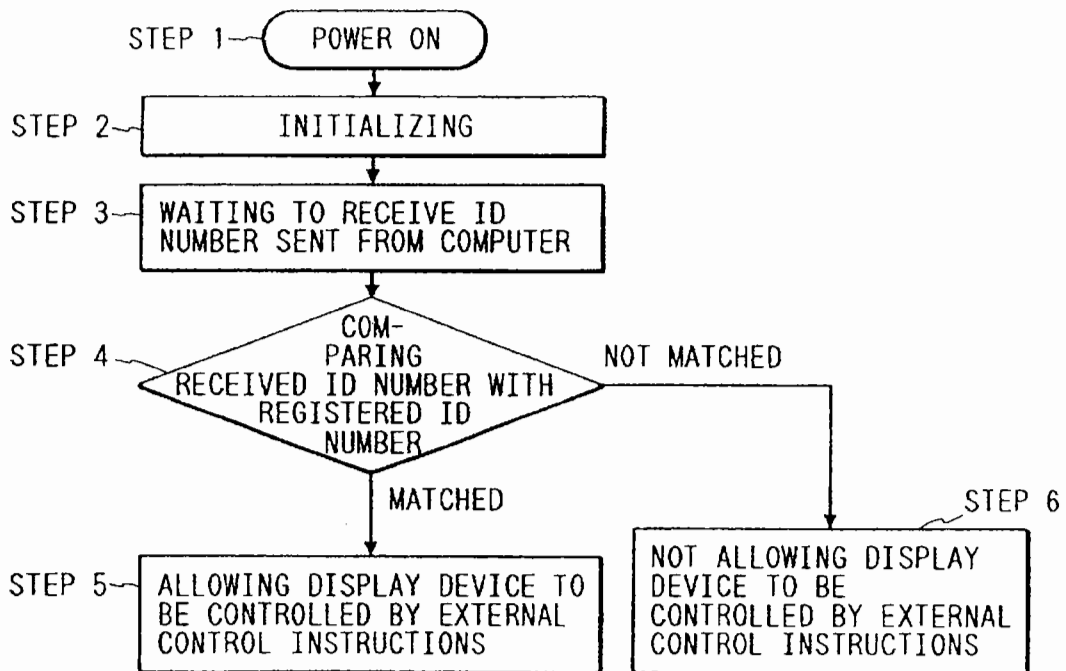


FIG. 4

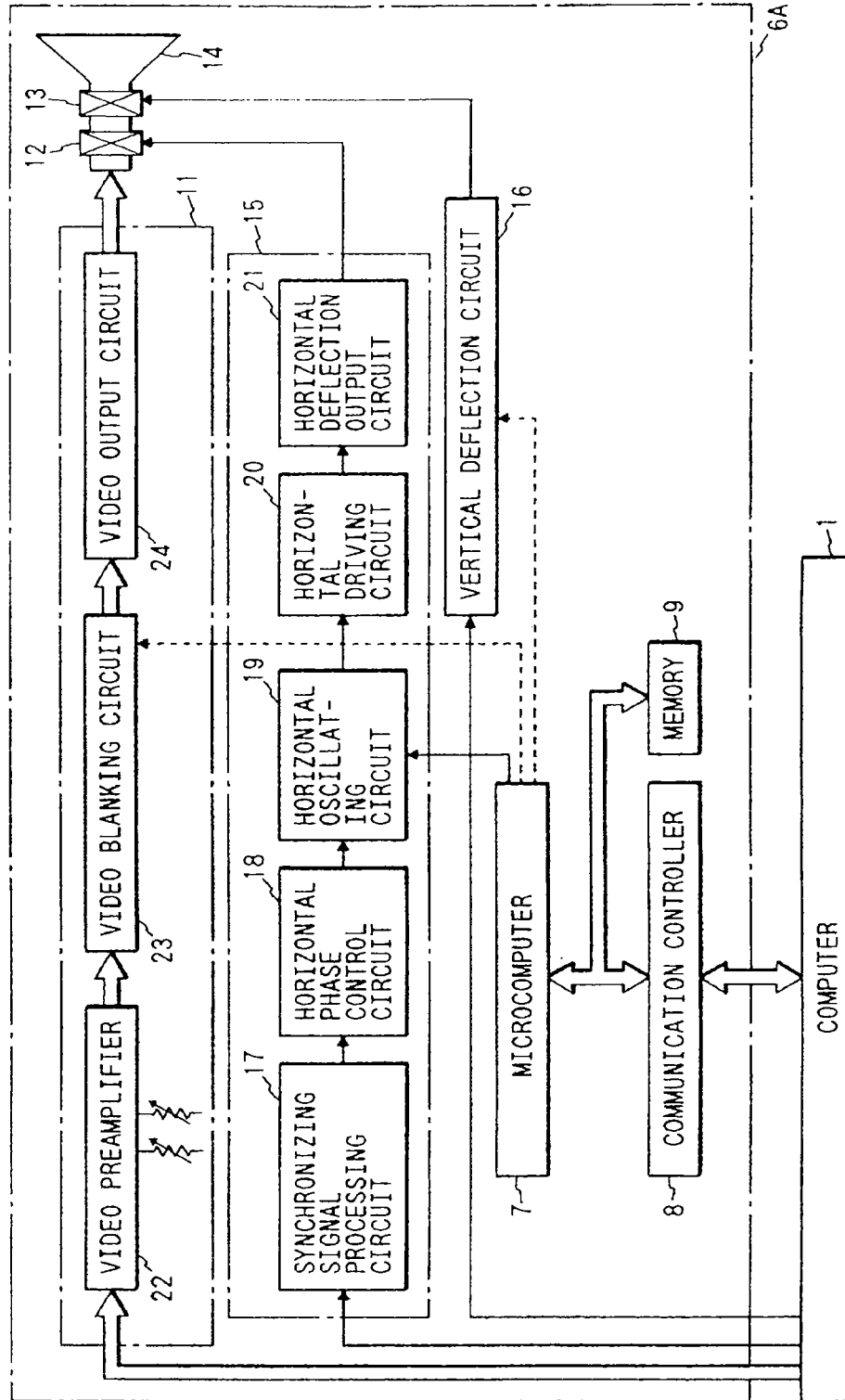


FIG. 5

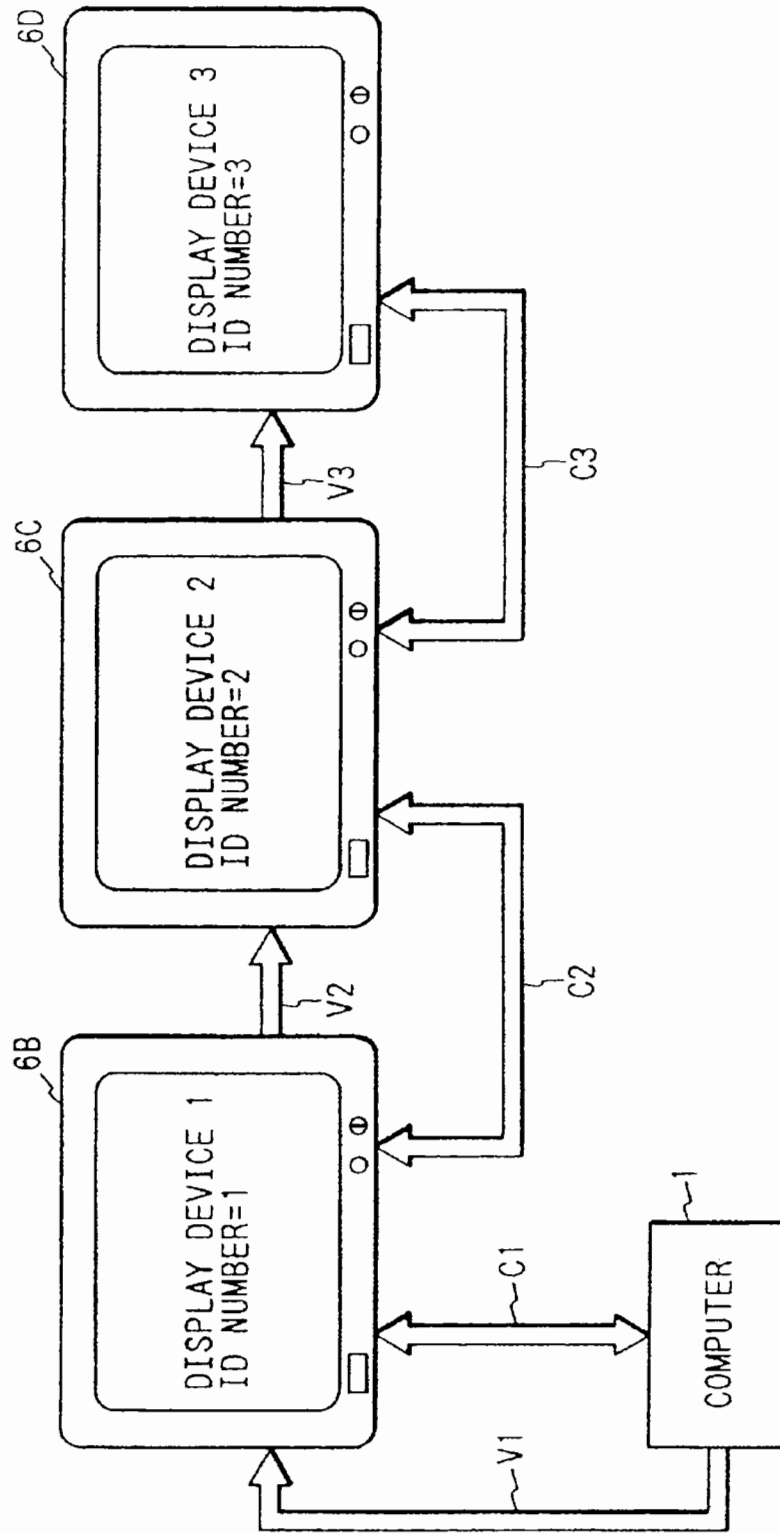




FIG. 6

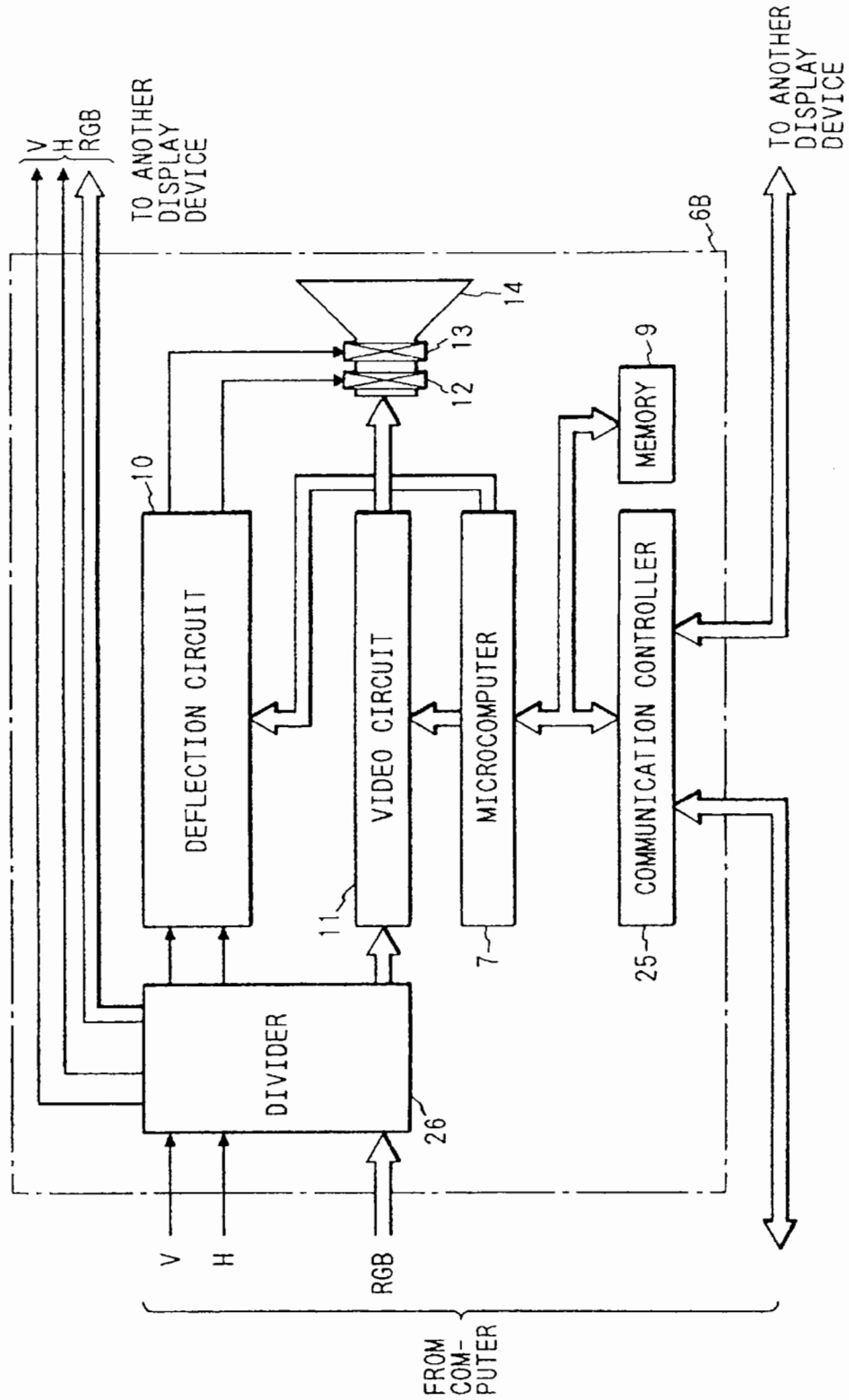


FIG. 7

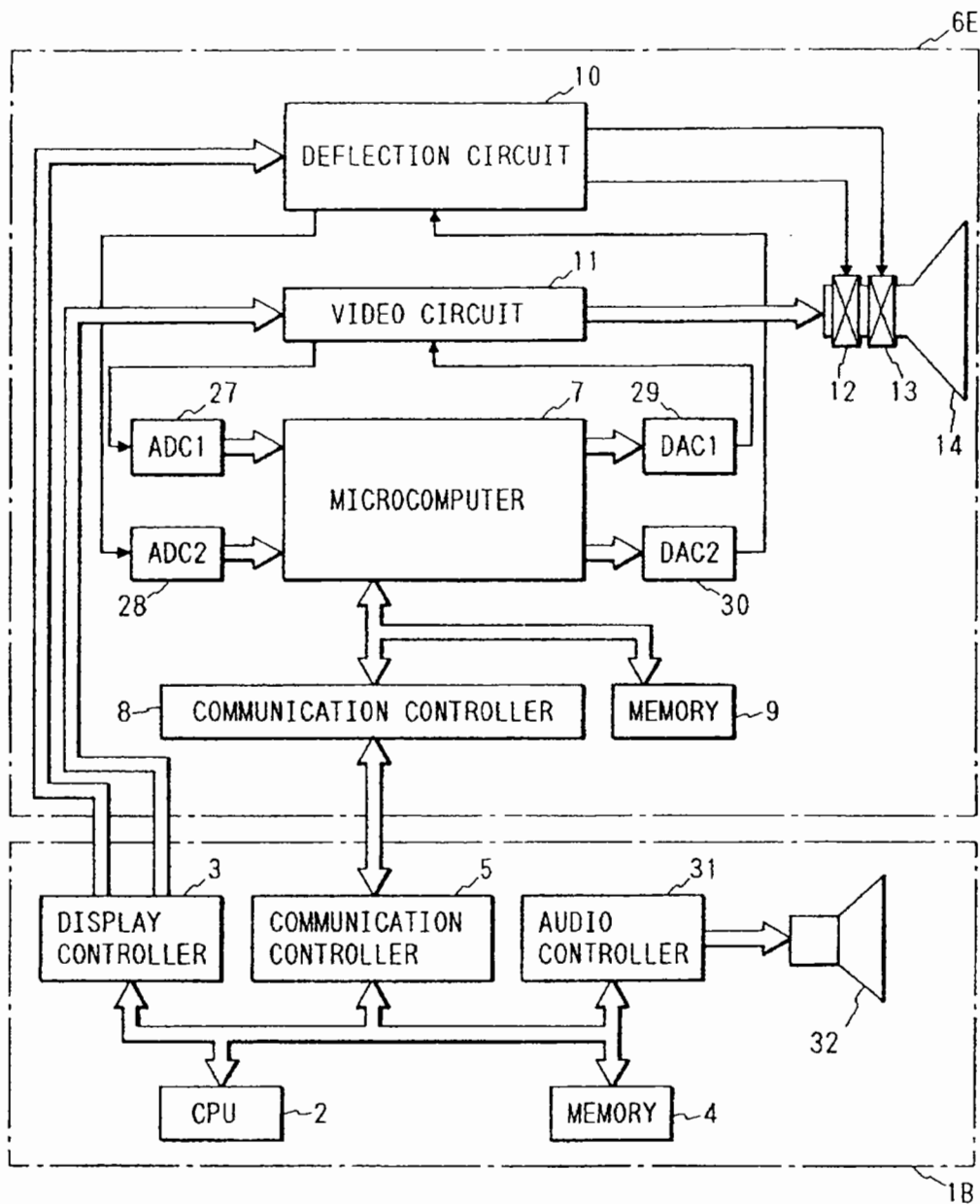


FIG. 8

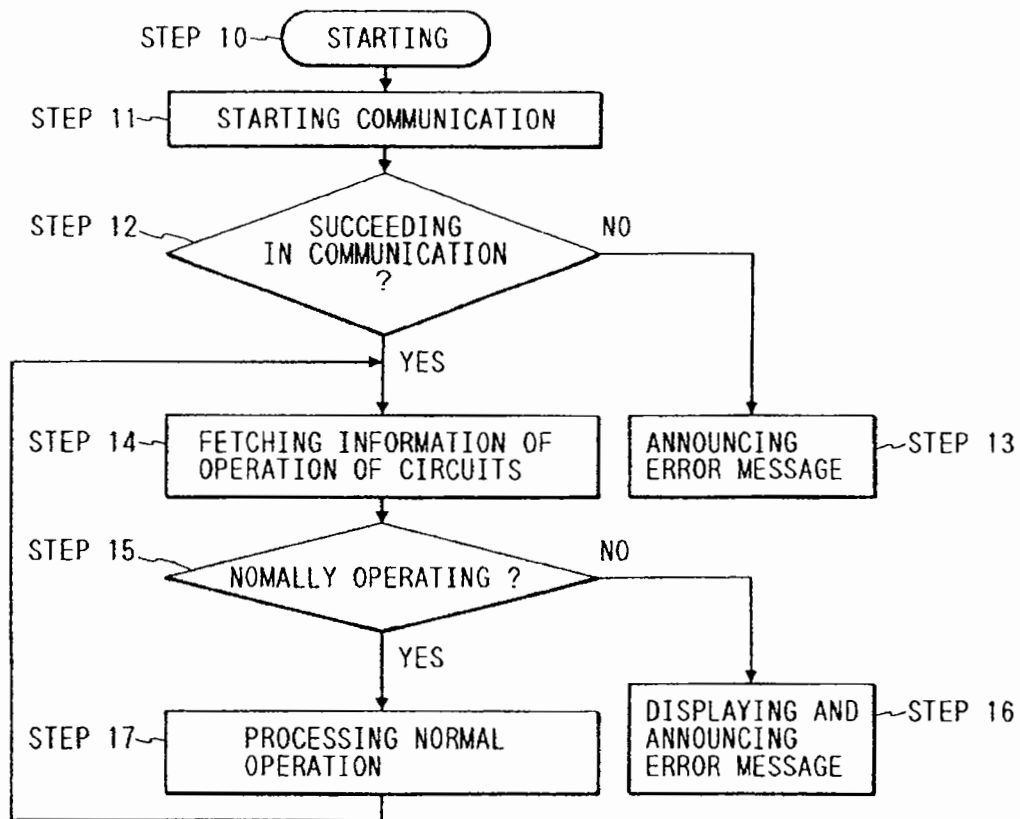


FIG. 9

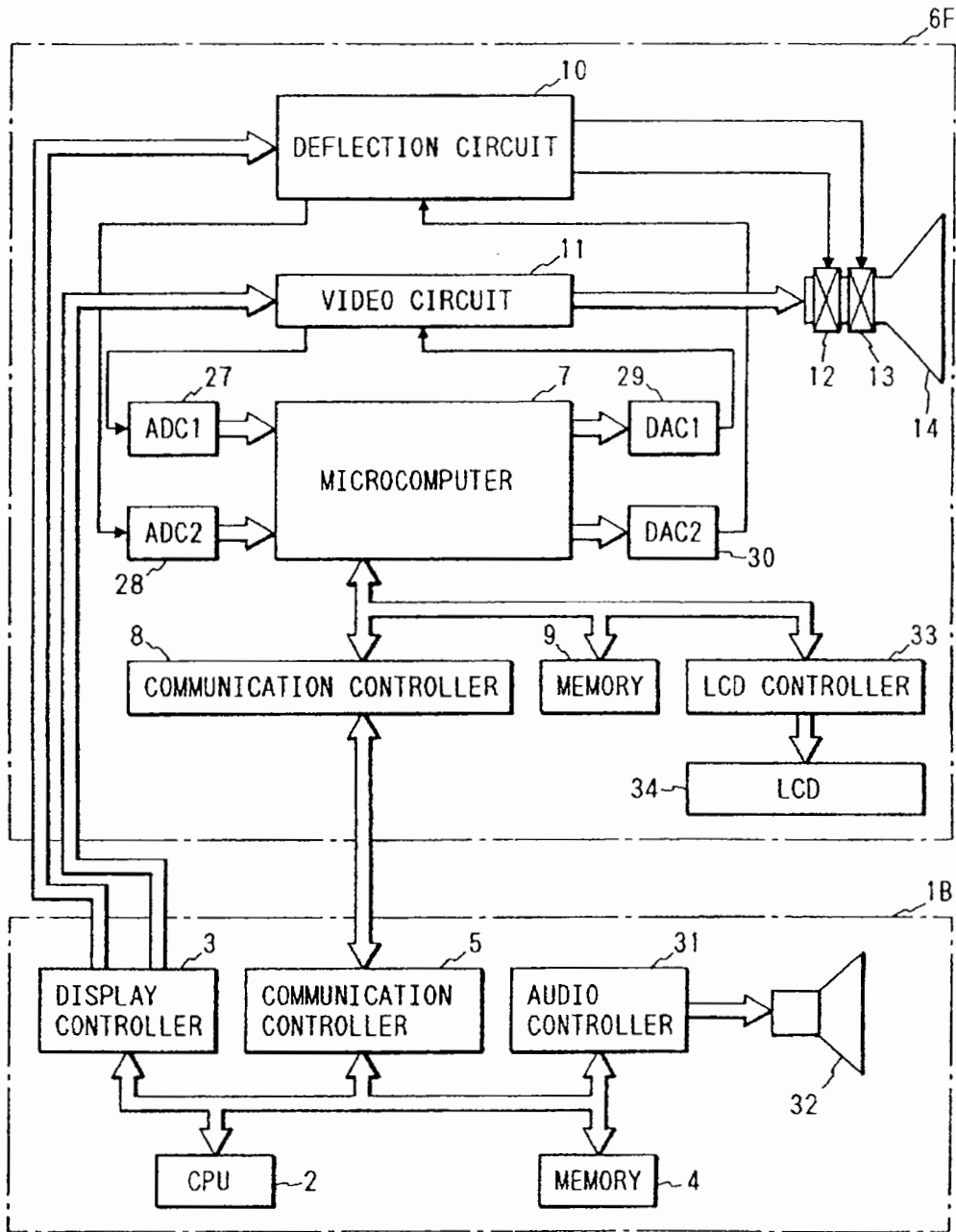


FIG. 10

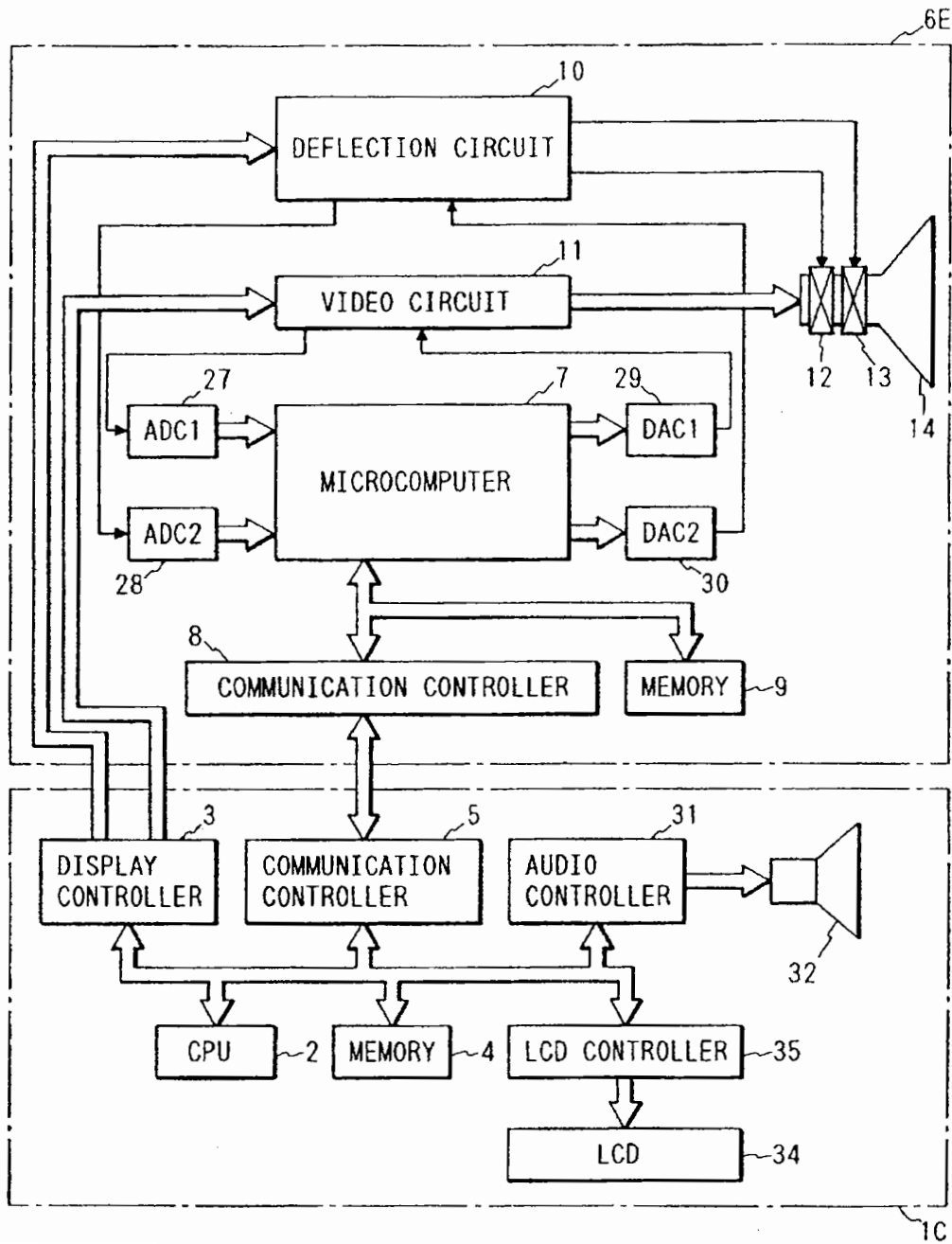


FIG. 11

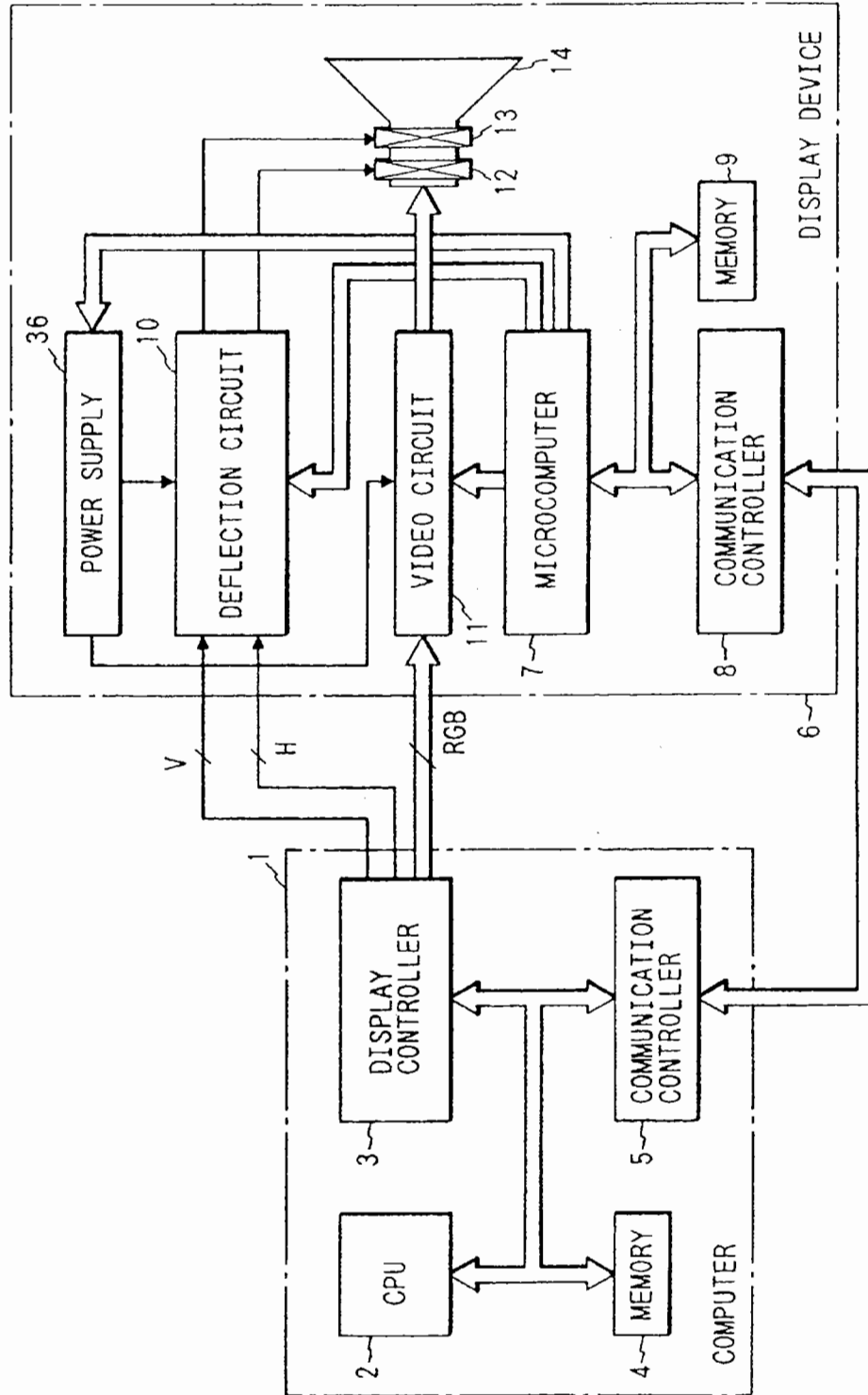
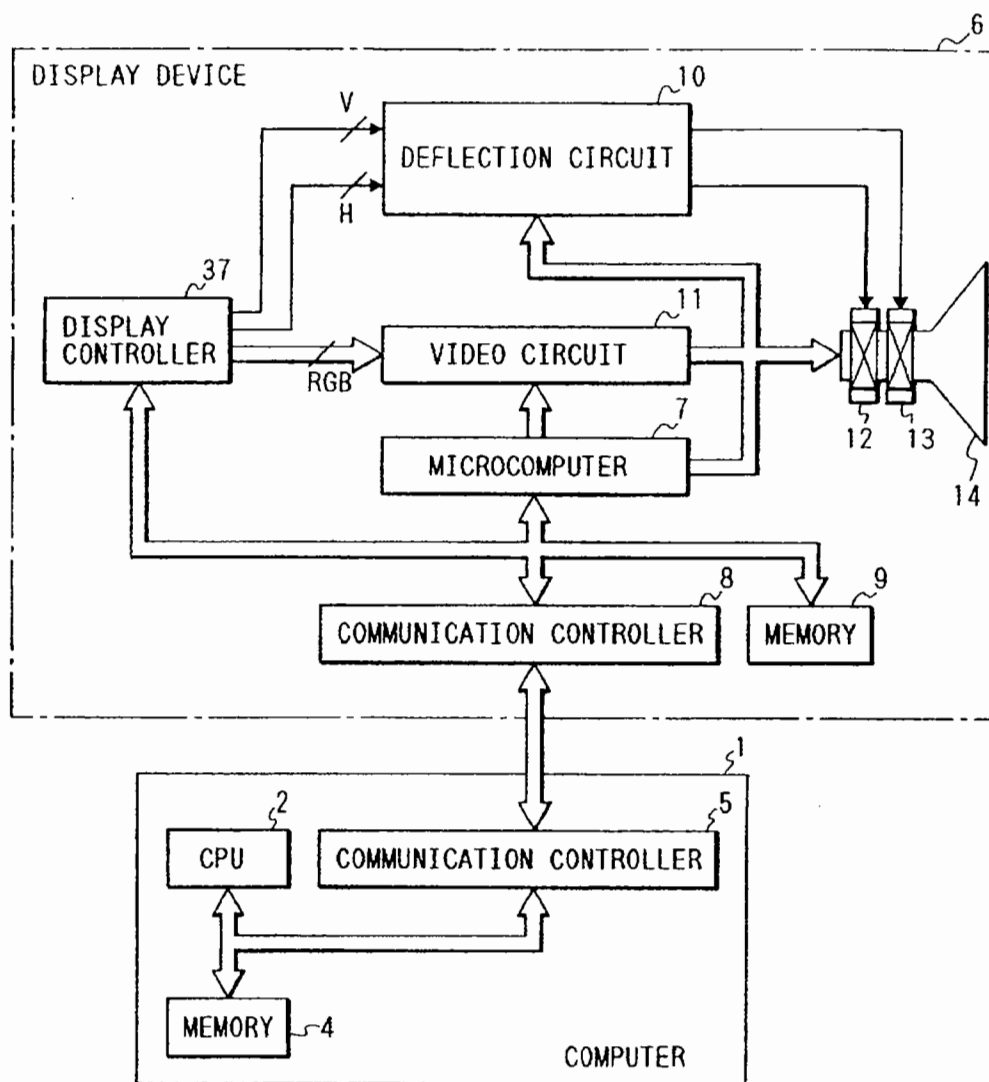


FIG. 12



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**DISPLAY UNIT AND METHOD ENABLING  
BI-DIRECTIONAL COMMUNICATION WITH  
VIDEO SOURCE**

**CROSS REFERENCE TO RELATED  
APPLICATION**

This application is related to U.S. application Ser. No. 09/732,291, filed on the same date, and is a continuation of U.S. application Ser. No. 09/265,363, filed Mar. 10, 1999, now U.S. Pat. No. 6,247,090 which is a continuation of U.S. application Ser. No. 08/833,346, filed Apr. 4, 1997, now U.S. Pat. No. 5,887,147, issued Mar. 23, 1999, which is a continuation of U.S. application Ser. No. 08/598,903, filed Feb. 9, 1996, now U.S. Pat. No. 5,652,845, issued Jul. 29, 1997, which is a continuation of U.S. application Ser. No. 08/190,848, filed Feb. 3, 1994, now abandoned, the subject matter of which is incorporated by reference herein.

**BACKGROUND OF THE INVENTION**

The present invention relates to an information output system or display apparatus including a computer and an information output device such as a display device or a printer as a computer terminal and more particularly to an information output system or display apparatus for performing various types of control such as the information output method and allowing or not allowing of information output from the computer connected to the above information output device via a communication interface.

In current display devices as computer terminals, a wide variety of display positions and sizes on the screen and video signal frequencies to be displayed are used depending on video signals to be inputted. Therefore, a display or a so-called multi-scan display has been used so that a display device can handle various video signals.

A microcomputer or a memory LSI is used to provide a most suitable display image for each video signal as this type of display device. Such a prior art is indicated in Japanese Patent Application Laid-Open No. 1-321475.

According to this prior art, the microcomputer controls the memory which stores information of the display position and size on the screen for each video signal beforehand and reads the information of the most suitable display position and size on the screen depending on the input video signal from the memory. The microcomputer outputs a control signal on the basis of the read information. This control signal is applied to the deflection circuit as a control voltage or control current through a D-A converter so as to control the voltage or current at a predetermined part of the deflection circuit. By doing this, the display size and position of the display device can be adjusted. When a video signal inputted to the display device is not a known signal, no corresponding information is kept in the above memory. Therefore, the switch mounted on the front of the display device is operated so as to input the adjustment information of the display position and size on the screen. The control circuit of the above microcomputer creates deflection control information on the basis of the above input information and adjusts the display position and size.

According to the aforementioned prior art, the display device obtains a most suitable screen display according to the input video signal. However, according to another prior art, the computer controls and changes the display status. Such a prior art is indicated in Japanese Patent Application Laid-Open No. 61-84688. According to this prior art, a discrimination pulse is superimposed at the blanking interval of a video signal outputted from the computer and the

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deflection frequency of the display device is changed on the basis of this discrimination pulse.

According to the former prior art among the aforementioned prior arts, the control of the display position and size on the screen is managed by the display device. Therefore, when adjustment is required or requested from the user of display device, it is necessary to perform manual adjustment using the adjustment switch of the display device each time and it is rather troublesome to operate the system.

According to the latter prior art among the aforementioned prior arts, the control can be operated by the computer. However, since the operation is such that the deflection frequency is simply changed on the basis of the discrimination pulse superimposed on the video signal, an image cannot be adjusted to the display image (display position and size) which is required by a user of the computer. Namely, there is a problem imposed that the status which is simply desired by the user cannot be obtained. Furthermore, no consideration is given to prevention of display (indication) of careless images (information) and restraining of unnecessary power consumption. Even if the discrimination pulse is superimposed at the blanking interval of the video signal, the video blanking level is generally shallow in the case of the display device, so that the discrimination pulse is displaced. Furthermore, the control is applied only in one direction from the computer to the display device and no information is sent in the reverse direction, so that there is another problem imposed that a malfunction cannot be avoided.

**SUMMARY OF THE INVENTION**

An object of the present invention is to provide an information output system wherein a computer can exercise various types of control of an information output device such as a display device. Another object of the present invention is to provide an information output system for maintaining secrecy of information and for restraining power consumption. A further object of the present invention is to provide an information output system for informing the computer of the operation status of the information output device so as to allow easy maintenance.

To accomplish the above objects, according to the present invention, in an information output system consisting of at least a computer and an information output device, the computer is equipped with a first communication means and the information output device is equipped with a second communication means. Furthermore, a control processing means and a memory means for storing the identification number of the computer beforehand are added to the information output device, or a memory means for storing the identification number of the information output device beforehand is mounted in the computer in addition to the first communication means. The above second communication means has a plurality of communication interfaces. Furthermore, a detection means for detecting the internal operation status and a control processing means for judging the detection result are added to the information output device and an audio output means for outputting the operation status in voice is added to the computer. A second display means for displaying the operation status is mounted in the information output device. Or, a display means for displaying the operation status of the information output device is mounted in the computer.

The first communication means in the computer controls communication with the information output device and the second communication means in the information output



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device controls communication with the computer. The control processing means operates and generates control signals for exercising various types of control for the information output device on the basis of control instructions from the second communication means and compares the identification number of the computer stored in the memory means with the identification number sent from the computer via the first and second communication means. When a comparison result match occurs, the control processing means controls a predetermined part in the information output device.

In the memory means mounted in the computer, the identification number for identifying the information output device is stored beforehand. When the identification number which is sent from the information output device via the second and first communication means matches with the identification number which is stored in the memory means beforehand, the computer communicates with the information output device.

When no comparison result match occurs, the above control processing means controls so that information which is sent from the computer to the information output device is not normally outputted from the information output device. By doing this, information of a computer user will not be indicated carelessly.

When the second communication means has a plurality of communication interfaces, it can communicate with another plurality of information output devices and the computer and in the state that a plurality of similar information output devices are connected to the computer, it can exercise various types of control for the information output devices and can inform the computer of the status of each information output device.

The detection means detects the internal operation status of the information output device and the control processing means judges the detection result. The audio output means indicates the operation status of the information output device in voice on the basis of the judgment result which is sent from the information output device to the computer via the second and first communication means. Furthermore, the display means mounted in the information output device displays the above operation status. The display means mounted in the computer performs the same operation as that of the display means mounted in the information output device. In this case, information which is sent to the computer via the second and first communication means is used as display information.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing the first embodiment of the present invention.

FIG. 2 is a memory map showing the contents of the memory in the display device shown in FIG. 1.

FIG. 3 is a flow chart showing the operation of the essential section shown in FIG. 1.

FIG. 4 is a block diagram showing the second embodiment of the present invention.

FIG. 5 is a block diagram showing the third embodiment of the present invention.

FIG. 6 is a block diagram showing the internal structure of the display device 6B shown in FIG. 5.

FIG. 7 is a block diagram showing the fourth embodiment of the present invention.

FIG. 8 is a flow chart showing the operation outline shown in FIG. 7.

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FIG. 9 is a block diagram showing the fifth embodiment of the present invention.

FIG. 10 is a block diagram showing the sixth embodiment of the present invention.

FIG. 11 is a block diagram showing the seventh embodiment of the present invention.

FIG. 12 is a block diagram showing the eighth embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments of the present invention will be explained with reference to the accompanying drawings hereunder.

FIG. 1 is a block diagram showing the first embodiment of the present invention. In the drawing, a section 1 enclosed by a chained line indicates a computer. In the section 1, a reference numeral 2 indicates a CPU (central processing unit), 3 a display controller for generating various signals for video display, 4 a memory, and 5 a communication controller for communicating with peripheral devices. In addition, a magnetic recording unit is mounted as a data storage device which is not shown in the drawing.

A section 6 enclosed by another chained line indicates a so-called multi-scan display device which can be applied to various video signal specifications. In the section 6, a reference numeral 7 indicates a microcomputer for controlling display of the display device 6, 8 a second communication controller for communicating with the above communication controller 5, 9 a second memory, 10 a general deflection circuit of the display device, 11 a video circuit of the display device, 12 a horizontal deflection yoke, 13 a vertical deflection yoke, and 14 a color cathode-ray tube (hereinafter called a CDT (color display tube)) for displaying color images.

The operation shown in FIG. 1 is as shown below. The computer 1 has a structure which is the same as the general structure of a conventional personal computer or work station and the communication controller 5 controls a communication interface such as RS-232C which is installed in the standard type. When a control instruction of the display device 6 is inputted firstly by a user of the computer from a general keyboard which is not shown in the drawing of the computer 1, it is coded digitally by a keyboard controller which is neither shown in the drawing and CPU 2 identifies the instruction and controls the communication controller 5. The communication controller 5 sends the control instruction of the display device to the display device 6. When a control instruction of the display device 6 which is included in the software for allowing the computer 1 to operate is read from the external storage device such as a floppy disk drive or hard disk drive which is not shown in the drawing, CPU 2 identifies the instruction and controls the communication controller 5. The communication controller 5 also sends the control instruction of the display device to the display device 6.

Next, the display device 6 sends the control instruction from the computer 1 which is received by the communication controller 8 to the microcomputer 7. The microcomputer 7 identifies this control instruction and generates control signals to the relevant portions to be adjusted in the deflection circuit 10 or video circuit 11. The aforementioned deflection circuit 10 and video circuit 11 can be adjusted in the same way as with a conventional multiscan display and the adjustment means has a structure which is the same as that of a conventional multiscan display. By doing this, the

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display size and position, brightness, contrast, and hue of images displayed on the CDT 14 are made most suitable to a user of the computer system.

Furthermore, WYSIWYG (what you see is what you get) control which makes an image displayed on the display device 6 similar to print output of an output device other than the display, for example, a printer can be realized only by sending a control instruction for changing the display position and size to the display device 6 instead of operating and generating display data by the computer 1. The interface part of the above display device 6 such as the communication control terminal is mounted on the back or side of the display device from a viewpoint of easy connection to the computer 1 and appearance.

Furthermore, the aforementioned communication function is used for adjustment at a factory. In this case, necessary information is all written into the memory 9 in the display device 6. FIG. 2 is a memory map showing the contents of the memory 9 in the display device 6. For adjustment at factory, data to be written can be all set. In a case other than factory adjustment, namely, for adjustment in a system as shown in FIG. 1, to prevent data requiring no rewriting, namely, preset values at factory such as, for example, the number of all data or the data within the corresponding frequency range from being erased by mistake or rewritten, the computer 1 sends the ID number and the microcomputer 7 in the display device 6 checks the ID number with the registered ID number stored in the memory 9.

A flow chart of this check is shown in FIG. 3. As shown in the drawing, when the computer 1 and display device 6 are turned on at Step 1, each device is initialized at Step 2. Concretely, CPU 2 and the microcomputer 7 read the starting system software and put the peripheral circuit to be connected to the CPU into the active state so that the next operation can be performed. Then, at Step 3, the microcomputer 7 in the display device 6 waits for sending of the identification number assigned to the computer 1, that is, the so-called ID number from the computer 1. Next, at Step 4, the microcomputer 7 receives the ID number which is sent from the computer 1 and checks whether the received ID number is registered in the registered ID number list which is stored in the memory 9 in the display device 6.

When it is registered, at Step 5, the computer 1 is allowed to control the display device 6 by external control instructions so that the user control of the display size, position, brightness, and contrast can be performed by control instructions sent from the computer 1 thereafter. On the other hand, when the received ID number is not registered in the memory 9, at Step 6, the display device 6 is not allowed to be controlled by external control instructions thereafter. Therefore, even if any control instruction is sent from the computer 1, the display device 6 will not accept it.

Or, at Step 5, the computer 1 may be allowed to perform all the adjustments which can be performed by the display device 6, that is, the same control as that for adjustment at factory and at Step 6, a part of the control of the display device 6 such as display control may be allowed.

By doing this, the display device 6 can be prevented from careless control.

The above is an example that an ID number is sent to the display device 6 from the computer 1. However, needless to say, the reverse case of the above is possible. Namely, an ID number is sent to the computer 1 from the display device 6 so that the computer 1 identifies that the display device 6 having a communication function is connected and the

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computer 1 compares the ID number with the ID number registered in the computer 1. When the corresponding ID number is registered, the computer 1 controls the display device 6 by a predetermined control instruction. When it is not registered, the computer 1 judges that it cannot control the display device 6 and will not control the display device 6.

By doing this, the computer 1 communicates with a specific display device 6 and can exercise control such as changing the color temperature of an image displayed on the display device 6 or changing the display size depending on the application software.

According to this embodiment, RS-232C is used as a communication interface. However, a general-purpose interface such as RS-422, RS-423, SCSI or GP-IB, or network interface may be used. Furthermore, the embodiment may be applied to an interface using optical signals instead of electric signals. The above interface may be installed in the neighborhood of the rear cabinet or lower pedestal of the display device 6 for convenience of a user.

FIG. 4 is a block diagram showing the second embodiment of the present invention. According to this embodiment, when the ID number sent from the computer to the display device is not registered in the memory 9, another operation which is different from the operation shown in the first embodiment is performed. Namely, according to this embodiment, when the ID numbers do not match with each other, nothing is displayed on the display device so as to enhance the secrecy of information.

Next, the structure of FIG. 4 will be explained. In the drawing, a reference numeral 6A indicates another display device which is different from the display device 6 shown in FIG. 1, 15 a horizontal deflection circuit, 16 a vertical deflection circuit, 17 a synchronizing signal processing circuit, 18 a horizontal phase control circuit, 19 a horizontal oscillating circuit, 20 a horizontal driving circuit, 21 a horizontal deflection output circuit, 22 a video pre-amplifier circuit, 23 a video blanking circuit, and 24 a video output circuit. The other reference numerals which are the same as those shown in FIG. 1 indicate the same functions. The video circuit 11 is a general video circuit consisting of the video pre-amplifier circuit 22, video blanking circuit 23, and video output circuit 24. The horizontal deflection circuit 15 is a general deflection circuit consisting of the synchronizing signal processing circuit 17, horizontal phase control circuit 18, horizontal oscillating circuit 19, horizontal driving circuit 20, and horizontal deflection output circuit 21. The vertical deflection circuit 16 is also a general circuit which has a structure similar to that of the horizontal deflection circuit 15.

Next, the operation shown in FIG. 4 will be explained. In the drawing, an ID number sent from the computer 1 is inputted into the microcomputer 7 via the communication controller 8. The microcomputer 7 checks the above ID number with the ID number stored in the memory 9. When the ID number stored in the memory 9 matches with the ID number sent from the computer 1, the microcomputer 7 receives the control from the computer 1.

On the other hand, when the check results do not match with each other, the microcomputer 7 controls the horizontal oscillating circuit 19, fixes the oscillation frequency to a predetermined value, and allows the display device 6A to perform a horizontal deflection operation at a value different from the horizontal frequencies of the video signal and synchronizing signal which are sent from the computer. Therefore, the image displayed on the CDT 14 is not



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synchronized horizontally in this case and the screen content cannot be judged. When the vertical deflection circuit 16 is controlled in the same way, the image displayed on the CDT 14 is not synchronized vertically on the screen. By controlling the video blanking circuit 23 of the video circuit 11, the video display period may be blanked so that no image is displayed on the CDT 14.

By using the aforementioned methods independently or combined, only when a user of the computer system enters a predetermined ID number from the keyboard, it is displayed correctly on the display device 6A and information displayed on the CDT 14 can be prevented from careless indication.

FIG. 5 is a block diagram of the third embodiment of the present invention. According to this embodiment, the display device is provided with a plurality of communication functions and a plurality of display devices can be connected with the communication interface. In the drawing, reference numerals 6B, 6C, and 6D indicate display devices having the same structure, V1, V2, and V3 lines for video signals and synchronizing signals, C1, C2, and C3 communication lines for, for example, RS-232C, and 1 the aforementioned computer. Each of the display devices 6B, 6C, and 6D has a plurality of video signal I/O terminals and communication interface I/O terminals and a registered ID number. According to this embodiment, as shown in FIG. 5, 1 is assigned to the display device 6B as an ID number, 2 to the display device 6C as an ID number, and 3 to the display device 6D as an ID number.

Next, the operation shown in FIG. 5 will be explained. In the drawing, for example, when controlling the display device 6B from the computer 1, the ID number 1 is sent to the line C1 and the display device 6B is controlled appropriately from the computer 1. Next, when controlling the display device 6C, the ID number 2 is sent from the computer 1 in the same way. Then, the ID number is received by the display device 6C via the lines C1 and C2 and the display device 6C can be controlled appropriately from the computer 1.

Since a plurality of display devices can be controlled by a computer in this way, a plurality of display devices can be adjusted at a time, for example, at the time of delivery adjustment at a factory. Furthermore, by using a multi-display system for displaying an image by assembling a plurality of display devices and for displaying various images on each screen, the display devices can be hued and adjusted in brightness simply.

FIG. 6 is a block diagram showing the internal structure of the display device 6B shown in FIG. 5. In the drawing, a reference numeral 25 indicates a communication controller having two communication ports and 26 a divider of video signals and synchronizing signals. The communication controller 25 sends or receives data to or from the computer 1 in the same way as the communication controller 8 of the display device 6 shown in FIG. 1 and also divides the communication lines and relays other display devices. On the other hand, the divider 26 divides video signals or synchronizing signals sent from the computer 1 or signal source to other display devices. By using such a structure, a plurality of display devices can be connected to a computer as shown in FIG. 5.

Next, the fourth embodiment of the present invention will be described. FIG. 7 is a block diagram showing the fourth embodiment of the present invention. In the drawing, a reference numeral 1B indicates a computer, 31 an audio control circuit for producing a sound, 32 a speaker, 6E a

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display device, 27 and 28 analog-digital converters (hereinafter abbreviated to ADC), and 29 and 30 digital-analog converters (hereinafter abbreviated to DAC). The other reference numerals which are the same as those shown in FIG. 1 indicate the same functions. The operation of FIG. 7 will be explained hereunder with reference to the operation flow chart shown in FIG. 8.

When the computer 1B and display device 6E are started at Step 10 as shown in FIG. 8, they start communication with each other via the communication controllers 5 and 8 at Step 11 next. Then, at Step 12, the computer 1B calls the display device 6E. When no response is received, the computer 1B judges that the display device 6E is faulty, starts the audio control circuit 31 at Step 13, and informs the user of the computer 1B that the display device 6E is faulty from the speaker.

When the communication succeeds, at Step 14, the microcomputer 7 fetches information of the operation status of the deflection circuit 10 or video circuit 11 in the display device 6E from the voltage at a predetermined part in the circuit as digital information via the ADCs 27 and 28. Next, at Step 15, the microcomputer 7 judges whether the value which is fetched at Step 14 is a value in the normal operation status. When the microcomputer 7 judges it as an error, it informs the computer 1B of the faulty value via the communication controller 8 and CPU 2 of the computer 1B allows the audio control circuit 31 to operate and generates a message informing an error of the display device 6E from the speaker 32. Furthermore, CPU 2 allows the display controller 3 to operate and displays also a message informing an error on the CDT 14 via the video circuit 11.

In this case, when an indication code informing the faulty part is sent to the computer 1B from the display device 6E simultaneously, the computer 1B judges the indication code and can inform the user or a customer engineer of the display device 6E of the faulty part by sound or display.

When the display device 6E is normal at Step 15, the computer 1B can exercise the communication control such as the display size, hue, and brightness of the display device 6E at Step 17. At this step, when a control instruction is sent to the display device 6E from the computer 1B, the microcomputer 7 decodes the instruction and outputs the control code to the corresponding DAC 29 or 30. The DAC 29 or 30 controls a predetermined control part at the DC control voltage corresponding to the above control code and controls the display size, position, and hue of the image displayed on the CDT 14. When the above series of operations ends, the computer 1B returns to Step 14 and repeats the operations from the monitor mode of a faulty operation of the display device 6E to the normal operation at Step 17.

As mentioned above, the computer 1B can be informed of a faulty operation by using the communication function of the display device 6E. Therefore, the user can judge the faulty part and can maintain the system easily.

FIG. 9 is a block diagram showing the fifth embodiment of the present invention. This embodiment obtains the same effect as that of the embodiment shown in FIG. 7. In FIG. 9, a reference numeral 6F indicates a display device, 33 a liquid crystal display controller in the display device 6F, and 34 a liquid crystal display panel mounted in the display device 6F. The other reference numerals which are the same as those shown in FIGS. 1 and 7 indicate the same functions.

The operation shown in FIG. 9 is basically the same as that shown in FIG. 7. The operation of the deflection circuit 10 or video circuit 11 is monitored by the microcomputer 7 via the ADC 27 or 28. When an error occurs, the micro-

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computer 7 transmits an indication code informing the occurrence of an error to the computer 1B via the communication line and informs the user of it by voice from the speaker 32.

Furthermore, the microcomputer 7 allows the liquid crystal display controller 33 in the display device 6F to operate and displays information of the occurrence of the fault and faulty part on the liquid crystal display panel 34. By doing this, information when an error occurs in the display device 6F can be obtained more surely.

FIG. 10 is a block diagram showing the sixth embodiment of the present invention. This embodiment obtains the same effect as that of the embodiment shown in FIG. 9. In FIG. 10, a reference numeral 1C indicates a computer and 35 a liquid crystal display controller in the computer 1C. The other reference numerals which are the same as those shown in FIGS. 1 and 9 indicate the same functions. In FIG. 10, the display function for a fault and faulty operation of the display device shown in FIG. 9 is mounted in the computer 1C.

Namely, when an error occurs in the internal circuit of the display device 6E, the voltage detected by the ADC 27 or 28 is digitized and processed by the microcomputer 7 as faulty voltage occurrence information and information informing an error is transmitted to the computer 1C via the communication controller 8. In the computer 1C, CPU 2 decodes the transmitted faulty information. When CPU 2 identifies the faulty part of the display device 6E, it allows the audio control circuit 31 to operate as an audio signal and informs the user of the fault by an audio message from the speaker 32 on one hand. On the other hand, CPU 2 controls the liquid crystal display controller 35 so as to display characters or graphics on the liquid crystal display panel 34. By doing this, the user of the display device 6E can be informed of an error or fault of the display device 6E and can maintain the system easily.

FIG. 11 is a block diagram showing the seventh embodiment of the present invention. In the drawing, a reference numeral 36 indicates a power supply of the deflection circuit 10 and video circuit 11. The other reference numerals which are the same as those shown in FIG. 1 indicate the same functions.

Next, the operation shown in FIG. 11 will be explained. In FIG. 11, when a control instruction to the display device 6 is issued from CPU 2 of the computer 1, the communication controller 5 changes the control instruction to a one in the signal format suited to communication and sends it to the display device 6. The display device 6 returns the signal received by the communication controller 8 to the control instruction which can be identified by the microcomputer 7 and sends it to the microcomputer 7. The microcomputer 7 judges the control instruction and decides the part of a predetermined section in the display device 6 to be controlled.

When the control instruction relates to control of the power supply 36 and is an instruction for stopping power supply from the power supply 36 to the deflection circuit 10, or video circuit 11, or both circuits, the microcomputer 7 controls the power supply 36 so as to stop the above power supply. Therefore, the image display on the CDT 14 is also stopped.

By doing this, for example, when the computer 1 is not in operation for a predetermined period, the operation power supply for the display device 6 can be automatically put into the off state. Therefore, unnecessary power consumption can be restrained and the life span of the display device can be

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lengthened. The aforementioned is power supply off control. However, needless to say, power supply on control is also possible. Namely, in this case, when the computer 1 is turned on or the computer 1 is changed from the function stop state to the active state, the microcomputer 7, power supply 36, deflection circuit 10, and video circuit 11 perform the reverse operation of the aforementioned so that the display device automatically starts to display.

FIG. 12 is a block diagram showing the eighth embodiment of the present invention. In the drawing, a reference numeral 37 indicates a display controller and the other numerals which are the same as those shown in FIG. 1 indicate units performing the same functions as those shown in FIG. 1.

Next, the operation of FIG. 12 will be explained. In FIG. 12, video information is sent to the display device 6 from the communication controller 5 in addition to a control instruction of the display device 6 which is explained in the embodiment shown in FIG. 1. This video information is a digital signal in the same way as a signal which is inputted to the display controller 3 in the embodiment shown in FIG. 1. The communication controller 8 of the display device 6 sends video information among the received signals to the display controller 37. The display controller 37 performs an operation which is the same as that of the display controller shown in FIG. 1 and generates a video signal to be inputted to a general display. By doing this, also in the embodiment shown in FIG. 12, an effect which is the same as that shown in FIG. 1 can be obtained. Furthermore, in FIG. 12, since video information is transmitted via a communication interface which is connected between the computer 1 and display device 6, a video signal line which is conventionally necessary is not necessary.

According to the present invention, a user of a computer can exercise various types of control for an information output device such as a display device from the keyboard of the computer or by the software incorporated in the computer. Therefore, the operability of the computer system is improved so that the system can be used easily and the user can obtain a desired information output status easily.

When an identification number is set to each device, a value which is set by the above control will not be lost by a careless operation of a user. By setting an identification number for a specific user, the secret of information can be protected inversely. Since the power supply for the information output device can be controlled by the computer when necessary, unnecessary power consumption can be restrained.

Since the status of the information output device can be monitored simply, the system can be protected against a malfunction and maintained easily. Furthermore, the aforementioned control hardware can be realized in a minimum structure.

What is claimed is:

1. A display unit comprising:

means for receiving video signals for video display from a video source;

memory means for storing at least display unit information, wherein the display unit information includes identifying information of the display unit; and

a communication controller capable of bi-directionally communicating with the video source;

wherein the communication controller communicates the display unit information to the video source and the display unit receives a signal from the video source that



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- is generated based on at least a portion of the display unit information.
2. A display unit according to claim 1, wherein the video source is a computer.
3. A display unit according to claim 1, wherein the identifying information includes an identification number for uniquely identifying the display unit.
4. A display unit according to claim 3, wherein the display unit information includes information that identifies a function of the display unit.
5. A display unit comprising:  
a video circuit adapted to display video signals sent by a video source;  
a memory in which at least display unit information is stored, wherein the display unit information includes identifying information of the display unit; and  
a communication controller capable of bi-directionally communicating with the video source;  
wherein the communication controller communicates the display unit information from the display unit to the video source and the display unit receives a signal from the video source that is generated based on at least a portion of the display unit information.
6. A display unit according to claim 4, wherein the video source is a computer.
7. A display unit according to claim 4, wherein the identifying information includes an identification number for uniquely identifying the display unit.
8. A display unit according to claim 7, wherein the display unit information includes information that identifies a function of the display unit.
9. A method of communicating between a display unit and a video source from which video signals are sent to the display unit for display, the method comprising the steps of:  
communicating display unit information stored in a memory of the display unit from the display unit to the video source, wherein the display unit information includes identifying information of the display unit; and  
sending a signal from the video source to the display unit, wherein the signal is generated based on at least a portion of the display unit information;  
wherein information is bi-directionally communicated with the video source and the display unit.
10. A display unit comprising:  
a video circuit adapted to display video signals sent by an externally connected video source;  
a memory in which at least display unit information is stored, wherein the display unit information includes identifying information of the display unit; and  
a communication controller capable of bi-directionally communicating with the video source;  
wherein the communication controller communicates the display unit information from the display unit to the video source and the display unit receives a signal from the video source that is generated based on the display unit information.
11. A display unit according to claim 10, wherein the video source is a computer.
12. A display unit according to claim 10, wherein the identifying information includes an identification number for identifying the display unit.
13. A display unit according to claim 12, wherein the display unit information includes information that identifies a function of the display unit.

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14. A display unit comprising:  
means for receiving video signals for display from an externally connected video source;  
memory means for storing at least display unit information, wherein the display unit information includes identifying information of the display unit; and a communication controller capable of bi-directionally communicating with the video source;  
wherein the communication controller communicates the display unit information to the video source and the display unit receives a signal from the video source that is generated based on at least a portion of the display unit information.
15. A display unit according to claim 14, wherein the video source is a computer.
16. A display unit according to claim 14, wherein the identifying information includes an identification number for identifying the display unit.
17. A display unit according to claim 16, wherein the display unit information includes information that identifies a function of the display unit.
18. A display unit comprising:  
means for receiving video signals for displaying from a video signal source externally connected to the display unit;  
memory means for storing at least display unit information, wherein the display unit information includes identifying information of the display unit; and  
a communicating with the video signal source;  
wherein the communication controller communicates the display unit information to the video signal source and the display unit receives a signal from the video signal source that is generated based on at least a portion of the display unit information.
19. A display unit according to claim 18, wherein the video signal source is a computer.
20. A display unit according to claim 18, wherein the identifying information includes an identification number for identifying the display unit.
21. A display unit according to claim 20, wherein the display unit information includes information that identifies a function of the display unit.
22. A display unit comprising:  
a video circuit adapted to display video signals sent by a video signal source externally connected to the display unit;  
a memory in which at least display unit information is stored, wherein the display unit information includes identifying information of the display unit; and  
a communication controller capable of bi-directionally communicating with the video signal source;  
wherein the communication controller communicates the display unit information from the display unit to the video signal source and the display unit receives a signal from the video signal source that is generated based on at least a portion of the display unit information.
23. A display unit according to claim 22, wherein the video signal source is a computer.
24. A display unit according to claim 22, wherein the identifying information includes an identification number for identifying the display unit.

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25. A display unit according to claim 24, wherein the display unit information includes information that identifies a function of the display unit.

26. A display unit comprising:

a video circuit adapted to display video signals generated based on video information sent by a video information source;

a memory in which at least display unit information is stored, wherein the display unit information includes identifying information of the display unit; and

a communication controller capable of bi-directionally communicating with the video information source;

wherein the communication controller communicates the display unit information from the display unit to the video information source and the display unit receives a signal from the video information source that is generated based on at least a portion of the display unit information.

27. A display unit according to claim 26, wherein the video information source is a computer.

28. A display unit according to claim 26, wherein the identifying information includes an identification number for identifying the display unit.

29. A display unit according to claim 28, wherein the display unit information includes information that identifies a function of the display unit.

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30. A display unit comprising:

a video circuit adapted to display video signals generated based on video information sent by a video information source externally connected to the display unit information is stored, wherein the display unit information includes identifying information of the display unit; and

a communication controller capable of bi-directionally communicating with the video information source;

wherein the communication controller communicates the display unit information from the display unit to the video information source and the display unit receives a signal from the video information source that is generated based on at least a portion of the display unit information.

31. A display unit according to claim 30, wherein the video information source is a computer.

32. A display unit according to claim 30, wherein the identifying information includes an identification number for identifying the display unit.

33. A display unit according to claim 32, wherein the display unit information includes information that identifies a function of the display unit.

\* \* \* \* \*



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 6,513,088 B2  
DATED : January 28, 2003  
INVENTOR(S) : Arai et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 11,

Line 50, delete "includes" insert -- is --.

Column 12,

Delete line 8, and insert therefore:

-- and

a communication controller capable of --.

Line 25, delete "displaying" insert -- display --;

Line 33, after "communicating" insert -- controller capable of bi-directionally communicating --.

Column 14,

Line 4, delete "unit" and insert -- unit;

a memory in which at least display unit infor- --.

Signed and Sealed this

First Day of July, 2003



JAMES E. ROGAN  
*Director of the United States Patent and Trademark Office*