FOLEY & LARDNER LLP
Dorit S. Heimer (DH 7511)
Emily R. Sausen (ES 9097)
90 Park Avenue
New York, NY 10016
(212) 682-7474
Attorneys for Plaintiff Toshiba Corporation

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

TOSHIBA CORPORATION, Plaintiff, v. CYBERHOME ENTERTAINMENT, INC., Defendant.	Case No. 06-00828 **AMENDED COMPLAINT** JURY TRIAL DEMANDED

Plaintiff Toshiba Corporation ("Toshiba"), by its attorneys, Foley & Lardner LLP, for its first Amended Complaint against the defendant Cyberhome Entertainment, Inc. ("Cyberhome"), alleges as follows:

PARTIES

1. Plaintiff Toshiba is a Japanese corporation having offices at 1-1, Shibaura 1-chome Minato-ku, Tokyo 105-8001 Japan.

2. Upon information and belief, Defendant Cyberhome is organized under the laws of California, and has offices located at 48455 Fremont Blvd, Fremont, California. Defendant is in the business of selling media recorders and players such as DVD recorders and players.

JURISDICTION AND VENUE

3. These claims arise under the Patent Laws of the United States, 35 U.S.C. §101 *et seq.*, in that each is a claim for infringement of a United States patent. The jurisdiction of this Court is founded upon 28 U.S.C. § 1338(a).

4. This Court has personal jurisdiction over the Defendant. Upon information and belief, the Defendant has conducted and does conduct business within the State of New York. Upon information and belief, the Defendant has committed the tort of patent infringement within the State of New York.

5. Venue within this District is proper under 28 U.S.C. §§ 1391(b) and (c) and 1400(b).

COUNT 1: PATENT INFRINGEMENT

6. The allegations of paragraphs 1-5 are incorporated herein by reference.

7. Plaintiff Toshiba is the sole owner by assignment of United States Patent No. 5,587,991 ("the '991 patent") issued on December 24, 1996 and entitled "[r]ecording medium, signal recording apparatus thereof, and signal reproducing apparatus thereof". A copy of the '991 patent is attached as Exhibit A.

8. The '991 patent discloses and claims media and apparatus using special encoding schemes to aid synchronization and the cancellation of DC signal components.

9. Upon information and belief, Defendant Cyberhome has infringed, and if not enjoined will continue to infringe, one or more claims of the '991 patent by performing, without authority, one or more of the following acts: (a) making, using, offering for sale, and/or selling within the United States the invention of one or more claims of the '991 patent, in violation of 35 U.S.C. §271(a), including but not limited to selling the Cyberhome model CH-DVD 300 DVD

player, the Cyberhome model DVR-1600 DVD player/recorder and the Cyberhome model LDV-7000 portable DVD player; (b) importing into the United States the invention of one or more claims of the '991 patent, in violation of 35 U.S.C. § 271(a); (c) inducing infringement of one or more claims of the '991 patent, in violation of 35 U.S.C. § 271(b); and (d) contributing to infringement of one or more claims of the '991 patent, in violation of 35 U.S.C. § 271(c) (the "acts of infringement of the'991 patent").

10. Defendant Cyberhome was given actual notice of its infringement of the '991 patent at least as early as June 4, 2004.

11. Further upon information and belief, Defendant Cyberhome's acts of infringement of the '991 patent were, in whole or in part, done willfully.

COUNT 2: PATENT INFRINGEMENT

12. The allegations of paragraphs 1-5 are incorporated herein by reference.

13. Plaintiff Toshiba is the sole owner by assignment of United States Patent No. 5,732,185 (" the '185 patent") issued on March 24, 1998 and entitled "[m]ulti-scene recording medium and apparatus for reproducing data therefrom". A copy of the '185 patent is attached as Exhibit B.

14. The '185 patent discloses and claims methods and apparatus for reproducing information from multi-scene recording media including CDs and DVDs.

15. Upon information and belief, Defendant Cyberhome has infringed, and if not enjoined will continue to infringe, one or more claims of the '185 patent by performing, without authority, one or more of the following acts: (a) making, using, offering for sale, and/or selling within the United States the invention of one or more claims of the '185 patent, in violation of 35 U.S.C. § 271(a) including but not limited to selling the Cyberhome model CH-DVD 300 DVD

player, the Cyberhome model DVR-1600 DVD player/recorder and the Cyberhome model LDV-7000 portable DVD player; (b) importing into the United States the invention of one or more claims of the '185 patent, in violation of 35 U.S.C. § 271(a); (c) inducing infringement of one or more claims of the '185 patent, in violation of 35 U.S.C. § 271(b); and (d) contributing to infringement of one or more claims of the '185 patent, in violation of 35 U.S.C. § 271(c) (the "acts of infringement of the '185 patent").

16. Defendant Cyberhome was given actual notice of its infringement of the '185 patent at least as early as June 4, 2004.

18. Further upon information and belief, Defendant Cyberhome's acts of infringement of the '185 patent were, in whole or in part, done willfully.

COUNT 3: PATENT INFRINGEMENT

18. The allegations of paragraphs 1-5 are incorporated herein by reference.

19. Plaintiff Toshiba is the sole owner by assignment of United States Patent No. 6,009,433 (" the '433 patent") issued on December 28, 1999 and entitled "[i]nformation storage and information transmission media with parental control". A copy of the '433 patent is attached as Exhibit C.

20. The '433 patent discloses and claims systems, methods, apparatus and media for data storage and retrieval using media with a data area and a management area.

21. Upon information and belief, Defendant Cyberhome has infringed, and if not enjoined will continue to infringe, one or more claims of the '433 patent by performing, without authority, one or more of the following acts: (a) making, using, offering for sale, and/or selling within the United States the invention of one or more claims of the '433 patent, in violation of 35 U.S.C. § 271(a) including but not limited to selling the Cyberhome model CH-DVD 300 DVD

player, the Cyberhome model DVR-1600 DVD player/recorder and the Cyberhome model LDV-7000 portable DVD player; (b) importing into the United States the invention of one or more claims of the '433 patent, in violation of 35 U.S.C. § 271(a); (c) inducing infringement of one or more claims of the '433 patent, in violation of 35 U.S.C. § 271(b); and (d) contributing to infringement of one or more claims of the '433 patent, in violation of 35 U.S.C. § 271(c) (the "acts of infringement of the '433 patent").

22. Defendant Cyberhome was given actual notice of its infringement of the '433 patent at least as early as June 4, 2004.

23. Further upon information and belief, Defendant Cyberhome's acts of infringement of the '433 patent were, in whole or in part, done willfully.

COUNT 4: PATENT INFRINGEMENT

24. The allegations of paragraphs 1-5 are incorporated herein by reference.

25. Plaintiff Toshiba is the sole owner by assignment of United States Patent No. 6,128,434 (" the '434 patent") issued on October 3, 2000 and entitled "[m]ultilingual recording medium and reproduction apparatus ". A copy of the '434 patent is attached as Exhibit D.

26. The '434 patent discloses and claims a reproduction apparatus for reproducing information from a medium including an information recording management area and an information recording data area.

27. Upon information and belief, Defendant Cyberhome has infringed, and if not enjoined will continue to infringe, one or more claims of the '434 patent by performing, without authority, one or more of the following acts: (a) making, using, offering for sale, and/or selling within the United States the invention of one or more claims of the '434 patent, in violation of 35 U.S.C. § 271(a) including but not limited to selling the Cyberhome model CH-DVD 300 DVD

player, the Cyberhome model DVR-1600 DVD player/recorder and the Cyberhome model LDV-7000 portable DVD player; (b) importing into the United States the invention of one or more claims of the '434 patent, in violation of 35 U.S.C. § 271(a); (c) inducing infringement of one or more claims of the '434 patent, in violation of 35 U.S.C. § 271(b); and (d) contributing to infringement of one or more claims of the '434 patent, in violation of 35 U.S.C. § 271(c) (the "acts of infringement of the '434 patent").

28. Defendant Cyberhome was given actual notice of its infringement of the '434 patent at least as early as June 4, 2004.

29. Further upon information and belief, Defendant Cyberhome's acts of infringement of the '434 patent were, in whole or in part, done willfully.

COUNT 5: PATENT INFRINGEMENT

30. The allegations of paragraphs 1-5 are incorporated herein by reference.

31. Plaintiff Toshiba is the sole owner by assignment of United States Patent No. 6,226,727 (" the '727 patent") issued on May 1, 2001 and entitled "[c]omputer system". A copy of the '727 patent is attached as Exhibit E.

32. The '727 patent discloses and claims a computer system for managing data in units of logical blocks, wherein the logical blocks are of a different size than physical blocks of a recording medium.

33. Upon information and belief, Defendant Cyberhome has infringed, and if not enjoined will continue to infringe, one or more claims of the '727 patent by performing, without authority, one or more of the following acts: (a) making, using, offering for sale, and/or selling within the United States the invention of one or more claims of the '727 patent, in violation of 35 U.S.C. § 271(a) including but not limited to selling the Cyberhome model DVR-1600 DVD

player/recorder; (b) importing into the United States the invention of one or more claims of the '727 patent, in violation of 35 U.S.C. § 271(a); (c) inducing infringement of one or more claims of the '727 patent, in violation of 35 U.S.C. § 271(b); and (d) contributing to infringement of one or more claims of the '727 patent, in violation of 35 U.S.C. § 271(c) (the "acts of infringement of the '727 patent").

34. Further upon information and belief, Defendant Cyberhome's acts of infringement of the '727 patent were, in whole or in part, done willfully.

COUNT 6: PATENT INFRINGEMENT

35. The allegations of paragraphs 1-5 are incorporated herein by reference.

36. Plaintiff Toshiba is the sole owner by assignment of United States Patent No. 6,374,040 (" the '040 patent") issued on April 16, 2002 and entitled "[p]ortable DVD player". A copy of the '040 patent is attached as Exhibit F.

37. The '040 patent discloses and claims portable-type digital versatile disk (DVD) players.

38. Upon information and belief, Defendant Cyberhome has infringed, and if not enjoined will continue to infringe, one or more claims of the '040 patent by performing, without authority, one or more of the following acts: (a) making, using, offering for sale, and/or selling within the United States the invention of one or more claims of the '040 patent, in violation of 35 U.S.C. § 271(a) including but not limited to selling the Cyberhome model LDV-7000 portable DVD player; (b) importing into the United States the invention of one or more claims of the '040 patent, in violation of 35 U.S.C. § 271(a); (c) inducing infringement of one or more claims of the '040 patent, in violation of 35 U.S.C. § 271(b); and (d) contributing to infringement of one or

more claims of the '040 patent, in violation of 35 U.S.C. § 271(c) (the "acts of infringement of the '040 patent").

39. Further upon information and belief, Defendant Cyberhome's acts of infringement of the '040 patent were, in whole or in part, done willfully.

REQUEST FOR RELIEF

WHEREFORE, Plaintiff Toshiba petitions this Court and requests that a judgment be entered and relief be granted as follows:

A. Declaring that the Defendant Cyberhome has infringed the '991, '185, '433, '434, '727, and '040 patents as alleged herein (directly, by inducement, and/or contributorily);

B. Preliminarily and permanently enjoining, restraining, and prohibiting Defendant Cyberhome and any party acting through, for, or in concert with Defendant Cyberhome from further infringing (directly, by inducement, or contributorily) any claim of the '991, '185, '433, '434, '727, and '040 patents;

C. Awarding to Plaintiff Toshiba such monetary or compensatory damages as may be found or deemed adequate to fully compensate Plaintiff Toshiba for any of Defendant Cyberhome's acts of infringement of the '991, '185, '433, '434, '727, and '040 patents occurring prior to such judgment, and/or for any other injury suffered by Plaintiff Toshiba due to Defendant Cyberhome's acts of infringement of the '991, '185, '433, '434, '727, and '040 patents;

D. Declaring Defendant Cyberhome's conduct to have been willful, and trebling such award of monetary or compensatory damages;

E. Declaring this to be an exceptional case within the meaning of 35 U.S.C. §285, and awarding Plaintiff Toshiba its attorneys' fees;

F. Awarding to Plaintiff Toshiba its costs; and

G. Awarding to Plaintiff Toshiba such other, further, or general relief as this Court may deem proper.

JURY DEMAND

Plaintiff Toshiba hereby respectfully requests a jury trial on all issues triable to a jury.

Dated: February 7, 2006
New York, New York

FOLEY & LARDNER LLP

By: _____
Dorit S. Heimer (DH 7511)
Emily R. Sausen (ES 9097)
90 Park Avenue
New York, NY 10016
(212) 682-7474

Attorneys for Plaintiff
Toshiba Corporation

EXHIBIT A

US005587991A

United States Patent [19]

Nabeshima et al.

[11] Patent Number: 5,587,991

[45] Date of Patent: Dec. 24, 1996

[54] **RECORDING MEDIUM, SIGNAL RECORDING APPARATUS THEREOF, AND SIGNAL REPRODUCING APPARATUS THEREOF**

[75] Inventors: **Daiki Nabeshima; Naoki Ozaki**, both of Yokohama, Japan

[73] Assignee: **Kabushiki Kaisha Toshiba**, Kawagawa-ken, Japan

[21] Appl. No.: **375,428**

[22] Filed: **Jan. 18, 1995**

[30] **Foreign Application Priority Data**

Mar. 16, 1994 [JP] Japan 6-046010

[51] **Int. Cl.**[6] **G11B 7/00**

[52] **U.S. Cl.** **369/275.3**; 369/47; 369/48

[58] **Field of Search** 369/275.3, 47, 369/48, 49, 54, 58, 275.4

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,200,943	4/1993	Sano et al. .	
5,373,479	12/1994	Hanson	369/275.3
5,446,724	8/1995	Tabe et al.	369/275.3
5,469,416	11/1995	Yamagami et al.	369/48

FOREIGN PATENT DOCUMENTS

7-30431 3/1994 Japan .

Primary Examiner—David C. Nelms
Assistant Examiner—Vu A. Le
Attorney, Agent, or Firm—Cushman Darby & Cushman IP Group of Pillsbury Madison & Sutro LLP

[57] **ABSTRACT**

A recording medium having a SYNC (synchronous code) for synchronizing with data and a DCC (DC cancel code) for suppressing a DC component of a wave form of a signal recorded on the recording medium, the SYNC and the CDD being adjacently recorded on the recording medium. Both the SYNC and DCC are patterns that are not present in a data portion. A signal recording apparatus, comprising a DSV calculating means for calculating a DSV of a signal wave form recorded on the recording medium, a cancel code generating means for generating a cancel code for suppressing a DC component of the signal wave form corresponding to the DSV calculated by the DSV calculating means, and a recording means for connecting a synchronous code and record data to the cancel code generated by the cancel code generating means and recording the cancel code, the synchronous code, and the record data on the recording medium so that the cancel code and the synchronous code are adjacently disposed, the synchronous code being adapted for synchronizing with data. A signal reproducing apparatus, comprising a reading means for reading the signal from the recording medium, and a synchronous code detecting means for detecting a predetermined pattern contained in a continuous pattern of the synchronous code and the cancel code as a significant synchronous code for synchronizing with data from the signal read by the reading means.

7 Claims, 9 Drawing Sheets

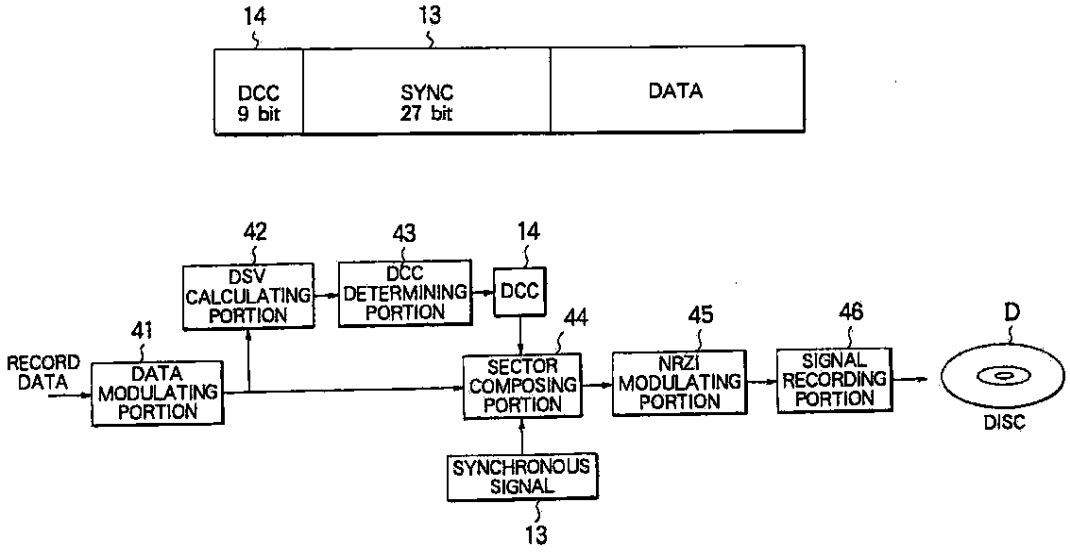


FIG. 1

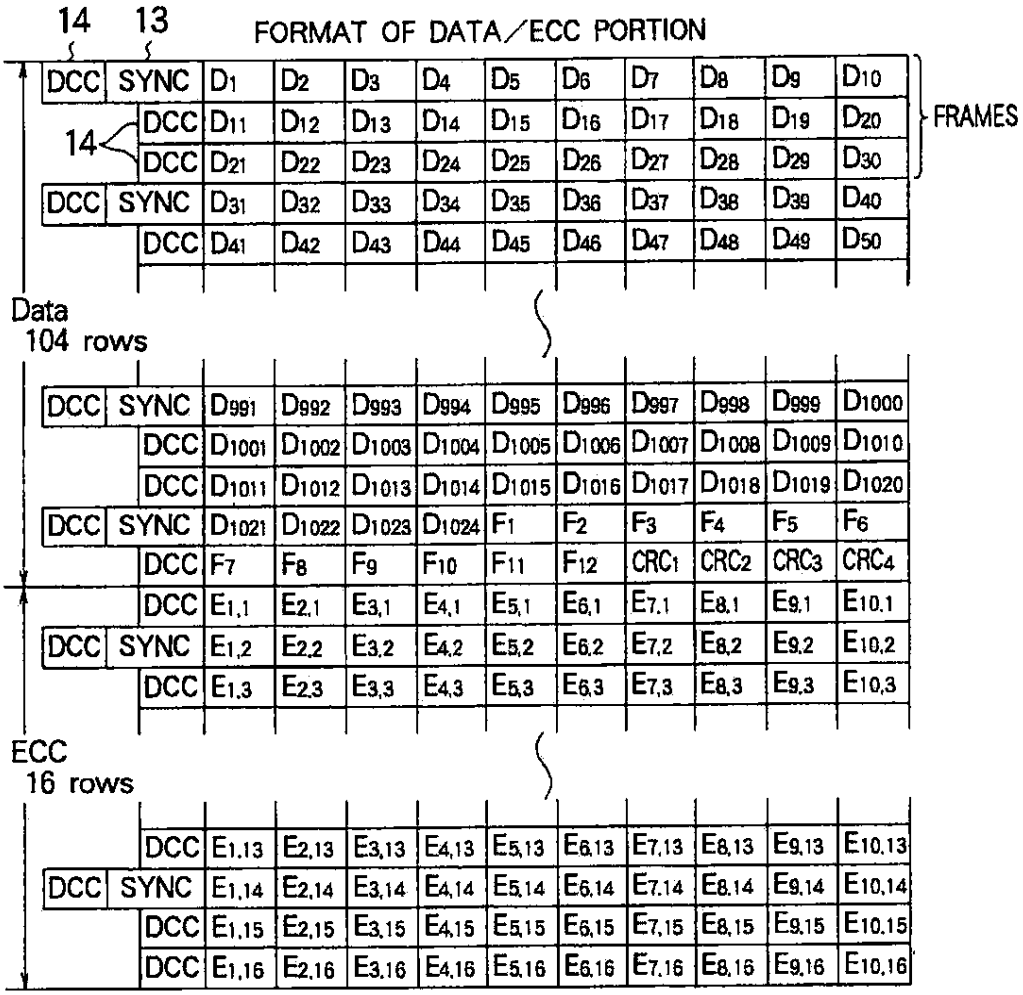

14
13
FORMAT OF DATA/ECC PORTION
DCC SYNC D1 D2 D3 D4 D5 D6 D7 D8 D9 D10
14 DCC D11 D12 D13 D14 D15 D16 D17 D18 D19 D20
DCC D21 D22 D23 D24 D25 D26 D27 D28 D29 D30
FRAMES
DCC SYNC D31 D32 D33 D34 D35 D36 D37 D38 D39 D40
DCC D41 D42 D43 D44 D45 D46 D47 D48 D49 D50
Data
104 rows
DCC SYNC D991 D992 D993 D994 D995 D996 D997 D998 D999 D1000
DCC D1001 D1002 D1003 D1004 D1005 D1006 D1007 D1008 D1009 D1010
DCC D1011 D1012 D1013 D1014 D1015 D1016 D1017 D1018 D1019 D1020
DCC SYNC D1021 D1022 D1023 D1024 F1 F2 F3 F4 F5 F6
DCC F7 F8 F9 F10 F11 F12 CRC1 CRC2 CRC3 CRC4
DCC E1,1 E2,1 E3,1 E4,1 E5,1 E6,1 E7,1 E8,1 E9,1 E10,1
DCC SYNC E1,2 E2,2 E3,2 E4,2 E5,2 E6,2 E7,2 E8,2 E9,2 E10,2
DCC E1,3 E2,3 E3,3 E4,3 E5,3 E6,3 E7,3 E8,3 E9,3 E10,3
ECC
16 rows
DCC E1,13 E2,13 E3,13 E4,13 E5,13 E6,13 E7,13 E8,13 E9,13 E10,13
DCC SYNC E1,14 E2,14 E3,14 E4,14 E5,14 E6,14 E7,14 E8,14 E9,14 E10,14
DCC E1,15 E2,15 E3,15 E4,15 E5,15 E6,15 E7,15 E8,15 E9,15 E10,15
DCC E1,16 E2,16 E3,16 E4,16 E5,16 E6,16 E7,16 E8,16 E9,16 E10,16

FIG. 2

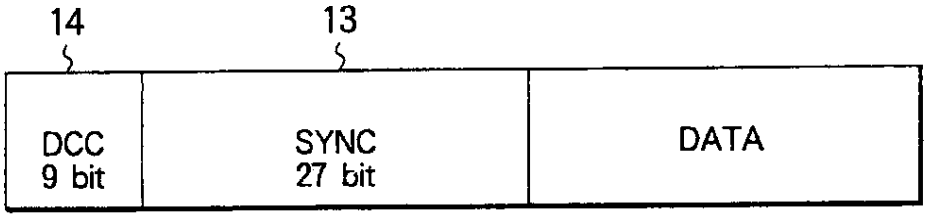

14
13
DCC
9 bit
SYNC
27 bit
DATA

FIG. 3

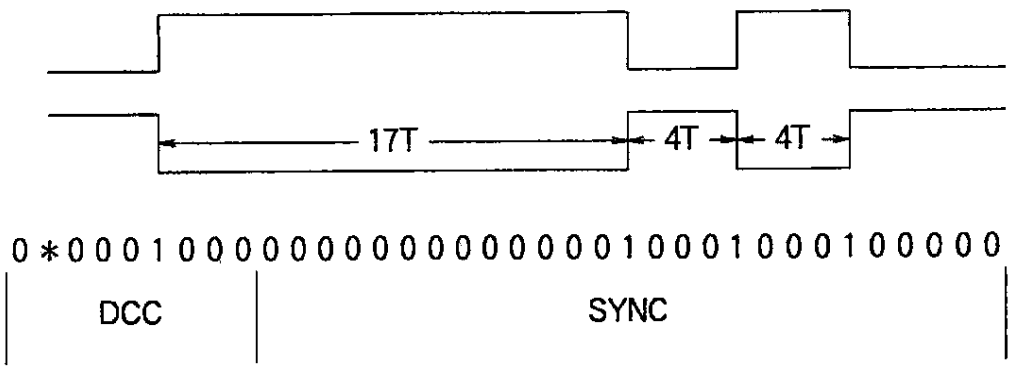

17T
4T
4T
0 * 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0
DCC
SYNC

FIG. 4

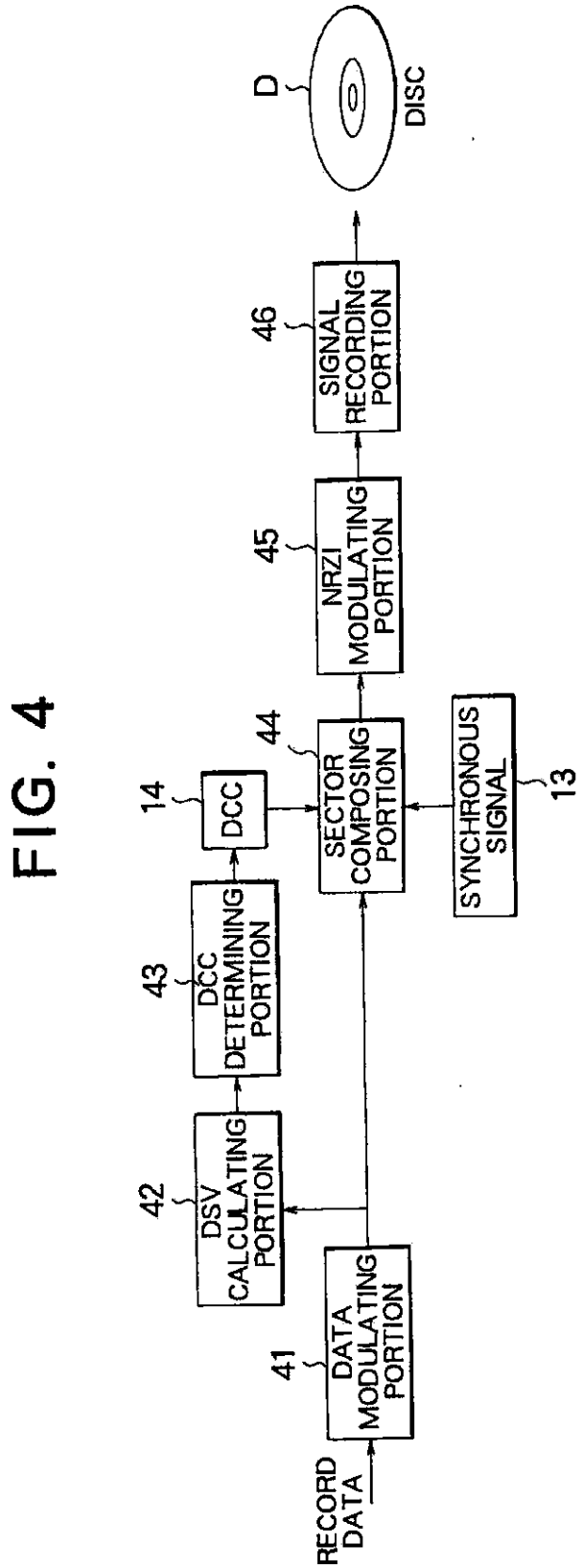

RECORD DATA
41
DATA MODULATING PORTION
42
DSV CALCULATING PORTION
43
DCC DETERMINING PORTION
14
DCC
44
SECTOR COMPOSING PORTION
13
SYNCHRONOUS SIGNAL
45
NRZI MODULATING PORTION
46
SIGNAL RECORDING PORTION
D
DISC

FIG. 5A

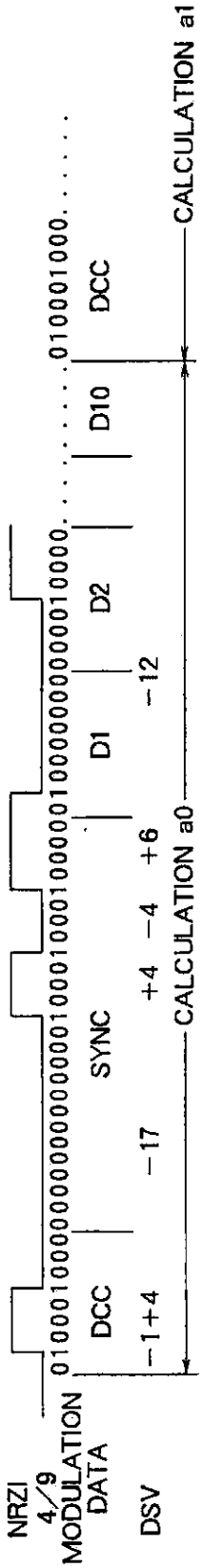

NRZI
4/9
MODULATION
DATA
DSV
DCC
SYNC
D1
D2
D10
DCC
CALCULATION a0
CALCULATION a1
−1+4
−17
+4
−4
+6
−12

FIG. 5B

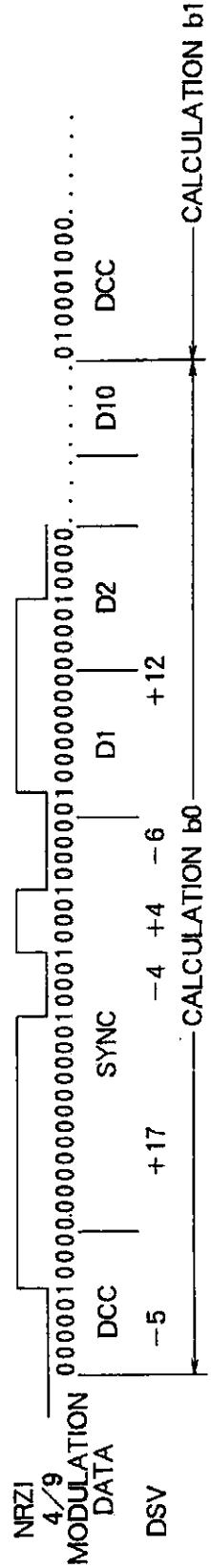
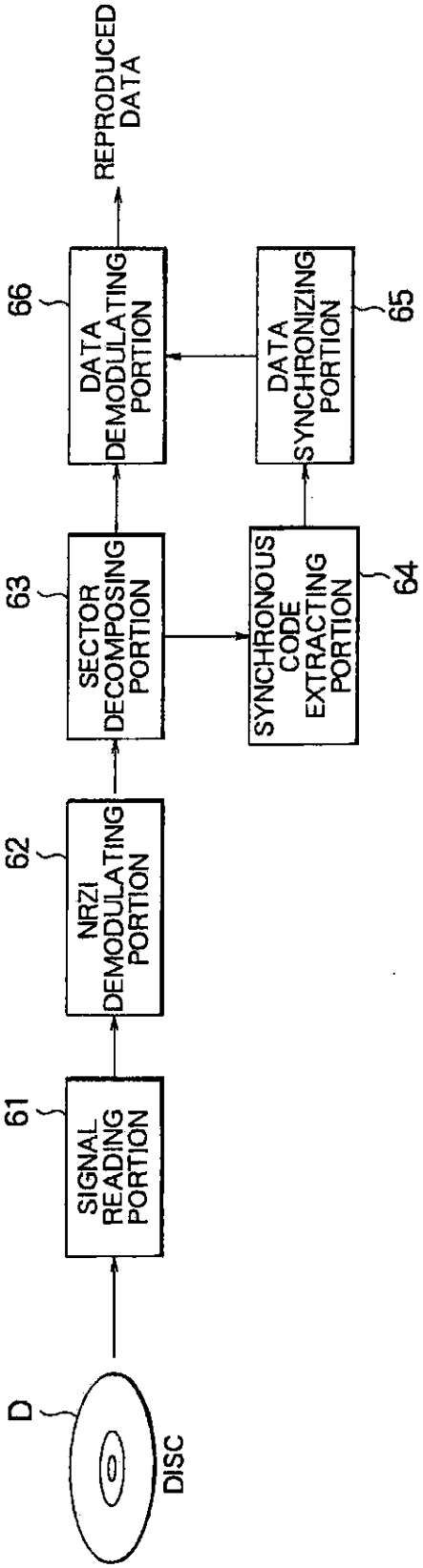

NRZI
4/9
MODULATION
DATA
DSV
DCC
SYNC
D1
D2
D10
DCC
CALCULATION b0
CALCULATION b1
−5
+17
−4
+4
−6
+12

FIG. 6


REPRODUCED DATA
66
DATA DEMODULATING PORTION
65
DATA SYNCHRONIZING PORTION
63
SECTOR DECOMPOSING PORTION
64
SYNCHRONOUS CODE EXTRACTING PORTION
62
NRZI DEMODULATING PORTION
61
SIGNAL READING PORTION
D
DISC

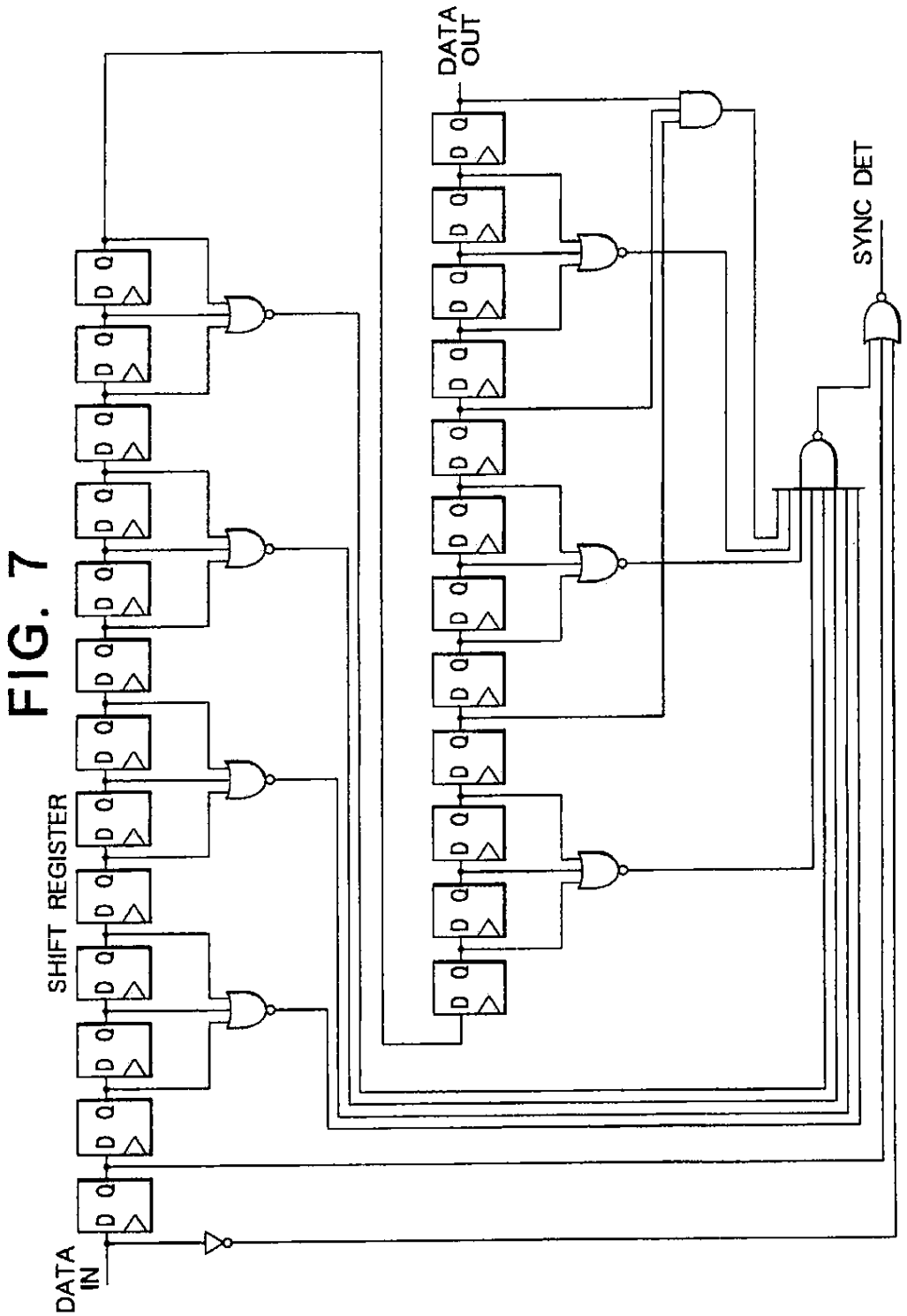


FIG. 7

FIG. 8

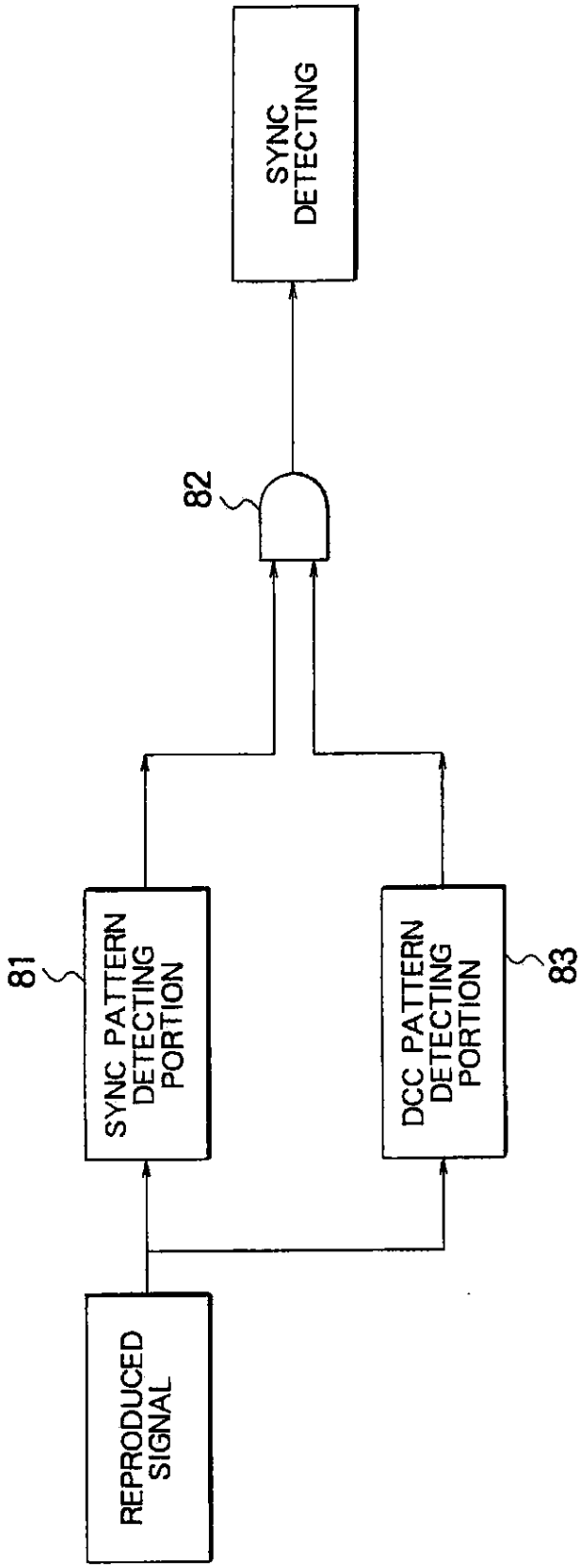

SYNC DETECTING
82
81
SYNC PATTERN DETECTING PORTION
DCC PATTERN DETECTING PORTION
83
REPRODUCED SIGNAL

FIG. 9

Dn	Tn	CONDITION BY Dn+1
0	010000000	
1	001000000	
2	000100000	
3	000010000	
4	000001000	
5	000000100	OTHER THAN (6,7,8,D,AND F),EM
	000010001	(6,7,8,D,F) case (1)
6	100010000	
7	100001000	
8	100000100	OTHER THAN (6,7,8,D,AND F),EM
	100000001	(6,7,8,D,F) case (1)
9	010001000	
A	010000100	OTHER THAN (6,7,8,D,AND F),EM
	010000001	(6,7,8,D,F) case (1)
B	001000100	OTHER THAN (6,7,8,D,AND F),EM
	001000001	(6,7,8,D,F) case (1)
C	001000010	OTHER THAN (0,6,7,8,9,A,D, AND F) AND DCC, EM
	000100001	(6,7,8,D,F) case (1) DCC (INV)
	000000001	(0,9,A) case (2) DCC (INV)
	100000010	OTHER THAN (0,6,7,8,9,A,D,

Case (1)

Dn+1	Tn+1	Dn+2	Tn+2
6	000000000	F	100000000
		0	010000000
		1	001000000
		2	000100000
		3	000010000
		4	000001000
		6	100010000
		7	100001000
		9	010001000
		DCC, EM	
	000100010	B	001000000
		C	000100000
		D	000010000
		E	000001000
	000010001	5	000100000
		8	000010000
		A	000001000
7	000000100	0	010000000
		1	001000000
		2	000100000
		3	000010000

DCC	000001000	INV
	010001000	non INV

Case (2)

0	000100000
9	000010000
A	000001000

FIG. 10

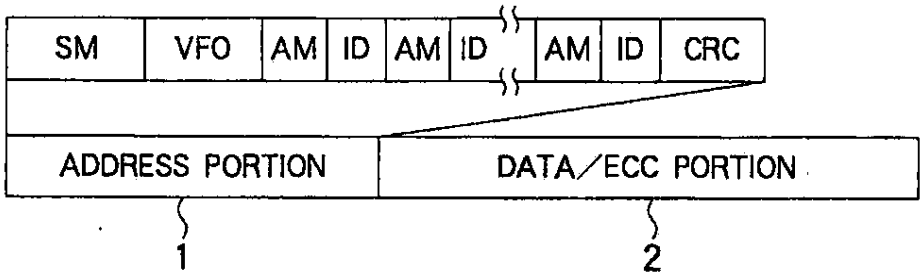
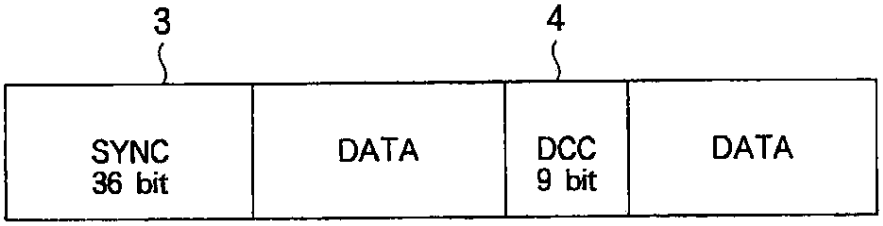


FIG. 11

FORMAT OF DATA/ECC PORTION

3						4					
SYNC	D_1	D_2	D_3	D_4	D_5	DCC	D_6	D_7	D_8	D_9	D_{10}
	D_{11}	D_{12}	D_{13}	D_{14}	D_{15}	DCC	D_{16}	D_{17}	D_{18}	D_{19}	D_{20}
3	D_{21}	D_{22}	D_{23}	D_{24}	D_{25}	DCC	D_{26}	D_{27}	D_{28}	D_{29}	D_{30}
SYNC	D_{31}	D_{32}	D_{33}	D_{34}	D_{35}	DCC	D_{36}	D_{37}	D_{38}	D_{39}	D_{40}
	D_{41}	D_{42}	D_{43}	D_{44}	D_{45}	DCC	D_{46}	D_{47}	D_{48}	D_{49}	D_{50}
Data 104 rows											
SYNC	D_{991}	D_{992}	D_{993}	D_{994}	D_{995}	DCC	D_{996}	D_{997}	D_{998}	D_{999}	D_{1000}
	D_{1001}	D_{1002}	D_{1003}	D_{1004}	D_{1005}	DCC	D_{1006}	D_{1007}	D_{1008}	D_{1009}	D_{1010}
	D_{1011}	D_{1012}	D_{1013}	D_{1014}	D_{1015}	DCC	D_{1016}	D_{1017}	D_{1018}	D_{1019}	D_{1020}
SYNC	D_{1021}	D_{1022}	D_{1023}	D_{1024}	F_1	DCC	F_2	F_3	F_4	F_5	F_6
	F_7	F_8	F_9	F_{10}	F_{11}	DCC	F_{12}	CRC_1	CRC_2	CRC_3	CRC_4
	$E_{1,1}$	$E_{2,1}$	$E_{3,1}$	$E_{4,1}$	$E_{5,1}$	DCC	$E_{6,1}$	$E_{7,1}$	$E_{8,1}$	$E_{9,1}$	$E_{10,1}$
SYNC	$E_{1,2}$	$E_{2,2}$	$E_{3,2}$	$E_{4,2}$	$E_{5,2}$	DCC	$E_{6,2}$	$E_{7,2}$	$E_{8,2}$	$E_{9,2}$	$E_{10,2}$
	$E_{1,3}$	$E_{2,3}$	$E_{3,3}$	$E_{4,3}$	$E_{5,3}$	DCC	$E_{6,3}$	$E_{7,3}$	$E_{8,3}$	$E_{9,3}$	$E_{10,3}$
ECC 16 rows											
	$E_{1,13}$	$E_{2,13}$	$E_{3,13}$	$E_{4,13}$	$E_{5,13}$	DCC	$E_{6,13}$	$E_{7,13}$	$E_{8,13}$	$E_{9,13}$	$E_{10,13}$
SYNC	$E_{1,14}$	$E_{2,14}$	$E_{3,14}$	$E_{4,14}$	$E_{5,14}$	DCC	$E_{6,14}$	$E_{7,14}$	$E_{8,14}$	$E_{9,14}$	$E_{10,14}$
	$E_{1,15}$	$E_{2,15}$	$E_{3,15}$	$E_{4,15}$	$E_{5,15}$	DCC	$E_{6,15}$	$E_{7,15}$	$E_{8,15}$	$E_{9,15}$	$E_{10,15}$
	$E_{1,16}$	$E_{2,16}$	$E_{3,16}$	$E_{4,16}$	$E_{5,16}$	DCC	$E_{6,16}$	$E_{7,16}$	$E_{8,16}$	$E_{9,16}$	$E_{10,16}$

FIG. 12



RECORDING MEDIUM, SIGNAL RECORDING APPARATUS THEREOF, AND SIGNAL REPRODUCING APPARATUS THEREOF

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a recording medium such as an optical disc, a signal recording apparatus thereof, and a signal reproducing apparatus thereof.

2. Description of the Related Art

When digital data is highly densely recorded on a recording medium such as an optical disc, the digital data should be modulated with a large value of the minimum code inversion length Tmin so as to record as much data in a limited bit length as possible.

To do that, in recent years, as a modulation system with a large value of the minimum code inversion length Tmin, 4-9 modulation system has been proposed. The 4-9 modulation system is described in for example Japanese Patent Application No. 5-76692. The 4-9 modulation system converts 4-bit data into 9-bit data. In the 4-9 modulation system, the minimum code inversion length Tmin is 4T (where T is a bit length) and the maximum code inversion length Tmax is 18T.

FIG. 9 is a schematic diagram showing the construction of a code conversion table for the 4-9 modulation system. In FIG. 2, Dn is a value of which an input binary data sequence is divided by every four bits and represented in hexadecimal (HEX) notation. T_n is a binary bit pattern in which the input D_n is converted into 9 bits and at least three "0s" are present between two bit "1s". Due to the relation between D_n and D_{n+1}, two or three T_n patterns are provided. Depending on the value of D_{n+1}, the pattern of T_n is determined. When D_n=5, T_n is either "000000100" or "000010001". When D_{n+1} is 6, 7, 8, D, or F, T_n is "000010001". Otherwise, T_n is "000000100". When T_n is "000000100", depending on D_{n+1}, D_{n+2} also corresponds to the table of case (1). As a practical example, when D is 5, 6, or 7, "000010001", "000000000", or "100001000" can be obtained, respectively.

When data is recorded on the recording medium, the resultant 4-9 modulation code is modulated corresponding to NRZI (Non-Return to Zero Inverted) technique.

On the other hand, when data is reproduced from the recording medium, a synchronous code should be regularly recorded on the recording medium so as to read data, byte by byte. The synchronous code is hereinafter referred to as SYNC. The SYNC is a predetermined pattern that is not present in data portion.

In the 4-9 modulation system or the like, the signal that has been modulated corresponding to the NRZI technique contains a DC component. To suppress the DC component, a DC cancel code (DCC) is added to the data portion.

FIG. 10 shows the construction of a sector of a conventional optical disc. FIG. 11 shows the construction of a data portion of FIG. 10. As shown in these drawings, each sector is composed of an address portion 1 and a DATA/ECC portion 2. The SYNCs 3 and the DCCs 4 are regularly placed in at least the DATA/ECC portion 2. The DATA/ECC portion 2 is composed of a plurality of blocks, each of which has a predetermined bit length.

FIG. 12 shows the relation of positions of the SYNC 3 and the DCC 4 of FIG. 11. As shown in FIG. 12, data is placed between the SYNC 3 and the DCC 4. The signal length of the SYNC 3 is 36 bits. The signal length of the DCC 4 is 9 bits.

Although the DCC 4 is an essential code for suppressing the DC component of the wave form of a signal recorded on the disc, the data recording area of the DATA/ECC portion 2 is correspondingly decreased, thereby obstructing the high dense recording of the recording medium.

In the sector format of the conventional optical disc or the like, since the synchronous code and the cancel code are dispersedly disposed, the redundant portion other than the data portion becomes large, thereby restricting the amount of data recorded on the recording medium.

SUMMARY OF THE INVENTION

The present invention is made to solve the above-described problem. An object of the present invention is to provide a recording medium, a signal recording apparatus thereof, and a signal reproducing apparatus thereof that allow the redundant portion composed of the synchronous code and the cancel code to be reduced and thereby the amount of recordable data and the recording density to be increased.

Another object of the present invention is to provide a recording medium, a signal recording apparatus thereof, a signal reproducing apparatus thereof that allow the redundant portion composed of the synchronous code and the cancel code to be reduced without deteriorating the function of the cancel code.

A further object of the present invention is to provide a recording medium, a signal recording apparatus thereof, a signal reproducing apparatus thereof that allow the reproduced data to be securely synchronized and thereby the reliability of the reproduced signal to be improved.

A first aspect of the present invention is a recording medium having a synchronous code and a cancel code, the synchronous code being adapted for synchronizing data, the cancel code being adapted for suppressing a DC component of a signal wave form recorded on the recording medium, the synchronous code and the cancel code being adjacently recorded on the recording medium.

A second aspect of the present invention is a recording medium having a cancel code and a synchronous code, the cancel code being adapted for suppressing a DC component of a signal wave form recorded on the recording medium, the synchronous code being adapted for synchronizing data, the cancel code containing part of the synchronous code being recorded on the recording medium.

A third aspect of the present invention is a signal recording apparatus of a recording medium, comprising a DSV calculating means for calculating a DSV (Digital Sum Value) of a signal wave form recorded on the recording medium, a cancel code generating means for generating a cancel code for suppressing a DC component of the signal wave form corresponding to the DSV calculated by the DSV calculating means, and a recording means for connecting a synchronous code and record data to the cancel code generated by the cancel code generating means and recording the cancel code, the synchronous code, and the record data on the recording medium so that the cancel code and the synchronous code are adjacently disposed, the synchronous code being adapted for synchronizing with data.

A fourth aspect of the present invention is a signal recording apparatus of a recording medium, comprising a DSV calculating means for calculating a DSV of a signal

wave form recorded on the recording medium, a cancel code generating means for generating a cancel code for suppressing a DC component of the signal wave form corresponding to the DSV calculated by the DSV calculating means, and a recording means for connecting a predetermined signal pattern and record data to the cancel code generated by the cancel code generating means and recording the cancel code, the predetermined signal pattern, and the record data on the recording medium so that the cancel code and the predetermined signal pattern are adjacently disposed, the predetermined signal pattern being part of a synchronous code, the synchronous code being adapted for synchronizing with data.

A fifth aspect of the present invention is a signal reproducing apparatus for reproducing data from a recording medium on which a synchronous code for synchronizing with data and a cancel code for suppressing a DC component of a wave form of a signal are recorded, the synchronous code and the cancel code being adjacently recorded on the recording medium, comprising a reading means for reading the signal from the recording medium, and a synchronous code detecting means for detecting a predetermined pattern contained in a continuous pattern of the synchronous code and the cancel code as a significant synchronous code for synchronizing with data from the signal read by the reading means.

A sixth aspect of the present invention is a signal reproducing apparatus for reproducing data from a recording medium on which a cancel code for suppressing a DC component of a wave form of a signal is recorded, the cancel code containing part of a synchronous code for synchronizing with data, comprising a reading means for reading the signal from the recording medium, and a synchronous code detecting means for detecting a predetermined pattern contained in a continuous pattern of the synchronous code and the cancel code as a significant synchronous code for synchronizing with data from the signal read by the reading means.

Thus, according to the present invention, the synchronous code and the cancel code have been adjacently recorded on the recording medium. When data is reproduced, a predetermined pattern contained in a continuous pattern of the synchronous code and the cancel code is detected as a significant synchronous code that synchronizes with data. Consequently, without need to reduce the bit length of the synchronous code to be detected and without deteriorating the function of the cancel code, the amount of data that is recorded on the recording medium can be increased, thereby increasing the recording density.

Moreover, according to the present invention, the cancel code is recorded on the recording medium in such a manner that part of the synchronous code is contained in the cancel code. When data is reproduced, a predetermined pattern contained in a continuous pattern of the synchronous code and the cancel code is detected as a significant synchronous code that synchronizes with the data. Thus, without reducing the bit length of the synchronous code to be detected and deteriorating the function of the cancel code, the amount of data that is recorded on the recording medium can be increased, thereby increasing the recording density.

Furthermore, according to the present invention, since part or all of the cancel code is included in the synchronous code, when data is reproduced, it can be securely synchronized, thereby improving the reliability of the reproduced signal.

These and other objects, features and advantages of the present invention will become more apparent in light of the following detailed description of best mode embodiments thereof, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram showing the construction of a DATA/ECC portion in a sector format of an optical disc according to an embodiment of the present invention;

FIG. **2** is a schematic diagram showing the relation of the positions of a SYNC and a DCC in the DATA/ECC portion of FIG. **1**;

FIG. **3** is a schematic diagram showing patterns of the SYNC and the DCC;

FIG. **4** is a block diagram showing the construction of a signal recording apparatus according to the present invention;

FIG. **5**A and **5**B are a schematic diagrams for explaining a calculating method of DSV and a determining method of DCC for two types of DCC values (a and b);

FIG. **6** is a block diagram showing the construction of a signal reproducing apparatus according to the present invention;

FIG. **7** is a block diagram showing the construction of a SYNC detecting circuit;

FIG. **8** is a block diagram showing the construction of a synchronous pattern detecting portion according to another embodiment of the present invention;

FIG. **9** is a schematic diagram showing the construction of a code conversion table for **4**-**9** modulation system;

FIG. **10** is a schematic diagram showing the construction of a sector of a conventional optical disc;

FIG. **11** is a schematic diagram showing the construction of a data portion of FIG. **10**; and

FIG. **12** is a schematic diagram showing the relation of the positions of a SYNC and a DCC of FIG. **11** and signal lengths thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Next, with reference to the accompanying drawings, embodiments of the present invention will be described.

FIG. **1** is a schematic diagram showing the construction of a DATA/ECC portion in a sector format of an optical disc according to an embodiment of the present invention. FIG. **2** is a schematic diagram showing the relation of the positions of a SYNC (synchronous code) and a DCC (DC cancel code) in the DATA/ECC portion of FIG. **1** and signal lengths thereof.

As shown in FIGS. **1** and **2**, at the beginning of each frame of the DATA/ECC portion, the SYNC **13** and the DCC **14** are adjacently disposed. In other words, at the beginning of the frame, the DCC **14** is disposed. The DCC **14** is followed by the SYNC **13**. The signal length of the SYNC **13** is 27 bits. The signal length of the DCC **14** is 9 bits. Thus, the total signal length of the SYNC **13** and the DCC **14** is 36 bits.

FIG. **3** is a schematic diagram showing patterns of the SYNC **13** and the DCC **14**. Referring to FIG. **3**, in the "*" portion, the value of "0" or "1" is placed. The SYNC **13** and the DCC **14** are represented with predetermined patterns that are not present in the data portion, namely the **4**-**9** modulation code. Thus, a continuous pattern composed of the SYNC **13** and the DCC **14** can be treated as a single SYNC pattern. In this example, as a pattern that is not present in the

data portion, a pattern with the code inversion lengths for 17T, 4T, 4T and 6T is used.

Thus, in the optical disc according to this embodiment, since the continuous pattern composed of (SYNC 13+DCC 14) can be treated as a single SYNC pattern, the signal length of the SYNC 13 can be reduced for the signal length of the DCC 14, thereby improving the recording density without deteriorating the function of the DCC 14.

Next, a signal recording apparatus that records the continuous pattern composed of the SYNC 13 and the DCC 14 will be described.

FIG. 4 is a block diagram showing the construction of a signal recording apparatus according to the present invention. Referring to FIG. 4, the signal recording apparatus comprises a data modulating portion 41, a DSV calculating portion 42, a DCC determining portion 43, a sector composing portion 44, an NRZI modulating portion 45, and a signal recording portion 46.

The data modulating portion 41 performs the 4-9 modulation for the input data and supplies a 4-9 modulation signal to the DSV calculating portion 42 and the sector composing portion 44. The DSV calculating portion 42 calculates a DSV (Digital Sum Value) corresponding to the input 4-9 modulation signal and supplies the DSV to the DCC determining portion 43. The DSV is obtained, block by block (for example, as blocks of D1 to D10, D11 to D20, and D21 to D30 of FIG. 1). Whenever the DSV is obtained, the DCC is determined. For example, as shown in FIGS. 5A and 5B, now assume that two DCC values ("010001000" and "000001000") are used so as to calculate DSVs for these values. Thereafter, the absolute values of the DSVs are compared and the DCC with the smaller absolute value is determined as the DCC 14 to be recorded. The sector composing portion 44 adds the determined DCC 14 to the record data along with the SYNC 13. Thereby the sector format shown in FIG. 1 is composed. Thereafter, the NRZI modulating portion 45 performs the NRZI modulation for the 4-9 modulation signal composed of the DCC 14, the SYNC 13, and the record data. The signal recording portion 46 records the 4-9 modulation signal on a recording medium (optical disc) D.

Next, a signal reproducing apparatus that reproduces a signal from the recording medium will be described.

FIG. 6 is a block diagram showing the construction of the signal reproducing apparatus. Referring to FIG. 6, the signal reproducing apparatus comprises a signal reading portion 61, an NRZI demodulating portion 62, a sector decomposing portion 63, a synchronous code extracting portion 64, a data synchronizing portion 65, and a data demodulating portion 66. The signal reading portion 61 reads a signal that has been recorded on a recording medium D and supplies the signal to the NRZI demodulating portion 62. The NRZI demodulating portion 62 performs NRZI demodulation for the read signal and supplies the demodulation signal that is a 4-9 modulation signal to the sector decomposing portion 63. The sector decomposing portion 63 extracts a data portion from the 4-9 modulation signal that composes the sector format and supplies the data portion to the data demodulating portion 66. The synchronous code extracting portion 64 extracts DCC 14+SYNC 13 from the 4-9 modulation signal and supplies them to the data synchronizing portion 65. The data synchronizing portion 65 includes a SYNC detecting circuit. The SYNC detecting circuit detects a significant SYNC pattern necessary for synchronizing with data from DCC 14+SYNC 13. The SYNC detecting circuit will be described later in more detail. The data synchronizing portion 65 generates a data extracting timing for the data demodulating portion 66 corresponding to the detected result of the SYNC pattern so that the data demodulating portion 66 performs the 4-9 demodulation for the data, byte by byte. Thus, reproduced data is output.

FIG. 7 is a schematic diagram showing a construction of the SYNC detecting circuit. The SYNC detecting circuit comprises a shift register and some logic gates. In other words, the SYNC detecting circuit inputs serial data that has been NRZI demodulated whenever a bit clock takes place. When the input pattern accords with the above-described SYNC pattern, the SYNC detecting circuit outputs a SYNC detection signal.

Tables 1 and 2 show pairs (a) to (j') of the significant SYNC pattern and detected bit sequences. The upper row of each pair represents the significant SYNC pattern composed of 36 bits of DCC+SYNC. The lower row of each pair represents part of the significant SYNC pattern. For example, the lower row of the pair (a) represents that 26 bits other than the high order five bits and the low order five bits of the significant SYNC pattern composed of 36 bits of DCC+SYNC are detected bits of the significant SYNC pattern. The 26-bit pattern is the minimum required number of bits for pattern comparison since the first bit is an inversion point of the value of the DCC and the last bit is the start bit of a sequence of 6T of the pattern of sequences of 17T, 4T, 4T, and 6T (that are not present in the data portion). The lower row of the pair (j') represents that all bits of DCC+SYNC are detected bits of the significant SYNC pattern. In other words, a bit sequence as the significant SYNC pattern can be selected from the minimum bit number of the lower row of the pair (a) in Table 1 to all the bits of DCC+SYNC of the lower row of the pair (j') of Table 2. In this embodiment, the DCC 14 is disposed at the first block of frames that contain the SYNC 13. In addition, the DCC 14 is disposed at the beginning of each block. Conventionally, the DCC is added so as to suppress the DC component when a signal is recorded. Thus, when data is reproduced, the DCC is not necessary. According to the present invention, since the DCC 14 is disposed at the beginning of each block along with the first block, the DCC 14 can be used as auxiliary information that allows data to be synchronized between each SYNC 13.

Thus, even if the SYNC 13 cannot be detected due to a burst error and thereby data cannot be synchronized, with the DCC 14 of each block, the data can be synchronized. Consequently, the synchronism restoring time can be more shortened than the case that data is synchronized with only the SYNC pattern. When the synchronism restoring time is shortened, the amount of data that is processed can be increased and the reliability of the data can be improved.

When only the SYNC pattern is used, an incorrectable error may take place. However, when data is synchronized using the DCC 14 of each block, the probability of which the error is corrected is increased. The situation that the error cannot be corrected is remarkably reduced, thereby reducing the load applied to the error correcting side.

In the embodiment, a significant SYNC pattern contained in the continuous pattern of SYNC 13+DCC 14 is detected so as to synchronize with data. However, as shown in FIG. 8, not only the SYNC pattern, but a pattern of the DCC 14 may be detected so as to synchronize with data. In FIG. 8, reference numeral 81 is a SYNC pattern detecting portion. As with the above-described SYNC detecting circuit, the SYNC pattern detecting portion 81 detects a significant SYNC pattern contained in the continuous pattern of SYNC

13+DCC 14 and supplies the detected signal to an AND gate 82. Reference numeral 83 is a DCC pattern detecting portion that detects only a pattern of the DCC 14 and outputs the detected signal to the AND gate 82. Thus, in this construction, only when both the patterns of the SYNC 13 and the DCC 14 are detected, the SYNC is detected. Consequently, the accuracy of detecting the SYNC is raised and thereby the reliability of synchronism of data can be improved.

In the first embodiment, the SYNC pattern contains a sequence of a code inversion length for 17T. However, the SYNC pattern may contain a sequence of a code inversion length for 18T.

In the first embodiment, the 4-9 modulation system is used. However, as long as the sector format contains the SYNC 13 and the DCC 14, a variety of modulation systems such as another RLL (Run Length Limited) modulation system may be applied to the present invention.

In the first embodiment, the DCC 14 is disposed at the beginning of each frame and followed by the SYNC 13. However, the SYNC 13 may be disposed at the beginning of each frame and followed by the DCC 14.

As described above, in the recording medium, the signal recording apparatus thereof, and the signal reproducing apparatus thereof according to the present invention, the amount of data that is recorded on the recording medium can be increased without shortening the bit length of the synchronous pattern to be detected and without deteriorating the function of the cancel code. In addition, since part or all of the cancel code is contained in the synchronous pattern to be detected, when data is reproduced, it can be securely synchronized, thereby improving the reliability of the reproduced signal.

Although the present invention has been shown and described with respect to a best mode embodiment thereof, it should be understood by those skilled in the art that the foregoing and various other changes, omissions, and additions in the form and detail thereof may be made therein without departing from the spirit and scope of the present invention.

TABLE 1

(a)	0*000100000000000000001000100010000010000000001000100001
(b)	0*000100000000000000001000100010000001000000000100010001
(c)	0*000100000000000000001000100010000000100000000010001000
(d)	0*000100000000000000001000100010000000010000000001000100
(e)	0*000100000000000000001000100010000000001000000000100010
(f)	0*000100000000000000001000100010000000000100000000010001
(g)	0*000100000000000000001000100010000000000010000000001000
(h)	0*000100000000000000001000100010000000000001000000000100
(i)	0*000100000000000000001000100010000000000000100000000010
(j)	0*000100000000000000001000100010000000000000010000000001
(k)	0*000100000000000000001000100010000000000000001000000000
(l)	0*000100000000000000001000100010000000000000000100000000
(m)	0*000100000000000000001000100010000000000000000010000000
(n)	0*000100000000000000001000100010000000000000000001000000
(o)	0*000100000000000000001000100010000000000000000000100000
(p)	0*000100000000000000001000100010000000000000000000010000
(q)	0*000100000000000000001000100010000000000000000000001000
(r)	0*000100000000000000001000100010000000000000000000000100

TABLE 2

(s)	0*000100000000000000001000100010000000000000000000000010
(t)	0*000100000000000000001000100010000000000000000000000001
(u)	0*000100000000000000001000100010000000000000000000000000
(v)	0*000100000000000000001000100010000000000000000000000000

TABLE 2-continued

(w)	0*0001000000000000000001000100010000
	*0001000000000000000010001000100
(x)	0*0001000000000000000001000100010000
	0*0001000000000000000010001000100
(y)	0*0001000000000000000001000100010000
	1000000000000000001000100010000
(z)	0*0001000000000000000001000100010000
	0100000000000000000100010001000
(a')	0*0001000000000000000001000100010000
	0010000000000000000100010001000
(b')	0*0001000000000000000001000100010000
	0001000000000000000010001000100
(c')	0*0001000000000000000001000100010000
	*0001000000000000000010001000100
(d')	0*0001000000000000000001000100010000
	0*0001000000000000000010001000100
(e')	0*0001000000000000000001000100010000
	1000000000000000001000100010000
(f')	0*0001000000000000000001000100010000
	0100000000000000000100010001000
(g')	0*0001000000000000000001000100010000
	0010000000000000000100010001000
(h')	0*0001000000000000000001000100010000
	0001000000000000000010001000100
(i')	0*0001000000000000000001000100010000
	*0001000000000000000010001000100
(j')	0*0001000000000000000001000100010000
	0*0001000000000000000010001000100

What is claimed is:

1. A recording medium having a synchronous code and a cancel code, the synchronous code being adapted for synchronizing data, the cancel code being adapted for suppressing a DC component of a signal wave form recorded on said recording medium, the synchronous code and the cancel code being adjacently recorded on said recording medium.

2. A recording medium having a cancel code and a synchronous code, the cancel code being adapted for suppressing a DC component of a signal wave form recorded on said recording medium, the synchronous code being adapted for synchronizing data, the cancel code containing part of the synchronous code being recorded on said recording medium.

3. The recording medium as set forth in claim 1 or 2,

wherein a code sequence composed of the synchronous code and the cancel code contains a signal pattern that is not present in record data.

4. A signal recording apparatus of a recording medium, comprising:

DSV calculating means for calculating a DSV of a signal wave form recorded on the recording medium;

cancel code generating means for generating a cancel code for suppressing a DC component of the signal wave form corresponding to the DSV calculated by said DSV calculating means; and

recording means for connecting a synchronous code and record data to the cancel code generated by said cancel code generating means and recording the cancel code, the synchronous code, and the record data on the recording medium so that the cancel code and the synchronous code are adjacently disposed, the synchronous code being adapted for synchronizing with data.

5. A signal recording apparatus of a recording medium, comprising:

DSV calculating means for calculating a DSV of a signal wave form recorded on the recording medium;

cancel code generating means for generating a cancel code for suppressing a DC component of the signal wave form corresponding to the DSV calculated by said DSV calculating means; and

recording means for connecting a predetermined signal pattern and record data to the cancel code generated by said cancel code generating means and recording the cancel code, the predetermined signal pattern, and the record data on the recording medium so that the cancel code and the predetermined signal pattern are adjacently disposed, the predetermined signal pattern being part of a synchronous code, the synchronous code being adapted for synchronizing with data.

6. A signal reproducing apparatus for reproducing data from a recording medium on which a synchronous code for synchronizing with data and a cancel code for suppressing a DC component of a wave form of a signal are recorded, the synchronous code and the cancel code being adjacently recorded on the recording medium, comprising:

reading means for reading the signal from the recording medium; and

synchronous code detecting means for detecting a predetermined pattern contained in a continuous pattern of the synchronous code and the cancel code as a significant synchronous code for synchronizing with data from the signal read by said reading means.

7. A signal reproducing apparatus for reproducing data from a recording medium on which a cancel code for suppressing a DC component of a wave form of a signal is recorded, the cancel code containing part of a synchronous code for synchronizing with data, comprising:

reading means for reading the signal from the recording medium; and

synchronous code detecting means for detecting a predetermined pattern contained in a continuous pattern of the synchronous code and the cancel code as a significant synchronous code for synchronizing with data from the signal read by said reading means.

* * * * *

EXHIBIT B

US005732185A

United States Patent [19]

Hirayama et al.

[11] Patent Number: 5,732,185

[45] Date of Patent: Mar. 24, 1998

[54] **MULTI-SCENE RECORDING MEDIUM AND APPARATUS FOR REPRODUCING DATA THEREFROM**

[75] Inventors: **Koichi Hirayama**, Yokohama; **Masatoshi Nakai**, Kawasaki; **Kenji Shimoda**, Yokohama, all of Japan

[73] Assignee: **Kabushiki Kaisha Toshiba**, Kawasaki, Japan

[21] Appl. No.: **694,099**

[22] Filed: **Aug. 8, 1996**

Related U.S. Application Data

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **386/70**; 386/95; 386/108

[58] **Field of Search** 358/906, 909.1; 348/7, 13, 27; 386/4, 40, 52, 70, 92, 95–96, 108, 125–126; H04N 5/91, 7/08, 5/781, 5/783

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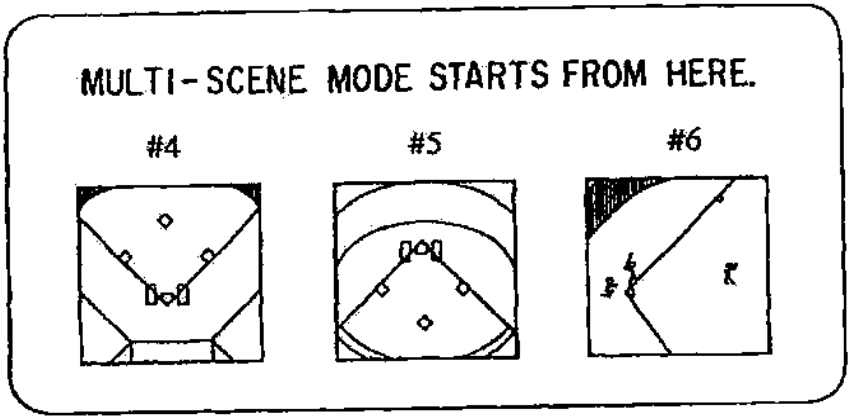
(List continued on next page.)

Primary Examiner—Andrew Faile
Assistant Examiner—Vincent F. Boccio
Attorney, Agent, or Firm—Cushman Darby Cushman IP Group of Pillsbury Madison & Sutro, LLP

[57] **ABSTRACT**

A multi-scene recording disk and a data reproducing apparatus which enables a user to select and enjoy one of simultaneously proceeding scenes, and also enables a program editor to edit programs using a new concept and novel fashion. Related program movements, each consisting of program bars, are recorded on the disk **100**. The data reproducing apparatus includes a data string processing section **203**, a system control section **204**, an operator panel **205**, a video processing section **206**, and audio processing sections **211** and **213**. The sections **203** and **204** and the panel **205** select any one of the program movements and switch one movement to another, and select any one of the program bars of the movement selected and switch one bar to another. The information thus selected is supplied to the video processing section **206** and the audio processing sections **211** and **213**.

4 Claims, 22 Drawing Sheets



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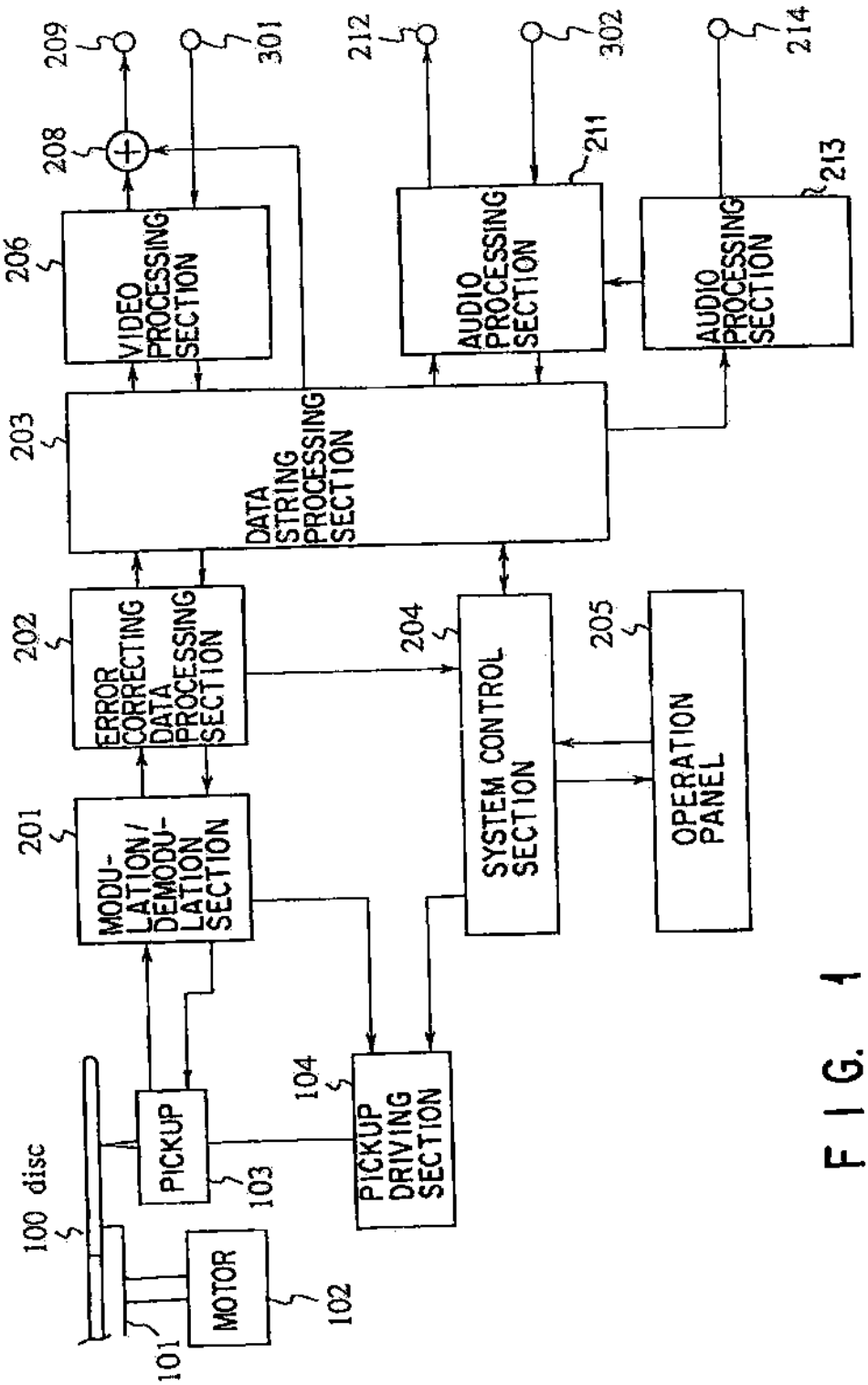

209
301
212
302
214
208
211
213
206
VIDEO PROCESSING SECTION
AUDIO PROCESSING SECTION
AUDIO PROCESSING SECTION
203
DATA STRING PROCESSING SECTION
202
ERROR CORRECTING DATA PROCESSING SECTION
204
SYSTEM CONTROL SECTION
205
OPERATION PANEL
201
MODU-LATION/ DEMODU-LATION SECTION
104
PICKUP DRIVING SECTION
100 disc
PICKUP
103
MOTOR
102
101

FIG. 1

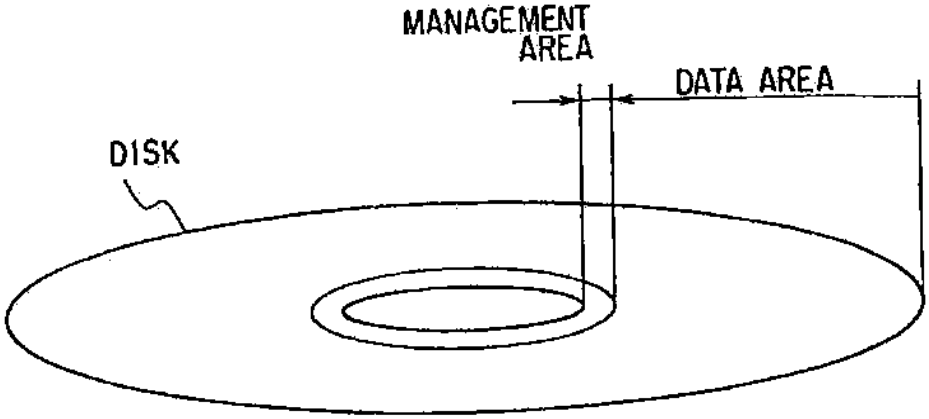

MANAGEMENT AREA
DATA AREA
DISK

FIG. 2A

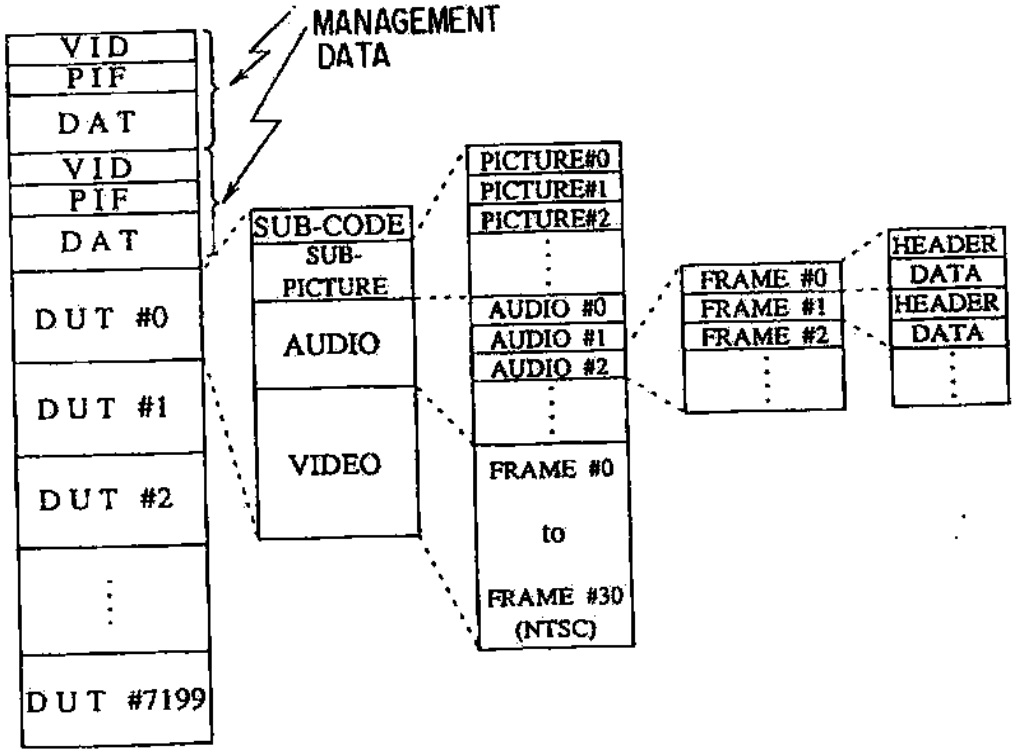

MANAGEMENT DATA
VID
PIF
DAT
VID
PIF
DAT
DUT #0
DUT #1
DUT #2
DUT #7199
SUB-CODE
SUB-PICTURE
AUDIO
VIDEO
PICTURE#0
PICTURE#1
PICTURE#2
AUDIO #0
AUDIO #1
AUDIO #2
FRAME #0
to
FRAME #30
(NTSC)
FRAME #0
FRAME #1
FRAME #2
HEADER
DATA
HEADER
DATA

FIG. 2B

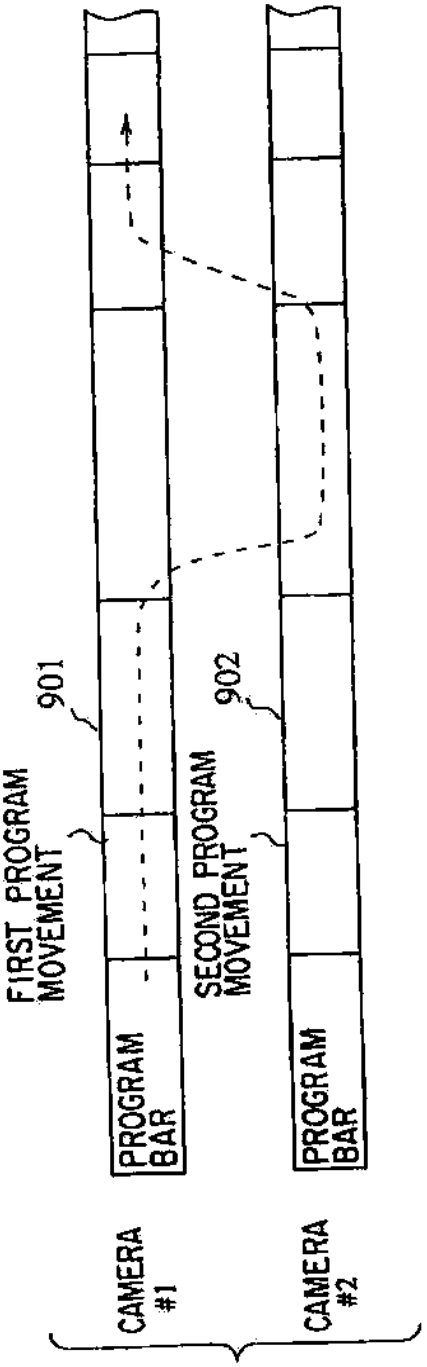

FIRST PROGRAM MOVEMENT
901
SECOND PROGRAM MOVEMENT
902
PROGRAM BAR
PROGRAM BAR
CAMERA #1
CAMERA #2

FIG. 3A

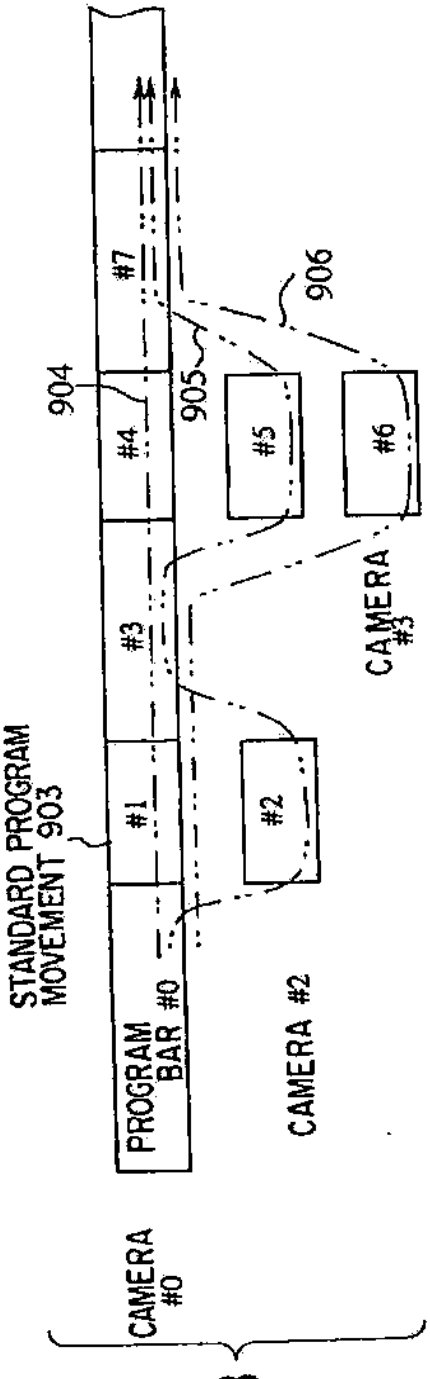

STANDARD PROGRAM MOVEMENT 903
904
905
906
#1
#2
#3
#4
#5
#6
#7
PROGRAM BAR #0
CAMERA #0
CAMERA #2
CAMERA #3

FIG. 3B

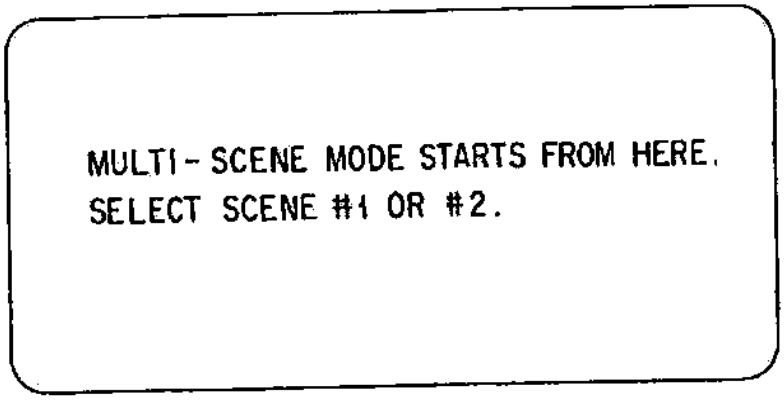


FIG. 4A

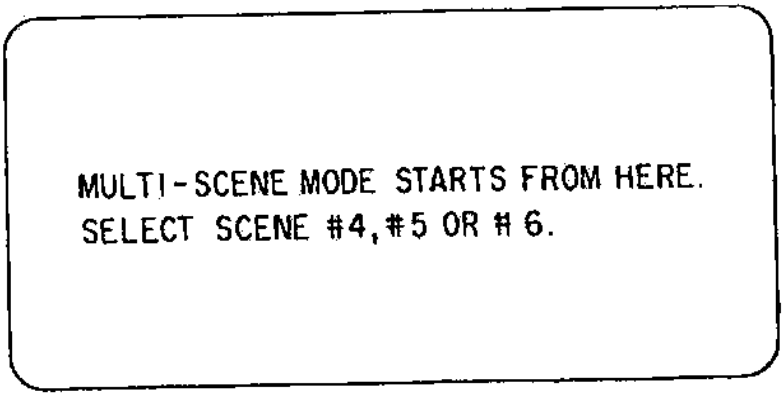


FIG. 4B

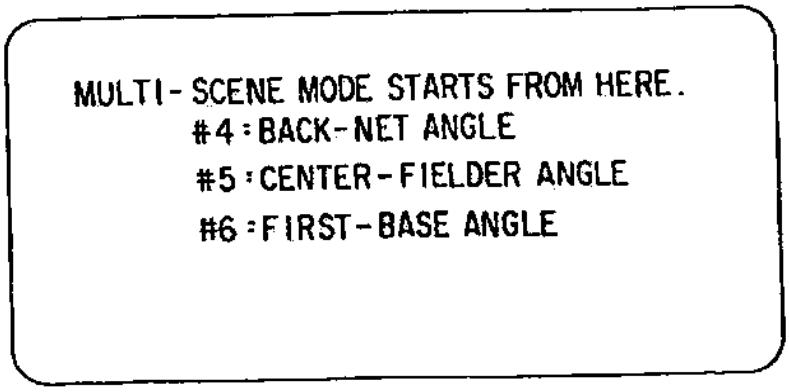


FIG. 4C

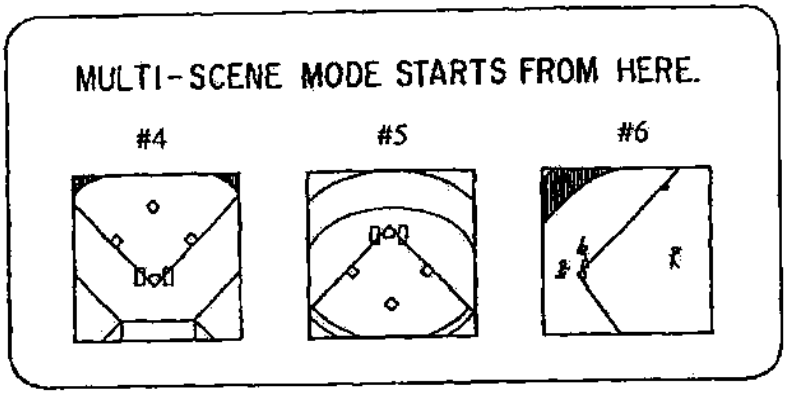


FIG. 5A

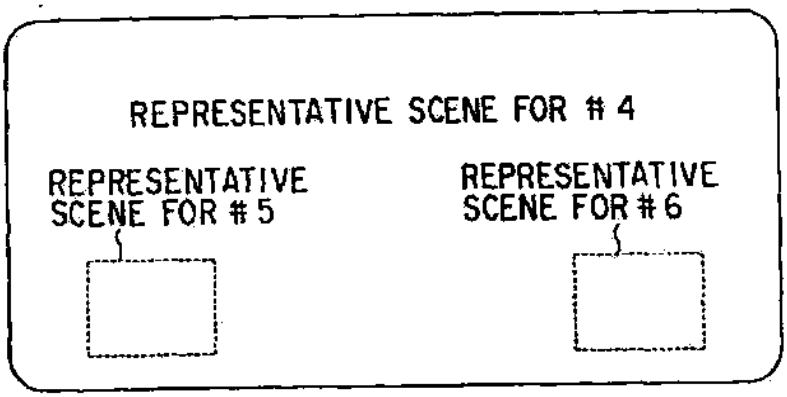


FIG. 5B

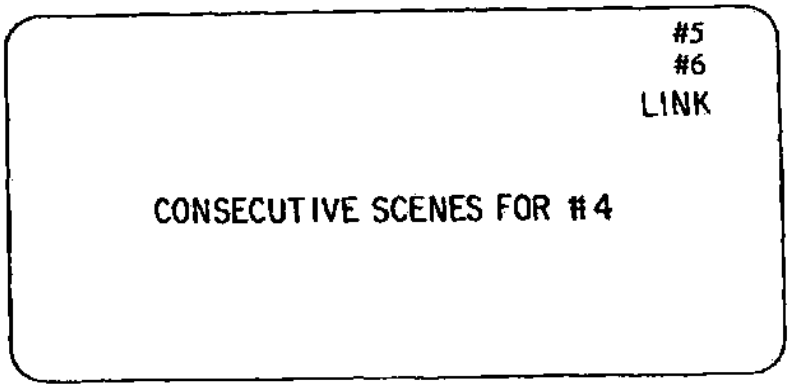


FIG. 5C

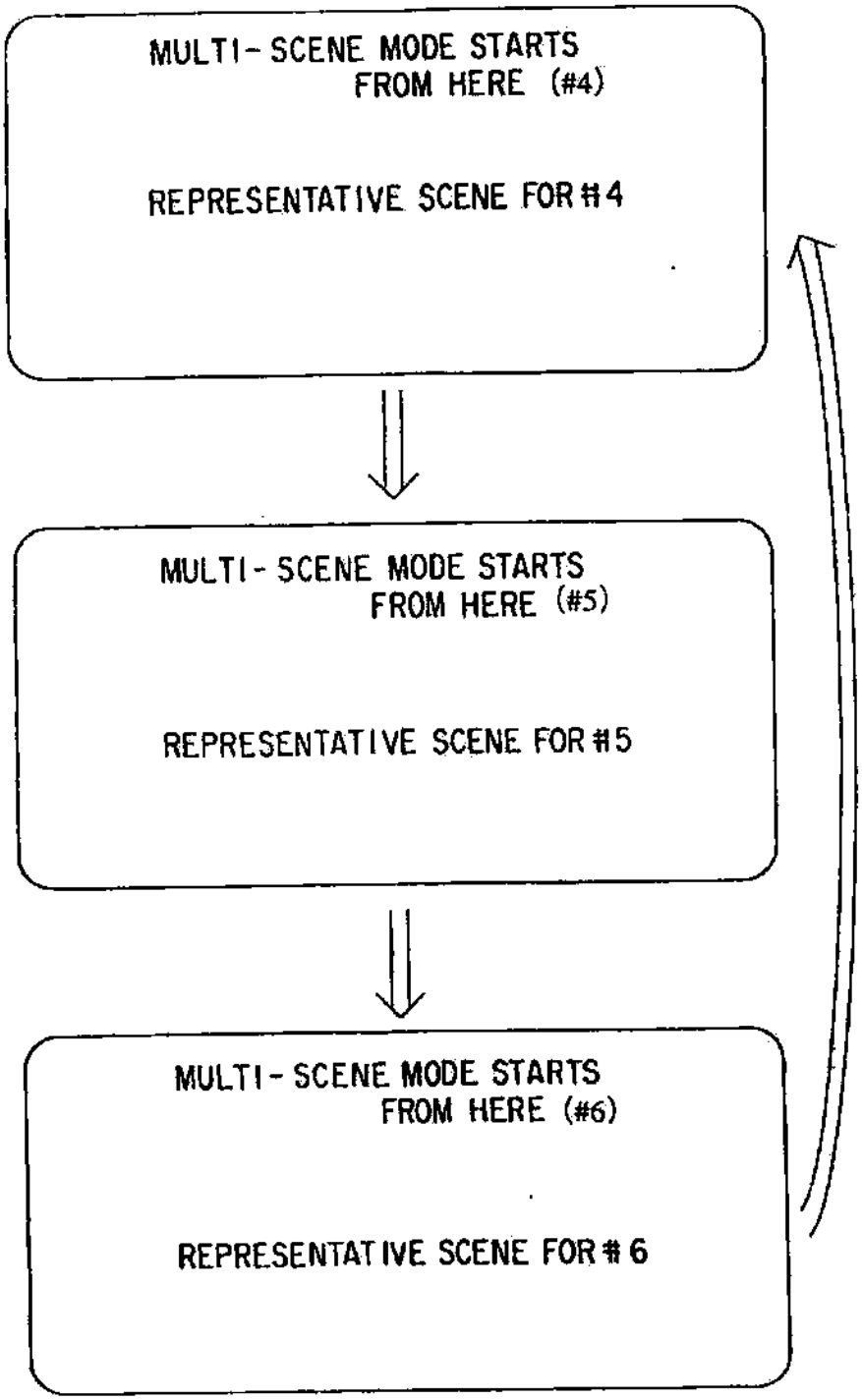

MULTI-SCENE MODE STARTS FROM HERE (#4)
REPRESENTATIVE SCENE FOR #4
MULTI-SCENE MODE STARTS FROM HERE (#5)
REPRESENTATIVE SCENE FOR #5
MULTI-SCENE MODE STARTS FROM HERE (#6)
REPRESENTATIVE SCENE FOR #6

FIG. 6

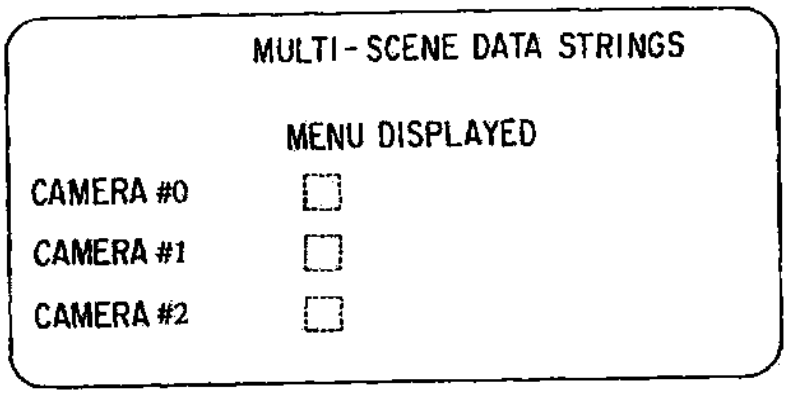

MULTI-SCENE DATA STRINGS
MENU DISPLAYED
CAMERA #0
CAMERA #1
CAMERA #2

FIG. 7

FIG. 8A

VID

PROGRAM BAR	#1	#2	
PROGRAM BAR	#4	#5	#6
⋮			

FIG. 8B

PIF

PROGRAM BAR	NEXT PROGRAM BAR TO BE REPRODUCED
#0	#1
#1	#3
#2	#3
#3	#4
#4	#7
#5	#7
#6	#7

FIG. 8C

DAT

PROGRAM BAR	TIME FOR REPRODUCING EACH DATA UNIT	PROGRAM BAR	TIME FOR REPRODUCING EACH DATA UNIT
#0	0 1 2 ⋮ 3° 40′	#2	0 1 ⋮ 1° 18′
#1	0 1 ⋮ 1° 18′		

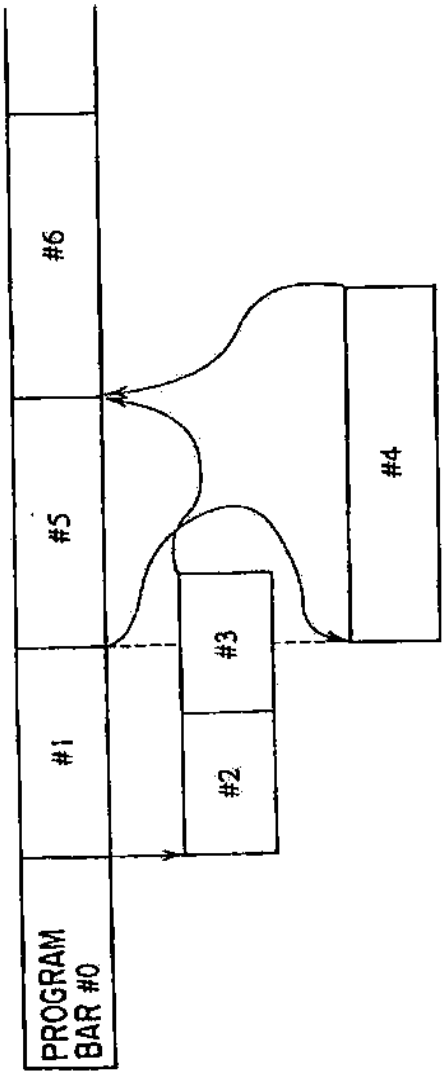


FIG. 9A

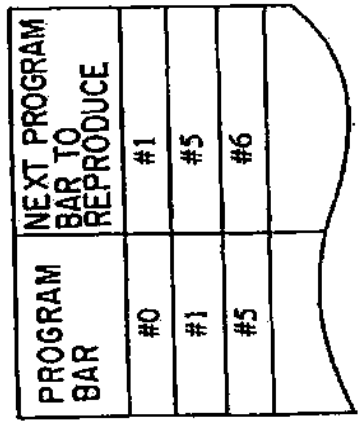


FIG. 9B

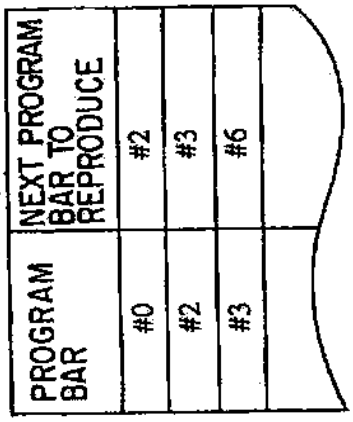


FIG. 9C

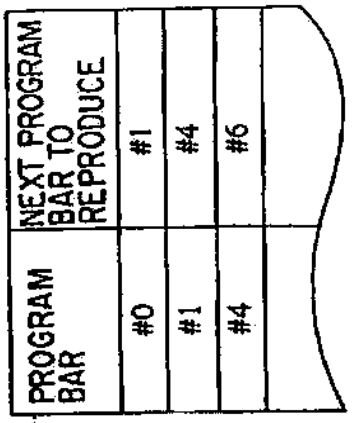


FIG. 9D

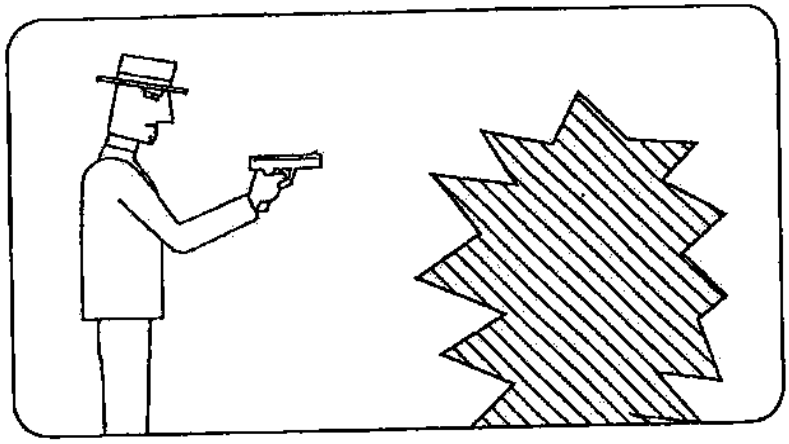


FIG. 10A

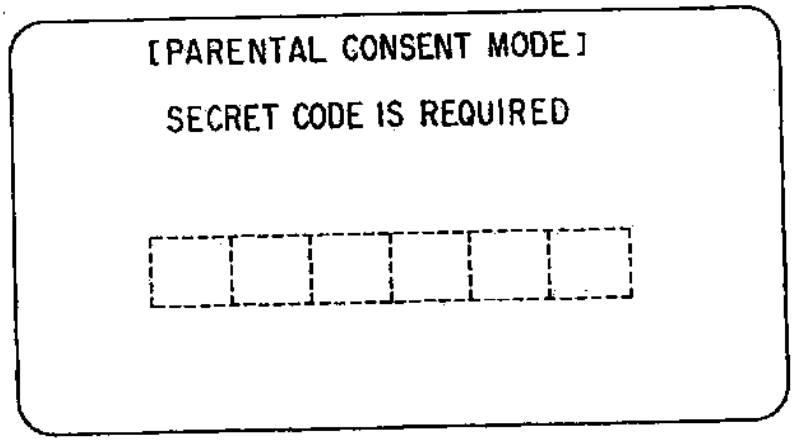


FIG. 10B

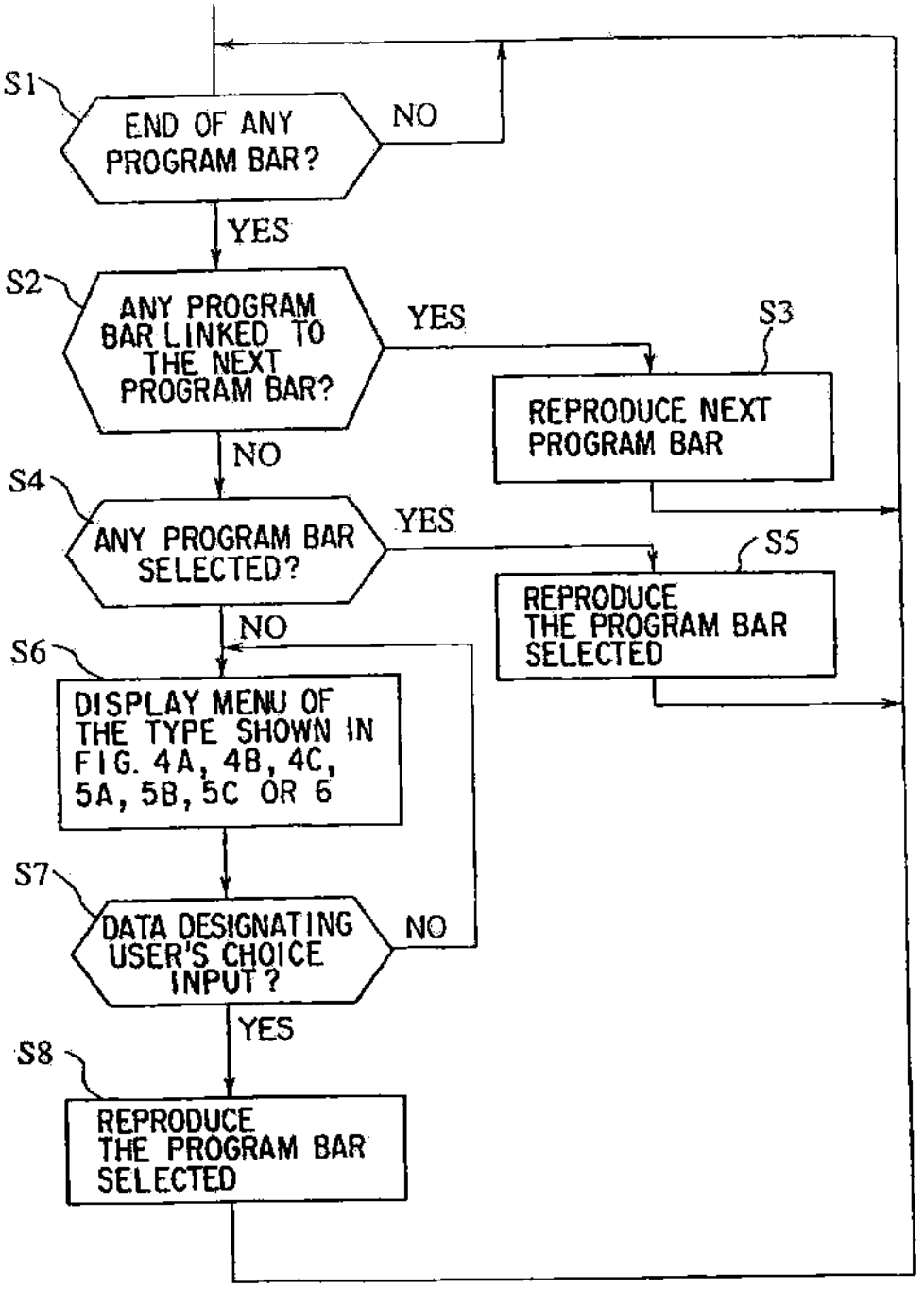

S1
END OF ANY PROGRAM BAR?
NO
YES
S2
ANY PROGRAM BAR LINKED TO THE NEXT PROGRAM BAR?
YES
S3
REPRODUCE NEXT PROGRAM BAR
NO
S4
ANY PROGRAM BAR SELECTED?
YES
S5
REPRODUCE THE PROGRAM BAR SELECTED
NO
S6
DISPLAY MENU OF THE TYPE SHOWN IN FIG. 4A, 4B, 4C, 5A, 5B, 5C OR 6
S7
DATA DESIGNATING USER'S CHOICE INPUT?
NO
YES
S8
REPRODUCE THE PROGRAM BAR SELECTED

FIG. 11

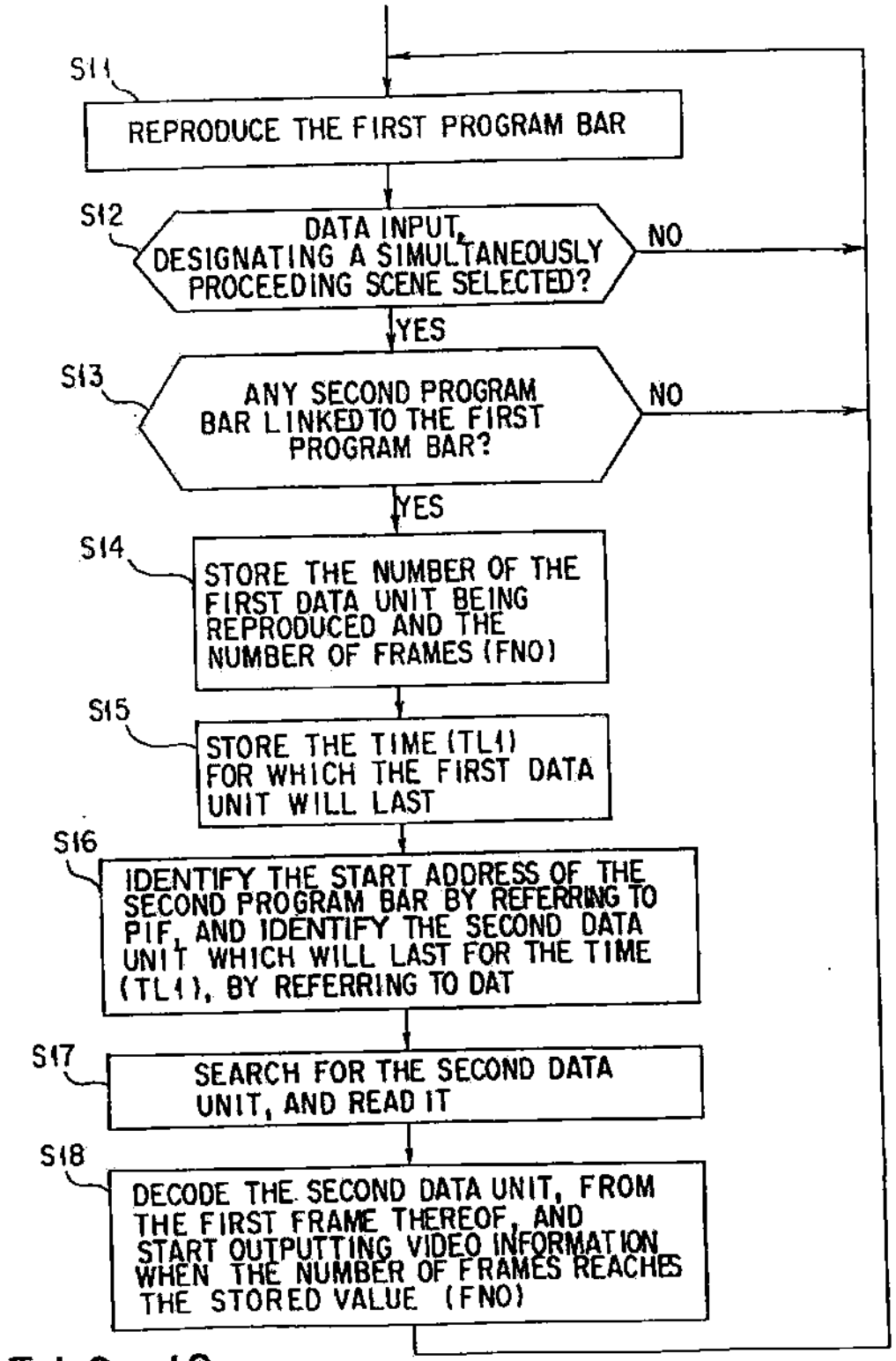

S11
REPRODUCE THE FIRST PROGRAM BAR
S12
DATA INPUT, DESIGNATING A SIMULTANEOUSLY PROCEEDING SCENE SELECTED?
NO
YES
S13
ANY SECOND PROGRAM BAR LINKED TO THE FIRST PROGRAM BAR?
NO
YES
S14
STORE THE NUMBER OF THE FIRST DATA UNIT BEING REPRODUCED AND THE NUMBER OF FRAMES (FNO)
S15
STORE THE TIME (TL1) FOR WHICH THE FIRST DATA UNIT WILL LAST
S16
IDENTIFY THE START ADDRESS OF THE SECOND PROGRAM BAR BY REFERRING TO PIF, AND IDENTIFY THE SECOND DATA UNIT WHICH WILL LAST FOR THE TIME (TL1), BY REFERRING TO DAT
S17
SEARCH FOR THE SECOND DATA UNIT, AND READ IT
S18
DECODE THE SECOND DATA UNIT, FROM THE FIRST FRAME THEREOF, AND START OUTPUTTING VIDEO INFORMATION WHEN THE NUMBER OF FRAMES REACHES THE STORED VALUE (FNO)

FIG. 12

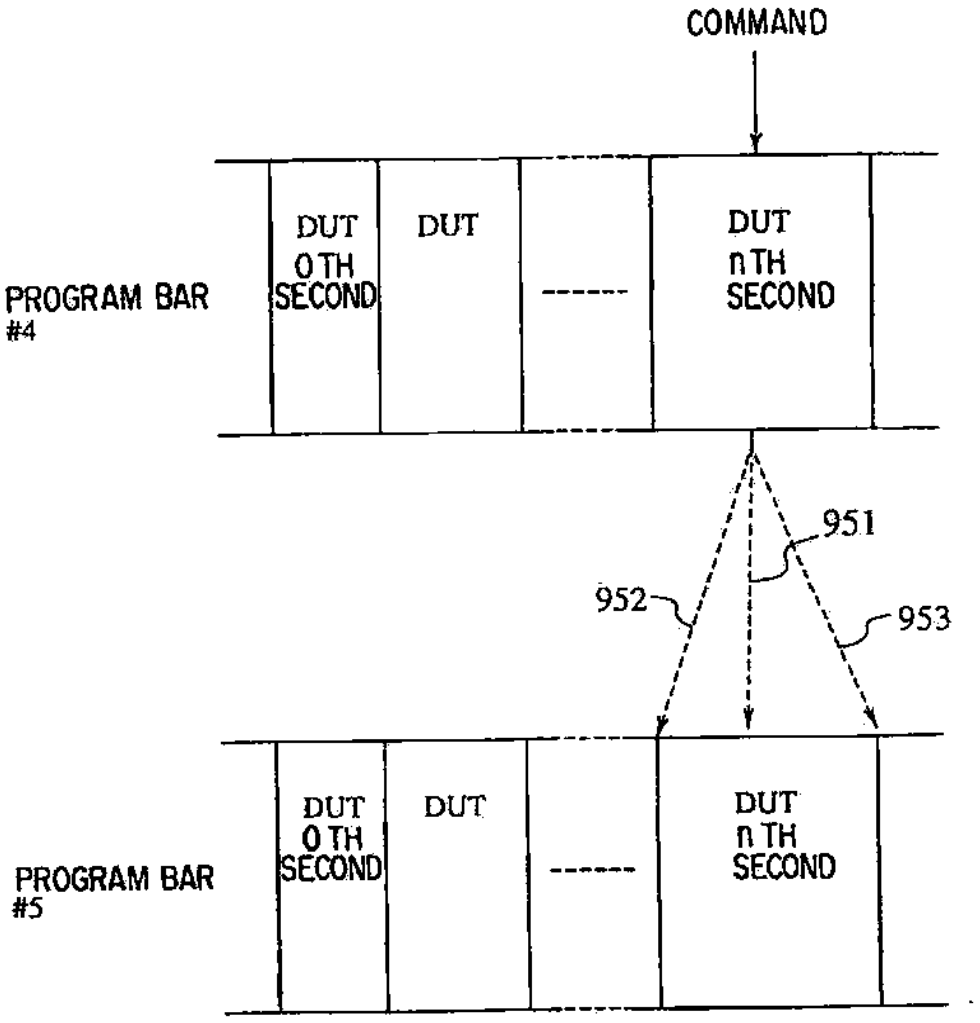

COMMAND
PROGRAM BAR #4
DUT 0TH SECOND
DUT
DUT nTH SECOND
951
952
953
PROGRAM BAR #5
DUT 0TH SECOND
DUT
DUT nTH SECOND

FIG. 13

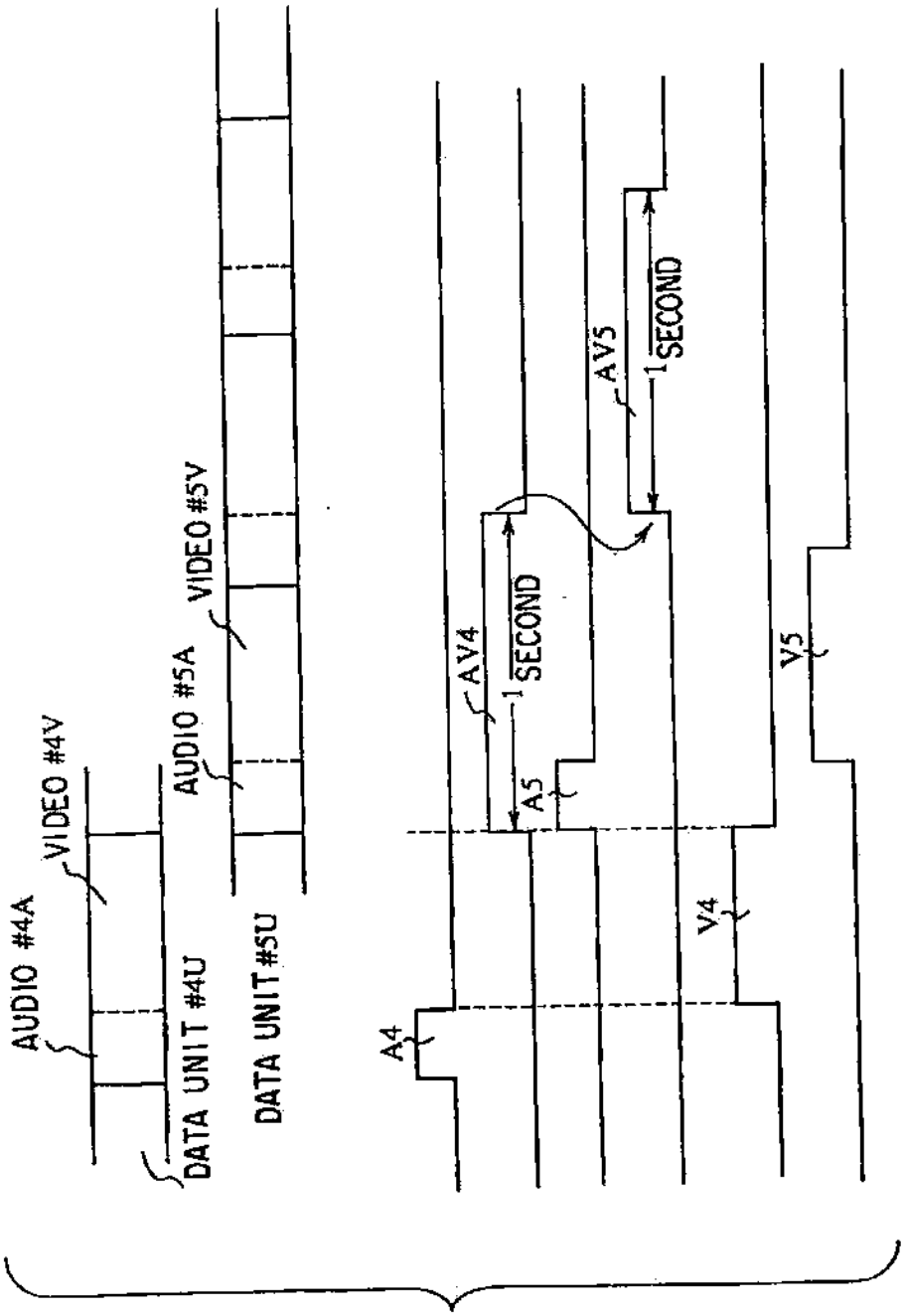

AUDIO #4A
VIDEO #4V
DATA UNIT #4U
AUDIO #5A
VIDEO #5V
DATA UNIT #5U
A4
AV4
1 SECOND
A5
AV5
1 SECOND
V4
V5

FIG. 14

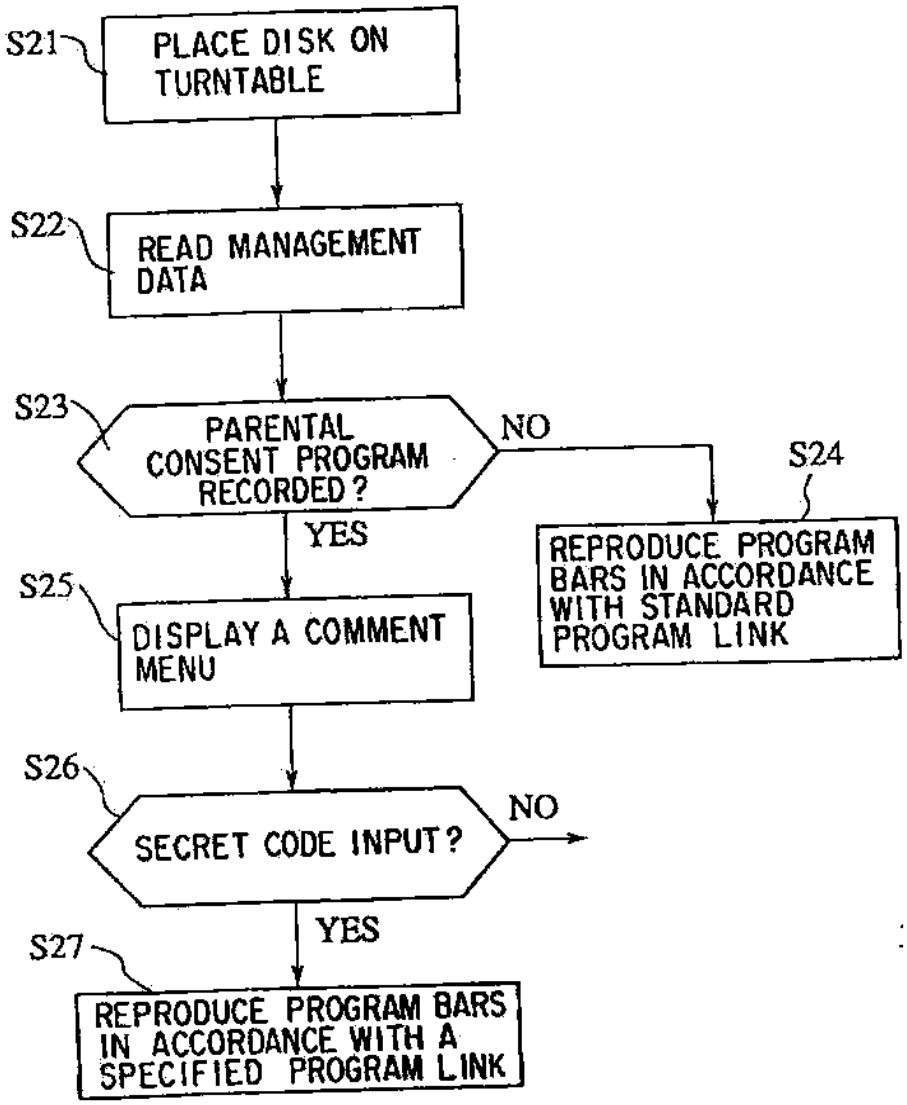

S21
PLACE DISK ON TURNTABLE
S22
READ MANAGEMENT DATA
S23
PARENTAL CONSENT PROGRAM RECORDED?
NO
S24
REPRODUCE PROGRAM BARS IN ACCORDANCE WITH STANDARD PROGRAM LINK
YES
S25
DISPLAY A COMMENT MENU
S26
SECRET CODE INPUT?
NO
YES
S27
REPRODUCE PROGRAM BARS IN ACCORDANCE WITH A SPECIFIED PROGRAM LINK

FIG. 15

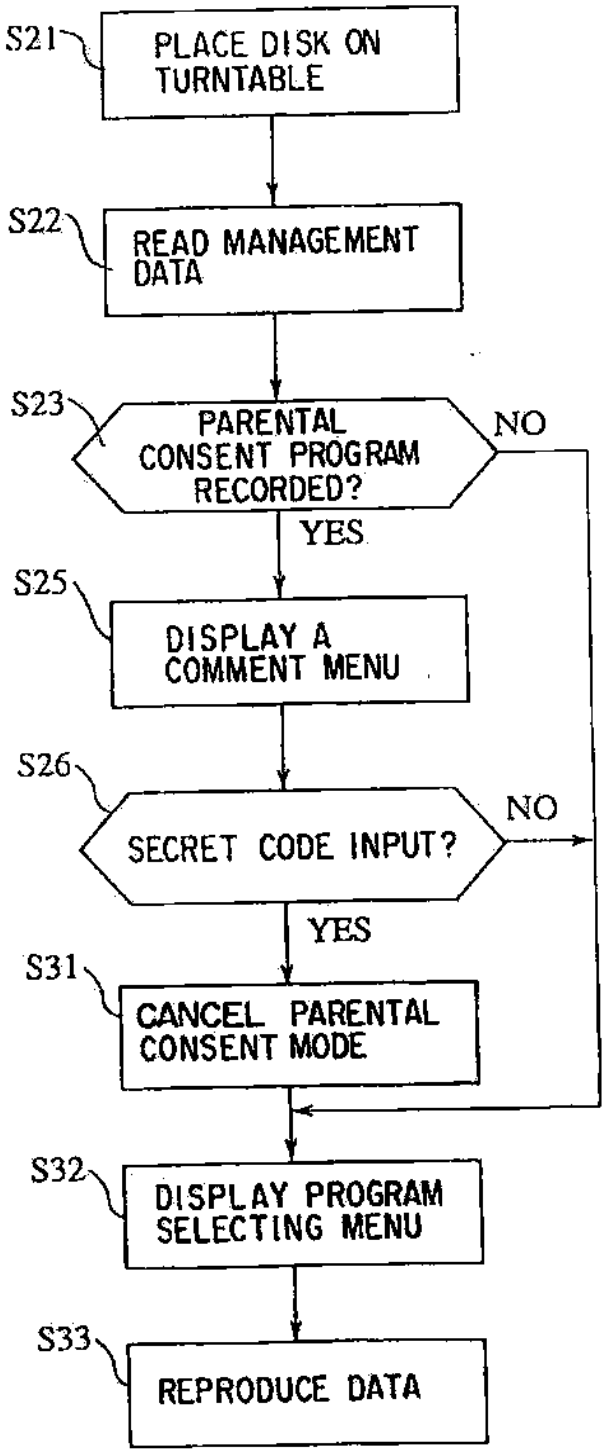

S21
PLACE DISK ON TURNTABLE
S22
READ MANAGEMENT DATA
S23
PARENTAL CONSENT PROGRAM RECORDED?
NO
YES
S25
DISPLAY A COMMENT MENU
S26
SECRET CODE INPUT?
NO
YES
S31
CANCEL PARENTAL CONSENT MODE
S32
DISPLAY PROGRAM SELECTING MENU
S33
REPRODUCE DATA

FIG. 16

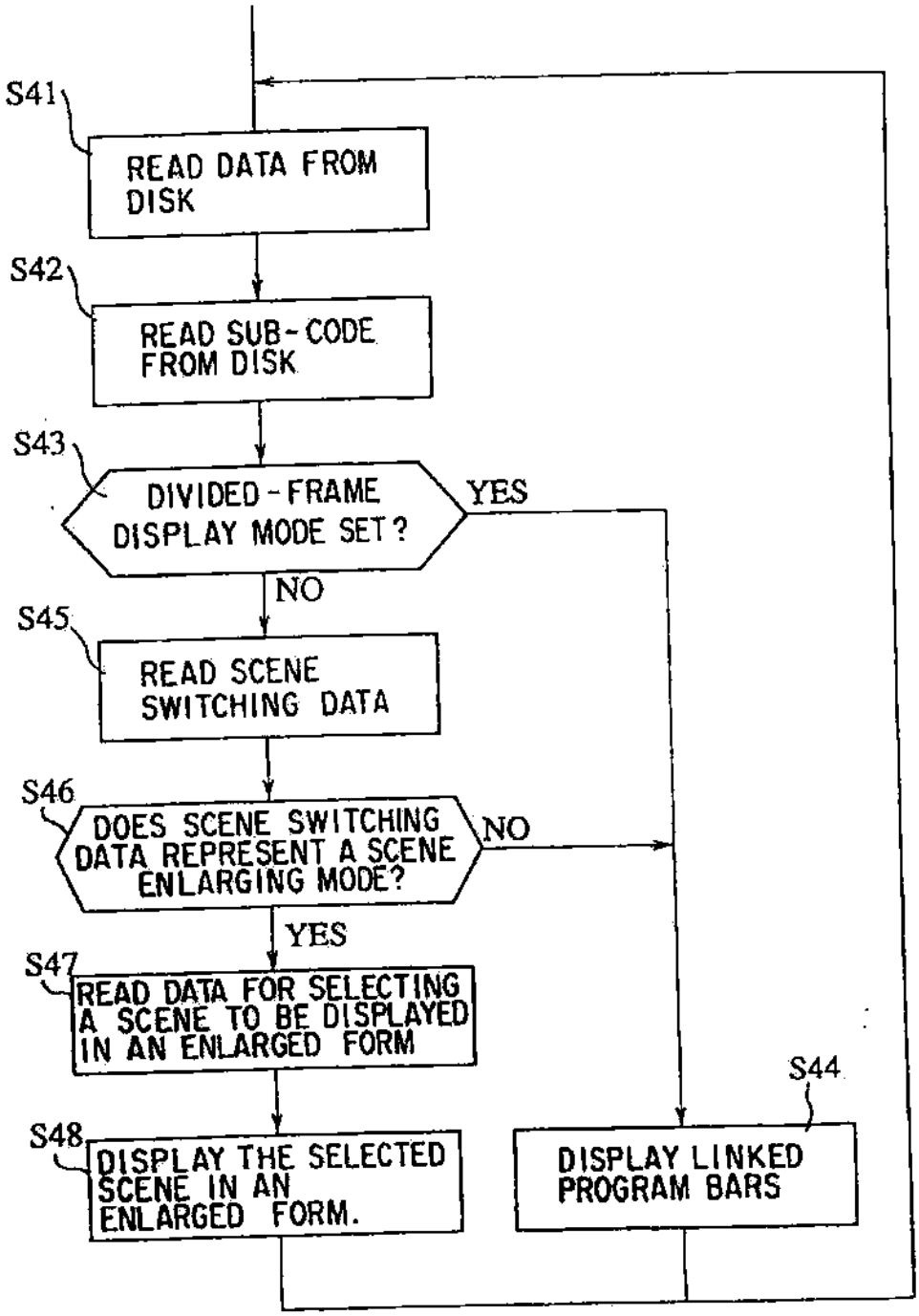

S41
READ DATA FROM DISK
S42
READ SUB-CODE FROM DISK
S43
DIVIDED-FRAME DISPLAY MODE SET?
YES
NO
S45
READ SCENE SWITCHING DATA
S46
DOES SCENE SWITCHING DATA REPRESENT A SCENE ENLARGING MODE?
NO
YES
S47
READ DATA FOR SELECTING A SCENE TO BE DISPLAYED IN AN ENLARGED FORM
S48
DISPLAY THE SELECTED SCENE IN AN ENLARGED FORM.
S44
DISPLAY LINKED PROGRAM BARS

FIG. 17

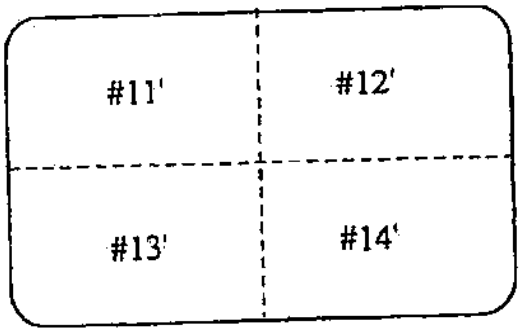
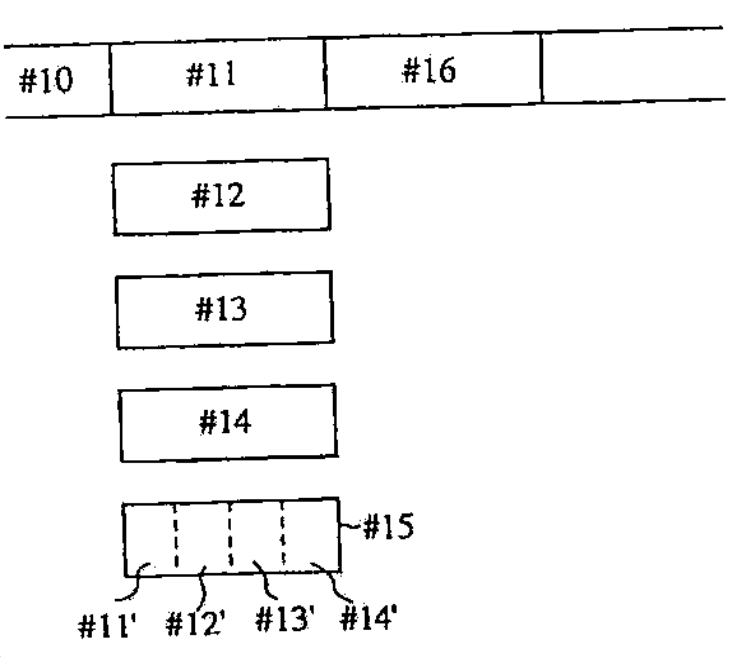


FIG. 18A

FIG. 18B



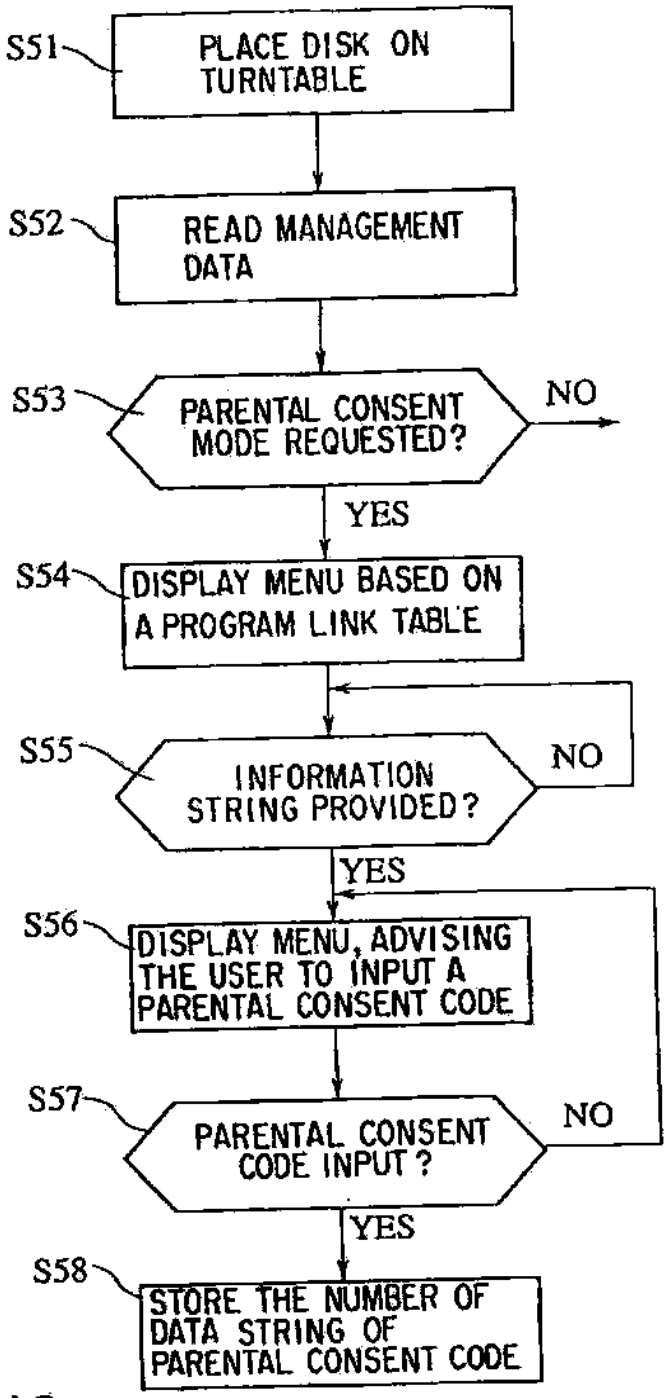

S51
PLACE DISK ON TURNTABLE
S52
READ MANAGEMENT DATA
S53
PARENTAL CONSENT MODE REQUESTED?
NO
YES
S54
DISPLAY MENU BASED ON A PROGRAM LINK TABLE
S55
INFORMATION STRING PROVIDED?
NO
YES
S56
DISPLAY MENU, ADVISING THE USER TO INPUT A PARENTAL CONSENT CODE
S57
PARENTAL CONSENT CODE INPUT?
NO
YES
S58
STORE THE NUMBER OF DATA STRING OF PARENTAL CONSENT CODE

FIG. 19

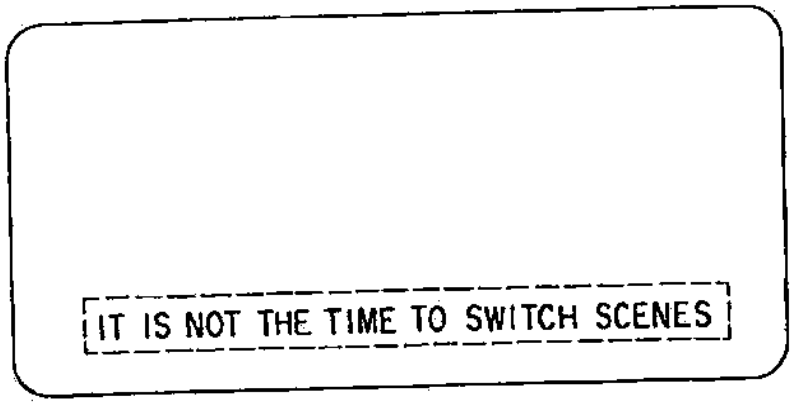


FIG. 20A

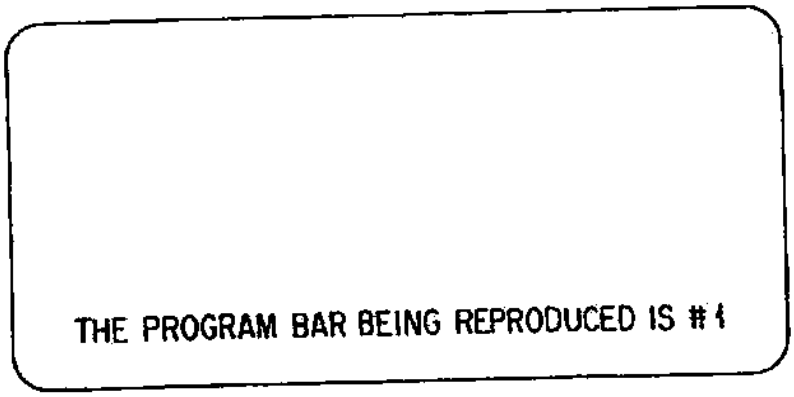


FIG. 20B

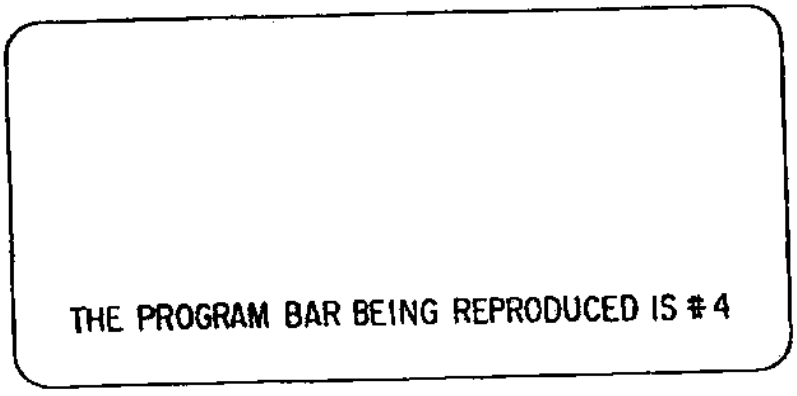


FIG. 20C

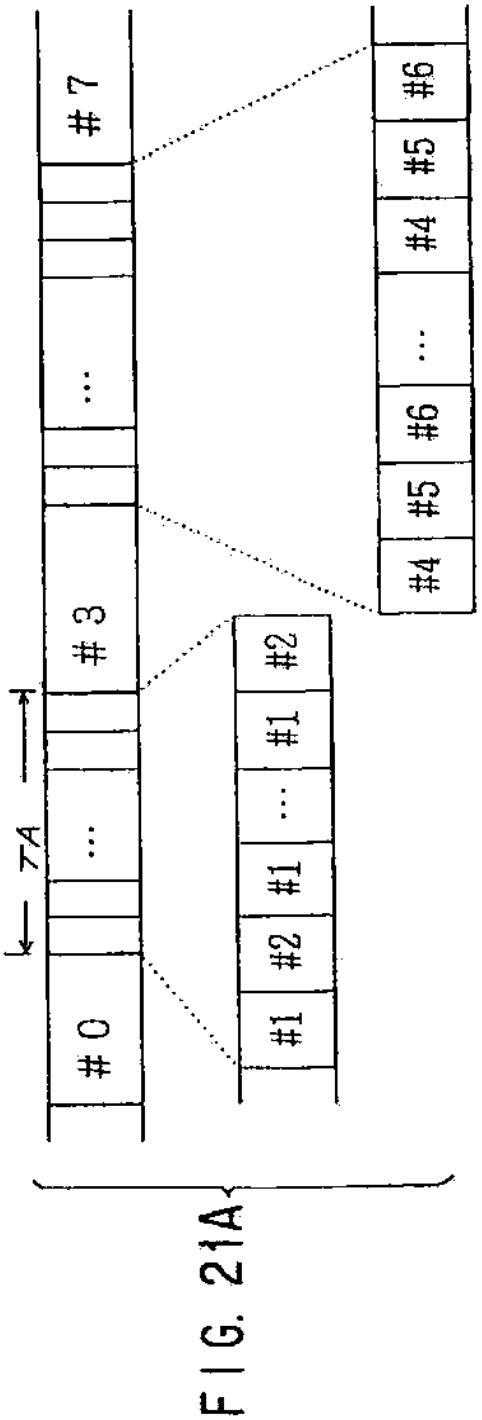


FIG. 21A

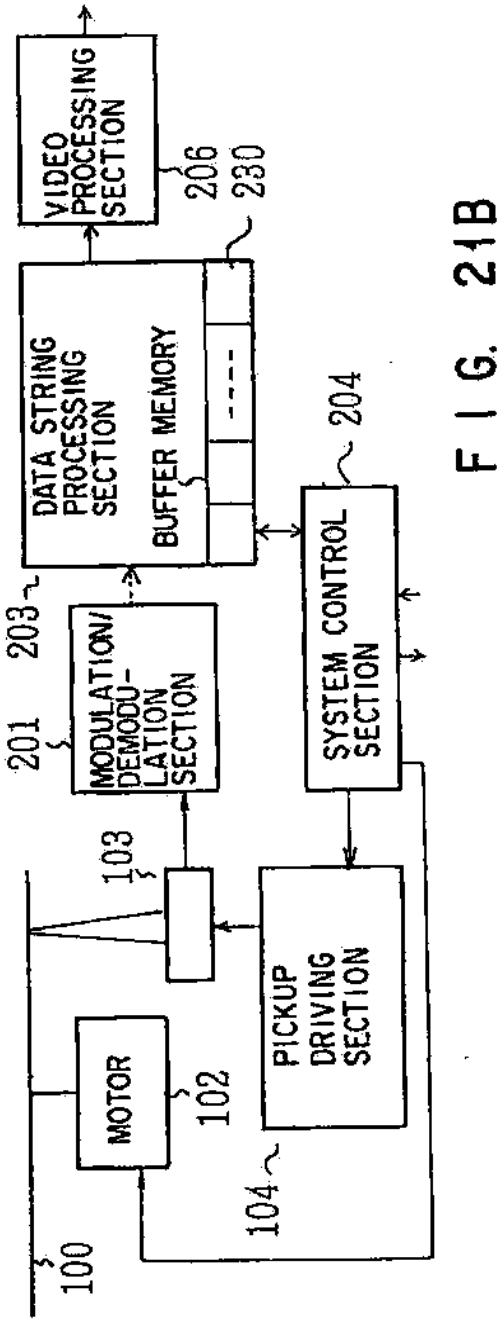


FIG. 21B

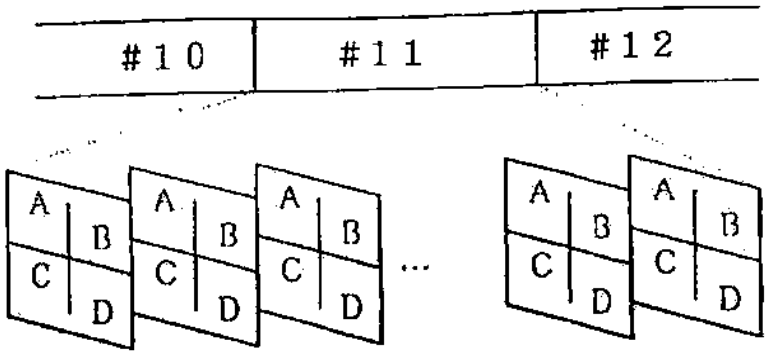


FIG. 22A

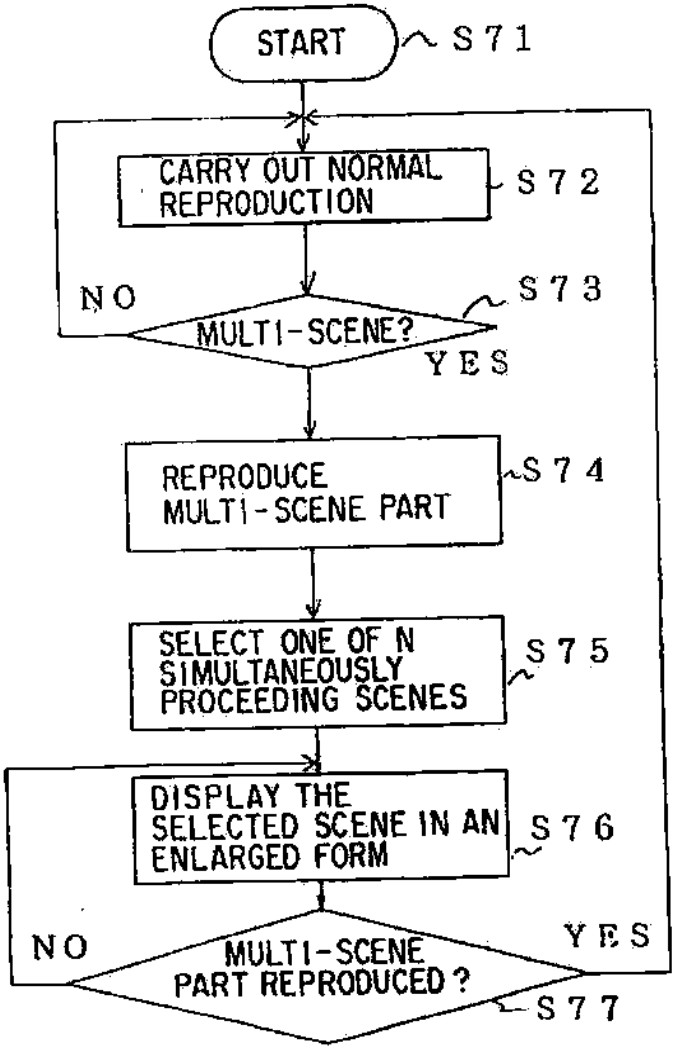


FIG. 22B

MULTI-SCENE RECORDING MEDIUM AND APPARATUS FOR REPRODUCING DATA THEREFROM

This application is a divisional of application Ser. No. 08/454,289, filed on Jun. 15, 1995 now U.S. Pat. No. 5,630,006.

TECHNICAL FIELD

The present invention relates to a multi-scene recording medium, such as an optical disk or a CD-ROM, for recording a program such as a movie, and also to an apparatus for reproducing any one of the data strings of the program, which represent independently proceeding scenes of a movie.

BACKGROUND ART

Conventional movies are formed from a time-series of scenes. They contain no scenes which proceed simultaneously. Hence, the audience sees only one scene at a time on the screen. The audience cannot enjoy seeing another scene which can proceed along with the scene they are actually seeing. For example the audience cannot see a scene of the cockpit of a space shuttle and a scene of the ground control center at the same time, though these scenes are proceeding simultaneously. This is because these scenes have been connected together forming a sequential time series of scenes which is generally known as a movie film. Another example may be an opera movie. Some of the audience may wish to see only the scene of the entire orchestra for some time, some others may want to watch the zoom-up face of a leading opera singer-player, and still some others may like to look into the conductor's zoom-up face. In other words, people in the movie theater may wish to, but cannot see, different scenes at different timing. With television broadcasting it is possible to present two scenes of the same program at the same time on a multi-screen. For instance, a moving picture of an object, photographed at a long distance, and a moving zoom-up picture of the same object can be transmitted on two channels, respectively. Therefore, the TV watcher can select whichever picture he or she wants to see on the TV screen at any timing he or she wants.

However, the program data recorded on a recording medium is nothing but a time-series of scenes, and the user cannot see any other scene than the very scene being reproduced from the medium. In other words, he or she is unable to select one of the simultaneously proceeding scenes. Although movie film editors can combine two simultaneously proceeding scenes, forming a times series of scenes, the user can have but a limited freedom of selecting scenes.

With television broadcasting technology it is possible to transmits two or more simultaneously proceeding scenes through a plurality of channels. The program data recorded on a recording medium represents a time series of scenes, and the user has no freedom of selecting any one of simultaneously proceeding scenes.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to provide a multi-scene recording medium recording a program representing simultaneously proceeding scenes, and also an apparatus which enables a user to select any one of the simultaneously proceeding scenes.

Another object of the invention is to provide a multi-scene recording medium recording a program representing simultaneously proceeding scenes, and also an apparatus which enables a user to switch the simultaneously proceeding scenes, from one to another.

Still another object of the invention is to provide a multi-scene recording medium recording a program representing simultaneously proceeding scenes, and also an apparatus which enables only an authorized user to select specified ones of the simultaneously proceeding scenes.

A further object of this invention is to provide a multi-scene recording medium recording a program representing simultaneously proceeding scenes, and also an apparatus which can easily reproduce from the recording medium any one of the simultaneously proceeding scenes which a user wishes to enjoy.

The multi-scene recording medium according to the present invention has a management area and a data area. In the data area, there is recorded program information which comprises a first program movement containing a plurality of first program bars and a second program movement containing a plurality of second program bars. In the management area, there is recorded multi-scene configuration information representing the existence of the first and second program movements.

The data reproducing apparatus comprises scene selecting means for reading the multi-scene configuration information from the management area of the recording medium for reproducing the first program movement or the second program movement from the data area of the recording medium in accordance with the multi-scene configuration information.

Provided with the scene selecting means, the data reproducing apparatus gives a user the freedom of selecting one of simultaneously proceeding scenes, and enables a program editor to edit programs in new concept.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing a data reproducing apparatus according to an embodiment of the present invention;

FIG. 2A is a diagram illustrating the recording regions of a disk according to this invention, and FIG. 2B is a diagram representing the data format of the disk shown in FIG. 2A;

FIGS. 3A and 3B are diagrams showing examples of data strings recorded on the disk shown in FIG. 2A;

FIGS. 4A to 4C are diagrams showing three different menus, respectively, which the apparatus of FIG. 1 displayed;

FIGS. 5A to 5C are diagrams showing other menus which the apparatus displays;

FIG. 6 is a diagram for explaining how the menus can be switched, from one to another, by operating the data reproducing apparatus;

FIG. 7 is a diagram representing a menu displayed by the data reproducing apparatus;

FIGS. 8A to 8C are diagrams illustrating the data tables recorded in the management area of the disk;

FIG. 9A shows another example of data string recorded on the disk, and FIGS. 9B to 9D are diagram illustrating information tables recorded on the disk;

FIGS. 10A and 10B are diagrams showing another example of a menu presented by the data reproducing apparatus;

FIG. 11 is a flow chart for explaining an operation of the data reproducing apparatus;

FIG. 12 is also a flow chart for explaining an operation of the data reproducing apparatus;

FIG. 13 is a diagram explaining how the data reproducing apparatus switches scenes;

FIG. 14 is a diagram also explaining how the data reproducing apparatus switches scenes;

FIG. 15 is a flow chart for explaining an operation of the data reproducing apparatus;

FIG. 16 is another flow chart for explaining an operation of the data reproducing apparatus;

FIG. 17 is still another flow chart for explaining an operation of the data reproducing apparatus;

FIG. 18A is a diagram showing an image which the data producing apparatus has reproduced, and FIG. 18B is a diagram illustrating an example of a data string recorded on the disk;

FIG. 19 is a flow chart for explaining an operation of the data reproducing apparatus;

FIGS. 20A to 20C are diagrams showing examples of messages reproduced by the data reproducing apparatus;

FIG. 21A is a diagram illustrating another example of a data string, and FIG. 21B is a diagram showing part of the data reproducing apparatus which serves to process the data string; and

FIG. 22A shows another example of a data string recorded on the disk, and FIG. 22B is a flow chart for explaining how the data string is processed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings.

As shown in FIG. 1, a recording medium such as an optical disk **100** (hereinafter referred to as "disk") according to the present invention is installed in a data recording/reproducing apparatus (access apparatus).

The disk **100** is placed on a turntable **101** which is rotated by a motor **102**. In the reproducing mode, the information recorded on the disk **100** is read by pickup means **103**. A pickup driving section **104** provides movement and tracking control of the pickup means **103**. The output of the pickup means **103** is supplied to a modulation/demodulation section **201**, which demodulates the signal into demodulated data. The data is supplied to an error correcting data processing section **202**, which corrects errors and supplies the resultant signal to a data string processing section **203**. The section **203** extracts video information, subtitle and character information, and audio information from the signal. As will be explained later, the subtitle and character information and audio information are recorded on the disk **100** in correspondence with the video information. Various languages can therefore be selected for the subtitle and character information and audio information. The selection is made under the control of a system control section **204**. The user supplies the input from an operator panel **205** to the system control section **204**.

Information, e.g., movie information, is recorded on the disk **100**. More specifically, a plurality of simultaneously proceeding scenes are recorded on the disk **100**, one of which can be selected by a user and can subsequently be reproduced. To enable the user to select one of the scenes and have it reproduced, the data string processing section **203**, the system control section **204** and the operation section **205** constitute a data string control means and a scene selecting means.

The video information is separated at the data string processing section **203** and supplied to a video processing section **206**. The section **206** decodes the data string in accordance with the type of the display unit used. For example, the section **203** converts the video information into a suitable form for an NTSC, PAL, SECAM, or wide screen. The video signal obtained by decoding the video information is supplied to an adder **208**. The adder **208** adds the signal to the subtitle and character information. The resultant sum is supplied to an output terminal **209**. Meanwhile, the audio information separated at the data string processing section **203** is supplied to an audio processing section **211**. The section **211** demodulates the audio information into a demodulated signal, which is supplied to an output terminal **212**.

The audio processing section **211** and another audio processing section **213** constitute an audio unit which works as a decoding section. The audio processing section **213** can reproduce speech in another language, which is supplied to an output terminal **214**. (This function will be described later.)

The apparatus can record information on the disk **100**. In the record mode, a video signal to be recorded is supplied to an input terminal **301**, and an audio signal to be recorded is supplied to an input terminal **302**. The video processing section **206** acts as a video encoder, whereas the audio processing section **211** as an audio encoder. The data string processing section **203** works as a formatter for recording information, and the error correcting data processing section **202** functions as an error code adding section. The data, thus processed, is modulated by the modulation section **201** and sent to the pickup means **103** as data to be recorded.

As described above, the disk **100** stores a plurality of program data items (multi-scene program data) which are related to one another. Therefore, the data reproducing apparatus can reproduce any of the program data items that the user has designated, and can stop reproducing one program data item and immediately start reproducing another program data item.

Also recorded on the disk **100** are: audio data including speed data in various languages, music data and sound effect data; and visual data such as subtitle data in various languages. One or more of these various types of data are selected and reproduced by the data string control means and scene selecting means constituted by the data string processing section **203**, the system control section **204** and the operator panel **205**.

The disk used in the invention, its recording format, and its application will be described.

A movie may be recorded on the disk used in the invention. In this case, the disk stores the data representing a plurality of simultaneously proceeding scenes, a plurality of language data items, and a plurality of subtitle data items in various languages.

FIG. 2A shows the data area of the disk **10**. A management data area is provided at the center of the disk **10**, and the data area surrounds the management data area. Recorded in the management area is management data for managing the programs recorded in the data area as will be explained later. The programs recorded in the data area include subcodes, subpictures, audio information, and video information.

The kinds of information items recorded in the data area will be described, with reference to FIG. 2B.

FIG. 2B is an enlarged view of the contents of data unit DUT #0 in the data area. In data unit DUT #0, there is a subcode (SUB-CODE) at the start, followed by a subpicture information (SUB-PICTURE), audio information (AUDIO), video information (VIDEO) in the order they are mentioned. The subcode (SUB-CODE) contains the attributes of data unit DUT #0, such as the size of the data unit, the start positions of the video information and audio information included in the data unit, and control information for the data unit. Each subpicture (SUB-PICTURE) contains, for example, subtitle information (for movie video) or character information (for Kara-OK video and educational video). The subtitle information and the character information are comprised of eight pictures PICTUREs #0 TO #7 each. All of these PICTURES differ in language (or some of them differ in language) and the remaining ones contain no signals. Furthermore, other item of information, which differ in purpose, such as those representing questions and answers, may be recorded on the disk 100. The audio (AUDIO) information is recorded in the form of music information or speech information, which consists of at most eight information items AUDIOs #0 to #7. (Each of the eight audio information items last about one second when reproduced.) The audio (AUDIO) information can be used in various fashions; it may be reproduced in the form of a combination of orchestra and solo-singing or a combination of Kara-OK and vocal performance. The audio information is recorded in units of frames, each frame #0, #1, . . . comprising a header (HEADER) and data (DATA). The video (VIDEO) information consists of, for example, 30 frames of images. (When reproduced, the information lasts about one second.) The video (VIDEO) information is recorded by high-efficient coded image compression technique. The number of frames is not limited by standard. The audio information has been subjected to high-effect encoding.

The types of data units DUTs will be described.

FIG. 3A illustrates an example of program data.

Hereinafter, a program forming one stream shall be called "program movement," and a plurality of programs forming the program movement shall be called "program bars." Each of the program bars is composed of a plurality of data units which have been explained with reference to FIG. 2.

The program data shown in FIG. 3A consists of two program movements 901 and 902. The first program movement 901 represents a scene showing an entire orchestra, photographed by a first camera, and the second program movement 902 represents a scene showing a zoom-up picture of the conductor only, photographed by a second camera. Either the first program movement or the second program movement can be reproduced from the disk 100 by means of a monitor, so that a user may listen to the music and watch a moving picture of the selected program movement. Further, as is indicated by the broken line in FIG. 3A, the user can enjoy the picture and sound of the second program movement, while listening to the music of the second program movement 901 and seeing the picture thereof, reproduced and displayed on the monitor. That is, the user has freedom of selecting a scene. A program consisting of more program movements than the program shown in FIG. 3A may be recorded on the disk. The program movements of such a program may represent simultaneous proceeding scenes tracking brothers who grew in the same house and then started different walks of life.

FIG. 3B shows an example of a program data with which it is possible to output scenes which proceed simultaneously with part of the standard program movement 903. This program data can be smaller in amount than the program data of FIG. 3A. Of the program bars constituting this program data, the bars #1 and #2 form a multi-scene, and the bars #4, #5 and #6 form another multi-scene. The program data can be edited such that the standard program movement 903 is one photographed by a camera 0, the program bars #2 and #5 are those photographed by a camera 2, and the program bar #6 is one photographed by a camera 3.

Let us assume that the standard program movement 903 represents, for example, a time-series of baseball game scenes photographed by the camera 1 located right behind the home plate, that the program bars #2 and #5 represent two baseball game scenes photographed by the camera 2 installed in the outfield, and that the program bar #6 represents a baseball game scene photographed by the camera 3 set in the right stand. Then, when this program data is reproduced, the program bar #0 is reproduced first, and a menu is displayed immediately after the last frame of the program bar #0 has been reproduced. Thus, the user can select any one of the following scenes.

FIG. 4A shows an example of a menu which gives the user the opportunity to select any scene he or she wishes to see. The menu reads, "MULTI-SCENE MODE STARTS FROM HERE. SELECT SCENE #1 OR #2." At completion of the reproduction of the program bar #3, another menu is displayed which reads, as shown in FIG. 4B, "MULTI-SCENE MODE STARTS FROM HERE. SELECT SCENE #4, #5 OR #6." The menu may be displayed in another form. For example, as shown in FIG. 4C, it may read:

"MULTI-SCENE MODE STARTS FROM HERE.
#4: BACK-NET ANGLE
#5: CENTER-FIELDER ANGLE
#6: FIRST-BASE ANGLE"

The user operates the operator panel 205, thereby selecting one of the program bars. The data reproducing apparatus reproduces the program bar selected.

As mentioned above, the menu shown in FIG. 4A, FIG. 4B or FIG. 4C is displayed at completion of the reproduction of any program bar.

Instead, other types of menus may be displayed. For example, as shown in FIG. 5A, representative scenes or heat scenes of the program bars #4, #5 and #6 are simultaneously read from the disk and displayed. Alternatively, as shown in FIG. 5B, the scene of the standard program movement 903 is displayed in a large size, whereas the representative scenes of the program bars #5 and #6 are displayed in a small size. This also gives the user freedom of selecting scenes.

Also, as shown in FIG. 5C, only the key data of the program bars #5 and #6 may be displayed, for example, in the order of the screen, while the scene of the program bar #4 of the standard program movement 903, is displayed thereby indicating that there are program bars #5 and #6 which correspond to the program bar #4.

Furthermore, as shown in FIG. 6, the representative scenes of the program bars #4, #5 and #6 may be repeated and cyclically displayed, one after another, each scene for a period of, for example, two seconds. In this case, the user selects the desired program bar by operating the operator panel while the representative scene of the desired program bar is being displayed.

In the instances described above, while the standard program movement 903 is being reproduced, a menu is displayed to inform the user that a program bar other than those of the program movement 903 is recorded on the disk, constituting a multi-scene. According to the present invention, the user can designate and set an order in which program bars should be reproduced.

FIG. 7 shows an example of a menu which is displayed when the disk is inserted into the data reproducing apparatus. The data reproducing apparatus reads the management data from the disk **100**, and determines that there are two or more program bars recorded representing simultaneously proceeding scenes. Then, the apparatus causes the monitor to display the menu. Seeing the menu, the user operates the operator panel **205** to select from among the image photographed by the camera **#0**, the image photographed by the camera **#2**, or the image photographed by the camera **#3**. If the key data corresponding to the camera **#0** is selected, the apparatus is set to reproduce the program bars of the data string **904** shown in FIG. 3B. If the key data corresponding to the camera **#2** is selected, the apparatus is set to reproduce the program bars of the data string **905** shown in FIG. 3B. If the key data corresponding to the camera **#3** is selected, the apparatus is set to reproduce the program bars of the data string **906** shown in FIG. 3B.

The management data recorded in the management area of the disk **100** will be explained first. This data is provided in the form of a management table.

As shown in FIG. 2, the management table consists of a volume identity field (VID), a picture information field (PIF), and a data unit allocation table (DAT). The the VID is the innermost annular field of the disk **100**. The PIF is the second innermost annular field surrounding the VID. The DAT is the third innermost annular field.

The VID is a 256-byte field, the first byte of which is the first byte in the management area. The VID represents various items of information about the disk **100**, among which are items showing the countries where the recorded languages are used.

As shown in FIG. 8A, when there are program movements and bars which constitute a multi-scene, information regarding how those program bars are combined is recorded in table form. FIG. 8A shows the combined information on the program shown in FIG. 3B.

The link of the program bars is defined by the PIF. FIG. 8B shows the PIF used for controlling the program data illustrated in FIG. 3B. The number (e.g., the first address) of the current and subsequent program bar to be reproduced is defined in the PIF. As can be understood from FIG. 8B, the program bar **#1** will be reproduced after the program bar **#0** has been reproduced, the program bar **#3** will then be reproduced immediately after the program bar **#1** has been reproduced, and so forth. The fact that the program bars **#1** and **#2** represent two simultaneously proceeding scenes is recognized not from the PIF, but from the VID. The control software has been prepared so as to display a menu, giving the user a chance to select program bar **#1** or **#2** after the completion of the reproduction of the program bar **#0**. Namely, the data reproducing apparatus does not immediately start reproducing the program bar **#1** immediately after reproducing the program bar **#0**. Rather, it waits until the user inputs bar-selecting data. If the user selects the program bar **#2**, the data reproducing apparatus begins to reproduce the program bar **#3** after the reproduction of the program bar **#2**, in accordance with the program link which is recorded in the PIF.

After reproducing the program bar **#3**, the data reproducing apparatus waits for any instruction made by the user. This is because the program bar **#4**, which is to be reproduced after the program bar **#2** (as defined by the program link recorded in the PIF), represents a scene which proceeds simultaneously with those represented the program bars **#5** and **#6**. After reproducing the program bar **#4**, **#5**, or **#6**, the data reproducing apparatus starts reproducing the program bar **#7**, as defined by the program link recorded in the PIF.

Recorded in the PIF is information on various elements of each program. For example, 16 bytes are used for each program bar. The information includes the start and end time of the program bar, no matter whether the program bar is for home video, movie, Kara-OK, computer graphics, interactive use, game or computer data. The identification of a speech encoding system, the identification of an image encoding system, and the picture attributes (i.e., the information identifying the aspect ratio and a system such as PAL or NTSC system, and information on horizontal resolution and vertical resolution). It also includes a start pointer having a value indicating the DAT address at which the data at the start point of a program bar is recorded.

In the DAT, the information indicating the order in which the program bars of a program are to be read from the data area of the disk **100**, after the program bar been selected and identified.

The DAT contains parameters such as a zone number (NZON), a sector number (NSCT), a track number (NTRC), a program time (PTMB), and a ling pointer (PNTL). From the zone number (NZON), the track number (NTRC) and the sector number (NSTC), the sector at the start of the data unit can be determined. The NZON is the zone number to which the sector at the start of the data unit belongs. The zone number is assigned to a unit of a plurality of tracks, separated from any other unit in the radial direction of the disk; zone number **0** is assigned to the innermost unit of tracks. The NSTC indicates the number of the sector at the start of the data unit recorded in a track. The sector number is a number complete in the zone. The NTRC indicates a track number in the zone. The PTMB is a flag representing the time position of the image data (i.e., I picure) at the start of the data unit. The time position is the time (in seconds) elapsed from the program starting point. The time position is used in searching for time codes. Furthermore, the time position is input into the data reproducing apparatus. The apparatus uses the time position as the start reference data in order to display the program time, the absolute time, the remaining time of the program, and the like. The PNTL is a flag showing the data unit number immediately following the present data unit number in time. The unit for this flag corresponds to the number of the data unit. When there is no link designation at the end of the program, all bits are set at "1" (=0×FFFF). The effective value for the link point ranges from 0×0000 to 0×FFFF.

FIG. 8C illustrates part of the DAT. Assume the program bars **#0** and **#1**, both shown in FIG. 3B, last 3 minutes 40 seconds and 1 minute and 18 seconds, respectively. Then, as shown in FIG. 8C, the lasting time of 1 minute and 18 seconds is set for the program bar **#2** which is linked to the program bar **#1** as shown in FIG. 3B. Thus, if the standard program movement **903** represents a series of scenes showing an orchestra playing music, which has been photographed by a camera located at a position, then it is possible for the user to select and see another scene of the orchestra, photo-graphed by a camera located at a different position. As shown in FIG. 8C, the DAT contains a zone number (NZON), a sector number (NSTC), a track number (NTRC), and a link pointer (PNTL). It is the program time (PTMB) which corresponds to the time for which each data unit last. In other words, the PTMB indicates the period for which each of the data units forming any the program bar reproduced from the disk **100**.

Once a program to be reproduced has been determined, the system control section **204** controls the pickup driving section **104**. Under the control of the section **204**, the section **104** moves the pickup means **103** to that portion of the disk

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100 where the desired program is recorded. Thus, the apparatus reproduces the desired program from the disk 100 in accordance with the management data read from the management area of the disk 100 and the selection data input by the user.

In the program illustrated in FIG. 3B, the program bars which are linked to one another will last for the same period of time they have been reproduced. For example, as has been described, the program bars #1 and #2 will last for the same time of 1 minute and 18 seconds when they are reproduced.

A program, which does not include audio information representing a piece of music continuously lasting for some time, may be recorded on the disk 100 in a form different from the program illustrated in FIG. 3B. FIG. 9A shows the format of such a program. This is a movie program consisting of three program movements representing three stories 1, 2 and 3. More specifically, the program bars #0, #1, #5 and #6 represent the story 1 about a first hero; the program bars #0, #2 #3 and #6 represent the story 2 about a second hero; and the program bar #0, #1, #4 and #6 represents the story 3 of the third hero. In the case of a multi-scene story like this, the program bar #1 need not last for the same time as the program bars #2 and #3, when reproduced. When a program of this type is recorded on the data area of the disk, the picture information field (PIF) recorded in the management area of the disk contains a plurality of program link tables of the types. The table shown in FIG. 9B is a standard PIF table which is used when the user selects the story #1. The table of FIG. 9C is a standard PIF table which is used when the user selects the story #2. The table of FIG. 9D is a standard PIF table which is used when the user selects the story #3.

The various types of the multi-scene movie programs thus far described can be reproduced from the disk in such a way that the user can select and enjoy any one of the simultaneous proceeding scenes or stories.

According to the present invention, it is possible to record a multi-scene movie program such that specified ones of the scenes or stories cannot be selected or enjoyed by those who are not authorized in accordance with laws or in only some countries.

The specified scenes or stories cannot be selected or enjoyed in some countries, because they are prohibited from being displayed in those countries.

More specifically, the sub-code (SUB-CODE) of the data unit DUT representing, for example, the story #3 may contain a parental consent code or a country code, or both, thus prohibiting the story #3 of the movie program. In this case, when the user selects story #3, the data reproducing apparatus reads the program bar #4 from the disk 100, but will replace or mask the scene represented the program bar #4, either entirely or partly, with a totally different image. The parental consent code authorizes only the parents to have access to the scenes or stories to which this code is added. The country code is contained in the sub-code (SUB-CODE) of the data unit DUT recorded on a disk 100 sold in a country where the specified scenes or stories should not be displayed. Either type of a code is recognized in the data reproducing apparatus.

The video information representing the different image which will replace or mask the scene represented by the program bar, either entirely or partly, is recorded on the disk. Also, management data showing the address of this video information is contained in the standard PIF table which is used when the user selects a story. Alternatively, the data reproducing apparatus may incorporate a device for generating signals for jamming or masking the scene represented by the program bar selected.

When a country code is used, it defines a combination of scenes, i.e., a combination of program bars. If a country code for Country A is contained in the sub-code (SUB-CODE) recorded on the disk to be sold in Country A where the scene represented by the program bar #4 must not be displayed, the country code defines the combination of scenes #0, #2, #5 and #6. If a country code for Country B is contained in the subcode (SUB-CODE) recorded on the disk to be sold in Country B where the scene represented by the program bar #5 must not be displayed, the country code defines the combination of scenes #0, #1, #4 and #6. The combination of scenes, thus defined, can be displayed on the monitor as the data reproducing apparatus reproduces the corresponding program bars from the disk. Any country code contained in the sub-code (SUB-CODE) is compared with the various country codes stored in the data reproducing apparatus. If it is identical with none of the country codes stored in the apparatus, the apparatus will not reproduce the corresponding program bar.

FIG. 10A is a diagram showing a scene which is masked in part. FIG. 10B is a diagram illustrating a scene replaced by an image such as a message telling the user that the program being reproduced in parental consent mode and that the user needs to input the secret code in order to release the parental consent mode.

It will now be described how to switch simultaneously proceeding scenes, from one to another.

FIG. 11 is a flow chart explaining how the data reproducing apparatus operates to give the user a chance to select one of the simultaneously proceeding scenes represented by the program bars recorded on the disk 11. It is determined whether or not the end of any program bar is being reproduced (Step S1). If the end of any program is being produced, it is determined whether or not any program bar is linked to the next program bar (Step S2). This is possible by storing the management data into a work memory incorporated in the data producing apparatus. If such a program bar is linked to the next program par, the next program bar linked to the first one is reproduced from the disk (Step S3). If such a program bar is not linked to the next program bar, it is determined whether or not any data has been input which indicates that any program bar has already been selected (Step S4). The data, if any, has been input by operating the operator panel before the program is reproduced and has been stored in the memory incorporated in the system control section, as shown in FIG. 7. If such data has been input, the selected program bar is reproduced from the disk (Step S5). If such data has not been input, a menu of the type shown in FIG. 4A, 4B, 4C, 5A, 5B, 5C or 6 is displayed on the monitor, giving the user a chance to select one of the candidate program bars (Step S6). Then, it is determined whether or not the user has input data designating his or her choice using the operator panel (Step S7). If the user has input this data, the program bar selected is reproduced (Step S8). If the user has not input such data, Step S6 is performed again. If no data is input from the operator panel for a predetermined time, the program bar of the standard program movement will be automatically selected, reproduced from the disk, and displayed on the monitor.

FIG. 12 is a flow chart for explaining how the data reproducing apparatus operates when the user inputs the data designating a desired scene for viewing, at any time while the first program bar is being reproduced from the disk. In this case, program bars representing simultaneously proceeding scenes can be switched, from one to another, without break.

While the first program bar is being reproduced, it is determined whether or not data designating any selected one

of simultaneously proceeding scenes has been input (Steps S11 and S12). If the data has been input, it is determined whether or not any second program bar is linked to the first program bar, by referring to the volume identity field (VID) of the management table (Step S13). If the second bar is linked to the first program bar, the number of the first data unit contained in the first program bar, and the number (FNO) of the frames of the first program bar which have already been reproduced are stored into a memory (Step S14). Further, the time (TL1) for which the first data unit will last when reproduced is input also into the memory (Step S15). The time (TL1) can be obtained from the data unit allocation table (DAT), as has been explained with reference to FIG. 8C. Then, the start address of the second program bar to be reproduced is identified by referring to the picture information field (PIF), and the data unit contained in the second program unit which will last for a time equal to the time (TL1) when reproduced is identified by referring to the data unit allocation table (DAT) (Step S16). Then, the data reproducing apparatus controls the pickup driving section 104, whereby the pickup means searches for the start address of the second data unit (Step S17). Then, the data reproducing apparatus decodes the second data unit, from the first frame thereof, but section 203 prohibits the output of video information until the number of frames counted reaches the number (FNO) of the frames of the first program bar which are stored into the memory (Step S18).

The function illustrated in the flow chart of FIG. 12 may be incorporated in the data reproducing apparatus, either singly or together with the function represented in the flow chart of FIG. 11. If the flow chart of FIG. 11 and that of FIG. 12 are incorporated in the apparatus and used as main flow and sub flow, respectively, the latter will serve as an interruption routine, wherein Step S18 is followed by Step S11. Alternatively, the flow charts of FIGS. 11 and 12 may be incorporated into the apparatus such that they can be switched, from one to the other. In this case the menu shown in FIG. 5C or FIG. 7 is desirable. Namely, to allow the user to have a multi-scene with the present scene covered as little as possible, it is preferable to display the menu screen of FIG. 5C. When the user knows before the reproduction of the disk that there is a program containing a multi-scene and has decided to use the program, a multi-scene screen as shown in FIG. 7 is preferable. If the menu of FIG. 5C the choice, it should better be displayed in a step between Steps S13 and S14 in FIG. 12.

In Step S18 (FIG. 12), the output of video information may be initiated in an following alternative way, which will be explained below.

FIG. 13 is a diagram illustrating the timing of giving a command to the system control section in order to switch the program bars (FIG. 3A) representing simultaneously proceeding scenes, for example, from the program bar #4 to the program bar #5. Assume that the command is input the moment the fifth frame of the nth-second data unit (DUT) contained in the program bar #4. Then, the data reproducing apparatus starts outputting video information, frame by frame, from the fifth frame of the nth-second data unit of the program bar #5 if the apparatus performs the sequence of steps shown in FIG. 12. In other words, the apparatus starts outputting the video information counting the fifth of the pulses, each generated upon completion of a frame. When the apparatus starts outputting the video information, the nth-second data units of the program bars #4 and #5 have the positional relationship indicated by broken line 951. Alternatively, the apparatus may start outputting video information when the first frame of the nth-second data unit of the program bar #5 is decoded in its entirety, as is illustrated by broken line 952. Still alternatively, the apparatus may start outputting video information at the time the first frame of the (n+1)th-second data unit of the program bar #5 is decoded in its entirety, as is illustrated by broken line 953.

If time is available before the apparatus starts outputting the video information contained in the program bar #5, the last frame of the video information contained in the program bar #4, which has been already output, is written into the image memory incorporated in the decoder or the system control section 204. The last frame is repeatedly read from the image memory, whereby the scene represented by the last frame the video information is displayed on the monitor in the form of a still picture.

Assume that the nth-second data unit in the program bar #4 and the nth-second data unit in the program bar #5 represent two images of the same actor uttering words, which have been photographed by two cameras and, thus, at different angles. In this case, the program bars #4 and #5 are identical in terms of audio information. Hence, the audio information (AUDIO shown in FIG. 2B) contained in the nth-second data unit in the program bar #4 can be used while the nth-second data unit in the program bar #5 is being reproduced from the disk.

FIG. 14 is a timing chart for explaining a method of outputting audio or video information more easily after program bars representing simultaneously proceeding scenes have been switched, from one to another. In this method, a buffer memory is used to temporarily store the audio or video information read from the disk.

Illustrated in FIG. 14 are the nth-second data unit #4U in the program bar #4 shown in FIG. 13 and the nth-second data unit #5U in the program bar #5 shown in FIG. 13. Also shown in FIG. 14 are: the period A4 during which audio information #4A is read from the disk; the period A5 during which audio information #5A is read from the disk; the period V4 during which video information #V4 is read from the disk; and period V5 during which video information #5V is read from the disk. Further, shown in FIG. 14 are: the period AV4 during which the audio information A4 and the video information V4 are output from the data reproducing apparatus; and the period AV5 during which the audio information A5 and the video information V5 are output from the data reproducing apparatus. The buffer memory used to facilitate the outputting of audio information and video information has a storage capacity large enough to store at least the data unit #4U and the data unit #5U. Thus, the data unit #5U can be decoded after the data unit #4U has been decoded in its entirety. The audio information and the video information can thereby be reproduced without break, even if the program bars representing simultaneously proceeding scenes are switched, from one to another. If the data units #4U and #5U are part of a movie program, audio information items contained in these data units are preferably recorded so as to be reproduced without a time lag. In the above explanation, the time required to move the pickup is not taken into consideration.

As has been described with reference to FIG. 10, the disk may contain a parental consent code if the movie program recorded on that disk contains program bars representing simultaneously proceeding scenes, at least one of which should not be displayed to children.

The operation the parental consent code will now be explained with reference to the flow chart of FIG. 15. First, when the disk is placed on a turntable and rotated, the management data (i.e., VID, PIF and DAT) is read from the management area of the disk and subsequently stored into

the work memory. Next, the data reproducing apparatus determines whether or not the management data contains a parental consent program (Steps S25 and S26). The step of determining this may be performed in various methods. One method is to detect the presence or absence of parental consent data in the sub-code of a data unit, either immediately after the disk has been placed on the turntable or while the data unit is being reproduced from the disk. Another method is to detect the presence or absence of a flag in the VID (see FIG. 8A), which has been set for a particular program movement (i.e., a story).

In the case of FIG. 15, it is first determined whether or not a parental consent program has been recorded (Steps S21 to 23). If the management data contains no parental consent program, the program bars are reproduced from the disk in accordance with the standard program link (Step S24). If the management data contains a parental consent program, a menu of the type shown in FIG. 10B is displayed (Step S25). If the secret code known only to adult users has been input, the program bars are reproduced from the disk in accordance with a specified program link (Step S27).

An alternative operation of the parental consent code will now be explained with reference to the flow chart of FIG. 16. In FIG. 16, the steps identical to some of the steps illustrated in FIG. 15 are designated by the identical symbols. When there is no parental consent program, control goes to Step S32, in which a program select menu screen is displayed. When a parental consent program is present, a comment screen is displayed, and it is determined whether or not a secret code key has been pressed (Steps S25 and S26). If the secret code key has not been pressed, control proceeds to Step S32, in which a program select menu screen is displayed. If the secret code key has been pressed, the parental consent mode is canceled (Step S31) and control goes to Step S32. When the user has selected a program, a data string, or a story under the program select menu screen, a reproducing operation is performed according to the selection. When the parental consent mode has been canceled, for example, an image display process is achieved in a normal state without effecting the image display process showing in FIG. 10A.

When reproduced data strings of any program are controlled, the extension tables described above with reference to FIG. 9B–9D and recorded as management data are useful.

FIG. 17 is a flow chart explaining how a monitor displays all simultaneously proceeding scenes recorded on the disk, one after another. First, the data is is read from the disk (Step S41). Then, a sub-code is read from the disk (Step S42). The sub-code contains a code (e.g., a parental consent code) which indicates the program information concerning program bars representing simultaneously proceeding scenes. Upon detecting this code, it is determined whether or the user has a divided-frame display mode by operating the operator panel (Step S43).

If the divided-frame display mode has been set, linked program bars are displayed (Step S44). FIG. 18A shows a divided-frame menu which is displayed when four program bars #11, #12, #13 and #14 are linked to one another. FIG. 18B shows a divided-frame menu, displaying the program bars #11, #12, #13 and #14 in the form of ¼-sized bars #11', #12', #13' and #14'. In Step S44, the program bar #15 is reproduced, thereby displaying ¼-sized bars #11', #12', #13' and #14'.

If the divided-frame display mode is found not to have been set has been set in Step S43, the scene switching data is read from the disk (Step S45). Then, it is determined whether or not the scene switching data represents a scene enlarging mode (Step S46). If the scene switching data does not represent a scene enlarging mode, the flow goes to Step S44, in which multi-scene display is performed. If the scene switching data represents a scene enlarging mode, data for selecting a scene to be displayed in an enlarged form (e.g., data-string selecting data or story selecting data) is read from the disk, and the program bar representing the selected scene is reproduced from the disk, whereby the scene is displayed on the monitor in an enlarged form (Steps S48). When a disk contains a program as shown in FIG. 18B, a screen as shown in FIG. 18A appears when control has been passed from Step S43 or Step S46 to Step 44. Namely, the program bars #10, #15, #10, #16, . . . are reproduced in that order. When an enlarged screen has been specified, the reproduction of program bar #10 is followed by the reproduction of any one of #11, #13, and #14 in a normal size. This is then followed by the reproduction of program bar #16.

In the embodiment described above, the program bar #15 has been recorded on the disk. Instead, to perform multi-scene display, the typical frames of the program bars #11, #12, #13 and #14, which represent simultaneously proceeding scenes, may be decoded, to form still pictures. These still pictures may be displayed on the monitor until it is determined that the scene switching data represents a scene enlarging mode. In this instance, the data reproducing apparatus needs to have additional video processing sections including decoders, and a circuit for processing the outputs from the decoders into reduced multi-scene video signals.

As has been described with reference to FIG. 2, recorded on the disk is a movie program which includes a plurality of data units, each containing a plurality of audio information items representing speech in various languages among other things. Therefore the user can select one of the audio information strings or one of the video information strings. Thus, the data string processing section 203 (FIG. 1) can select an audio information item representing speech or a subtitle in a specific language.

If selection mode is set in the data reproducing apparatus, a decoder starts decoding the audio information in a data unit to be reproduced automatically when one scene is switched to another. The language selected at this time is identical to that used in the previously displayed scene.

In the embodiment described above, the parental consent code is obtained from the management data or a sub-code recorded on the disk. The parental consent code is used to set the data reproducing apparatus in the parental consent mode. The parental consent mode is cancelled as has been explained with reference to FIG. 16. In some case, however, the user may wish to set parental consent codes to all or some of the movie stories recorded on a disk he or she has bought.

FIG. 19 is a flow chart for explaining how the data recording apparatus operates when set in parental consent mode. First, the disk is placed on the turntable and rotated, and the management data is read (Steps S51 and S52). Then, it is determined whether or not the user has operated the operator panel by inputting a request for a parental consent code (Step S53). If no request has been input, the data reproducing apparatus is set into normal reproduction mode. If a request has been input, a menu is displayed based on a program link table (Step S54). This menu show, for example the ID numbers of information strings, such one as is illustrated in FIG. 7, for example. Next, the user looks at the the menu and operates the operator panel, thus inputting the ID number of the information string he or she has selected

(Step S55). Then, such a menu as shown in FIG. 10B is displayed on the monitor, advising the user to input a parental consent code (Step S56). If the user inputs the parental consent code, the parental consent code, the the ID number of the selected information string, and the ID number of the disk, and the like are stored into the work memory in the form of a set of data.

As described above, while set in the parental consent mode, the data reproducing apparatus not only reads the management data from the disk when the disk is placed on the turntable, but also reads data from the work memory. Thereafter, the operation goes to Step S23 shown in FIGS. 15 and 16.

If the user has learned that the disk stores program bars representing simultaneously proceeding scenes, he may switch scenes at any time he or she want to. If the scene is not switched to the desired scene instantaneously, the user is likely to assume that the data reproducing apparatus has gone out of order, that the appropriate one of the simultaneously proceeding scenes may not be being reproduced. Having become rather restless, the user is likely to operate the panel repeatedly. To alleviate such anxiety, the messages shown in FIG. 20 may be displayed on the monitor screen.

For instance the moment the user operates the panel to switch the scenes represented by program bars linked in accordance with link information (for example, those program bars shown in FIG. 3B), the monitor displays the message shown in FIG. 20A, "IT IS NOT THE TIME TO SWITCH SCENES Alternatively, the moment the user operates the panel to switch simultaneously proceeding scenes from one to another, the monitor displays the message of FIG. 20B, "THE PROGRAM BAR BEING REPRODUCED IS #1" or the message of FIG. 20C, "THE PROGRAM BAR BEING REPRODUCED IS #4." Seeing such a message on the monitor screen, the user need not be irritated at all.

FIG. 21A illustrates another multi-scene program. The multi-scene program shown in FIG. 3B, for example, may be recorded in such a manner as illustrated in FIG. 21A. Namely, program bars #0, #1, #2, #1, #2, #1, #2, #3, #4, #5, #6, #4, #5, #6, #4, #5, #6, and #7 are arranged in this sequence. In other words, the program bar #0 is followed by program bars #1 and #2. On this disk, the program bars #1 and #2 are recorded in area TA. The program bars #4, #5 and #6 which follow the program bar #3 and which represent simultaneously proceeding scenes are recorded in a similar manner. In this case, the program bars representing simultaneously proceeding scenes are less in data amount than those shown in FIG. 3B. The disk 100 of this record format is accessed by a data reproducing apparatus of the type shown in FIG. 21B. This data reproducing apparatus is almost the same as the apparatus shown in FIG. 1, but differs in that the data string processing section 203 incorporates a buffer memory 230. The buffer memory 230 is provided for storing program bars which represent simultaneously proceeding scenes. For example, the data unit of program bars #1 and #2 are read and subsequently stored into the buffer memory 230 after program bar #0. Similarly, the data unit of program bars #4, #5 and #6 are read and subsequently stored into the buffer memory 230 after program bar #3. The program bars representing simultaneously proceeding scenes are sent to the video processing section 206. As a result, the monitor displays the scenes represented by these program bars at the same time, and generates sounds for these scenes. That is, multi-scene reproduction is achieved in real time. The program bars representing simultaneously proceeding scenes must be read from the disk at high speed. To this end, the system control section 204 drives the motor 102 at high speed. If n program bars are recorded on the disk representing n simultaneously proceeding scenes, then the motor 102 is driven at a speed n times higher. Since the program is recorded in the format shown in FIG. 21A, the pickup means need not be moved back and forth in the radial direction of the disk.

FIGS. 22A and 22B show another example of an arrangement of program bars which are recorded on a disk and which represent simultaneously proceeding scenes. In the case of this disk, four-scene information is recorded when the program bar #11 following the program bar #10 is reproduced. Four scenes A to D are illustrated in these figures. On the screen, the four scenes are simultaneously displayed in the form of moving pictures. Hence, the user can enjoy seeing the four scenes at the same time. While the multi-scene display is being performed, the user can select any one of the four scenes. When one of the four scenes is selected, it will be displayed in an enlarged size. FIG. 22B is a flow chart for explaining the software which is loaded in the data reproducing apparatus and which is designed to reproduce information from the disk. First, the data reproducing apparatus starts normal reproduction. If a multi-scene part is detected during the normal reproduction, a simultaneously proceeding scene is reproduced to be displayed on a part of the screen. That is, the program bar #11 shown in FIG. 22A is reproduced (Steps S71 to S74). If the user selects one of the simultaneously proceeding scenes being displayed, the data reproducing apparatus converts the selected program bar representing the selected scene to data which represents an enlarged scene. The selected scene is thereby displayed in an enlarged form. Upon completion of the reproduction of the multi-scene part, the apparatus will resume the normal reproduction (Steps S75 to S77).

Industrial Applicability

As has been described, the present invention can provide a multi-scene recording medium on which images are recorded together with speech and subtitle in various languages and which can therefore be used world-wide, and also a data reproducing apparatus which can reproduce data in various manners to meet various needs.

We claim:

1. An apparatus for reproducing information from a multi-scene recording medium including a disk having a management area and a data area, said data area recording a first program information item, a second program information item following said first program information item, a third program information item following said second program information item, and a fourth program information item for replacing said second program information item, said second and fourth program information items representing different views of a same event, said management area recording multi-scene configuration information indicating that said second and fourth program information items are linked to each other, data units of said second program information item and data units of said fourth program information item being alternatingly and continuously recorded on said recording medium, said apparatus comprising:

pickup means for generating signals based on information recorded on said disk;

demodulating means for generating multi-scene configuration data by demodulating signals generated by said pickup means, said multi-scene configuration data being based on said multi-scene configuration information recorded in said management area of said disk;

management data storage means for storing said multi-scene configuration data generated by said demodulation means; and

control means for automatically defining an order in which said program information items are to be reproduced from said disk based on said multi-scene configuration data and in accordance with a prescribed program link data if data representing a reproducing order for said program information items is not input when said second program information item begins being reproduced, where

when production is to be switched from a source program information item which is one of the second and fourth program information items to a destination program information item which is the other of the second and fourth program information items during reproduction of the source program information item, reproduction of the destination program information item starts from a head position of a data unit of the destination program information item, and

the switch between the source and the destination program information items is such that reproduction of the destination program information starts at the head position that does not correspond to a position last reproduced in the source program information item.

2. A method reproducing information from a multi-scene recording medium including a disk having a management area and a data area, said data area recording a first program information item, a second program information item following said first program information item, a third program information item following said second program information item, and a fourth program information item for replacing said second program information item, said second and fourth program information items representing different views of a same event, said management are recording multi-scene configuration information indicating that said second and fourth program information items are linked to each other, data units of said second program information item and data units of said fourth program information item being alternatingly and continuously recorded on said recording medium, said method comprising the steps of:

reading information from said disk and generating pickup signals based on said information;

generating multi-scene configuration data by demodulating said pickup signals, said multi-scene configuration data being based on multi-scene configuration information recorded in said management area of said disk;

storing said multi-scene configuration data; and

defining an order in which said program information items are to be reproduced from said disk on the basis of said multi-scene configuration data and in accordance with a prescribed program link data if data representing a reproducing order for said program information items is not input when said second program information item begins being reproduced, where

when production is to be switched from a source program information item which is one of the second and fourth program information items to a destination program information item which is the other of the second and fourth program information items during reproduction of the source program information, reproduction of the destination program information item starts from a head position of a data unit of the destination program information item, and

the switch between the source and the destination program information items is such that reproduction of the destination program information starts at the head position that does not correspond to a position last reproduced in the source program information item.

3. An apparatus for reproducing information from a multi-scene recording medium including a disk having a management area and a data area, said data area recording a first program information item, a second program information item following said first program information item, a third program information item following said second program information item, and a fourth program information item for replacing said second program information item, said second and fourth program information items representing different views of a same event, said management area recording multi-scene configuration information indicating that said second and fourth program information items are linked to each other, data units of said second program information item and data units of said fourth program information item being alternatingly and continuously recorded on said recording medium, said apparatus comprising:

pickup means for generating signals based on information recorded on said disk;

demodulating means for generating multi-scene configuration data by demodulating signals generated by said pickup means, said multi-scene configuration data being based on said multi-scene configuration information recorded in said management area of said disk;

management data storage means for storing said multi-scene configuration data generated by said demodulation means; and

control means for automatically defining an order in which said program information items are to be reproduced from said disk on the basis of said multi-scene configuration data and in accordance with a prescribed program link data if data representing a reproducing order for said program information items is not input when said second program information item begins being reproduced, where

when production is to be switched from a source program information item which is one of the second and fourth program information items to a destination program information item which is the other of the second and fourth program information items during reproduction of the source program information item, reproduction of the destination program information item starts from a head position of a data unit of a program information item next to the destination program information item, and

the switch between the source and the destination program information items is such that reproduction of the destination program information starts at the head position that does not correspond to a position last reproduced in the source program information item.

4. A method reproducing information from a multi-scene recording medium including a disk having a management area and a data area, said data area recording a first program information item, a second program information item following said first program information item, a third program information item following said second program information item, and a fourth program information item for replacing said second program information item, said second and fourth program information items representing different views of a same event, said management area recording multi-scene configuration information indicating that said second and fourth program information items are linked to each other, data units of said second program information

item and data units of said fourth program information item being alternatingly and continuously recorded on said recording medium, said method comprising the steps of:

reading information from said disk and generating pickup signals based on said information;

generating multi-scene configuration data by demodulating said pickup signals, said multi-scene configuration data being based on multi-scene configuration information recorded in said management area of said disk;

storing said multi-scene configuration data; and

defining an order in which said program information items are to be reproduced from said disk on the basis of said multi-scene configuration data and in accordance with a prescribed program link data if data representing a reproducing order for said program information items is not input when said second program information item begins being reproduced, where

when production is to be switched from a source program information item which is one of the second and fourth program information items to a destination program information item which is the other of the second and fourth program information items during reproduction of the source program information item, reproduction of the destination program information item starts from a head position of a data unit of a program information item next to the destination program information item, and

the switch between the source and the destination program information items is such that reproduction of the destination program information starts at the head position that does not correspond to a position last reproduced in the source program information item.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO.	:	5,732,185
DATED	:	March 24, 1998
INVENTOR(S)	:	HIRAYAMA et al.

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

Item [62], before "Patent No. 5,630,006" delete "Jun. 15, 1995, " and insert

— which was filed as application No. PCT/JP93/01570, Oct. 29, 1993 --

Column 1, numbered line 7, after "5,630,006, insert — which was filed as application No.

PCT/JP93/01570, Oct. 29, 1993 --

Signed and Sealed this

Seventh Day of March, 2000

Attest:

Attesting Officer

Q. TODD DICKINSON

Commissioner of Patents and Trademarks