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Maturi et al.

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[54] **MPEG DECODING SYSTEM INCLUDING TAG LIST FOR ASSOCIATING PRESENTATION TIME STAMPS WITH ENCODED DATA UNITS**

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[51] Int. Cl.^{6} **G06F 13/372**

[52] U.S. Cl. **395/550**; 348/7; 348/10; 370/94.2; 370/110.1; 395/182.18; 395/200.17

[58] Field of Search 395/200.17, 550, 395/182.18, 250; 348/7, 512, 10; 370/110.1, 94.2

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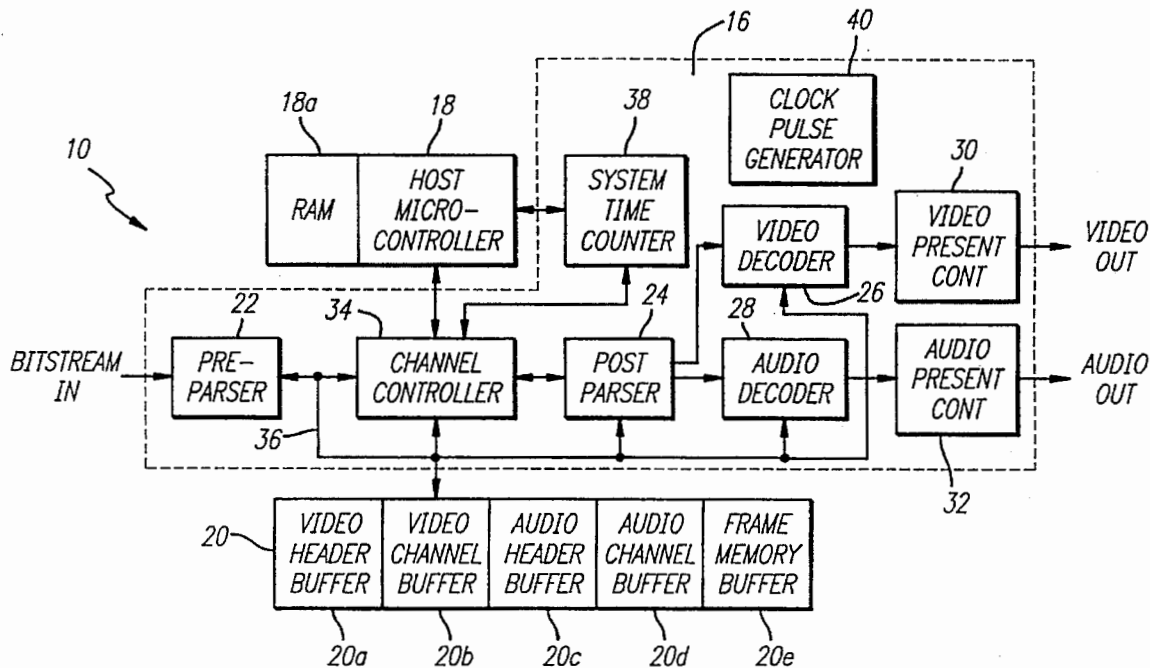|			
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Primary Examiner—Ken S. Kim

Attorney, Agent, or Firm—Poms, Smith, Lande & Rose

[57] **ABSTRACT**

A Motion Picture Experts Group (MPEG) multiplexed data bitstream includes encoded video and audio data units, which are prefixed with headers including Presentation Time Stamps (PTS) indicating desired presentation times for the respective data units. The data units are decoded, and presented at a fixed time after decoding, such that the fixed time can be subtracted from the PTS to provide a desired decoding time. The bitstream is parsed, the video and audio headers are stored in video and audio header memories, and the associated video and audio data units are stored in video and audio channel memories respectively. A first interrupt is generated each time a header is stored, and a host micro-controller responds by storing the PTS from the header and the starting address of the corresponding data unit in the channel memory as an entry in a list. A second interrupt is generated each time a data unit is decoded, and the host microcontroller responds by accessing the list using the starting address of the data unit to obtain the corresponding PTS and thereby the desired decoding time. Decoding and presentation are synchronized by comparing the desired decoding time with a system clock time. If the desired decoding time is later than the system clock time by more than one presentation (frame) time period for the data unit, presentation of the data unit is skipped. If the desired decoding time is earlier than the system clock time by more than the presentation time period, presentation of the data unit is repeated.
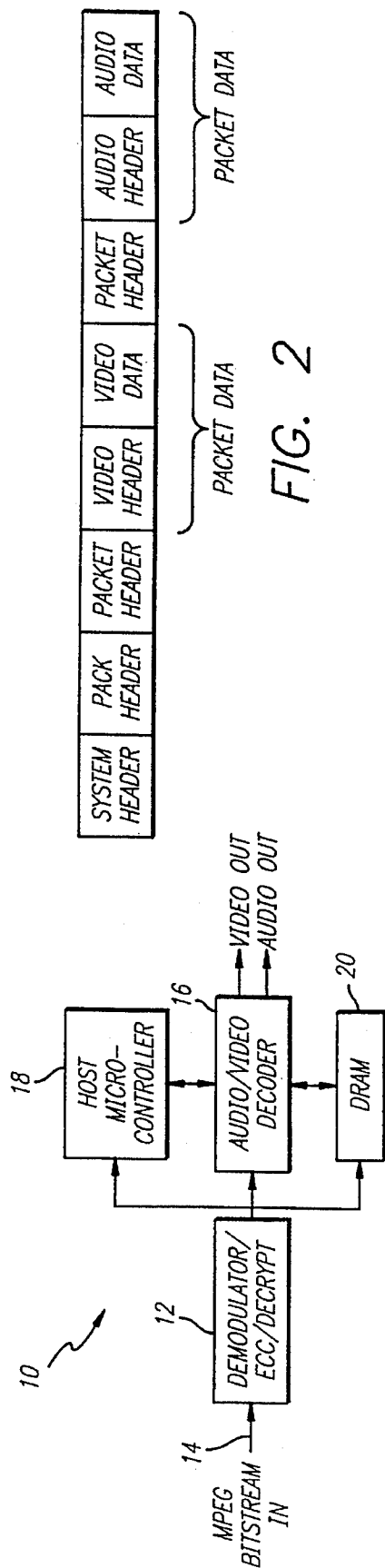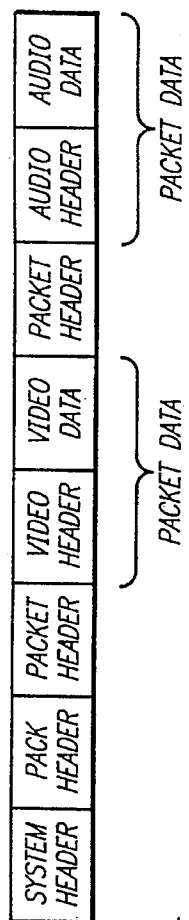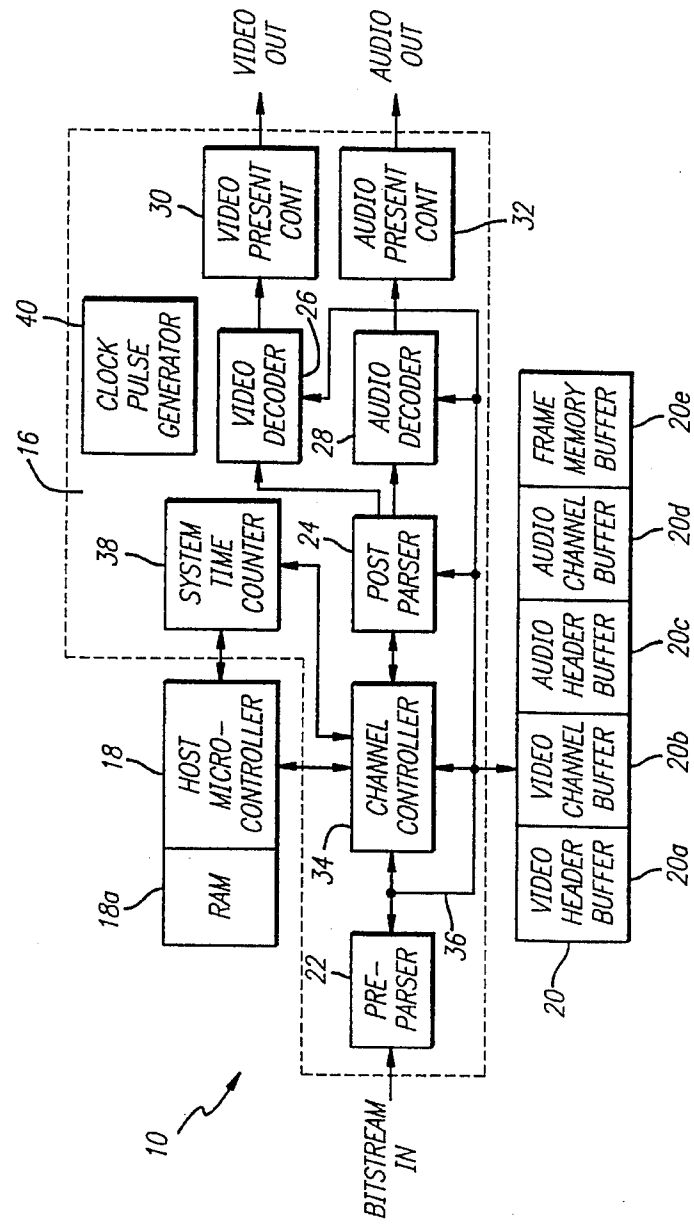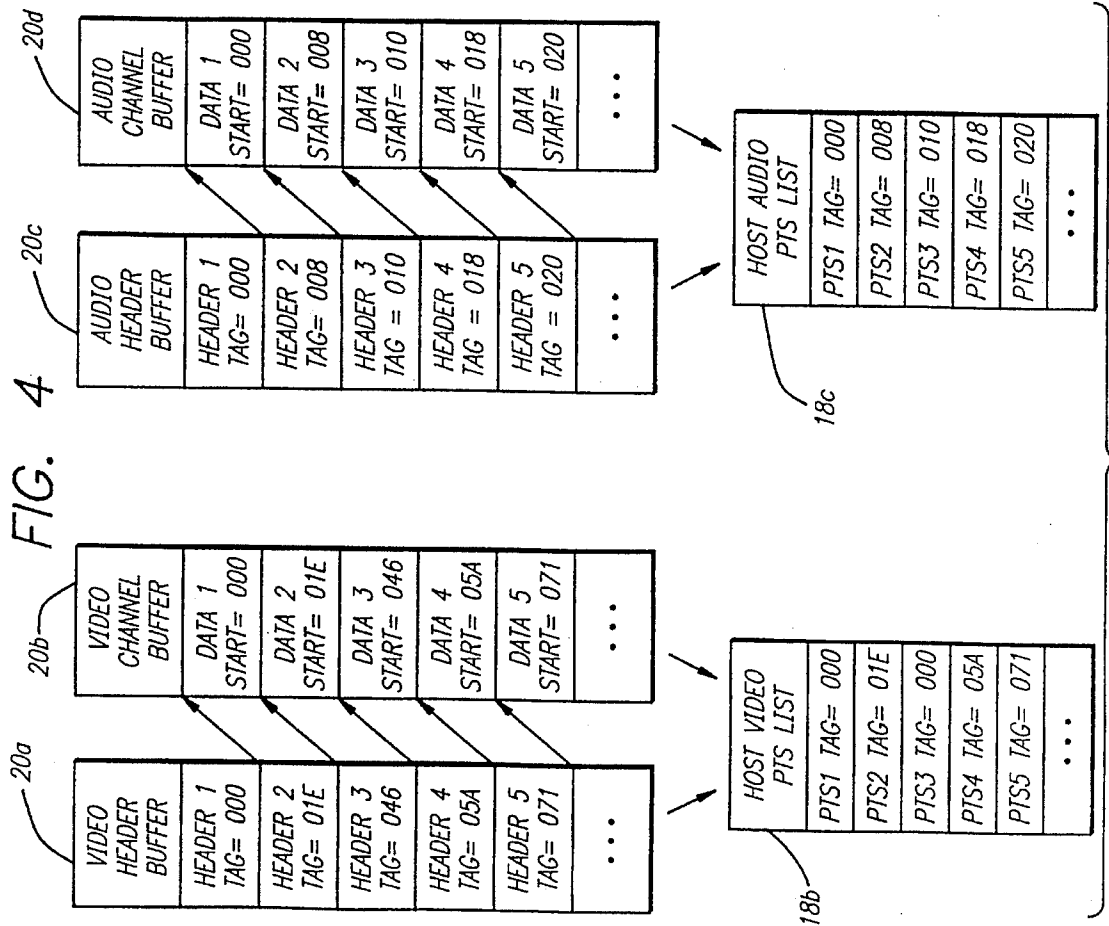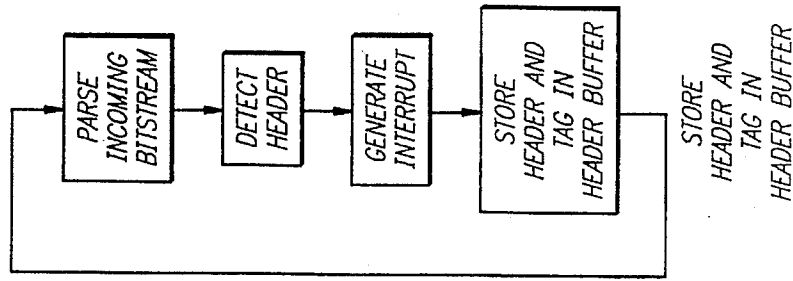
26 Claims, 4 Drawing Sheets

FIG. 2

FIG. 1

FIG. 3

FIG. 5

PARSE INCOMING BITSTREAM → DETECT HEADER → GENERATE INTERRUPT → STORE HEADER AND TAG IN HEADER BUFFER

STORE HEADER AND TAG IN HEADER BUFFER

FIG. 4

20a — VIDEO HEADER BUFFER

| HEADER 1 TAG= 000 |
| HEADER 2 TAG= 01E |
| HEADER 3 TAG= 046 |
| HEADER 4 TAG= 05A |
| HEADER 5 TAG= 071 |
| ... |

20b — VIDEO CHANNEL BUFFER

| DATA 1 START= 000 |
| DATA 2 START= 01E |
| DATA 3 START= 046 |
| DATA 4 START= 05A |
| DATA 5 START= 071 |
| ... |

18b — HOST VIDEO PTS LIST

| PTS1 TAG= 000 |
| PTS2 TAG= 01E |
| PTS3 TAG= 000 |
| PTS4 TAG= 05A |
| PTS5 TAG= 071 |
| ... |

20c — AUDIO HEADER BUFFER

| HEADER 1 TAG= 000 |
| HEADER 2 TAG= 008 |
| HEADER 3 TAG = 010 |
| HEADER 4 TAG = 018 |
| HEADER 5 TAG = 020 |
| ... |

20d — AUDIO CHANNEL BUFFER

| DATA 1 START= 000 |
| DATA 2 START= 008 |
| DATA 3 START= 010 |
| DATA 4 START= 018 |
| DATA 5 START= 020 |
| ... |

18c — HOST AUDIO PTS LIST

| PTS1 TAG= 000 |
| PTS2 TAG= 008 |
| PTS3 TAG= 010 |
| PTS4 TAG= 018 |
| PTS5 TAG= 020 |
| ... |

FIG. 9

INITIALIZE SCR COUNTER → GET SCR CODE FROM BITSTREAM → COMPARE SCR CODE WITH STC COUNTER → ADJUST STC COUNTER OR CLOCK FREQUENCY IF NECESSARY

SYNCHRONIZE STC COUNTER

FIG. 8

RECEIVE INTERRUPT → GET CHANNEL BUFFER READ POINTER → ACCESS HOST MEMORY LIST TO GET PTS → COMPARE PTS TO ADJUSTED SCR → REPEAT OR SKIP FRAME IF NECESSARY → PRESENT FRAME

SYNCHRONIZE PRESENTATION

FIG. 7

DETECT START CODE → GENERATE INTERRUPT → DECODE DATA

DECODE

FIG. 6

RECEIVE INTERRUPT → EXTRACT PTS AND TAG FROM HEADER → STORE PTS AND TAG IN HOST MEMORY LIST
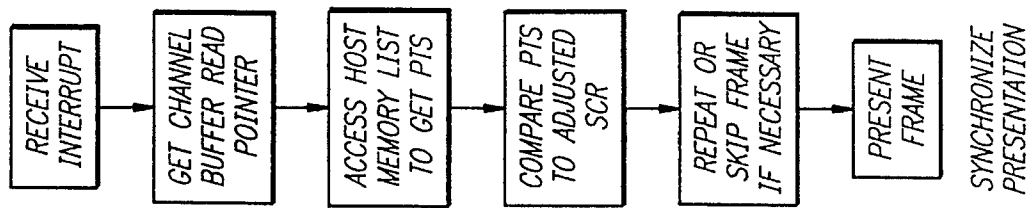
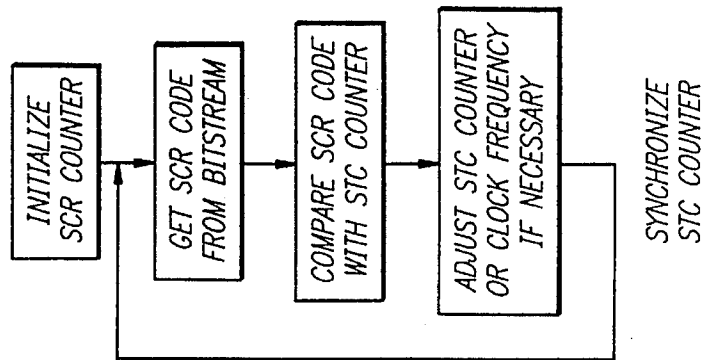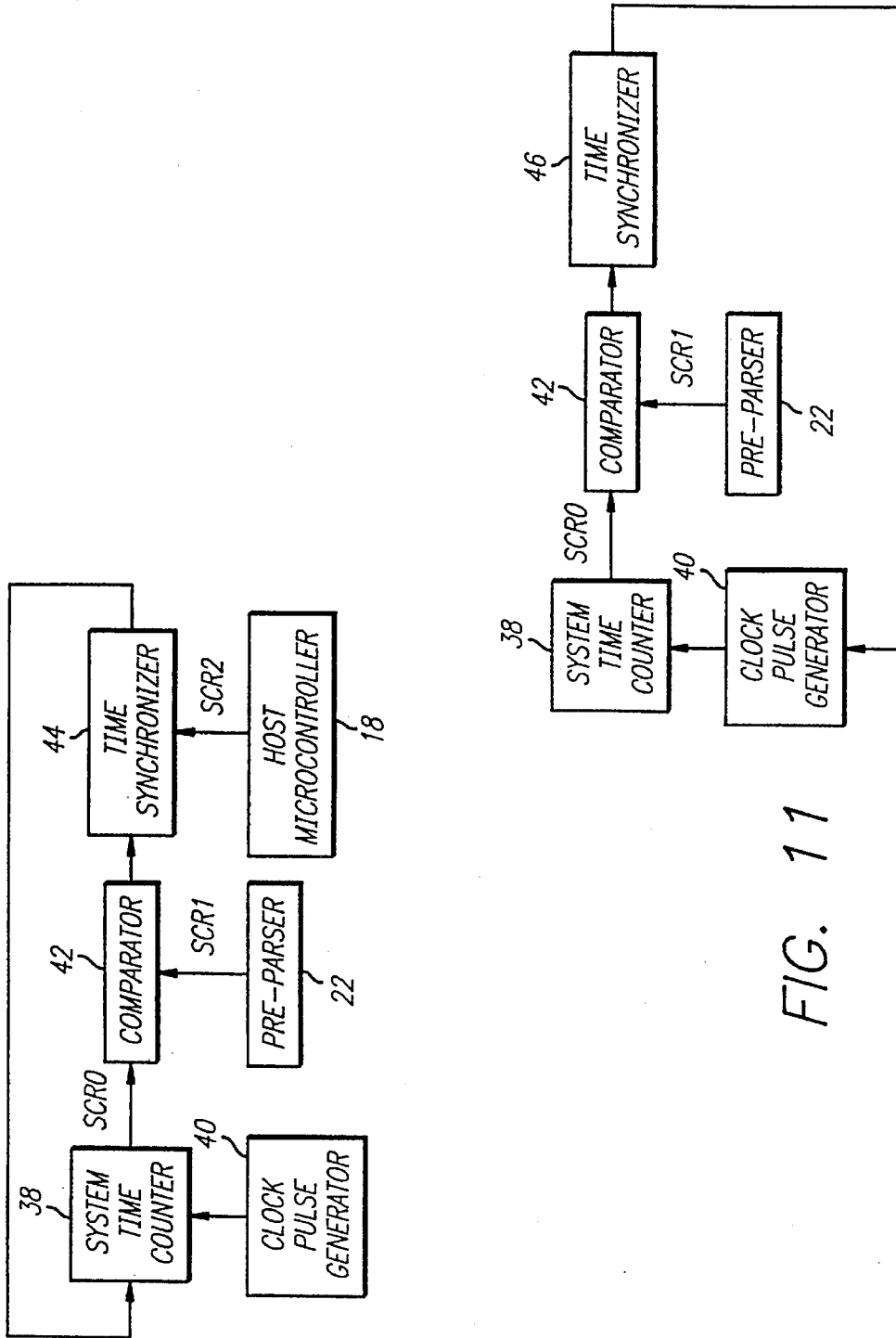STORE PTS AND TAG IN HOST MEMORY TABLE

FIG. 10

FIG. 11

DOCKET ALARM

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