FIG. 1

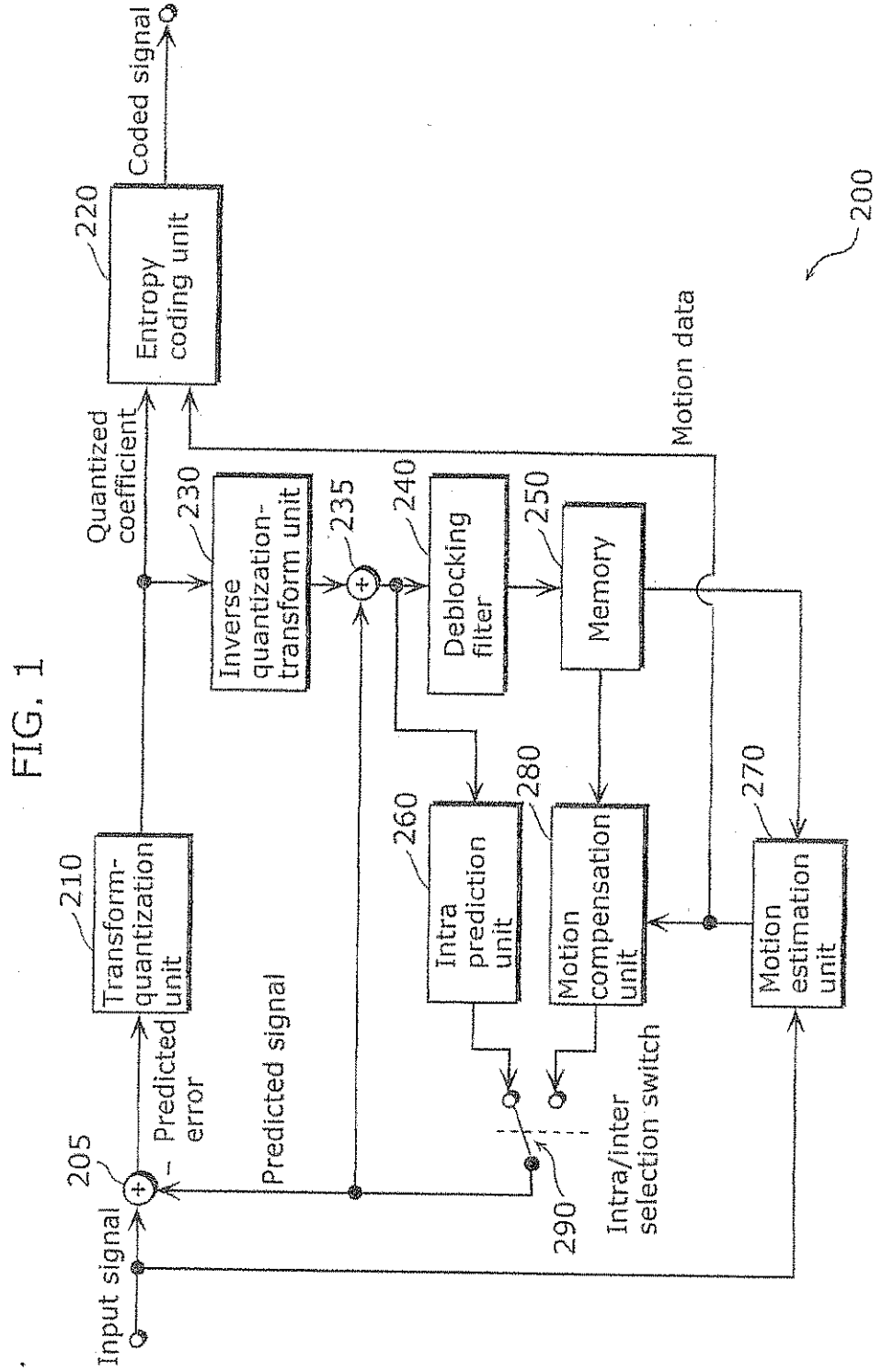

200
Coded signal
220
Entropy coding unit
Quantized coefficient
Motion data
230
Inverse quantization-transform unit
235
240
Deblocking filter
250
Memory
260
Intra prediction unit
280
Motion compensation unit
270
Motion estimation unit
210
Transform-quantization unit
Predicted error
205
Input signal
Predicted signal
290
Intra/inter selection switch

FIG. 2

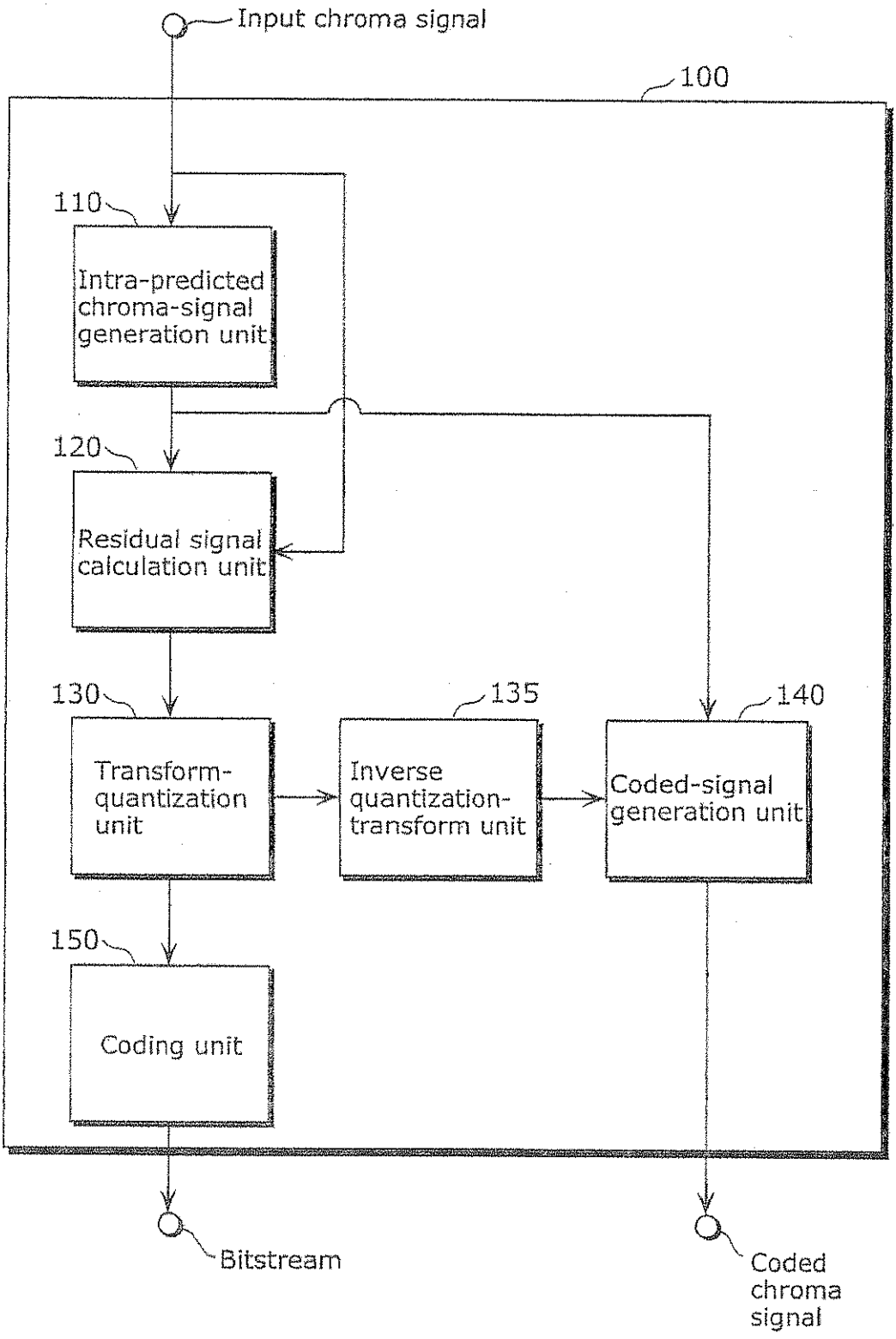

Input chroma signal
100
110
Intra-predicted chroma-signal generation unit
120
Residual signal calculation unit
130
Transform-quantization unit
135
Inverse quantization-transform unit
140
Coded-signal generation unit
150
Coding unit
Bitstream
Coded chroma signal

FIG. 3

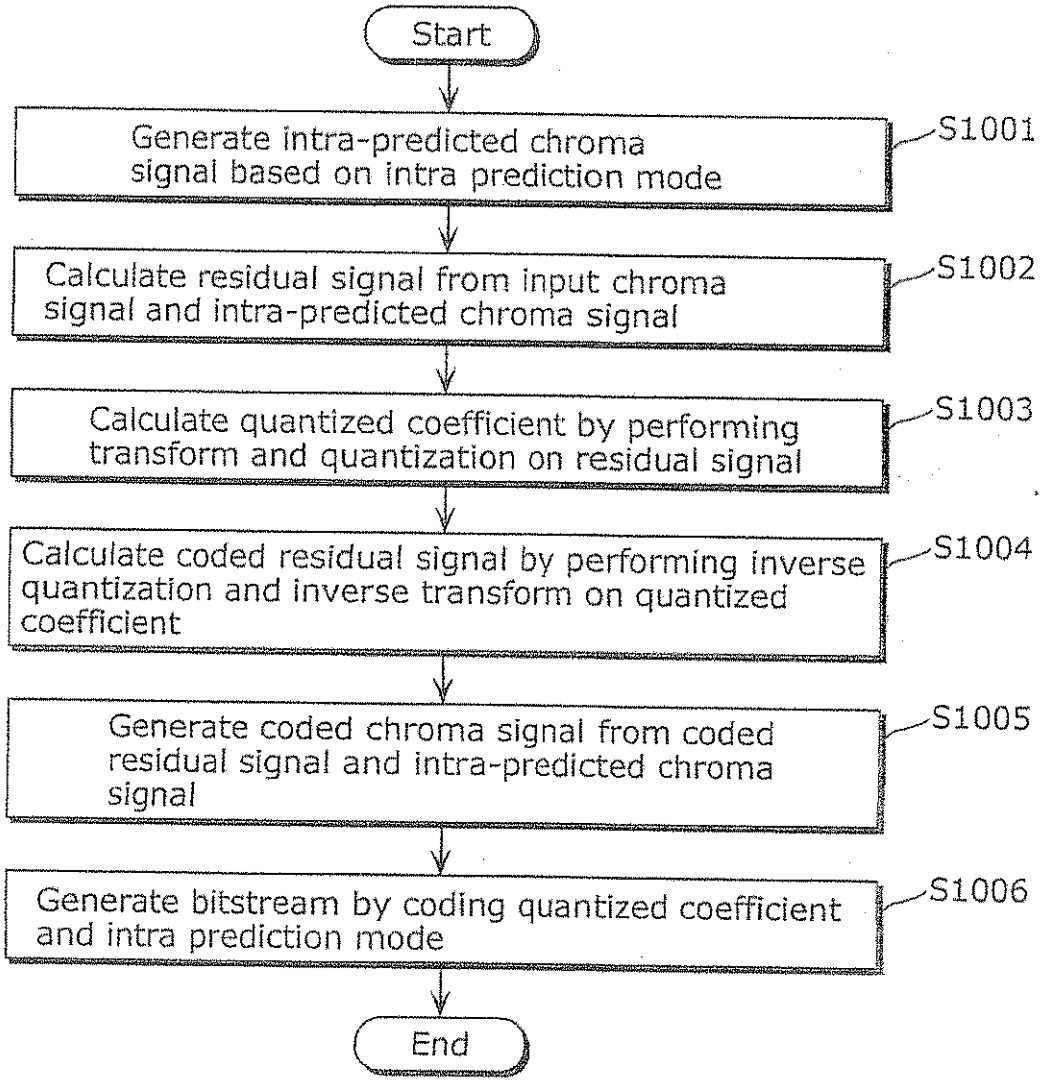

Start
Generate intra-predicted chroma signal based on intra prediction mode
S1001
Calculate residual signal from input chroma signal and intra-predicted chroma signal
S1002
Calculate quantized coefficient by performing transform and quantization on residual signal
S1003
Calculate coded residual signal by performing inverse quantization and inverse transform on quantized coefficient
S1004
Generate coded chroma signal from coded residual signal and intra-predicted chroma signal
S1005
Generate bitstream by coding quantized coefficient and intra prediction mode
S1006
End

FIG. 4

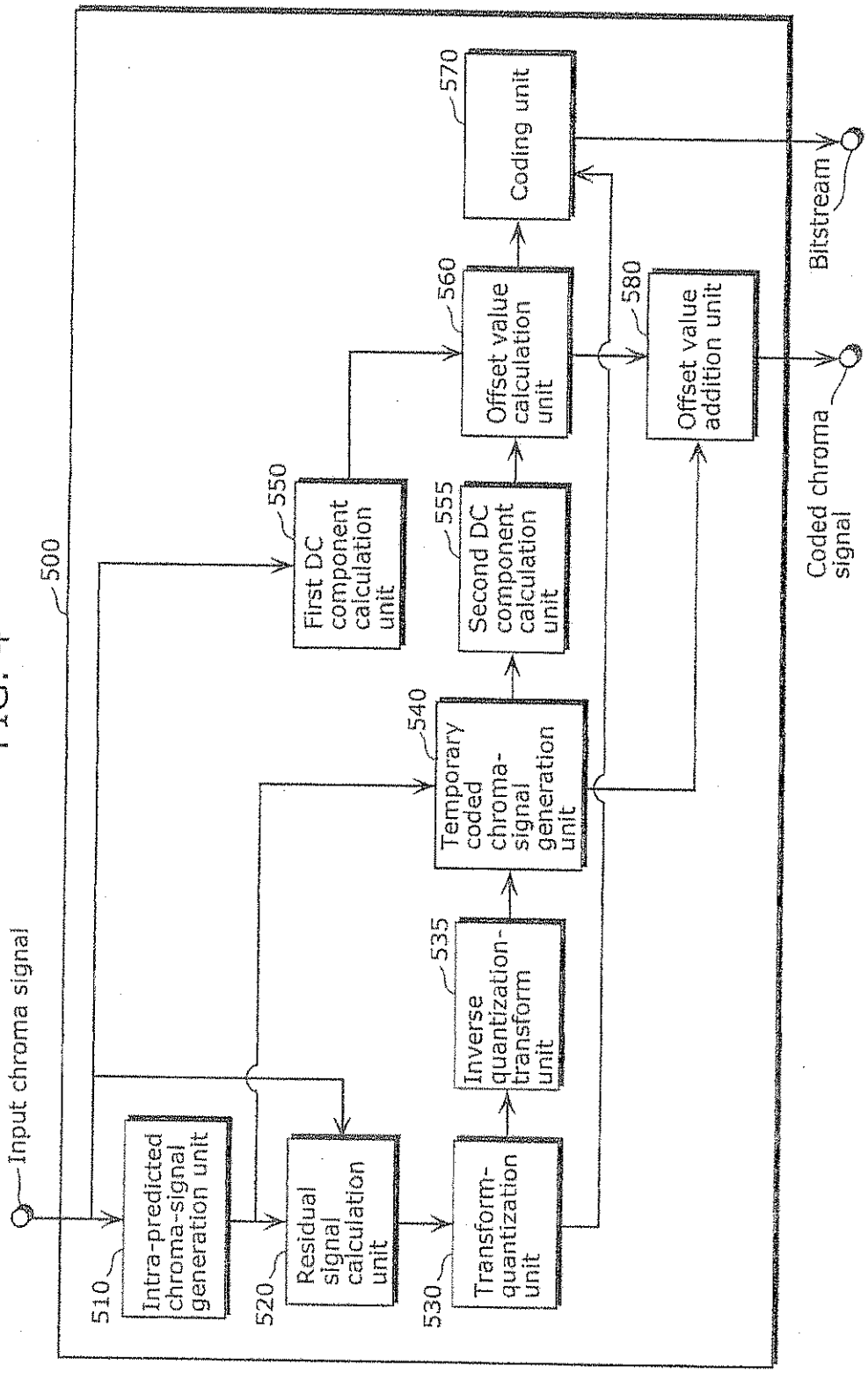

Input chroma signal
500
Intra-predicted chroma-signal generation unit
510
Residual signal calculation unit
520
Transform-quantization unit
530
Inverse quantization-transform unit
535
Temporary coded chroma-signal generation unit
540
First DC component calculation unit
550
Second DC component calculation unit
555
Offset value calculation unit
560
Coding unit
570
Offset value addition unit
580
Bitstream
Coded chroma signal

FIG. 5

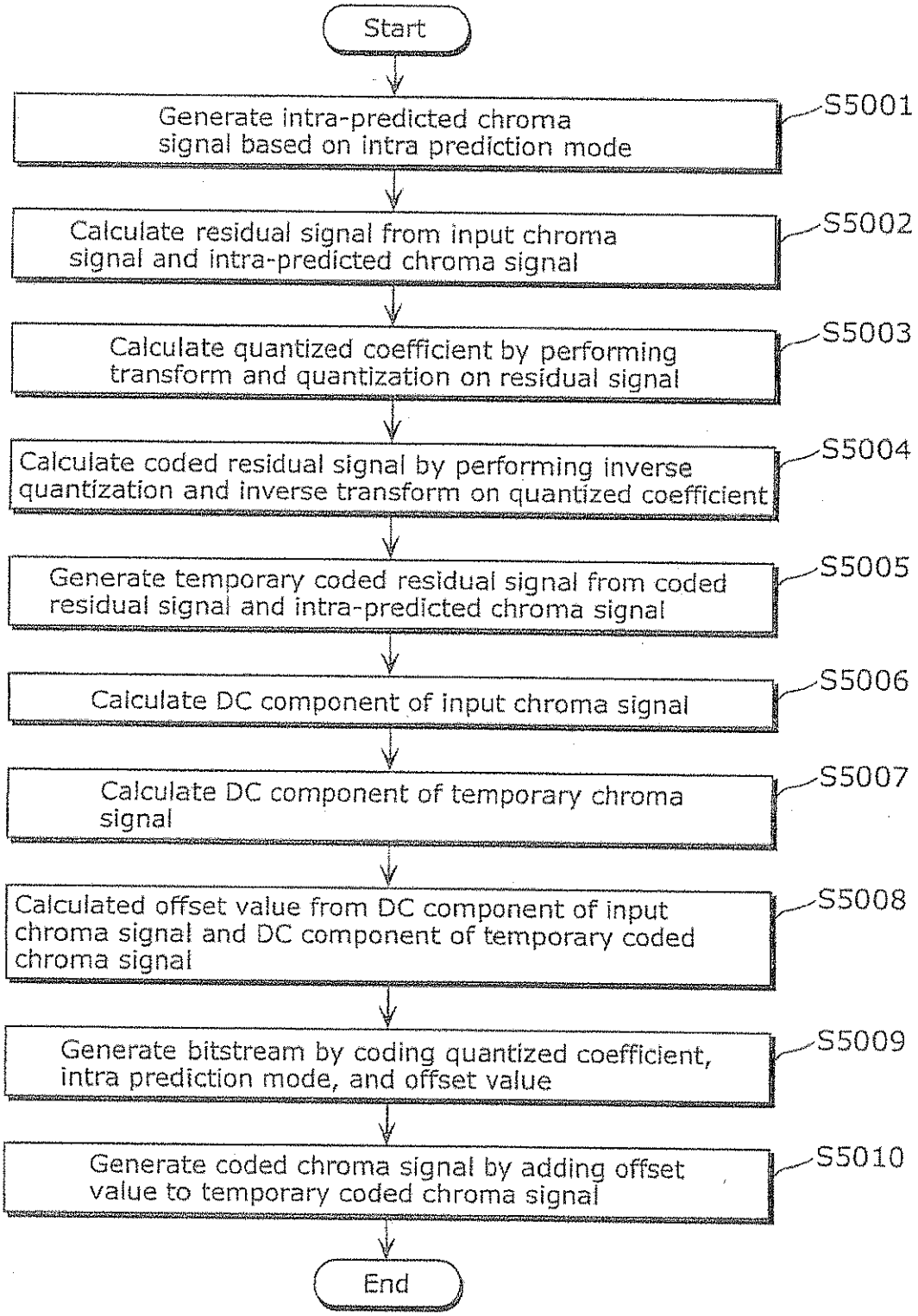

Start
Generate intra-predicted chroma signal based on intra prediction mode
S5001
Calculate residual signal from input chroma signal and intra-predicted chroma signal
S5002
Calculate quantized coefficient by performing transform and quantization on residual signal
S5003
Calculate coded residual signal by performing inverse quantization and inverse transform on quantized coefficient
S5004
Generate temporary coded residual signal from coded residual signal and intra-predicted chroma signal
S5005
Calculate DC component of input chroma signal
S5006
Calculate DC component of temporary chroma signal
S5007
Calculated offset value from DC component of input chroma signal and DC component of temporary coded chroma signal
S5008
Generate bitstream by coding quantized coefficient, intra prediction mode, and offset value
S5009
Generate coded chroma signal by adding offset value to temporary coded chroma signal
S5010
End

FIG. 6

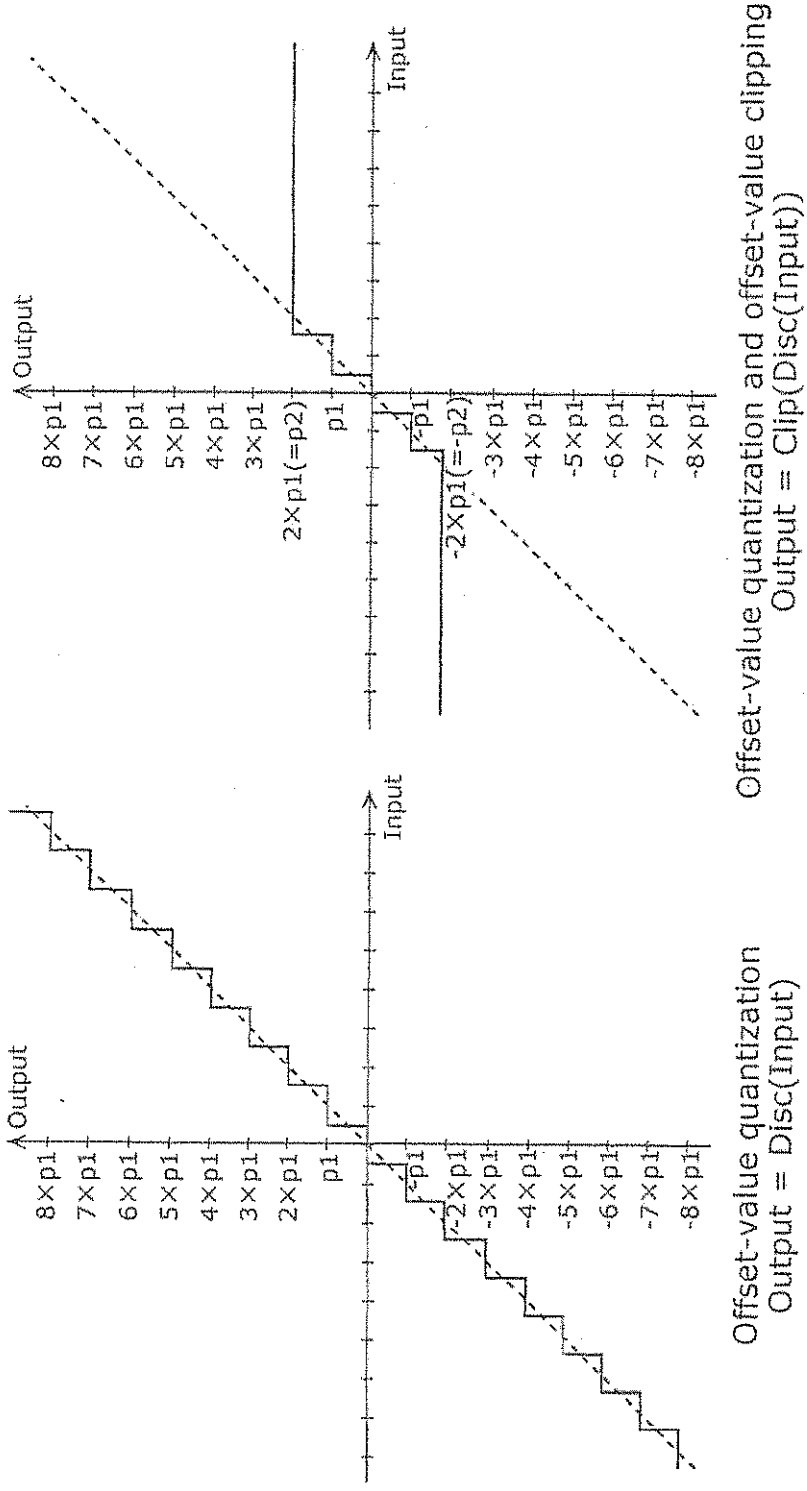

Output
Input
8×p1
7×p1
6×p1
5×p1
4×p1
3×p1
2×p1
p1
-p1
-2×p1
-3×p1
-4×p1
-5×p1
-6×p1
-7×p1
-8×p1
2×p1(=p2)
-2×p1(=-p2)
Offset-value quantization
Output = Disc(Input)
Offset-value quantization and offset-value clipping
Output = Clip(Disc(Input))

FIG. 7

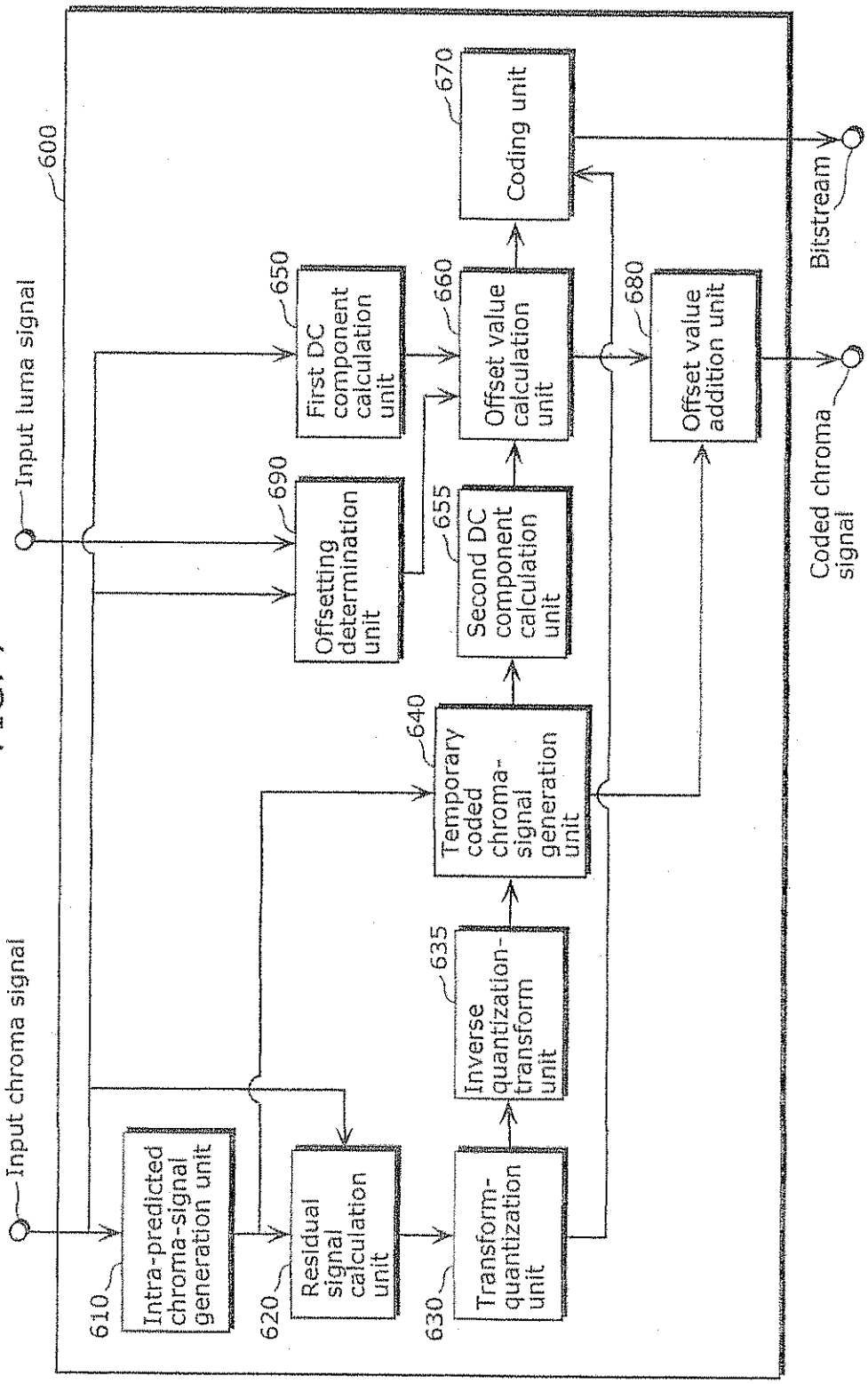

600
Input luma signal
Input chroma signal
Intra-predicted chroma-signal generation unit
610
Residual signal calculation unit
620
Transform-quantization unit
630
Inverse quantization-transform unit
635
Temporary coded chroma-signal generation unit
640
Second DC component calculation unit
655
First DC component calculation unit
650
Offsetting determination unit
690
Offset value calculation unit
660
Coding unit
670
Offset value addition unit
680
Bitstream
Coded chroma signal

FIG. 8

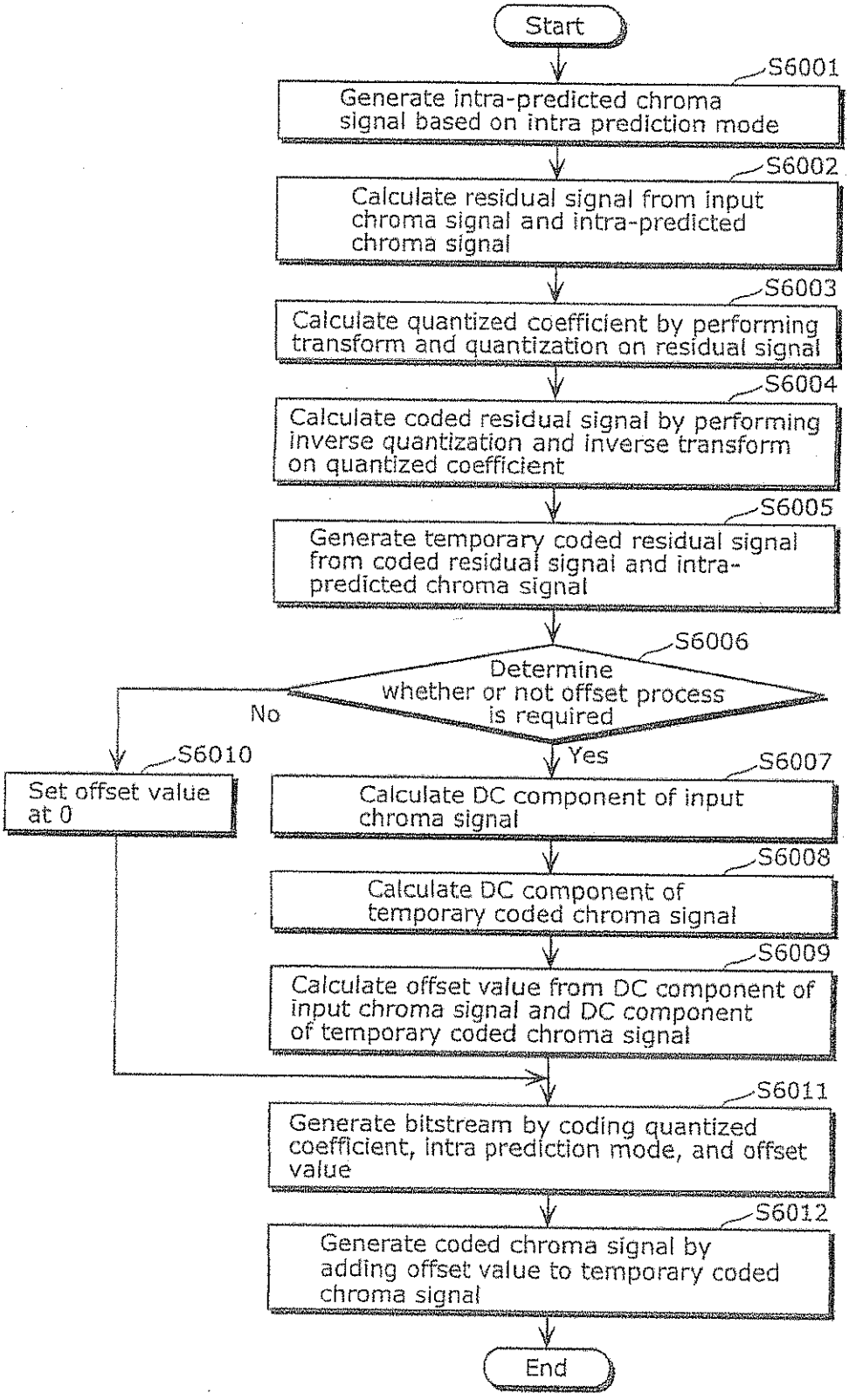

Start
S6001
Generate intra-predicted chroma signal based on intra prediction mode
S6002
Calculate residual signal from input chroma signal and intra-predicted chroma signal
S6003
Calculate quantized coefficient by performing transform and quantization on residual signal
S6004
Calculate coded residual signal by performing inverse quantization and inverse transform on quantized coefficient
S6005
Generate temporary coded residual signal from coded residual signal and intra-predicted chroma signal
S6006
Determine whether or not offset process is required
No
Yes
S6010
Set offset value at 0
S6007
Calculate DC component of input chroma signal
S6008
Calculate DC component of temporary coded chroma signal
S6009
Calculate offset value from DC component of input chroma signal and DC component of temporary coded chroma signal
S6011
Generate bitstream by coding quantized coefficient, intra prediction mode, and offset value
S6012
Generate coded chroma signal by adding offset value to temporary coded chroma signal
End

FIG. 9

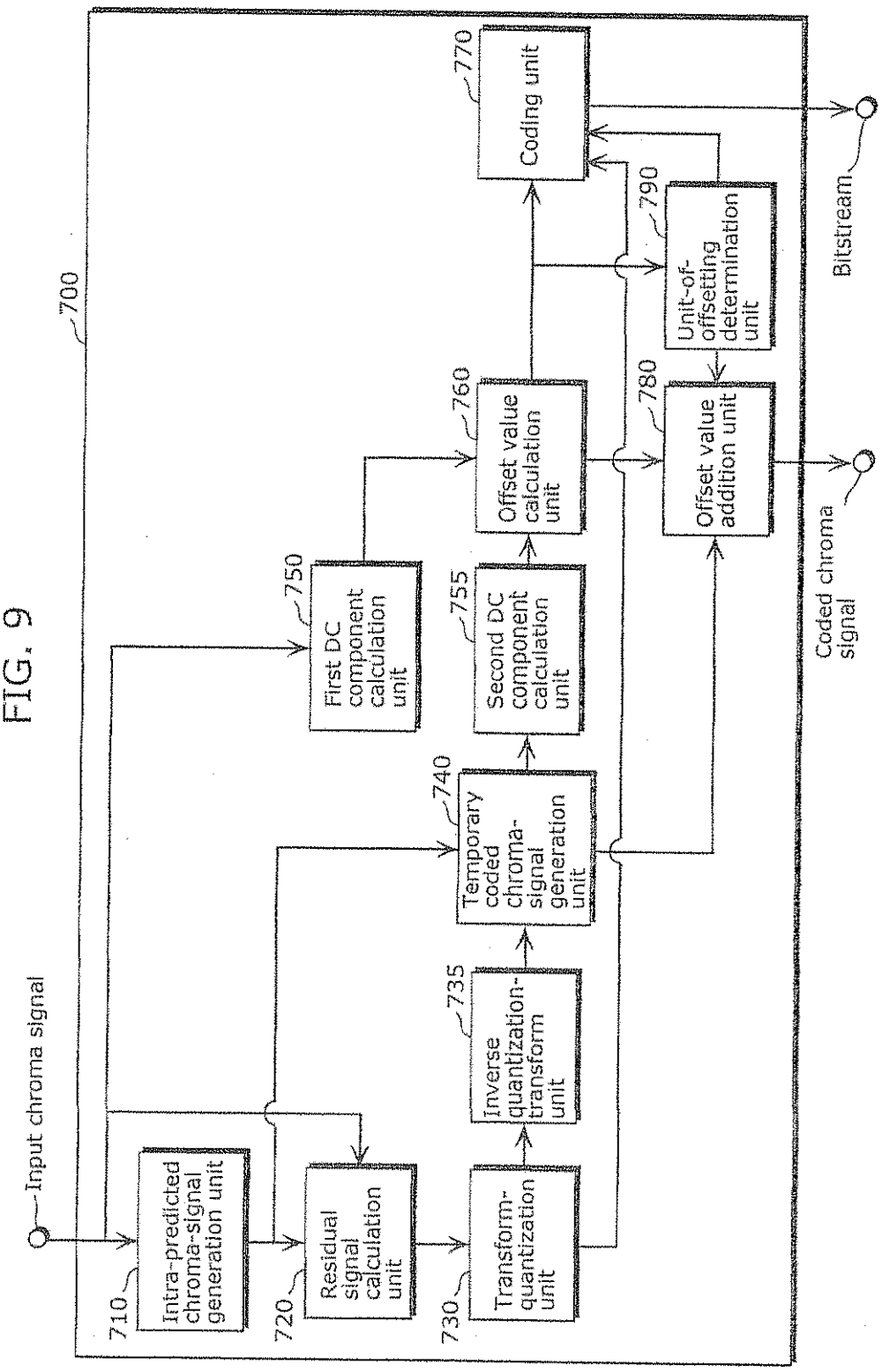

Input chroma signal
700
710
Intra-predicted chroma-signal generation unit
720
Residual signal calculation unit
730
Transform-quantization unit
735
Inverse quantization-transform unit
740
Temporary coded chroma-signal generation unit
750
First DC component calculation unit
755
Second DC component calculation unit
760
Offset value calculation unit
770
Coding unit
780
Offset value addition unit
790
Unit-of-offsetting determination unit
Bitstream
Coded chroma signal

FIG. 10

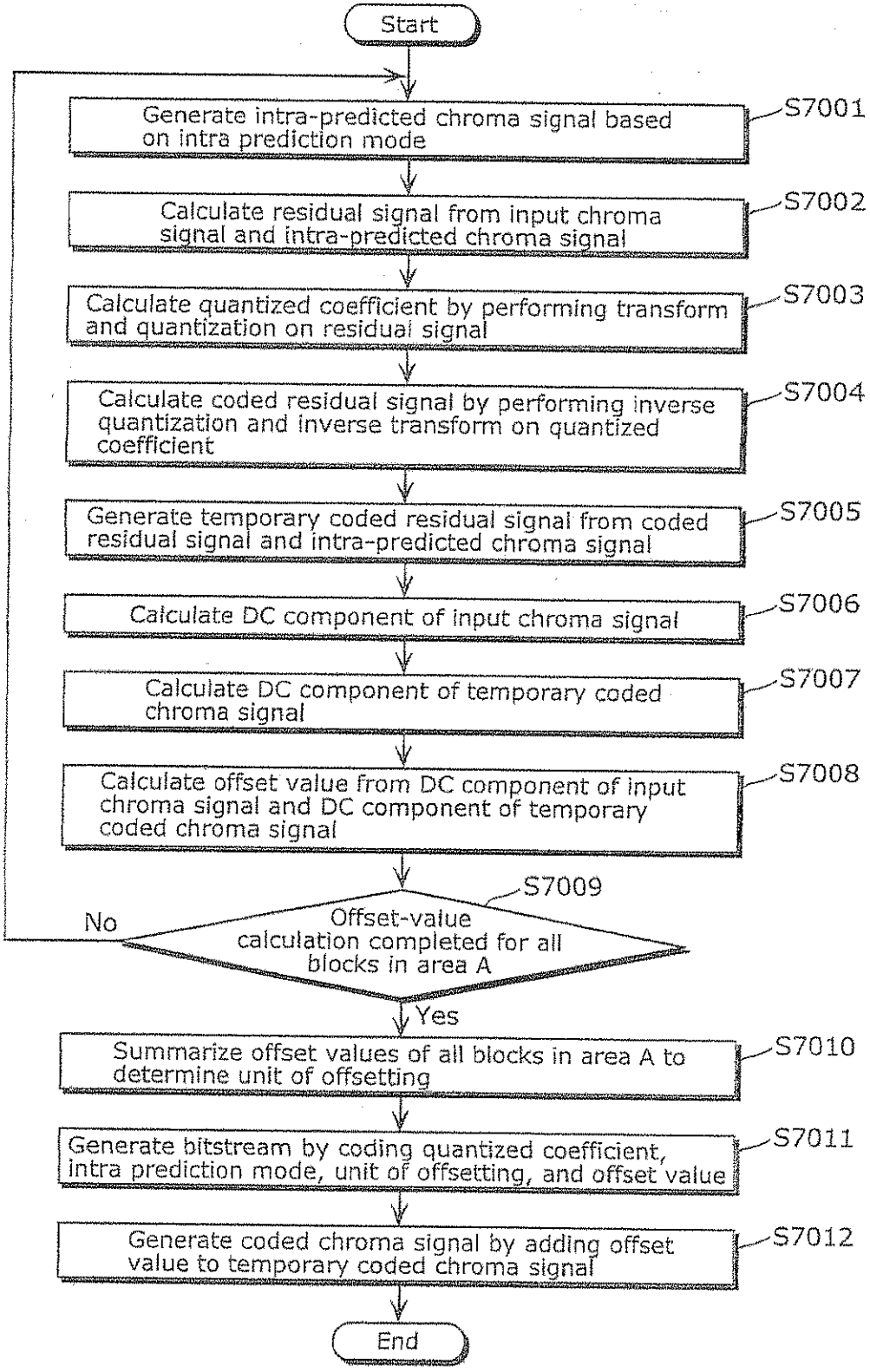

Start
Generate intra-predicted chroma signal based on intra prediction mode
S7001
Calculate residual signal from input chroma signal and intra-predicted chroma signal
S7002
Calculate quantized coefficient by performing transform and quantization on residual signal
S7003
Calculate coded residual signal by performing inverse quantization and inverse transform on quantized coefficient
S7004
Generate temporary coded residual signal from coded residual signal and intra-predicted chroma signal
S7005
Calculate DC component of input chroma signal
S7006
Calculate DC component of temporary coded chroma signal
S7007
Calculate offset value from DC component of input chroma signal and DC component of temporary coded chroma signal
S7008
S7009
Offset-value calculation completed for all blocks in area A
No
Yes
Summarize offset values of all blocks in area A to determine unit of offsetting
S7010
Generate bitstream by coding quantized coefficient, intra prediction mode, unit of offsetting, and offset value
S7011
Generate coded chroma signal by adding offset value to temporary coded chroma signal
S7012
End

FIG. 11A

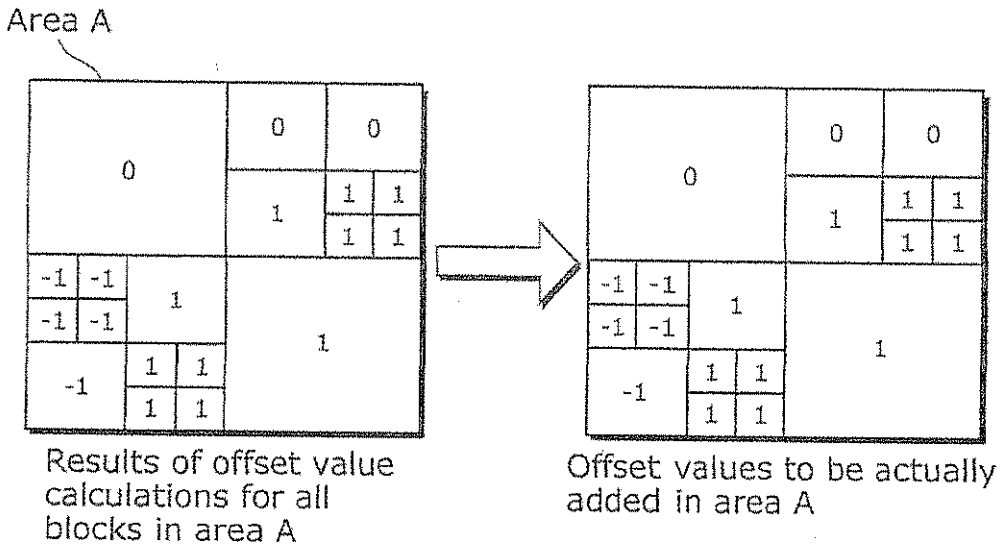



FIG. 11B

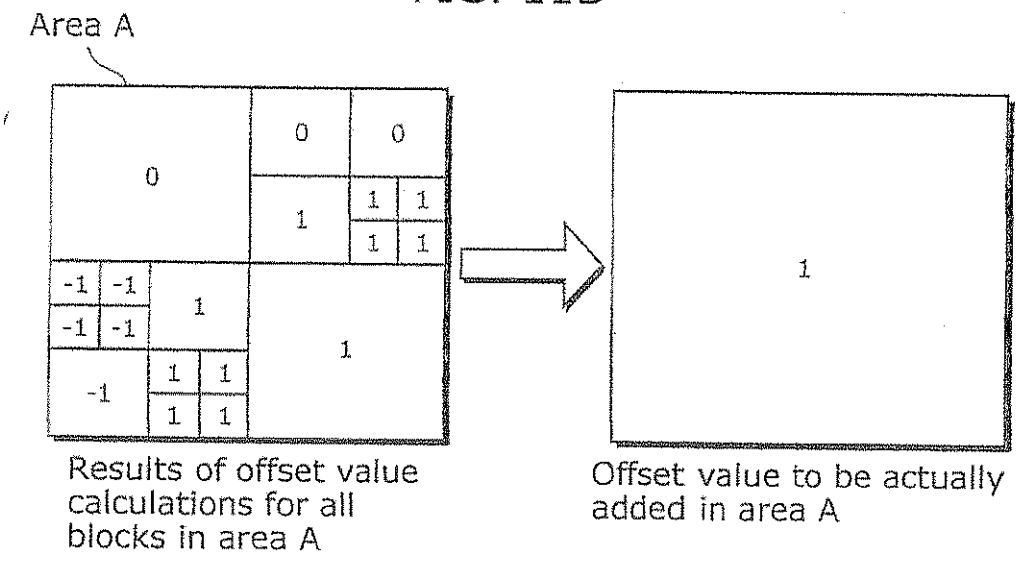


FIG. 12

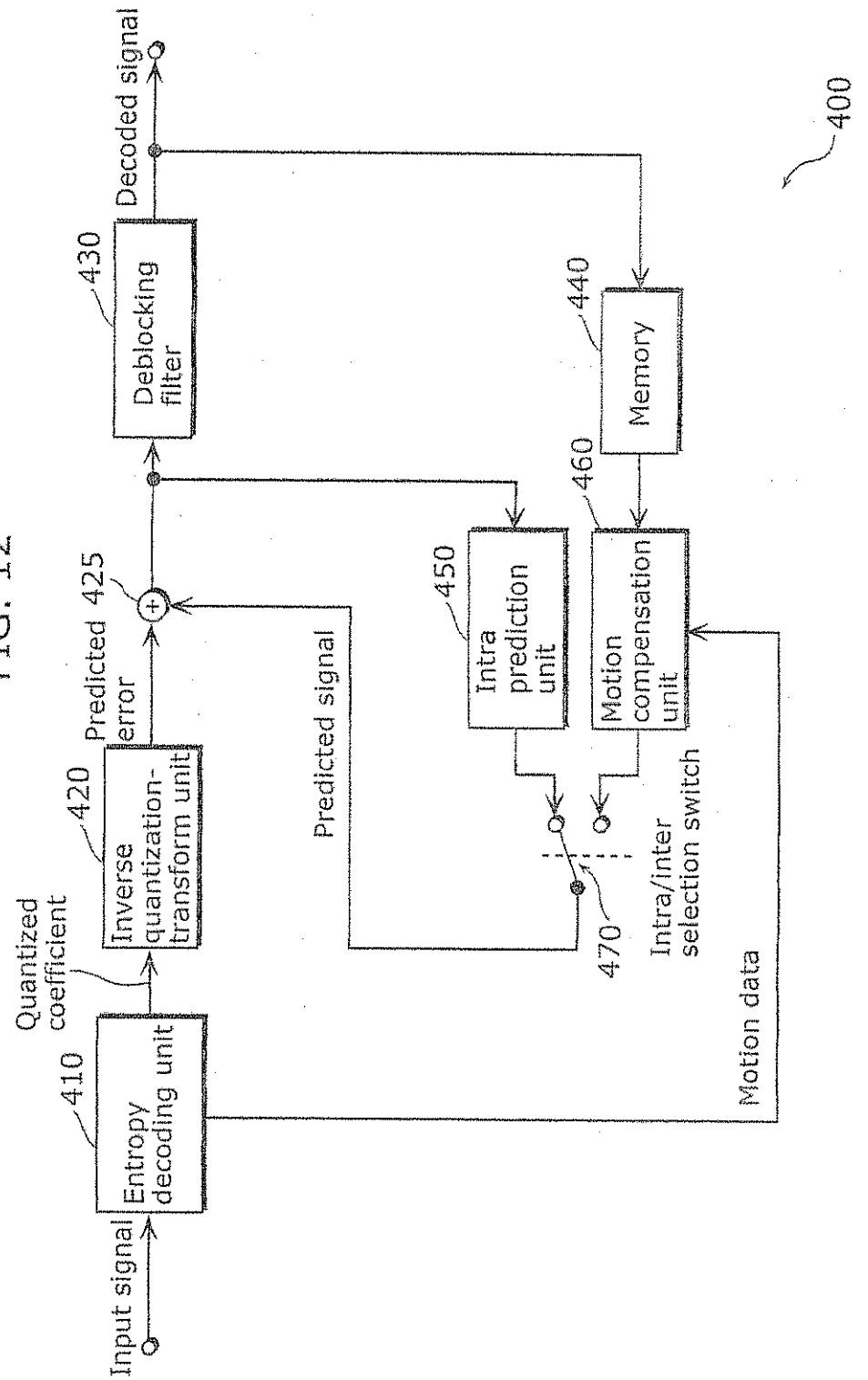

400
Input signal
Entropy decoding unit
410
Quantized coefficient
Inverse quantization-transform unit
420
Predicted error
425
Deblocking filter
430
Decoded signal
Memory
440
Intra prediction unit
450
Motion compensation unit
460
Predicted signal
Intra/inter selection switch
470
Motion data

FIG. 13

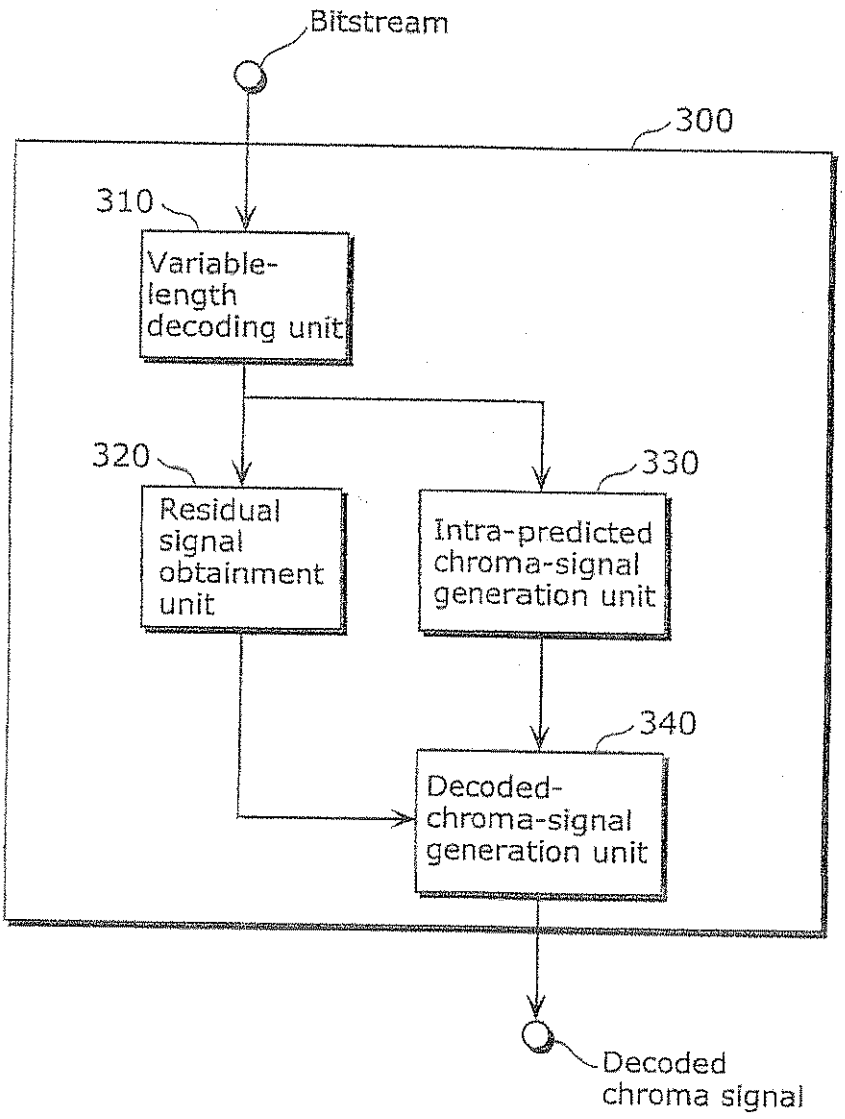

Bitstream
300
310
Variable-length decoding unit
320
Residual signal obtainment unit
330
Intra-predicted chroma-signal generation unit
340
Decoded-chroma-signal generation unit
Decoded chroma signal

FIG. 14

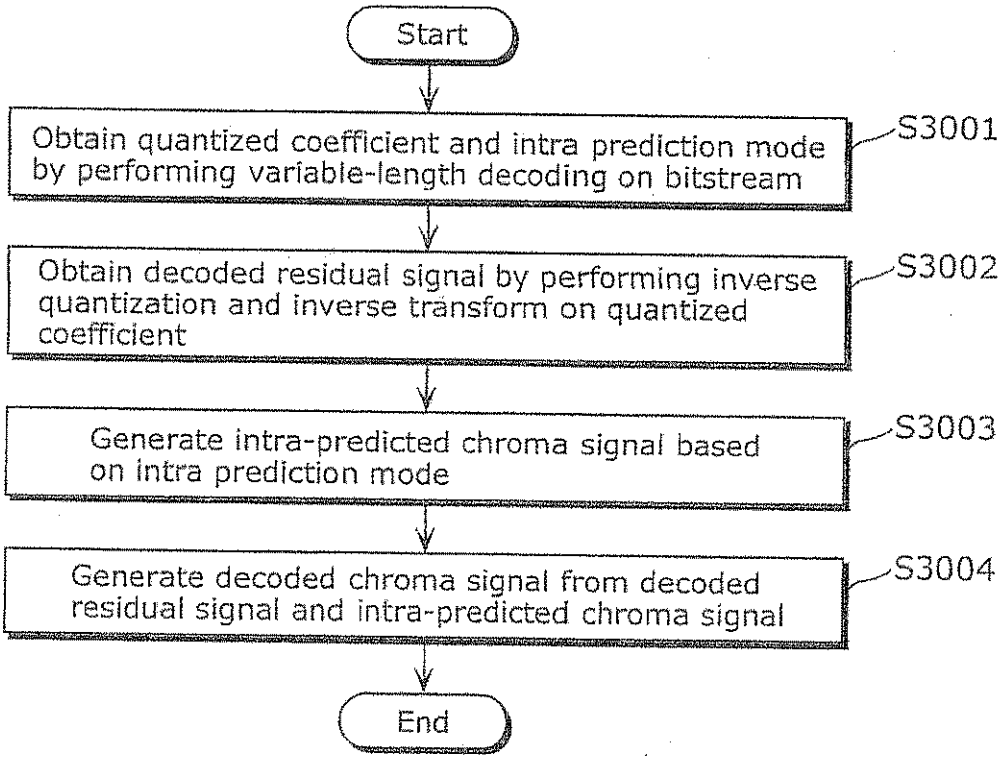

Start
Obtain quantized coefficient and intra prediction mode by performing variable-length decoding on bitstream
S3001
Obtain decoded residual signal by performing inverse quantization and inverse transform on quantized coefficient
S3002
Generate intra-predicted chroma signal based on intra prediction mode
S3003
Generate decoded chroma signal from decoded residual signal and intra-predicted chroma signal
S3004
End

FIG. 15

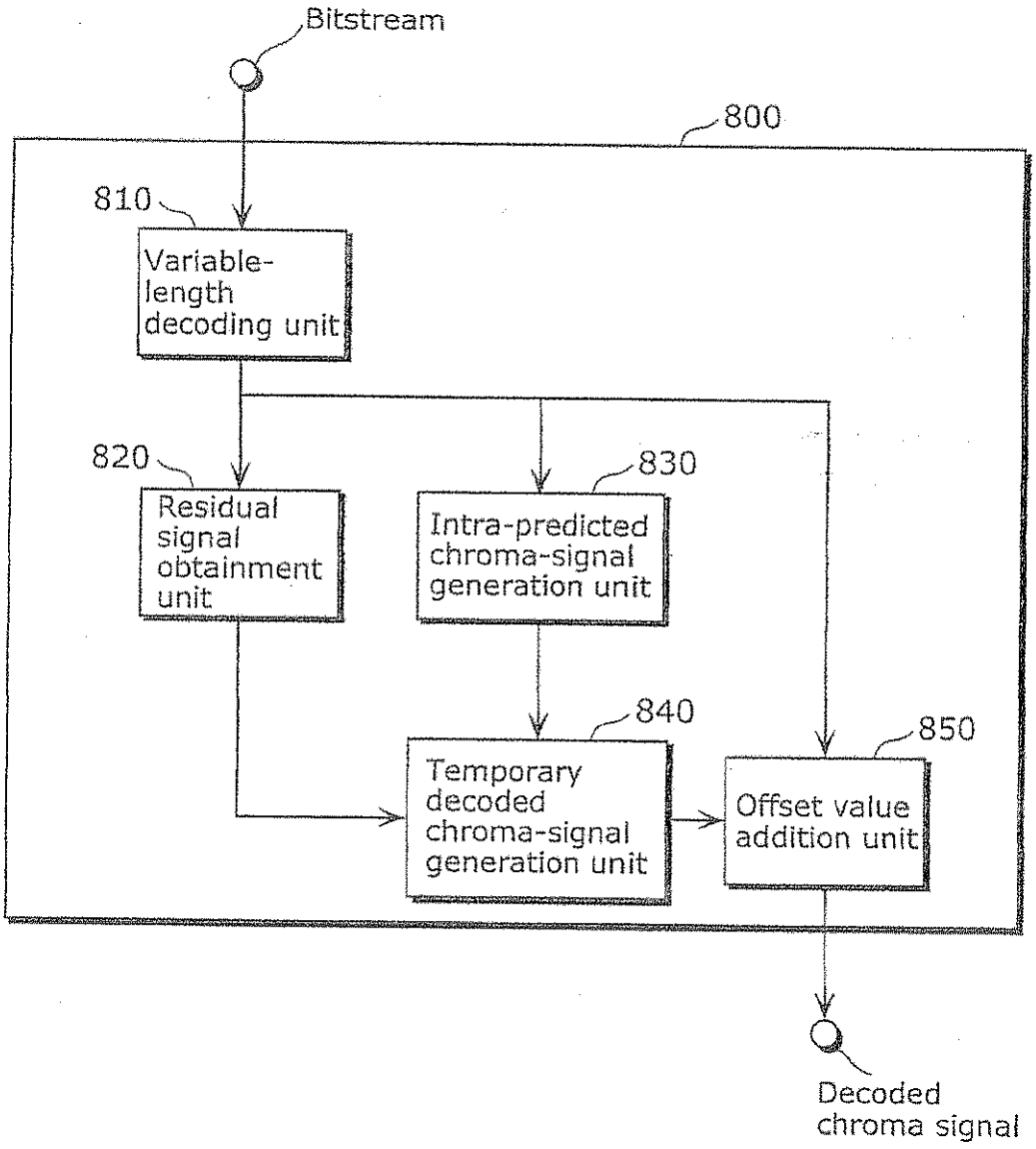

Bitstream
800
810
Variable-length decoding unit
820
Residual signal obtainment unit
830
Intra-predicted chroma-signal generation unit
840
Temporary decoded chroma-signal generation unit
850
Offset value addition unit
Decoded chroma signal

FIG. 16

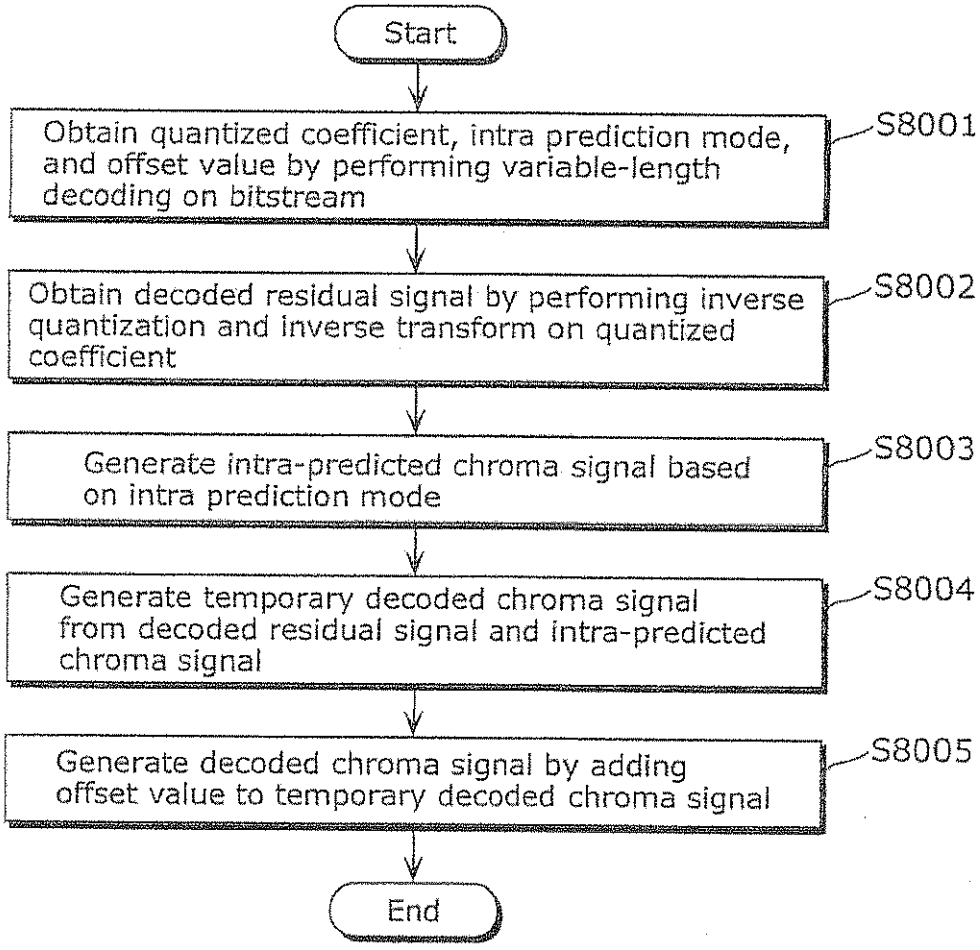

Start
Obtain quantized coefficient, intra prediction mode, and offset value by performing variable-length decoding on bitstream
S8001
Obtain decoded residual signal by performing inverse quantization and inverse transform on quantized coefficient
S8002
Generate intra-predicted chroma signal based on intra prediction mode
S8003
Generate temporary decoded chroma signal from decoded residual signal and intra-predicted chroma signal
S8004
Generate decoded chroma signal by adding offset value to temporary decoded chroma signal
S8005
End

FIG. 17

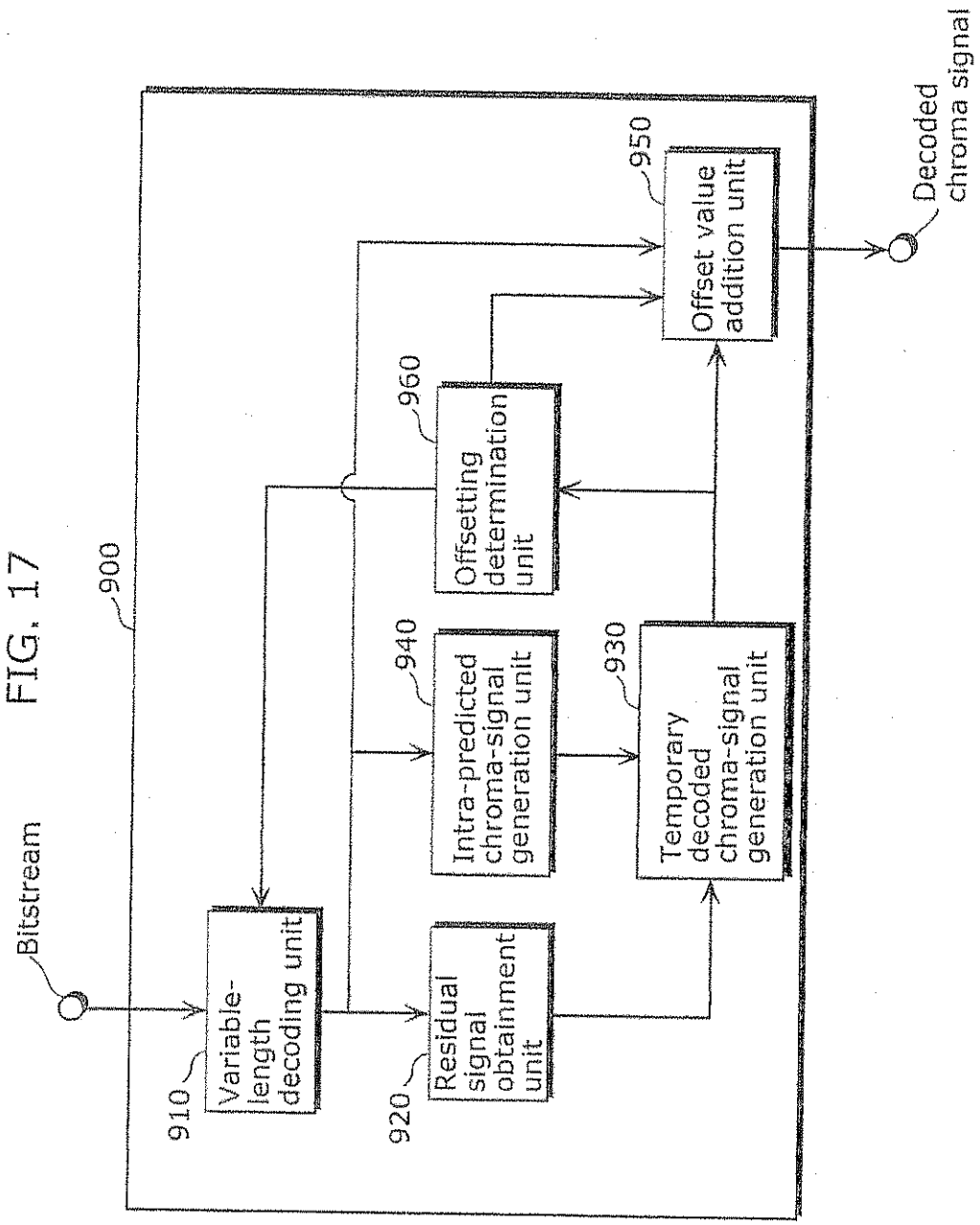

Bitstream
900
910
Variable-length decoding unit
920
Residual signal obtainment unit
930
Temporary decoded chroma-signal generation unit
940
Intra-predicted chroma-signal generation unit
960
Offsetting determination unit
950
Offset value addition unit
Decoded chroma signal

FIG. 18

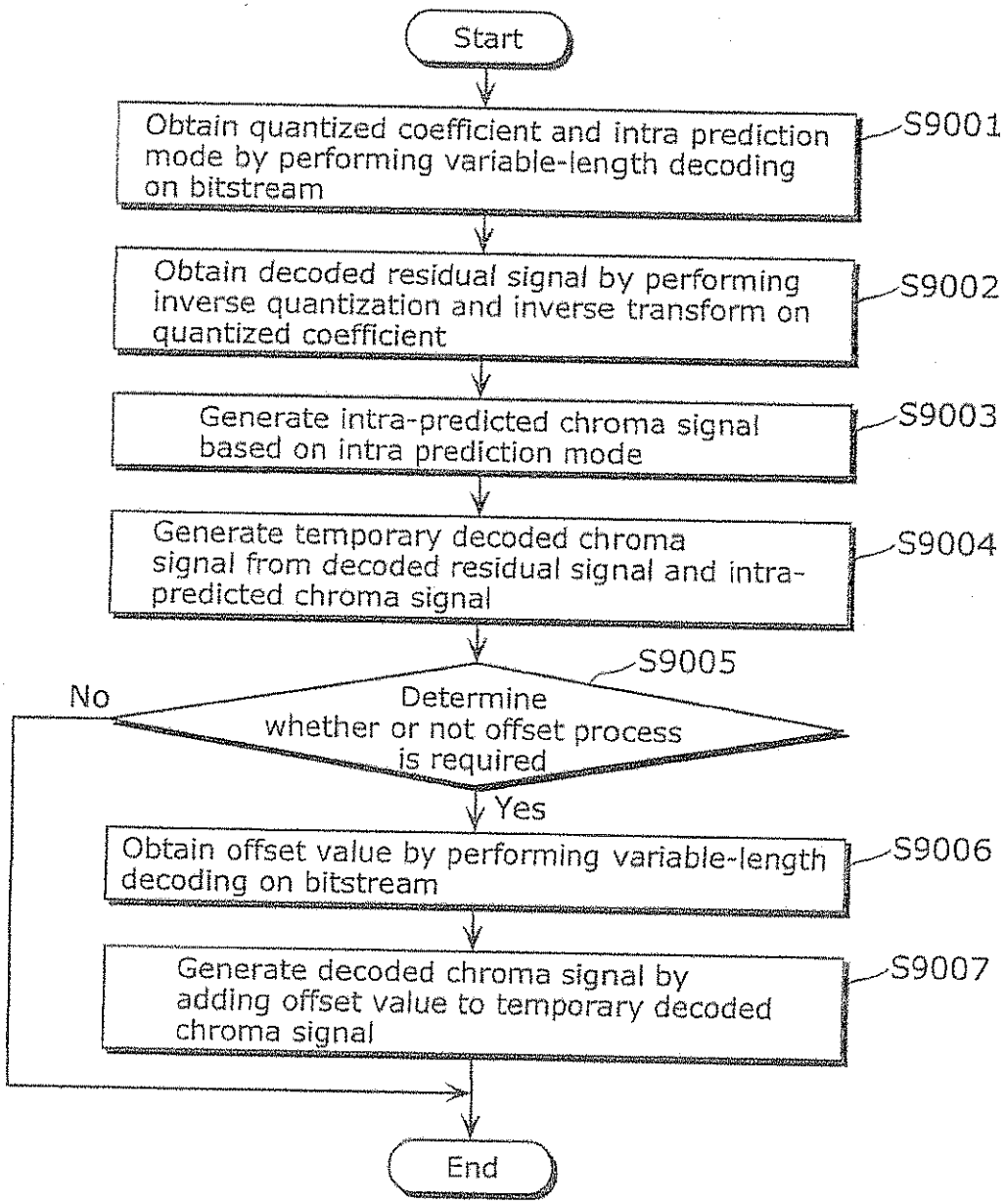

Start
Obtain quantized coefficient and intra prediction mode by performing variable-length decoding on bitstream
S9001
Obtain decoded residual signal by performing inverse quantization and inverse transform on quantized coefficient
S9002
Generate intra-predicted chroma signal based on intra prediction mode
S9003
Generate temporary decoded chroma signal from decoded residual signal and intra-predicted chroma signal
S9004
S9005
Determine whether or not offset process is required
No
Yes
Obtain offset value by performing variable-length decoding on bitstream
S9006
Generate decoded chroma signal by adding offset value to temporary decoded chroma signal
S9007
End

FIG. 19

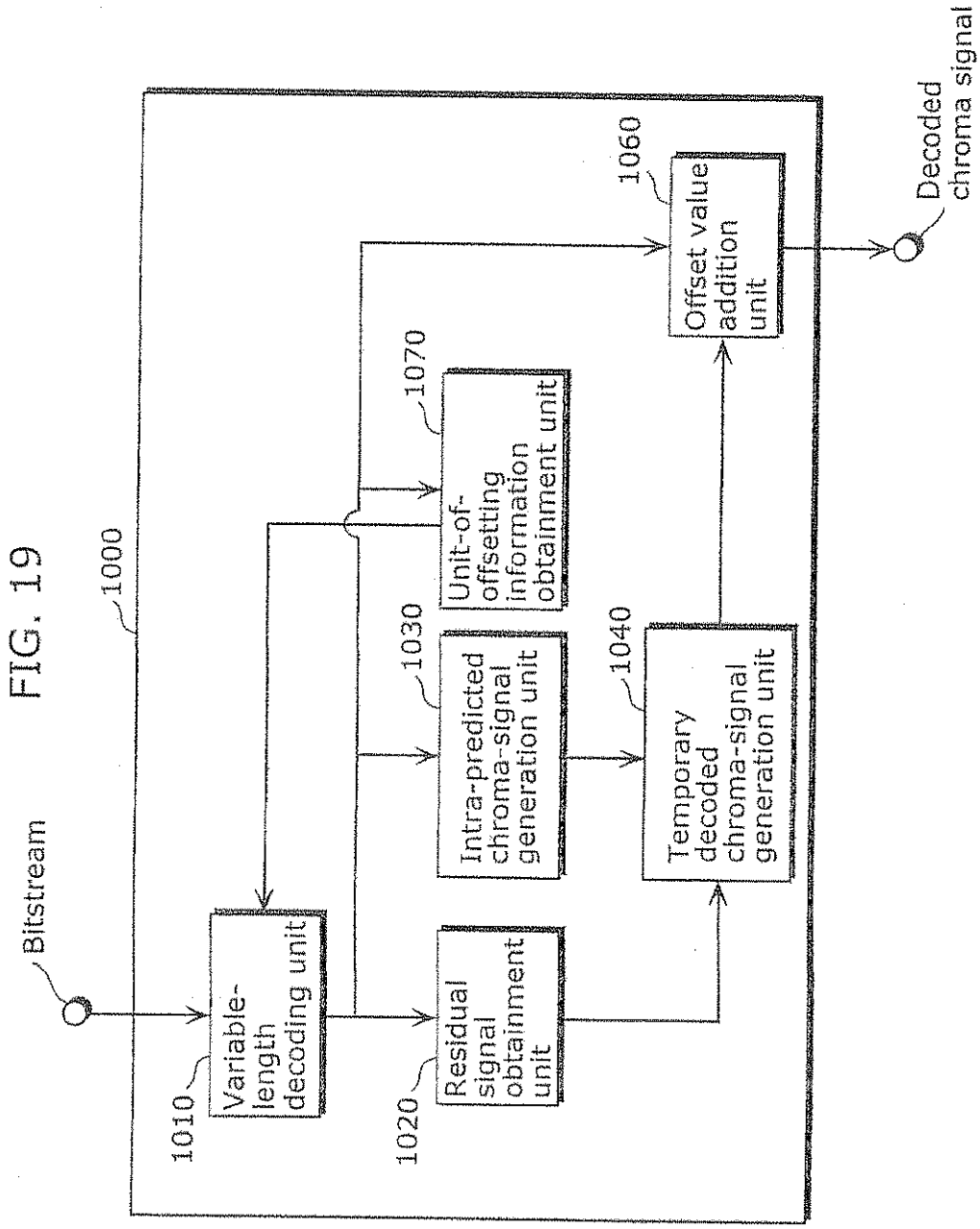

Bitstream
1000
1010
Variable-length decoding unit
1020
Residual signal obtainment unit
1030
Intra-predicted chroma-signal generation unit
1040
Temporary decoded chroma-signal generation unit
1060
Offset value addition unit
1070
Unit-of-offsetting information obtainment unit
Decoded chroma signal

FIG. 20

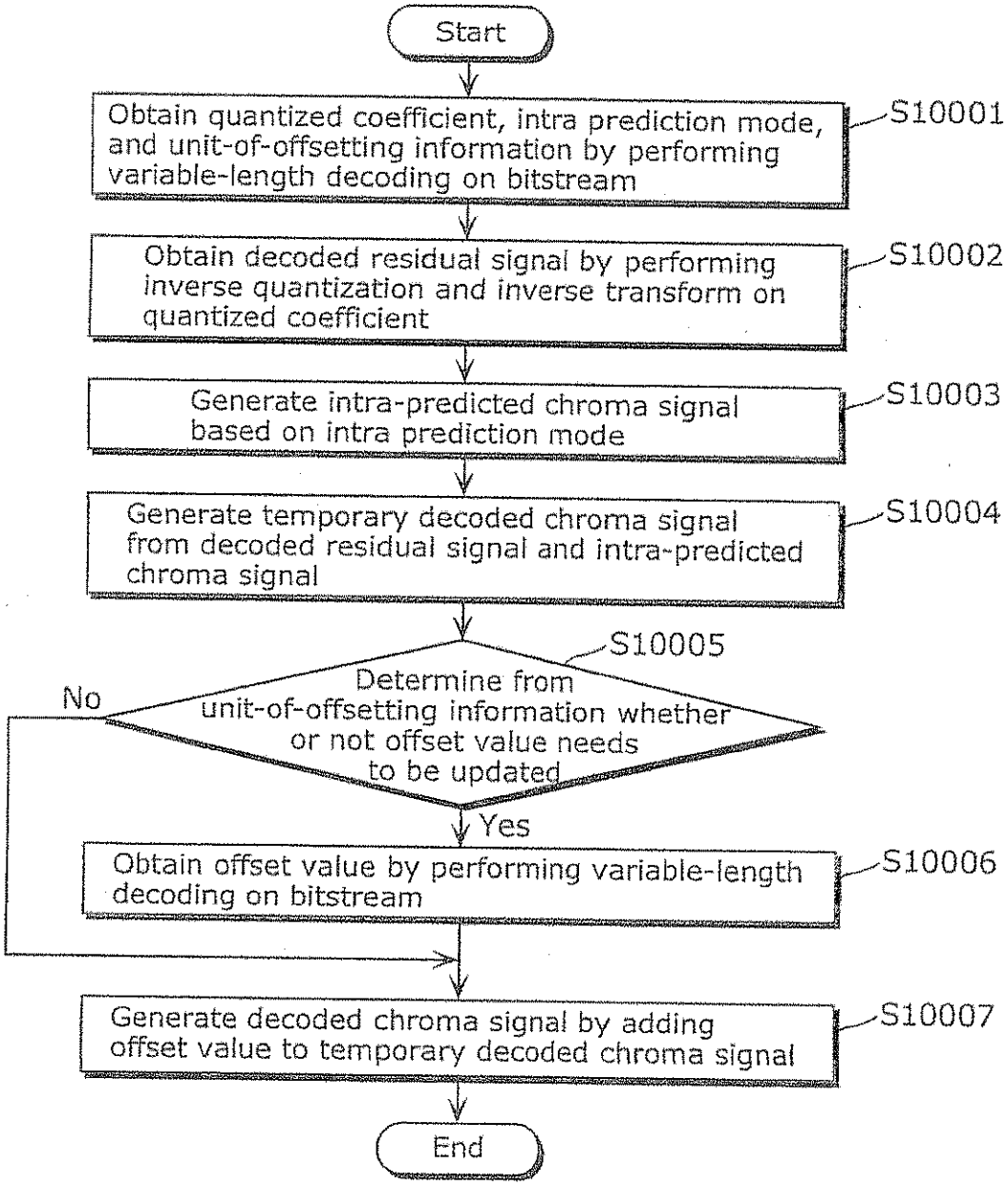

Start
Obtain quantized coefficient, intra prediction mode, and unit-of-offsetting information by performing variable-length decoding on bitstream
S10001
Obtain decoded residual signal by performing inverse quantization and inverse transform on quantized coefficient
S10002
Generate intra-predicted chroma signal based on intra prediction mode
S10003
Generate temporary decoded chroma signal from decoded residual signal and intra-predicted chroma signal
S10004
Determine from unit-of-offsetting information whether or not offset value needs to be updated
S10005
No
Yes
Obtain offset value by performing variable-length decoding on bitstream
S10006
Generate decoded chroma signal by adding offset value to temporary decoded chroma signal
S10007
End

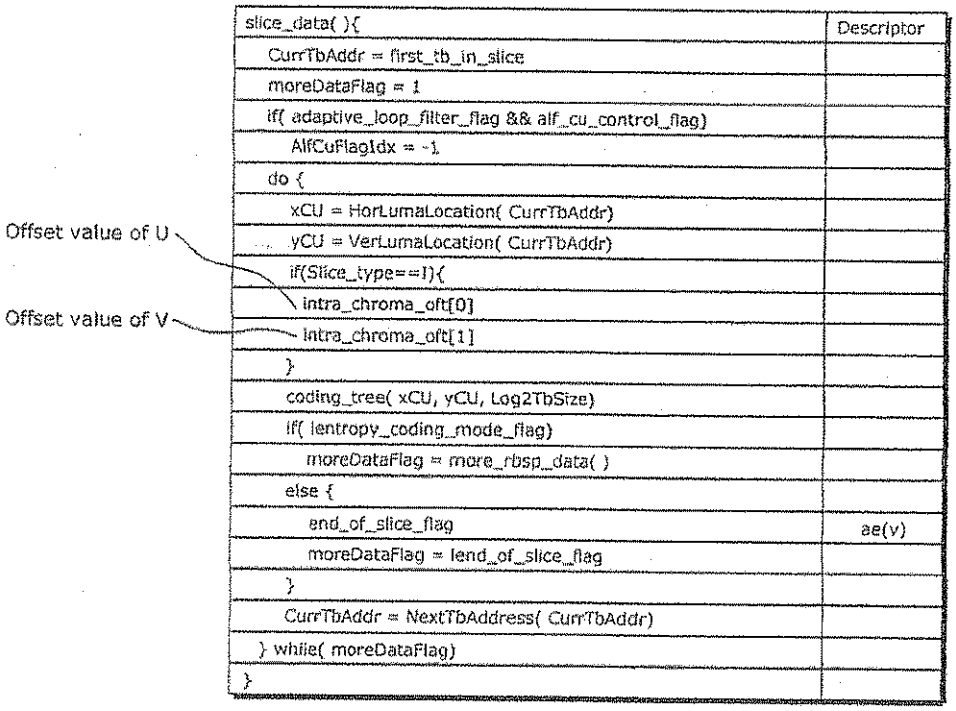
FIG. 21

Offset value of U

Offset value of V

| prediction_unit( x0,y0, log2PUWidth, log2PUHeight, PartIdx , InferredMergeFlag ) { | Descriptor |
|---|---|
| if( skip_flag[x0][y0]){ | |
| if( NumMergeCand > 1) | |
| merge_idx[x0][y0] | ue(v)\| ae(v) |
| } else if( PreMode == MODE_INTRA){ | |
| prev_intra_luma_pred_flag[x0][y0] | u(1)\| ae(v) |
| if( prev_intra_luma_pred_flag[x0][y0]) | |
| if( NumMPMCand > 1) | |
| mpm_idx[x0][y0] | u(1)\| ae(v) |
| else | |
| rem_intra_luma_pred_mode[x0][y0] | ce(v)\| ae(v) |
| intra_chroma_pred_mode[x0][y0] | ue(v)\| ae(v) |
| intra_chroma_oft[0] | |
| intra_chroma_oft[1] | |
| } else {/* MODE_INTER */ | |
| if(!InferreMergeFlag) | |
| if(entropy_coding_mode_flag \|\| PartMode !=PART_2Nx2N) | |
| merge_flag[x0][y0] | u(1)\| ae(v) |
| if(merge_flag[x0][y0] && NumMergeCand > 1){ | |
| merge_idx[x0][y0] | ue(v)\| ae(v) |
| } else { | |
| if( slice_type == B) | |
| inter_pred_flag[x0][y0] | ue(v)\| ae(v) |
| if( inter_pred_flag[x0][y0] == Pred_LC){ | |
| if( num_ref_idx_lc_active_minust > 0) | |
| ref_idx_lc[x0][y0] | ue(v)\| ae(v) |
| mvd_lc[x0][y0][0] | se(v)\| ae(v) |
| mvd_lc[x0][y0][1] | se(v)\| ae(v) |
| if( NumMVPCand(LcToLx) > 1) | |
| mvp_idx_lc[x0][y0] | ue(v)\| ae(v) |
| } | |
| else { /* Prsd_L0 or Pred_BI */ | |
| if( num_ref_idx_l0_active_minus 1 > 0) | |
| ref_idx_l0[x0][y0] | ue(v)\| ae(v) |
| mvd_l0[x0][y0][0] | se(v)\| ae(v) |
| mvd_l0[x0][y0][1] | se(v)\| ae(v) |
| if( NumMVPCand(L0) > 1) | |
| mvp_idx_l0[x0][y0] | ue(v)\| ae(v) |
| } | |
| if(inter_pred_flag[x0][y0] == Pred_BI){ | |
| if(num_ref_idx_l1_active_minus 1 > 0) | |
| ref_idx_l1[x0][y0] | ue(v)\| ae(v) |
| mvd_l1[x0][y0][0] | se(v)\| ae(v) |
| mvd_l1[x0][y0][1] | se(v)\| ae(v) |
| if( NumMVPCand(L1) > 1) | |
| mvp_idx_l1[x0][y0] | ue(v)\| ae(v) |
| } | |
| } | |
| } | |
| } | |

FIG. 22




| slice_data( ){ | Descriptor |
|---|---|
| CurrTbAddr = first_tb_in_slice | |
| moreDataFlag = 1 | |
| if( adaptive_loop_filter_flag && alf_cu_control_flag) | |
| AlfCuFlagIdx = -1 | |
| do { | |
| xCU = HorLumaLocation( CurrTbAddr) | |
| yCU = VerLumaLocation( CurrTbAddr) | |
| if(Slice_type==I){ | |
| intra_chroma_oft[0] | |
| Intra_chroma_oft[1] | |
| } | |
| coding_tree( xCU, yCU, Log2TbSize) | |
| if( !entropy_coding_mode_flag) | |
| moreDataFlag = more_rbsp_data( ) | |
| else { | |
| end_of_slice_flag | ae(v) |
| moreDataFlag = !end_of_slice_flag | |
| } | |
| CurrTbAddr = NextTbAddress( CurrTbAddr) | |
| } while( moreDataFlag) | |
| } | |

FIG. 23

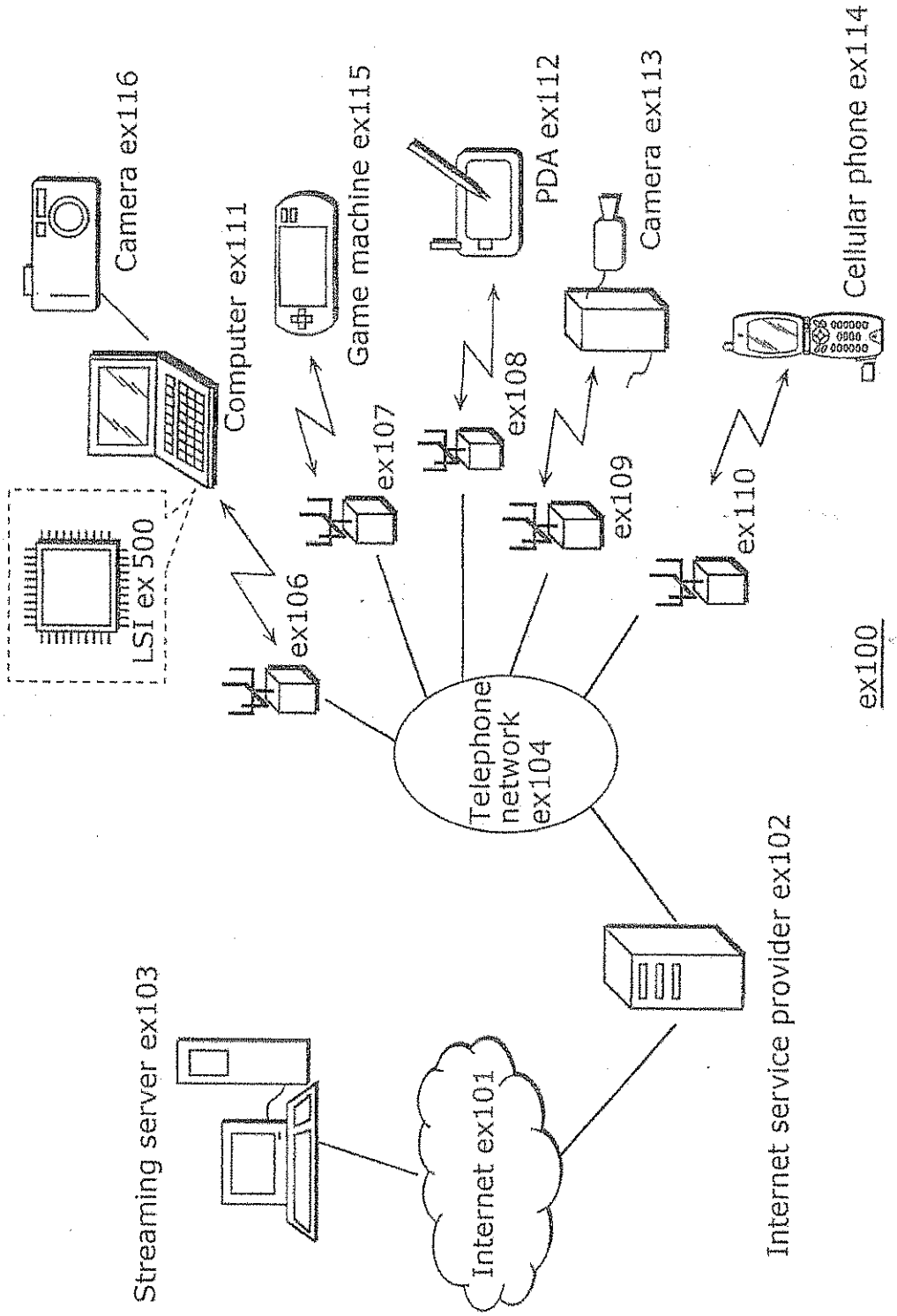

Camera ex116
Computer ex111
LSI ex500
Game machine ex115
ex107
ex106
ex108
PDA ex112
Camera ex113
ex109
ex110
Cellular phone ex114
Telephone network ex104
Streaming server ex103
Internet ex101
Internet service provider ex102
ex100

FIG. 24

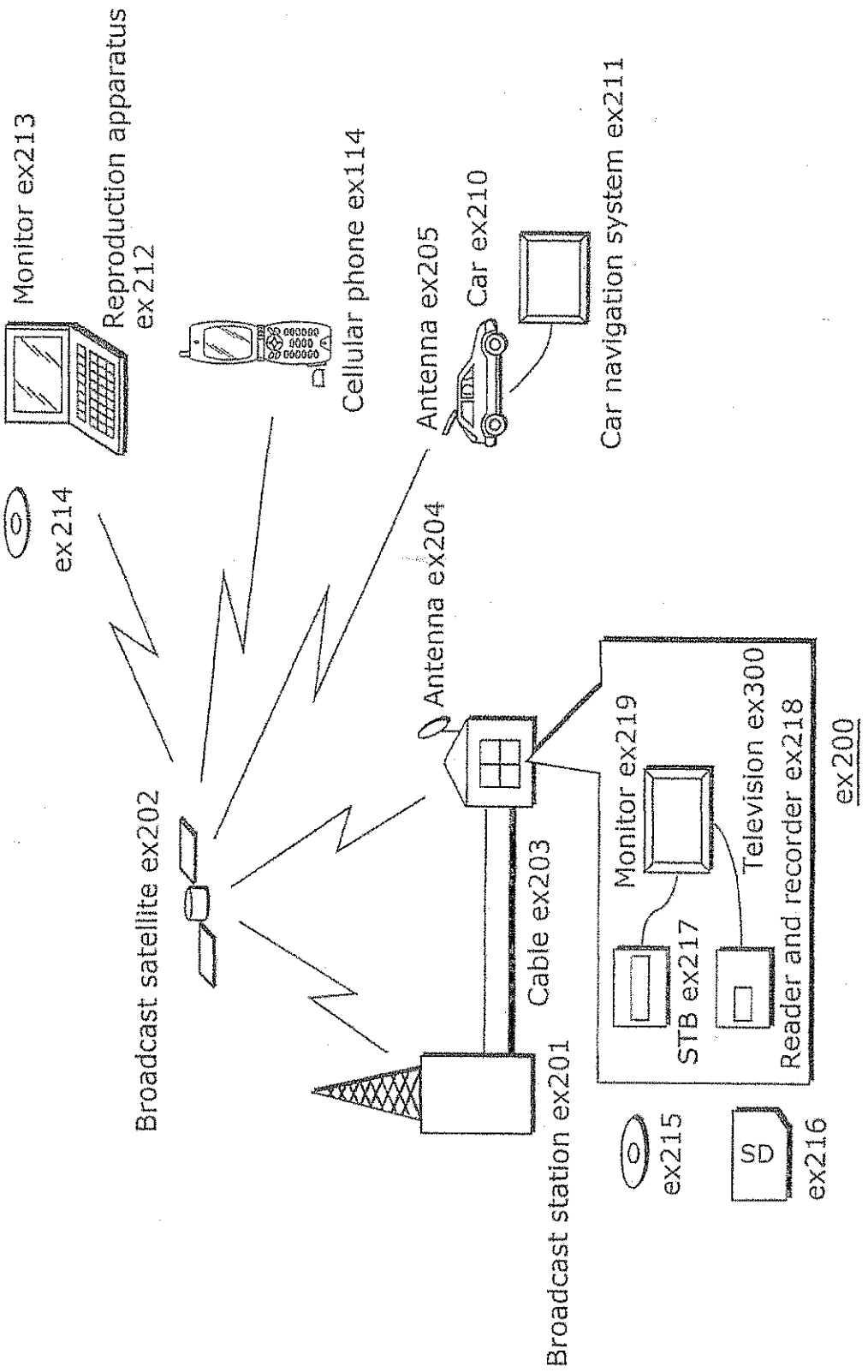

Monitor ex213
Reproduction apparatus ex212
ex214
Cellular phone ex114
Antenna ex205
Car ex210
Car navigation system ex211
Antenna ex204
Broadcast satellite ex202
Cable ex203
Monitor ex219
Television ex300
STB ex217
Reader and recorder ex218
ex200
Broadcast station ex201
ex215
SD
ex216

FIG. 25

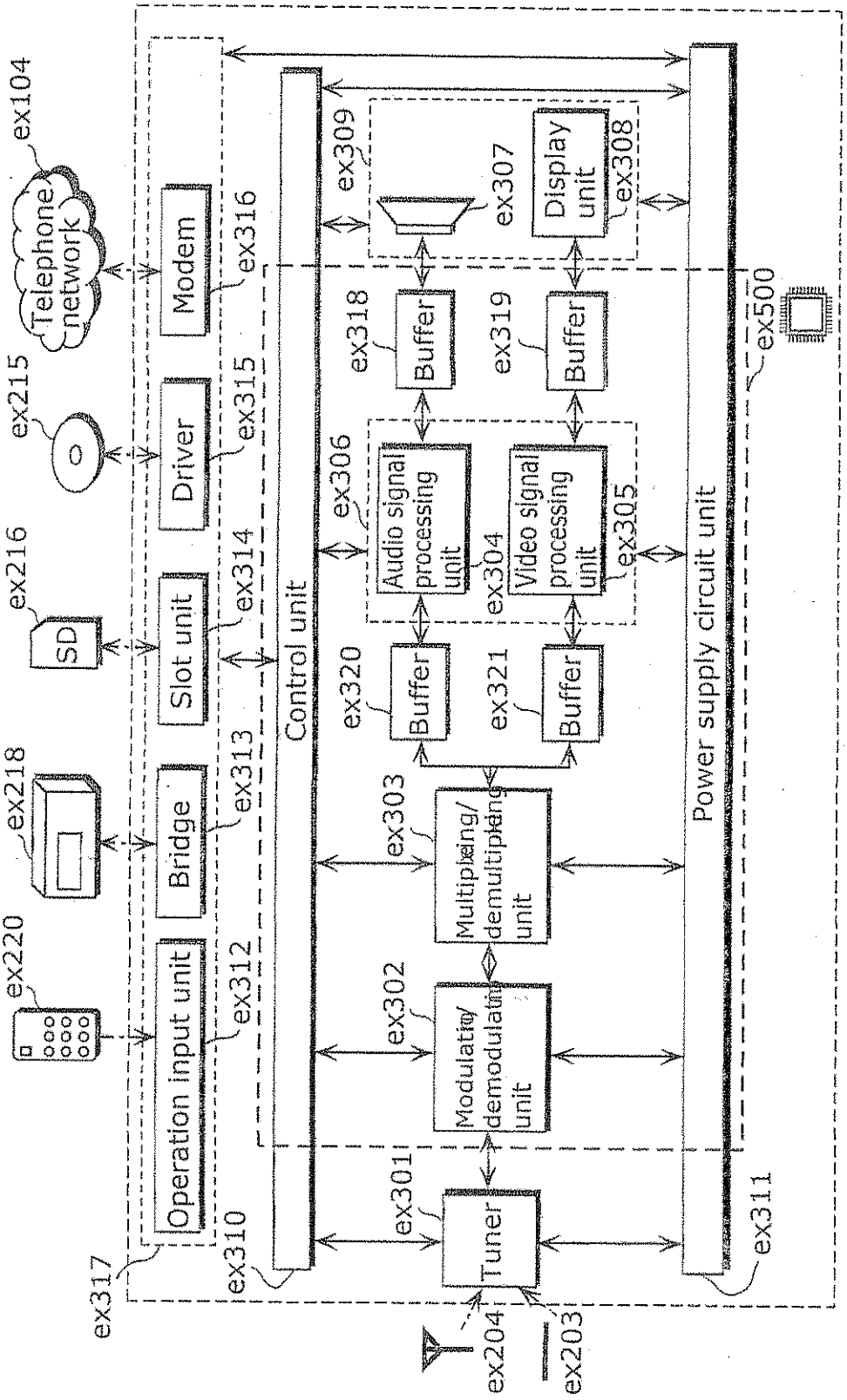

ex104
Telephone network
ex215
ex216
SD
ex218
ex220
ex317
Operation input unit
ex312
Bridge
ex313
Slot unit
ex314
Driver
ex315
Modem
ex316
ex310
Control unit
ex309
ex307
Display unit
ex308
ex318
Buffer
ex319
Buffer
ex306
Audio signal processing unit
ex304
Video signal processing unit
ex305
ex320
Buffer
ex321
Buffer
ex303
Multiplexing/ demultiplexing unit
ex302
Modulation/ demodulation unit
ex301
Tuner
ex204
ex203
Power supply circuit unit
ex311
ex500
ex300

FIG. 26

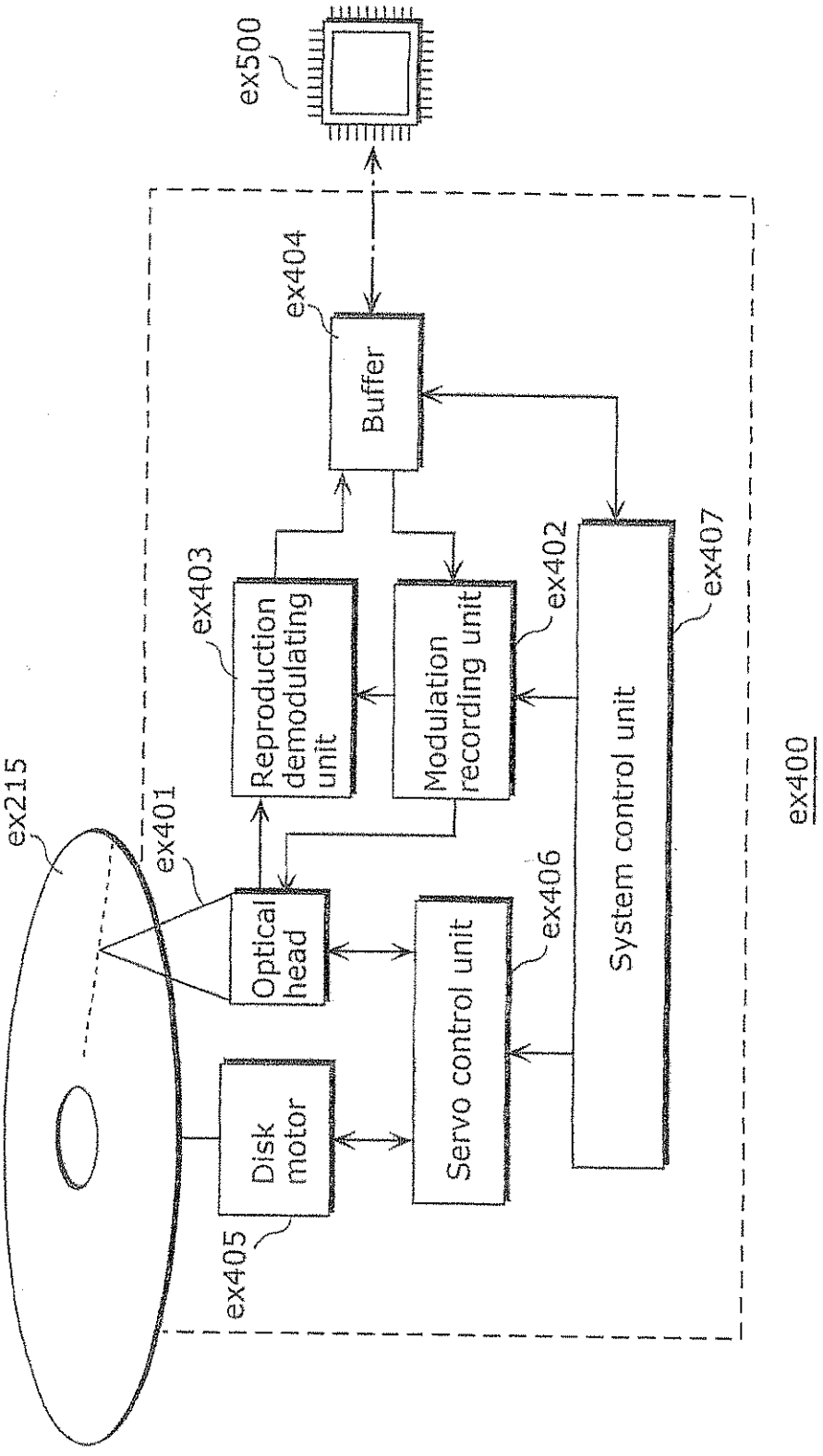

ex500
ex404
Buffer
ex403
Reproduction demodulating unit
ex402
Modulation recording unit
ex407
System control unit
ex400
ex215
ex401
Optical head
ex406
Servo control unit
Disk motor
ex405

FIG. 27

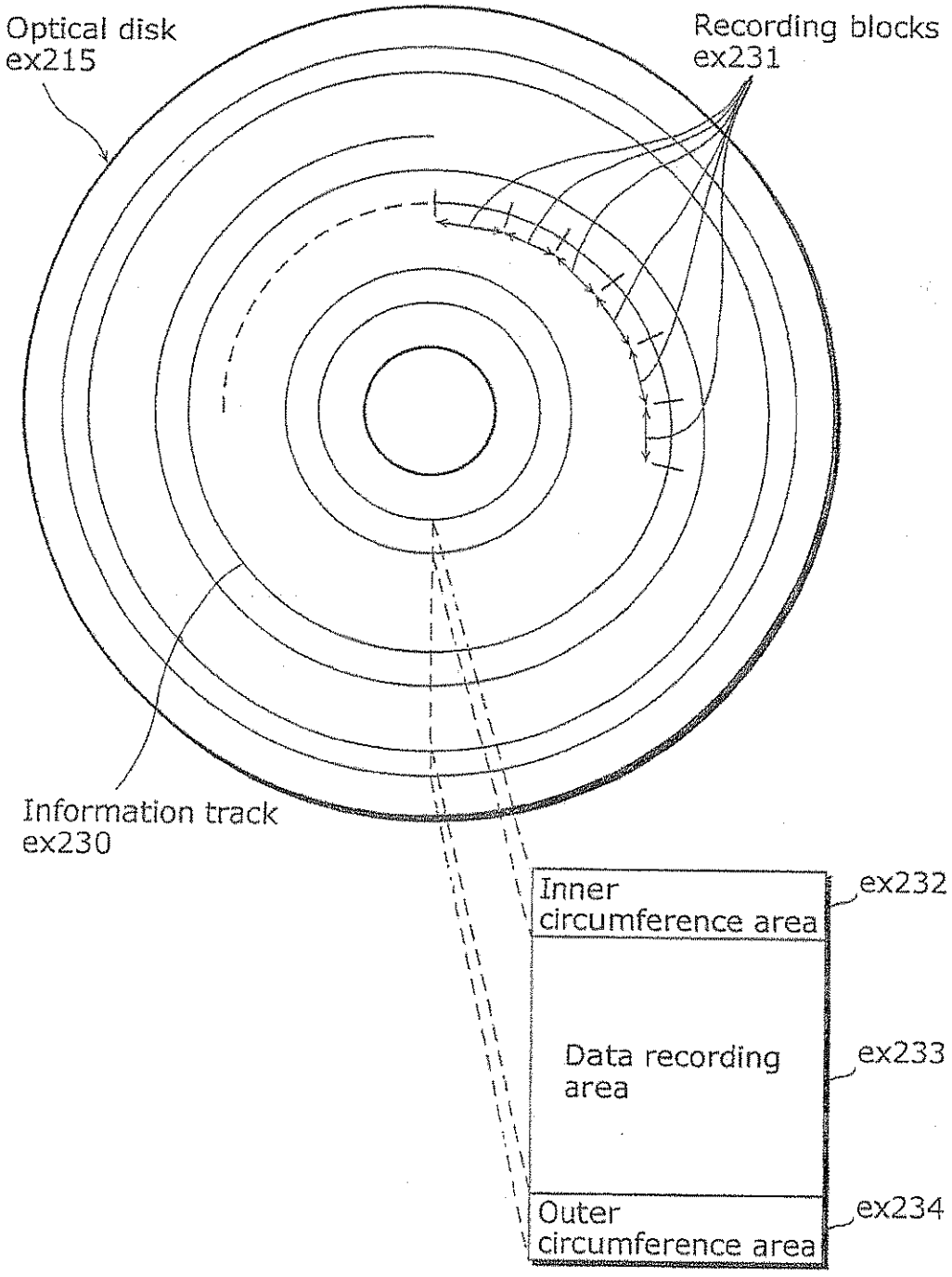

Optical disk
ex215
Recording blocks
ex231
Information track
ex230
Inner
circumference area
ex232
Data recording
area
ex233
Outer
circumference area
ex234

FIG. 28A

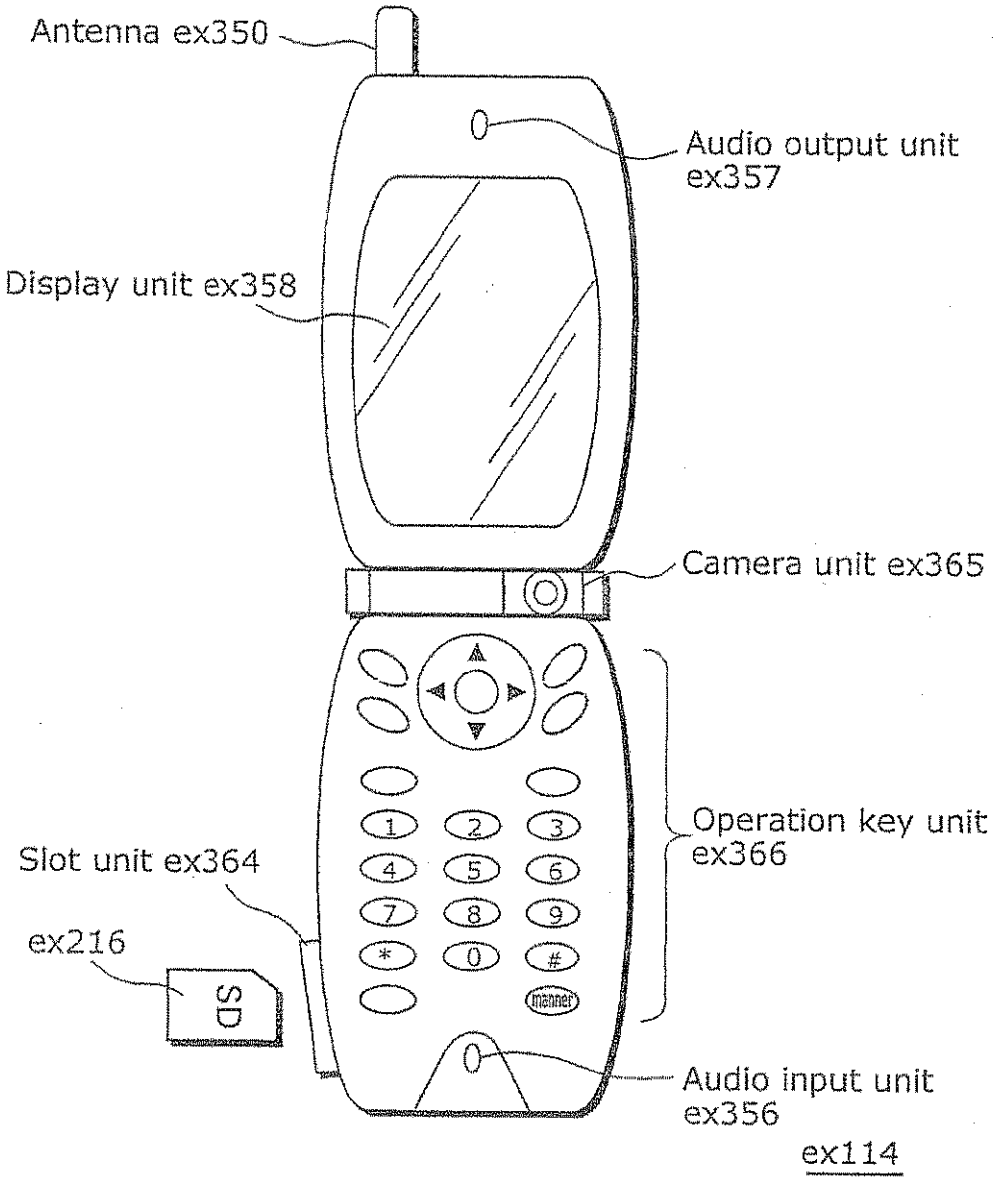

Antenna ex350
Audio output unit ex357
Display unit ex358
Camera unit ex365
Operation key unit ex366
Slot unit ex364
ex216
SD
Audio input unit ex356
ex114

FIG. 28B

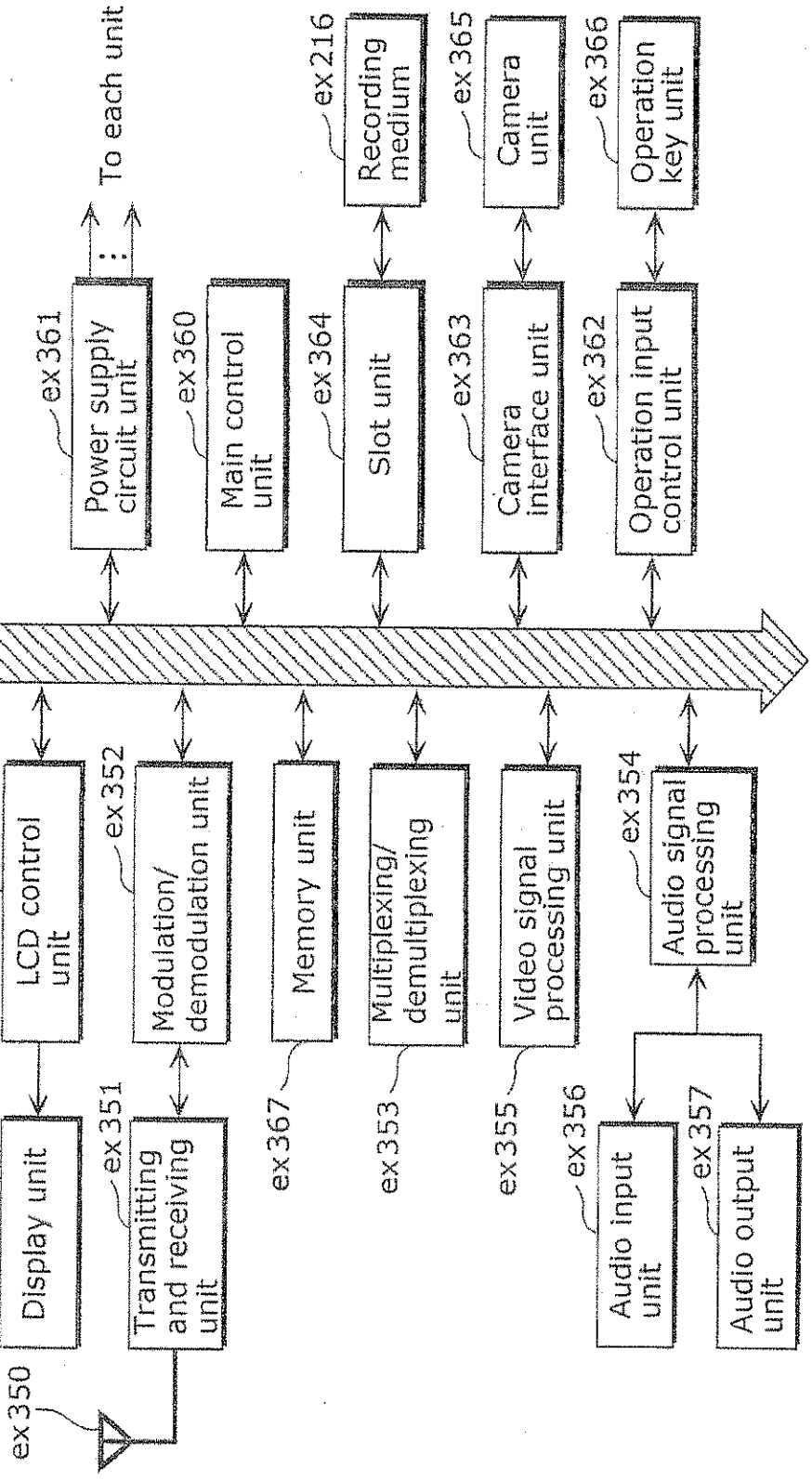

ex370
ex361
Power supply circuit unit
To each unit
ex360
Main control unit
ex364
Slot unit
ex216
Recording medium
ex363
Camera interface unit
ex365
Camera unit
ex362
Operation input control unit
ex366
Operation key unit
ex359
LCD control unit
ex352
Modulation/ demodulation unit
Memory unit
ex367
Multiplexing/ demultiplexing unit
ex353
Video signal processing unit
ex355
ex354
Audio signal processing unit
ex358
Display unit
ex351
Transmitting and receiving unit
ex350
ex356
Audio input unit
ex357
Audio output unit

FIG. 29

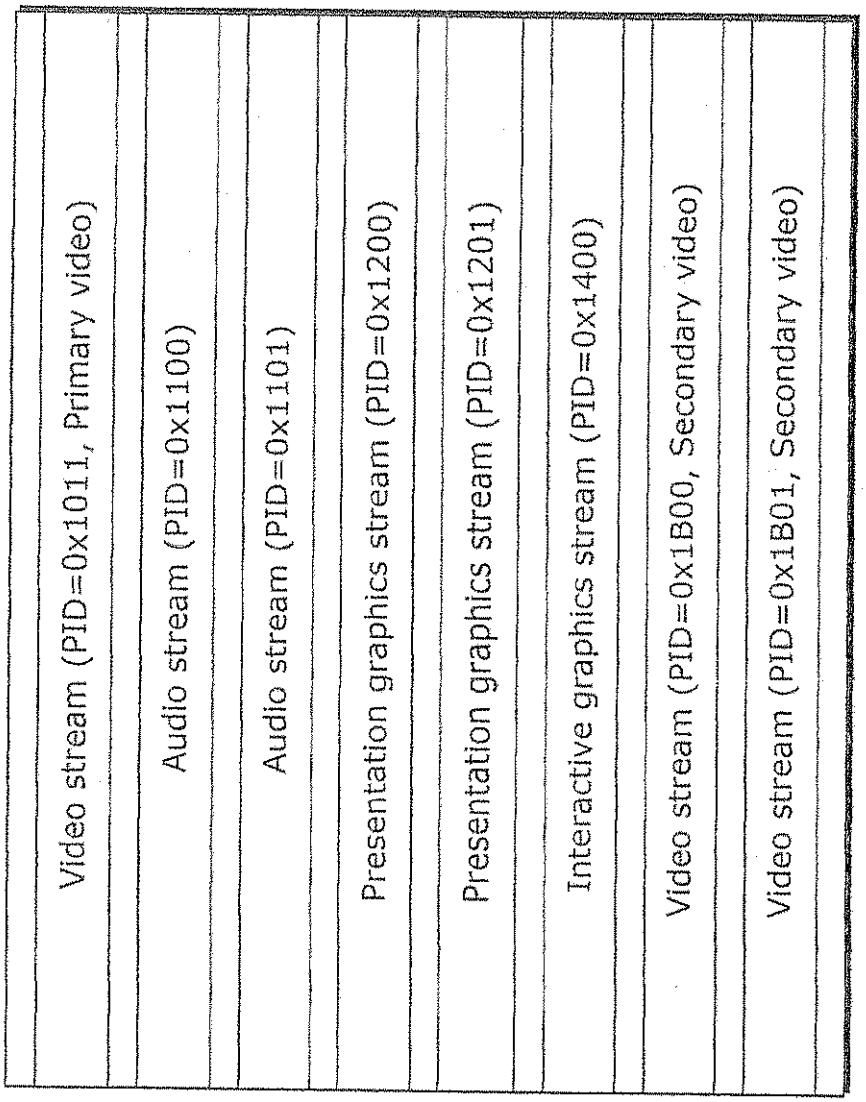

Video stream (PID=0x1011, Primary video)
Audio stream (PID=0x1100)
Audio stream (PID=0x1101)
Presentation graphics stream (PID=0x1200)
Presentation graphics stream (PID=0x1201)
Interactive graphics stream (PID=0x1400)
Video stream (PID=0x1B00, Secondary video)
Video stream (PID=0x1B01, Secondary video)

FIG. 30

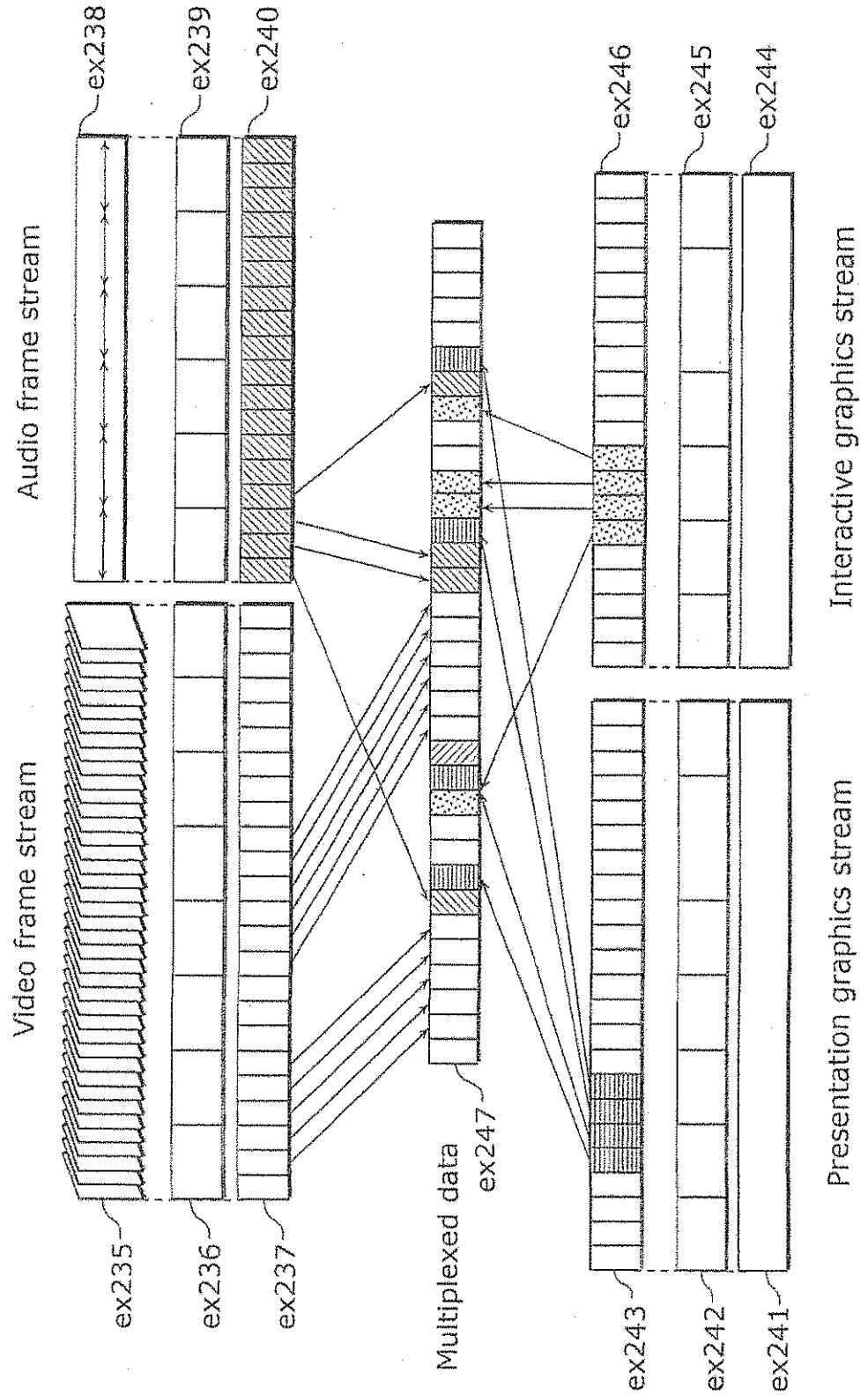

Video frame stream
Audio frame stream
Multiplexed data
Presentation graphics stream
Interactive graphics stream
ex235
ex236
ex237
ex238
ex239
ex240
ex241
ex242
ex243
ex244
ex245
ex246
ex247

FIG. 31

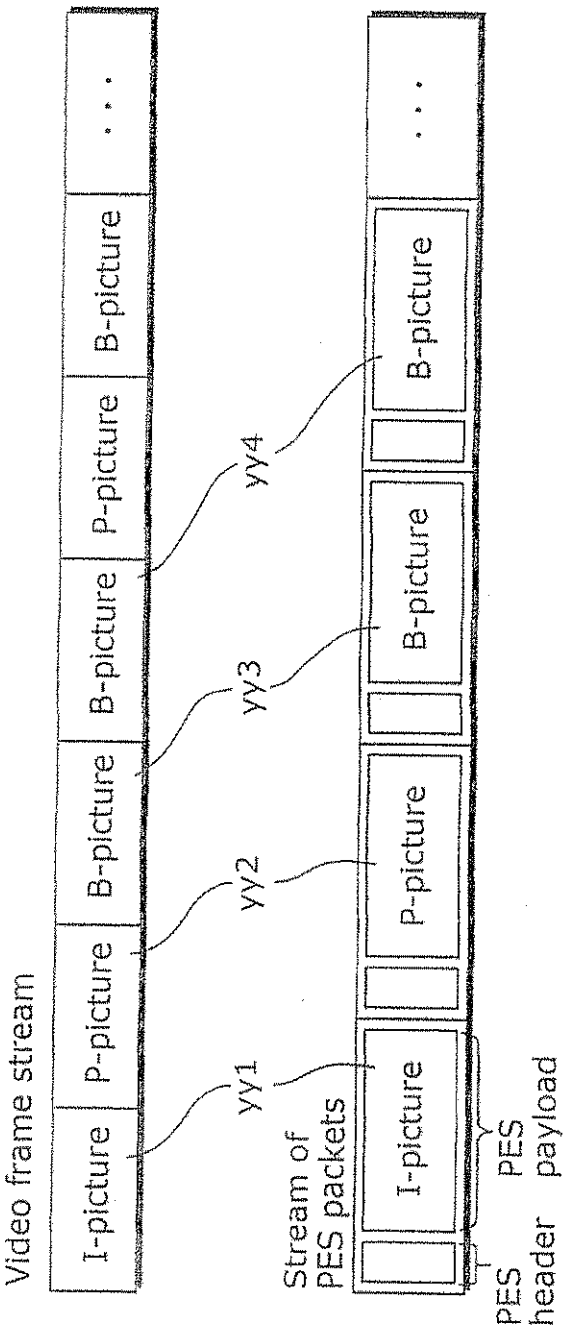
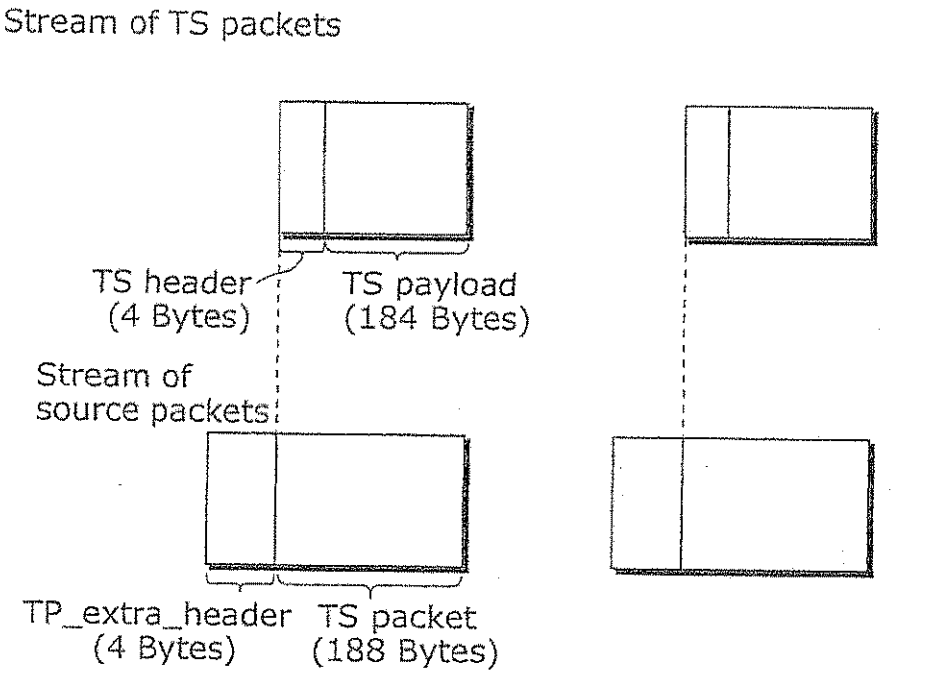

Video frame stream
I-picture
P-picture
B-picture
B-picture
P-picture
B-picture
. . .
yy1
yy2
yy3
yy4
Stream of PES packets
I-picture
P-picture
B-picture
B-picture
. . .
PES header
PES payload

FIG. 32


Stream of TS packets
TS header
(4 Bytes)
TS payload
(184 Bytes)
Stream of
source packets
TP_extra_header
(4 Bytes)
TS packet
(188 Bytes)

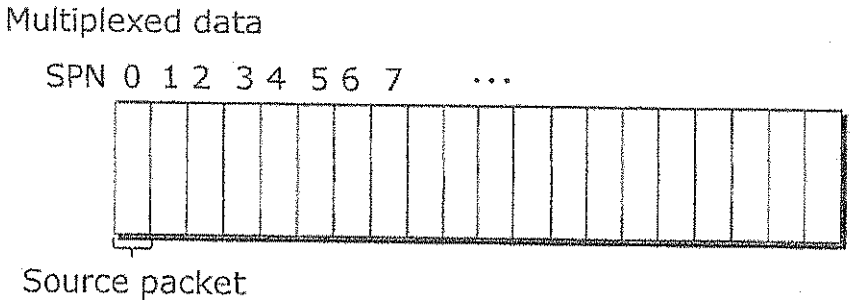

Multiplexed data
SPN 0 1 2 3 4 5 6 7 ...
Source packet

FIG. 33

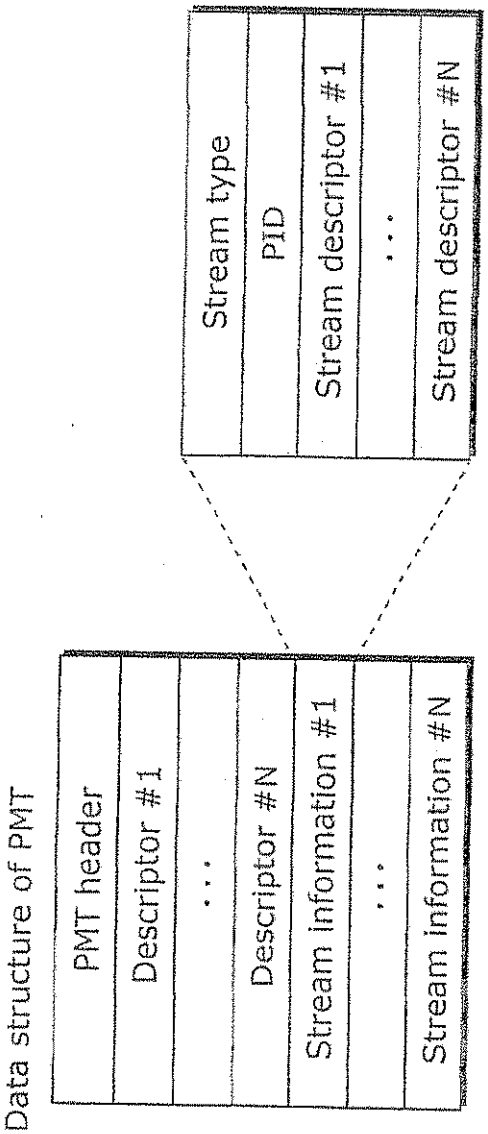

Data structure of PMT
PMT header
Descriptor #1
...
Descriptor #N
Stream information #1
...
Stream information #N
Stream type
PID
Stream descriptor #1
...
Stream descriptor #N

FIG. 34

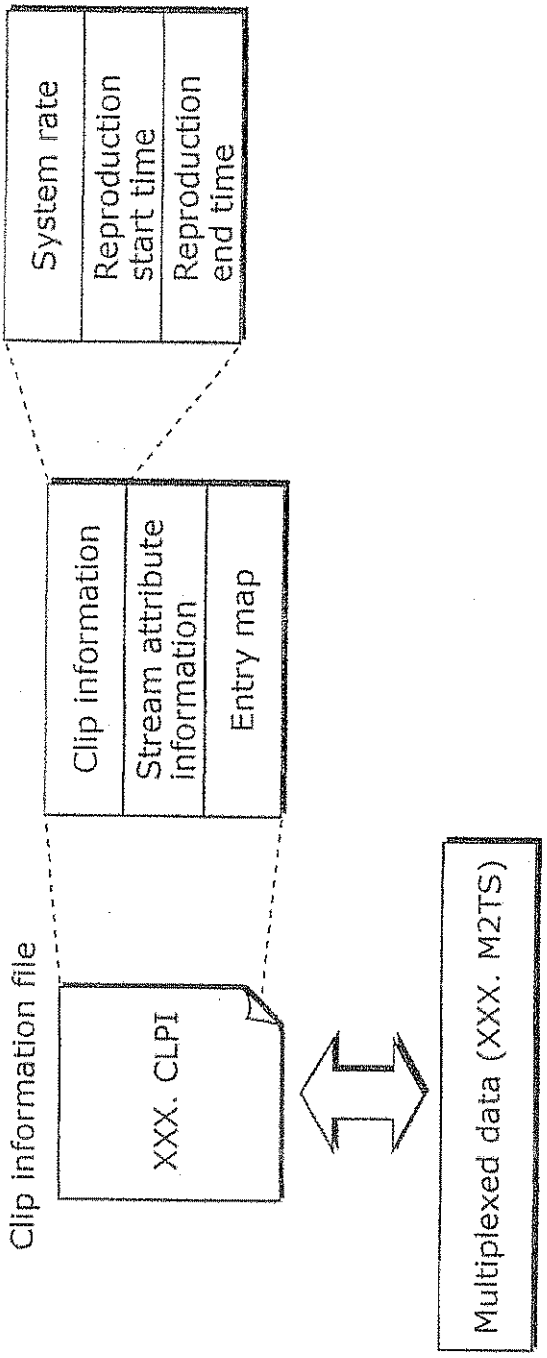

Clip information file
XXX. CLPI
Clip information
Stream attribute information
Entry map
System rate
Reproduction start time
Reproduction end time
Multiplexed data (XXX. M2TS)

FIG. 35

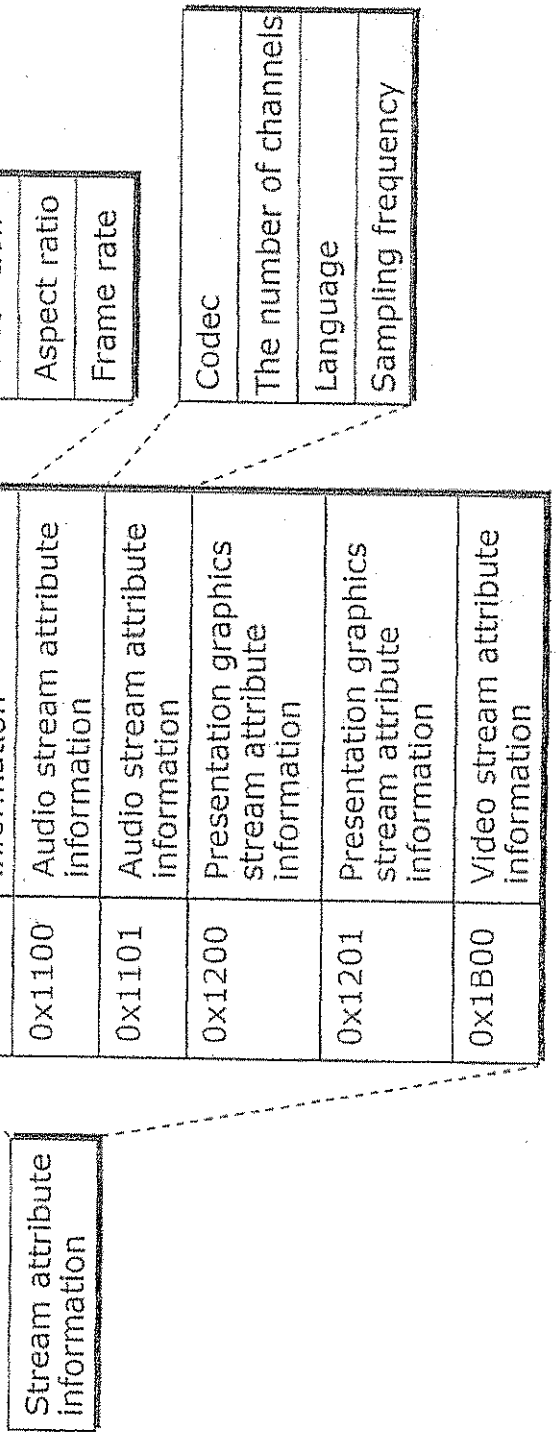

Stream attribute information
PID
Stream attribute information
0x1011
Video stream attribute information
0x1100
Audio stream attribute information
0x1101
Audio stream attribute information
0x1200
Presentation graphics stream attribute information
0x1201
Presentation graphics stream attribute information
0x1B00
Video stream attribute information
Codec
Resolution
Aspect ratio
Frame rate
Codec
The number of channels
Language
Sampling frequency

FIG. 36

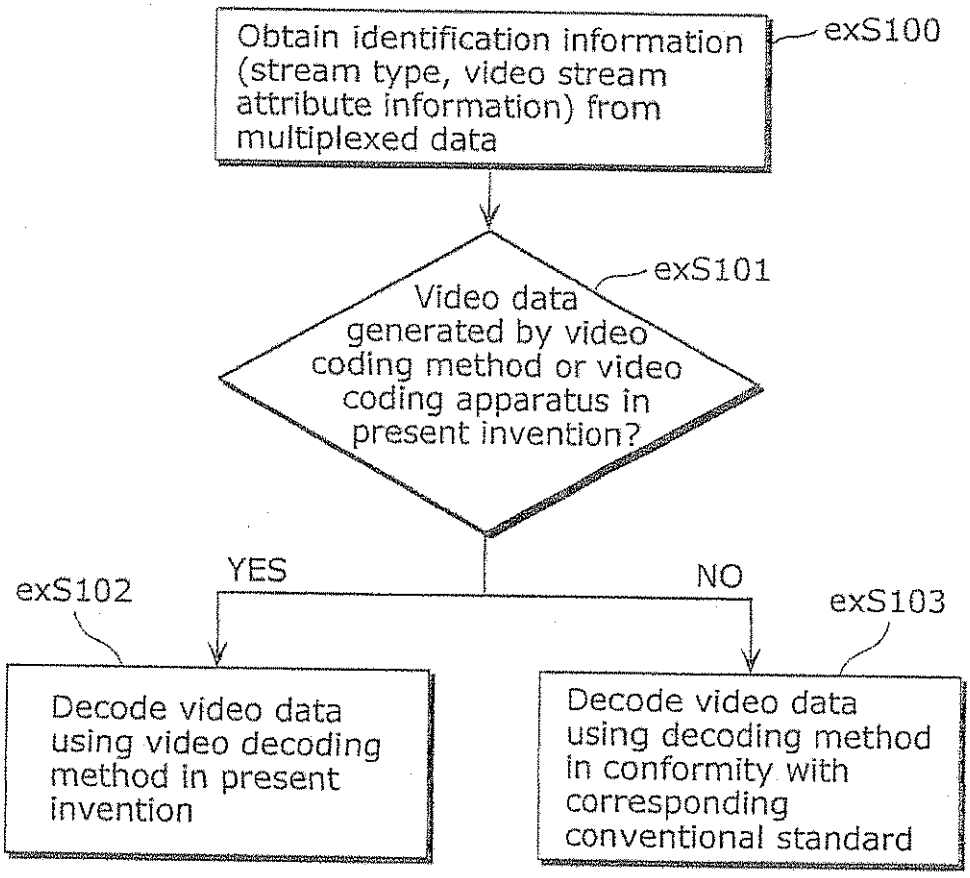

Obtain identification information (stream type, video stream attribute information) from multiplexed data
exS100
Video data generated by video coding method or video coding apparatus in present invention?
exS101
YES
NO
exS102
exS103
Decode video data using video decoding method in present invention
Decode video data using decoding method in conformity with corresponding conventional standard

FIG. 37

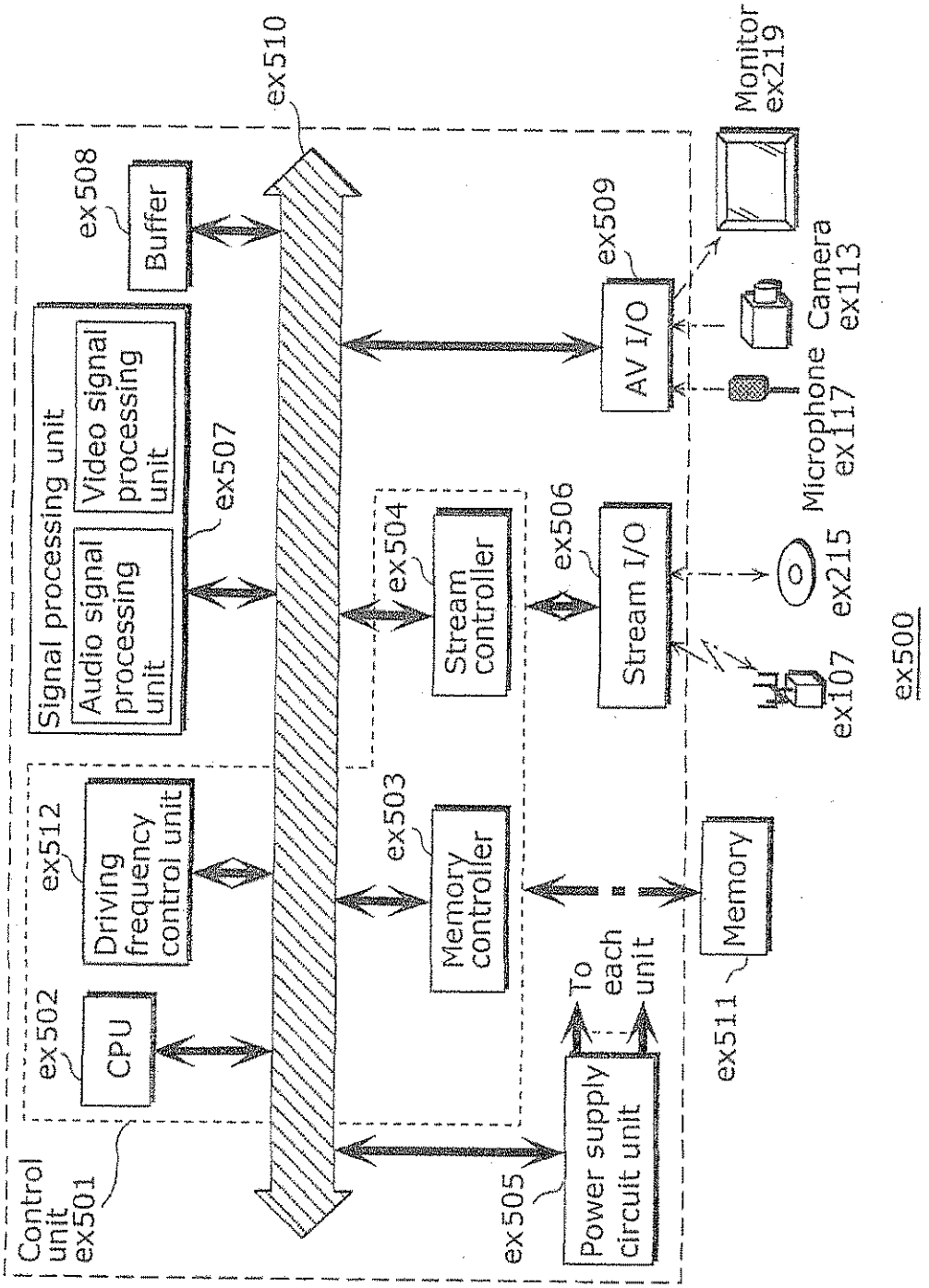
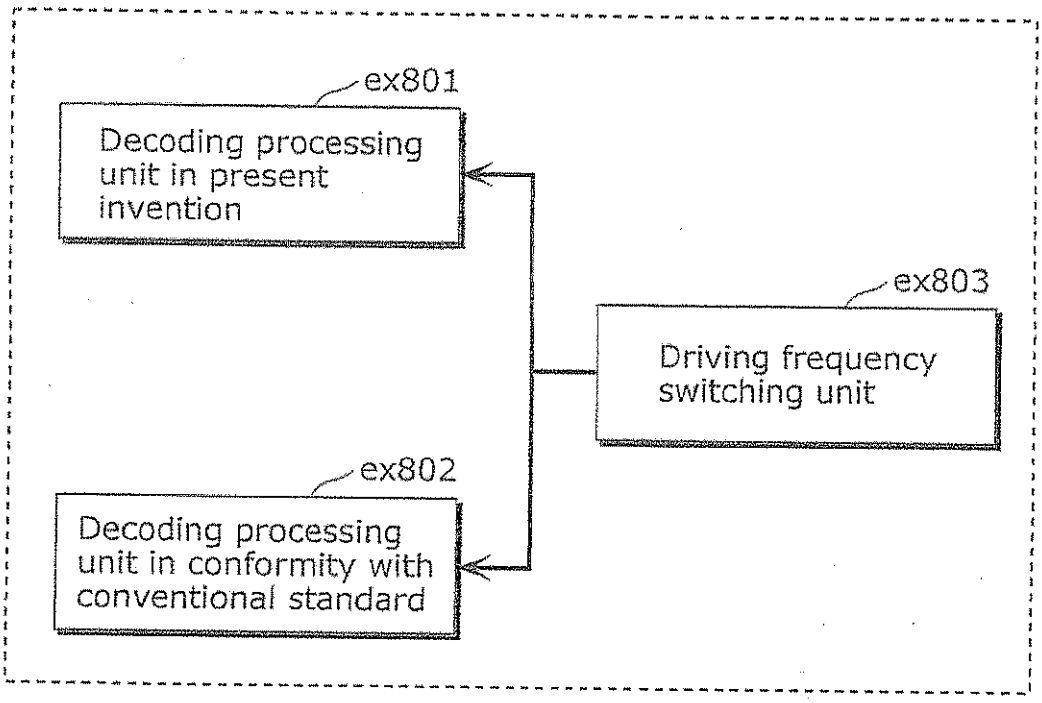

ex500
Control unit ex501
ex502
CPU
ex512
Driving frequency control unit
Signal processing unit
Audio signal processing unit
Video signal processing unit
ex507
ex508
Buffer
ex510
ex503
Memory controller
ex504
Stream controller
ex505
Power supply circuit unit
To each unit
ex506
Stream I/O
ex509
AV I/O
ex511
Memory
ex107
ex215
Microphone ex117
Camera ex113
Monitor ex219

FIG. 38


ex801
Decoding processing unit in present invention
ex803
Driving frequency switching unit
ex802
Decoding processing unit in conformity with conventional standard

ex800

FIG. 39

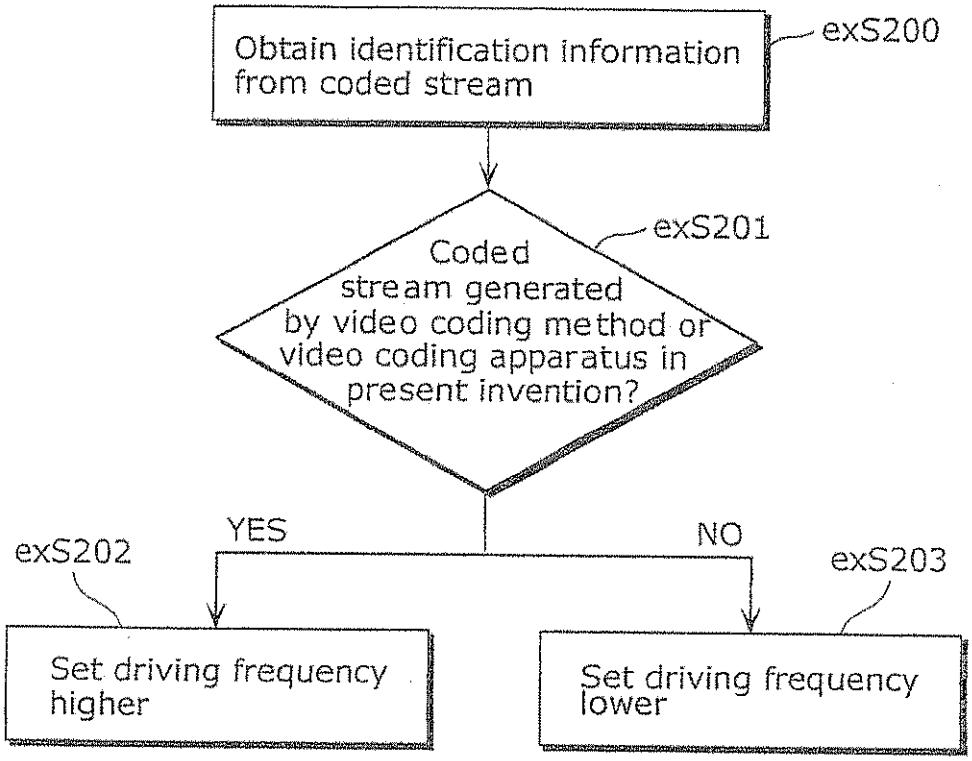
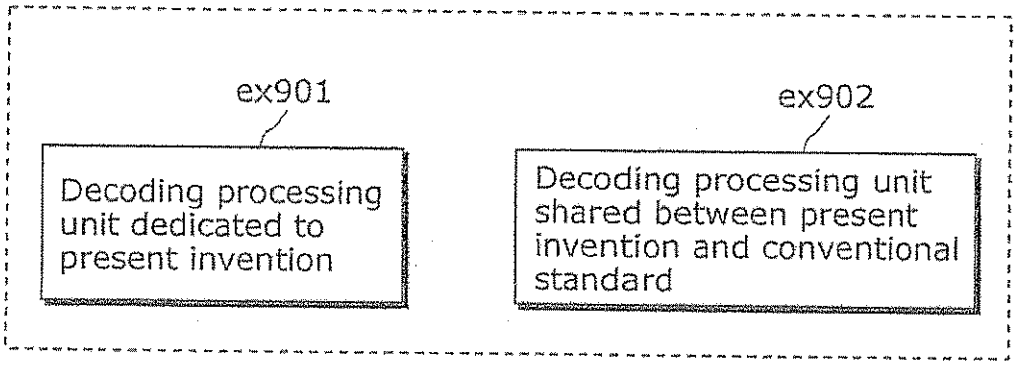

Obtain identification information from coded stream
exS200
Coded stream generated by video coding method or video coding apparatus in present invention?
exS201
YES
NO
exS202
exS203
Set driving frequency higher
Set driving frequency lower

FIG. 40

| Corresponding standard | Driving frequency |
|---|---|
| MPEG-4 AVC | 500 MHz |
| MPEG-2 | 350 MHz |
| ⋮ | ⋮ |

FIG. 41A



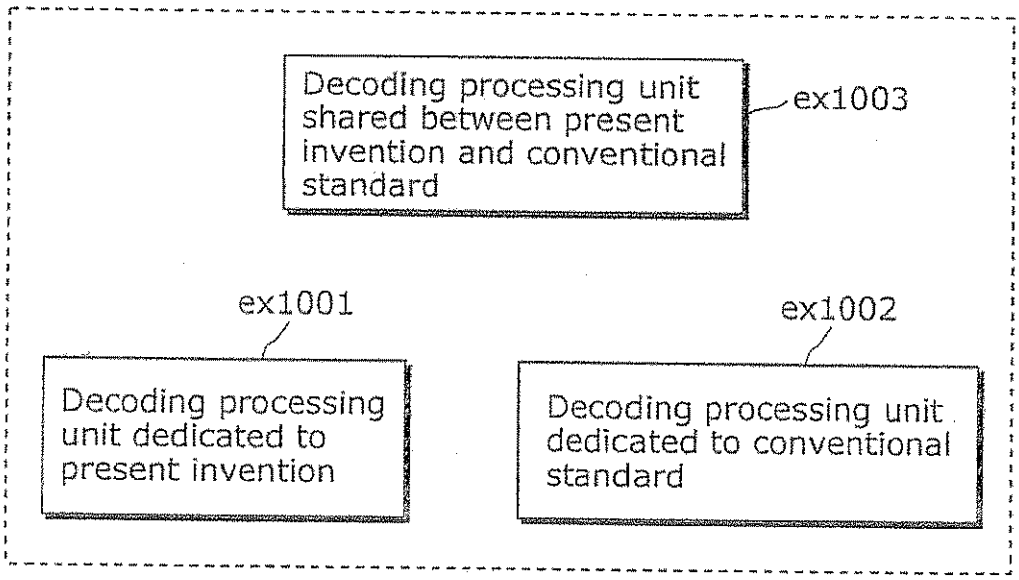


FIG. 41B