FIG. 1

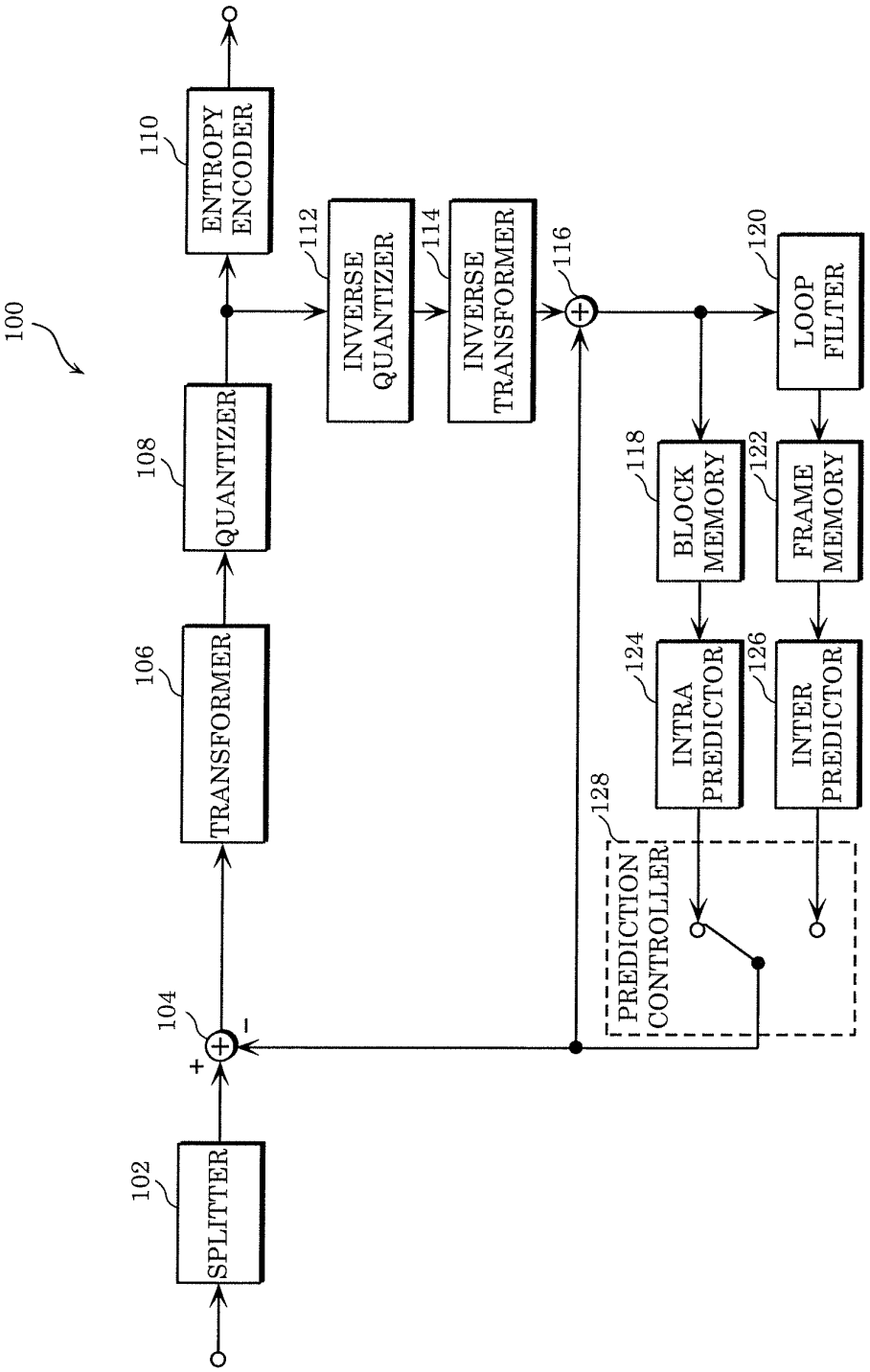

100
SPLITTER
102
104
+
-
TRANSFORMER
106
QUANTIZER
108
ENTROPY ENCODER
110
INVERSE QUANTIZER
112
INVERSE TRANSFORMER
114
116
LOOP FILTER
120
BLOCK MEMORY
118
FRAME MEMORY
122
INTRA PREDICTOR
124
INTER PREDICTOR
126
PREDICTION CONTROLLER
128

FIG. 2

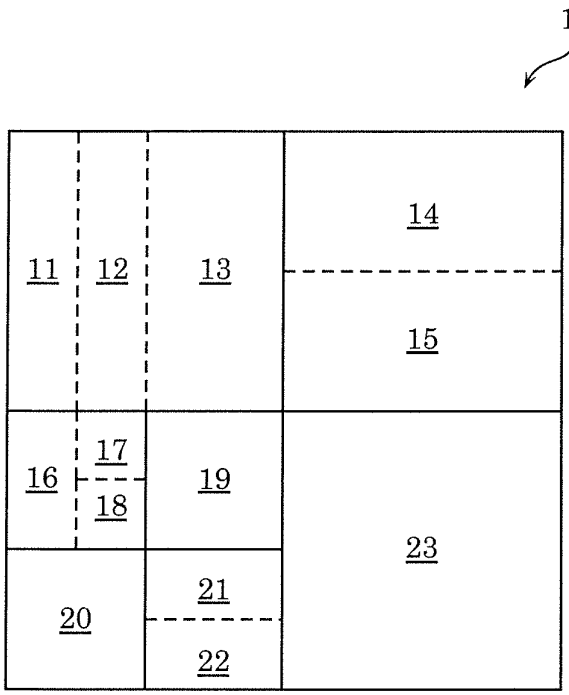


FIG. 3

TRANSFORM TYPE	BASIS FUNCTION $T_i(j)$, i, j = 0, 1, ..., N - 1
DCT - II	$T_i(j) = \omega_0 \cdot \sqrt{\frac{2}{N}} \cdot \cos\left(\frac{\pi \cdot i \cdot (2j+1)}{2N}\right)$ WHERE $\omega_0 = \begin{cases} \sqrt{\frac{2}{N}} & i = 0 \\ 1 & i \neq 0 \end{cases}$
DCT - V	$T_i(j) = \omega_0 \cdot \omega_1 \cdot \sqrt{\frac{2}{2N-1}} \cdot \cos\left(\frac{2\pi \cdot i \cdot j}{2N-1}\right)$ WHERE $\omega_0 = \begin{cases} \sqrt{\frac{2}{N}} & i = 0 \\ 1 & i \neq 0 \end{cases}$, $\omega_1 = \begin{cases} \sqrt{\frac{2}{N}} & j = 0 \\ 1 & j \neq 0 \end{cases}$
DCT - VIII	$T_i(j) = \sqrt{\frac{4}{2N+1}} \cdot \cos\left(\frac{\pi \cdot (2i+1) \cdot (2j+1)}{4N+2}\right)$
DST - I	$T_i(j) = \sqrt{\frac{2}{N+1}} \cdot \sin\left(\frac{\pi \cdot (i+1) \cdot (j+1)}{N+1}\right)$
DST - VII	$T_i(j) = \sqrt{\frac{4}{2N+1}} \cdot \sin\left(\frac{\pi \cdot (2i+1) \cdot (j+1)}{2N+1}\right)$

FIG. 4A

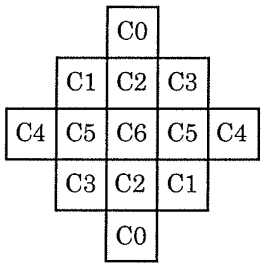


FIG. 4B

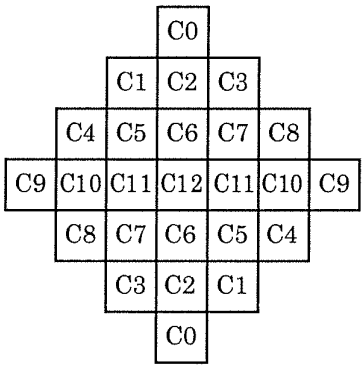


FIG. 4C

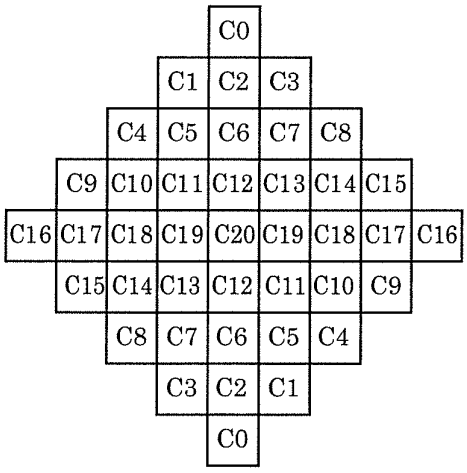


FIG. 5A

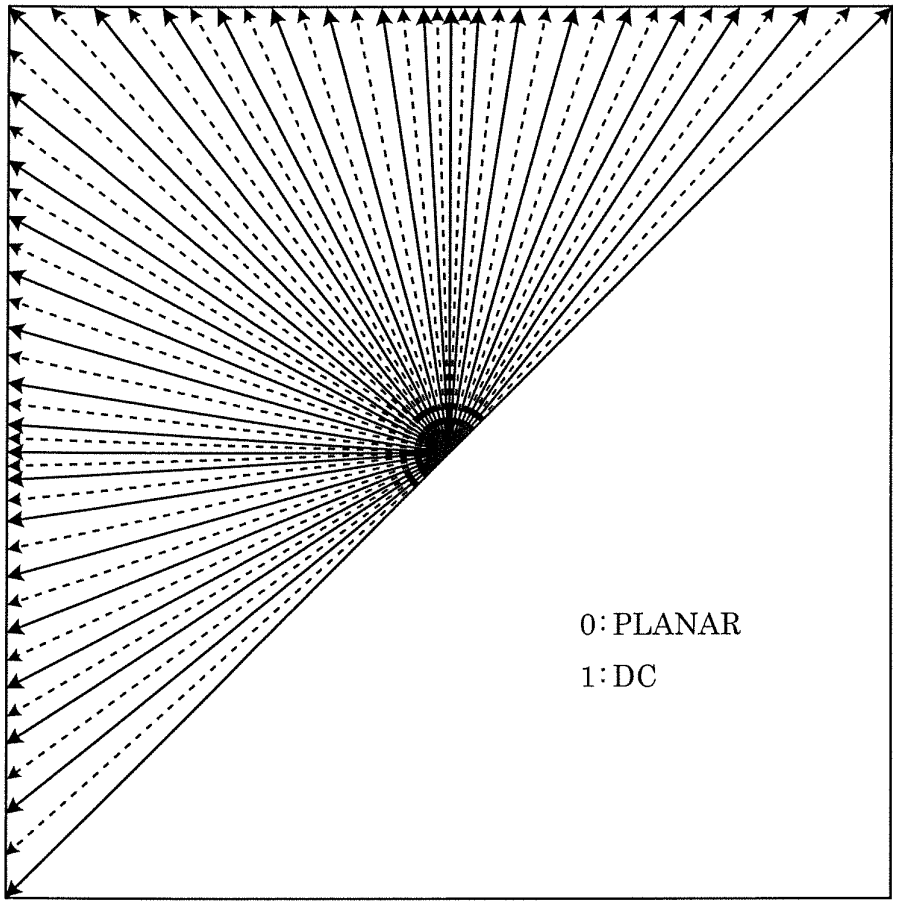


FIG. 5B

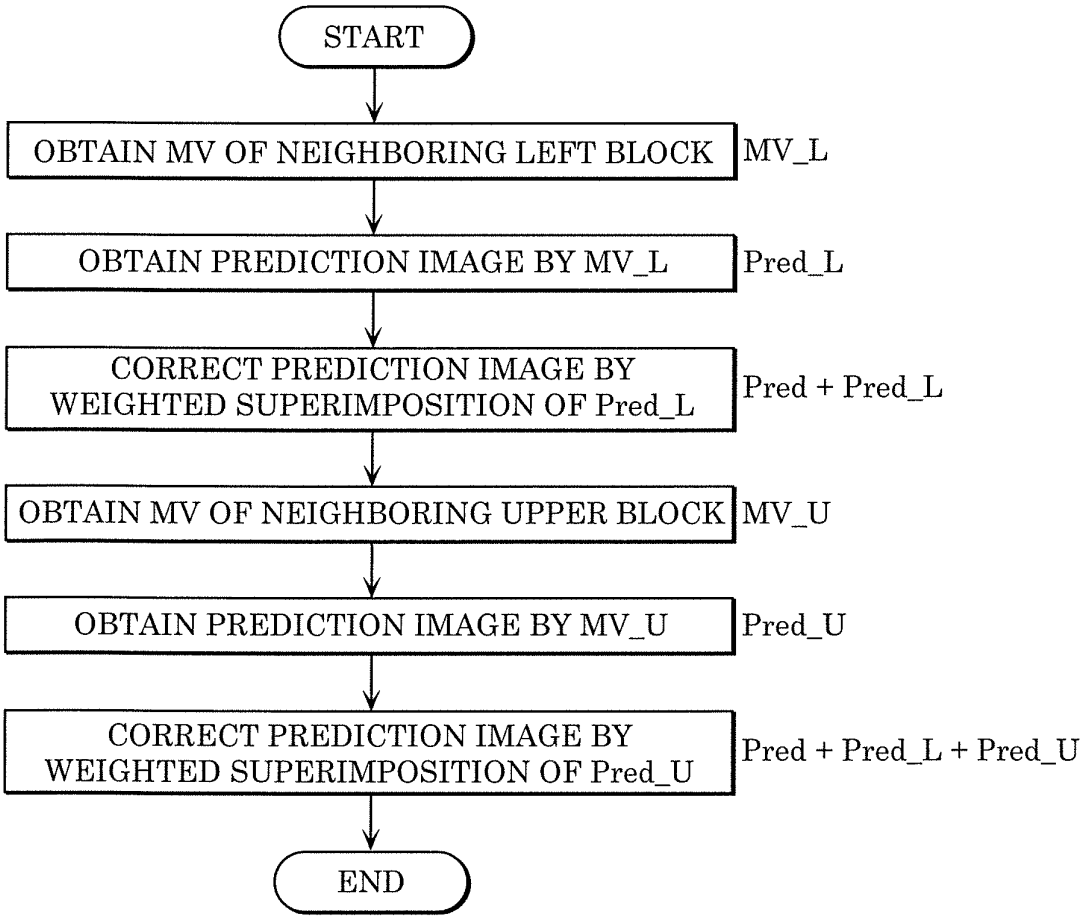

START
OBTAIN MV OF NEIGHBORING LEFT BLOCK
MV_L
OBTAIN PREDICTION IMAGE BY MV_L
Pred_L
CORRECT PREDICTION IMAGE BY WEIGHTED SUPERIMPOSITION OF Pred_L
Pred + Pred_L
OBTAIN MV OF NEIGHBORING UPPER BLOCK
MV_U
OBTAIN PREDICTION IMAGE BY MV_U
Pred_U
CORRECT PREDICTION IMAGE BY WEIGHTED SUPERIMPOSITION OF Pred_U
Pred + Pred_L + Pred_U
END

FIG. 5C

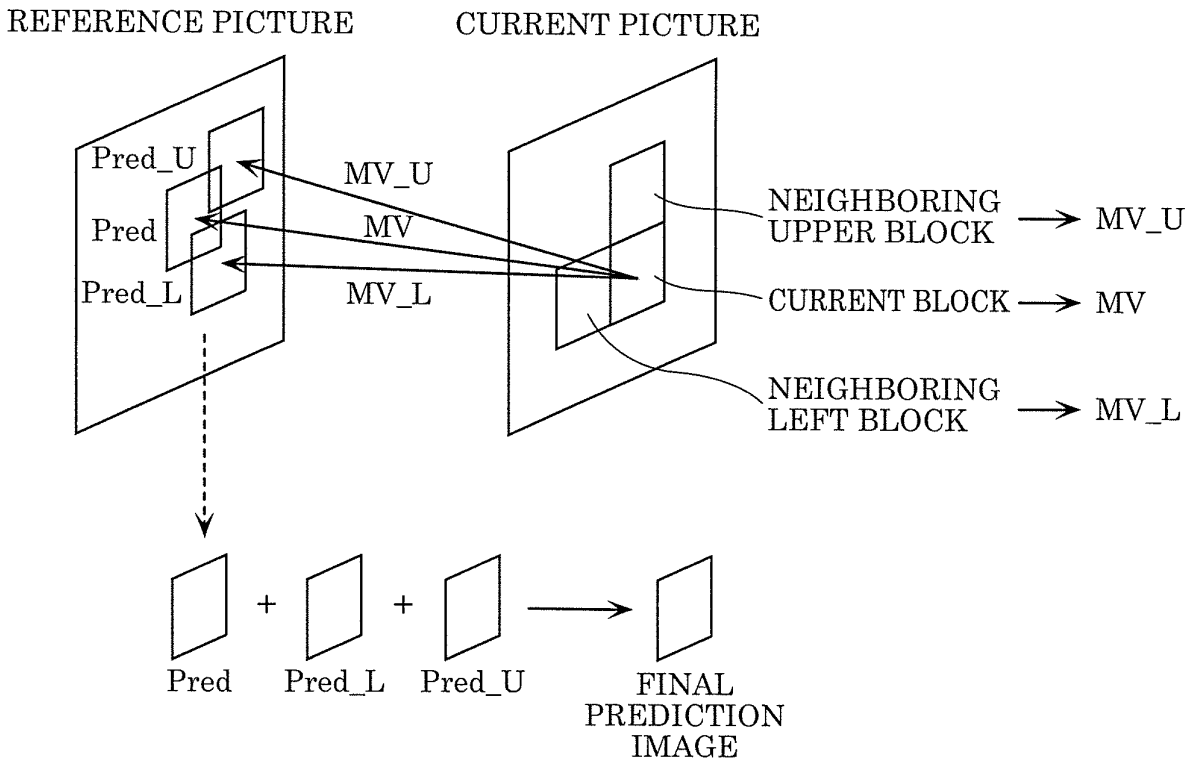

REFERENCE PICTURE
CURRENT PICTURE
Pred_U
Pred
Pred_L
MV_U
MV
MV_L
NEIGHBORING UPPER BLOCK
MV_U
CURRENT BLOCK
MV
NEIGHBORING LEFT BLOCK
MV_L
+
+
Pred
Pred_L
Pred_U
FINAL PREDICTION IMAGE

FIG. 5D

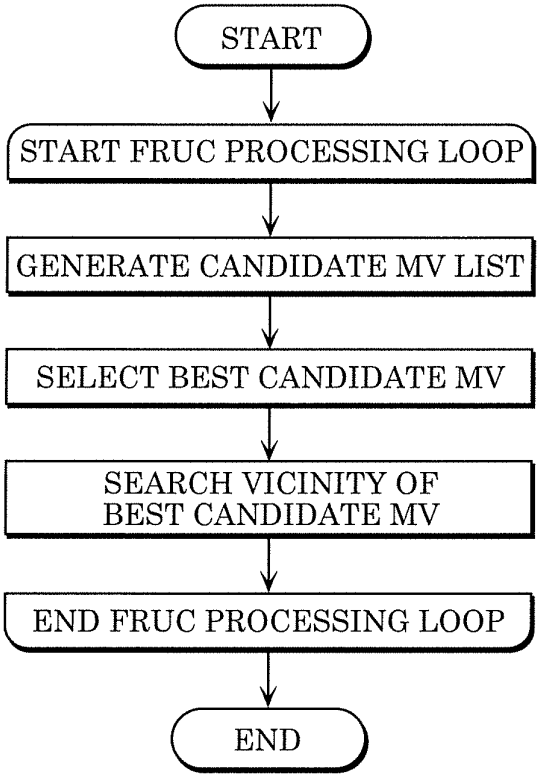

START
START FRUC PROCESSING LOOP
GENERATE CANDIDATE MV LIST
SELECT BEST CANDIDATE MV
SEARCH VICINITY OF BEST CANDIDATE MV
END FRUC PROCESSING LOOP
END

FIG. 6

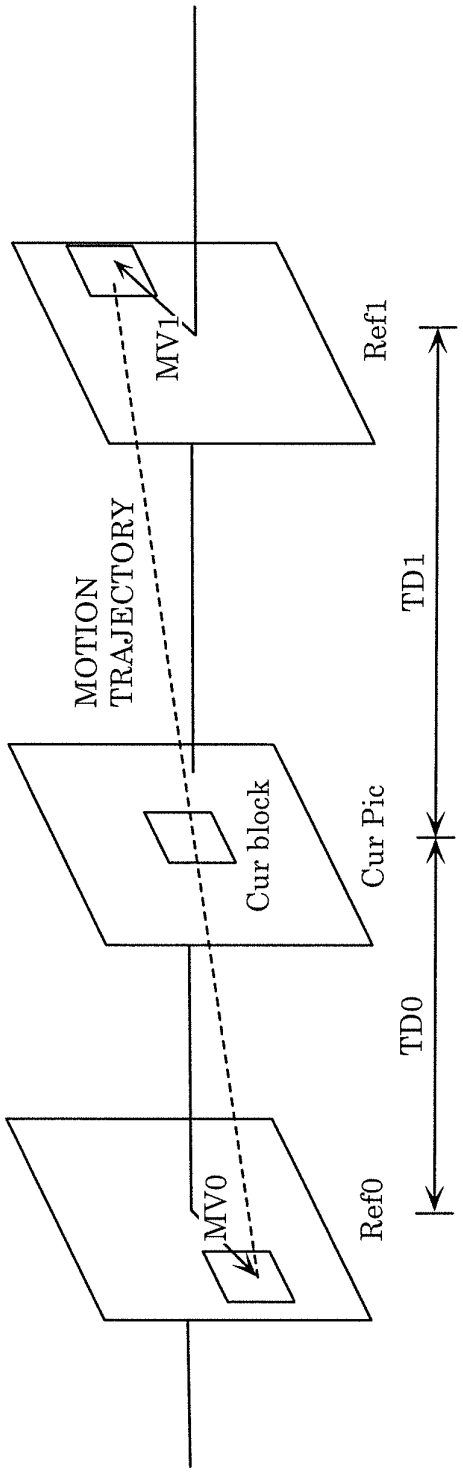

MV1
Ref1
MOTION
TRAJECTORY
TD1
Cur block
Cur Pic
TD0
MV0
Ref0

FIG. 7

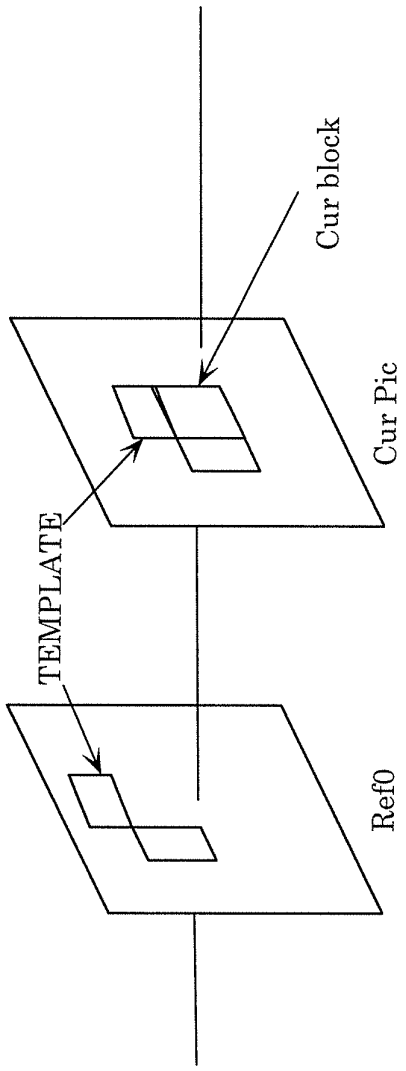


FIG. 8

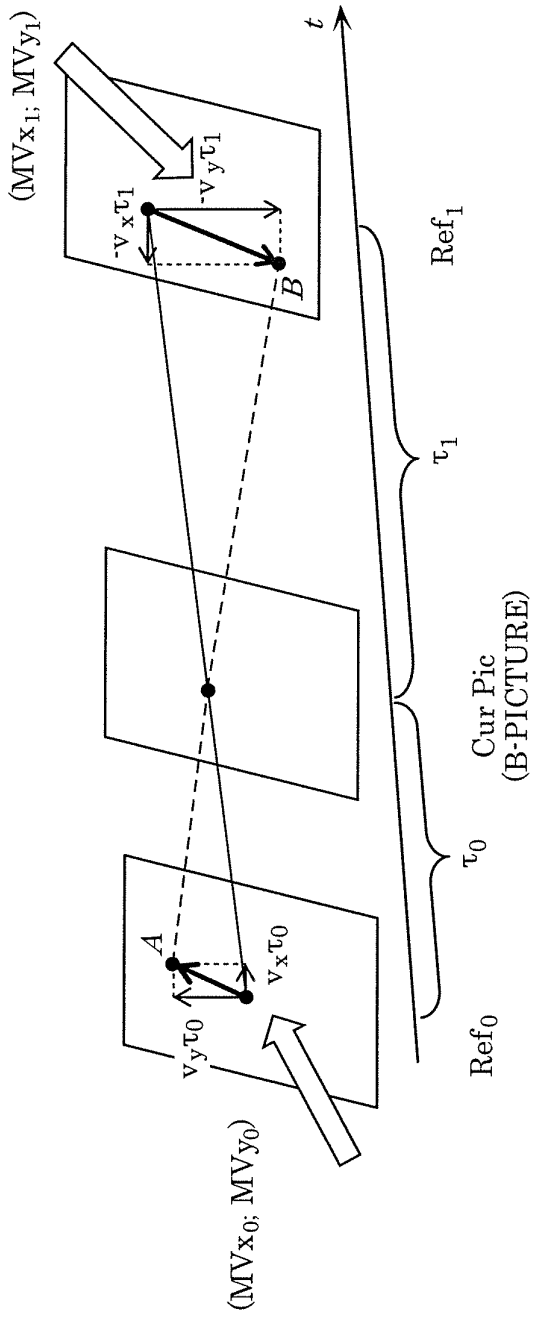

(MVx1; MVy1)
-vxτ1
-vyτ1
B
t
Ref1
τ1
Cur Pic
(B-PICTURE)
τ0
Ref0
A
vxτ0
vyτ0
(MVx0; MVy0)

FIG. 9A

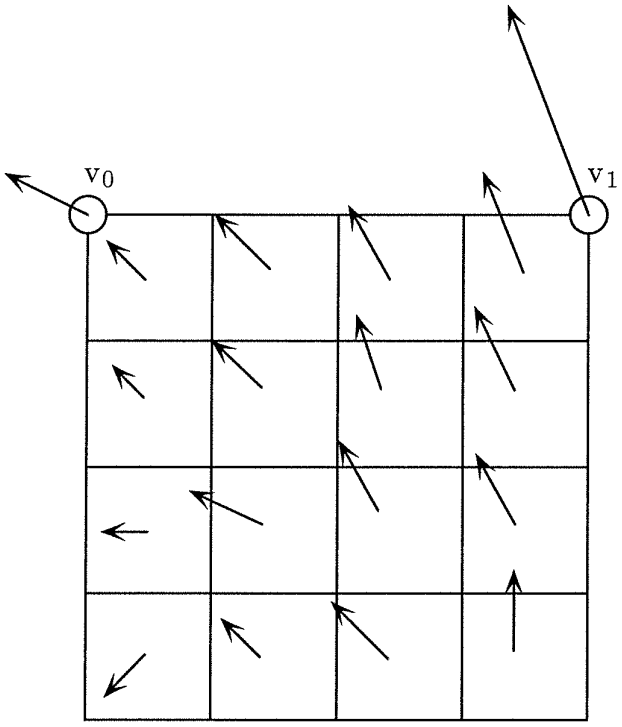


FIG. 9B

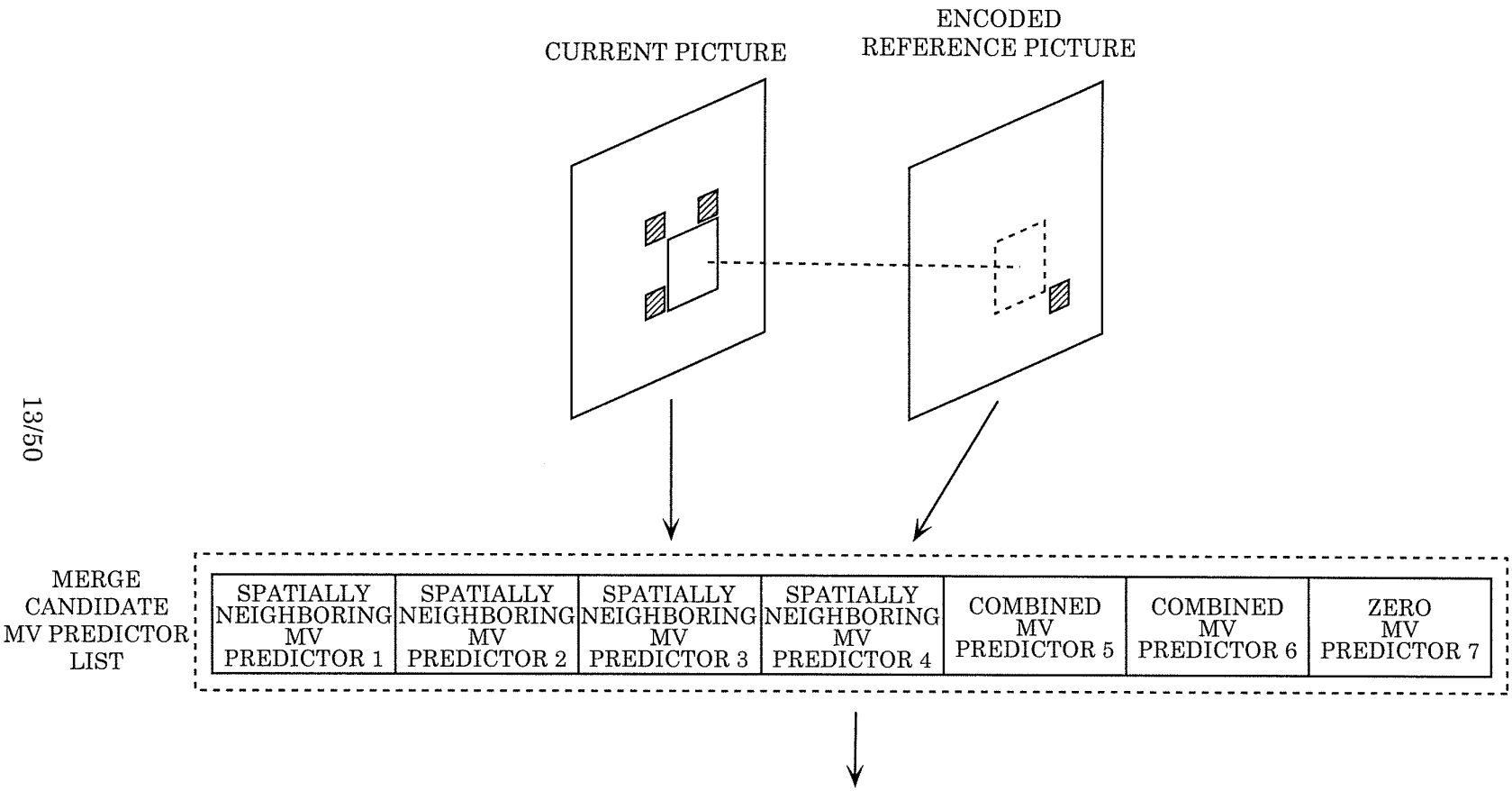

CURRENT PICTURE
ENCODED REFERENCE PICTURE
MERGE CANDIDATE MV PREDICTOR LIST
SPATIALLY NEIGHBORING MV PREDICTOR 1
SPATIALLY NEIGHBORING MV PREDICTOR 2
SPATIALLY NEIGHBORING MV PREDICTOR 3
SPATIALLY NEIGHBORING MV PREDICTOR 4
COMBINED MV PREDICTOR 5
COMBINED MV PREDICTOR 6
ZERO MV PREDICTOR 7
SELECT ONE MV PREDICTOR FROM MV PREDICTOR LIST AND ASSIGN AS MV FOR CURRENT BLOCK

FIG. 9C

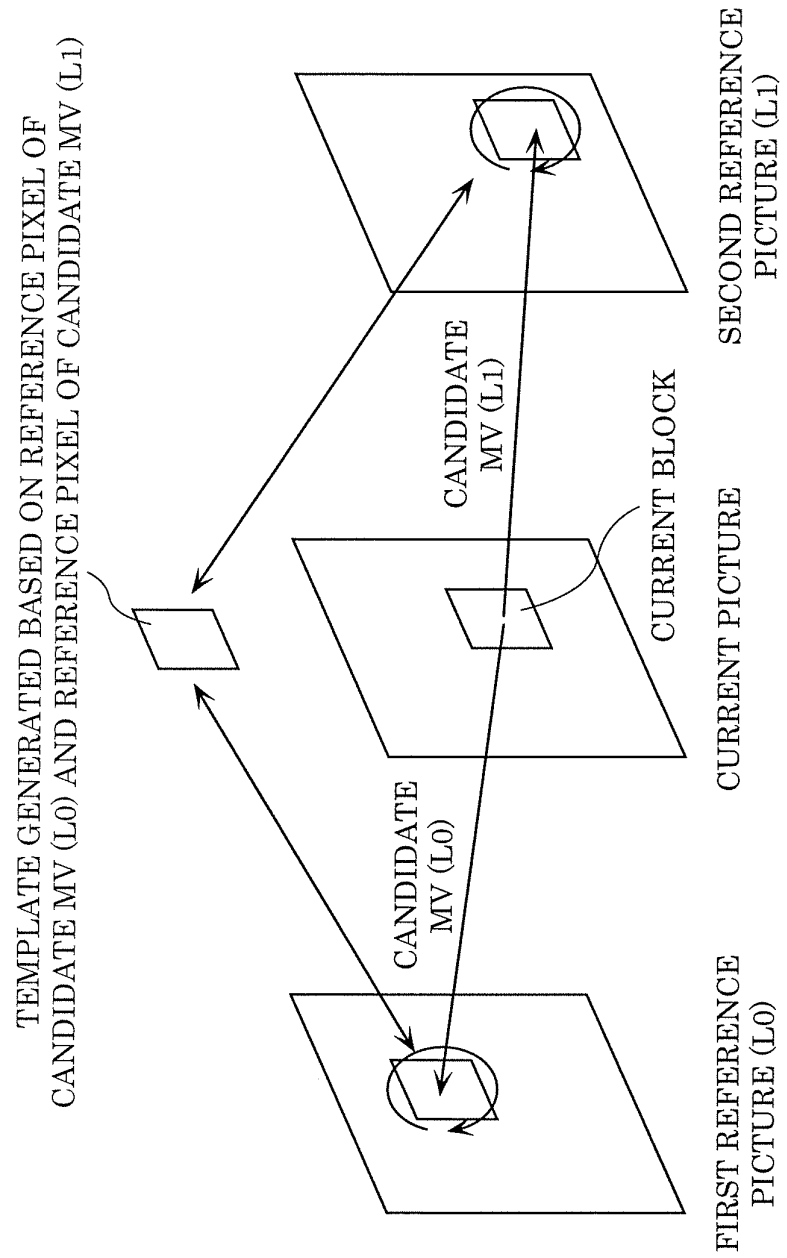

TEMPLATE GENERATED BASED ON REFERENCE PIXEL OF CANDIDATE MV (L0) AND REFERENCE PIXEL OF CANDIDATE MV (L1)
CANDIDATE MV (L0)
CANDIDATE MV (L1)
CURRENT BLOCK
FIRST REFERENCE PICTURE (L0)
CURRENT PICTURE
SECOND REFERENCE PICTURE (L1)

FIG. 9D

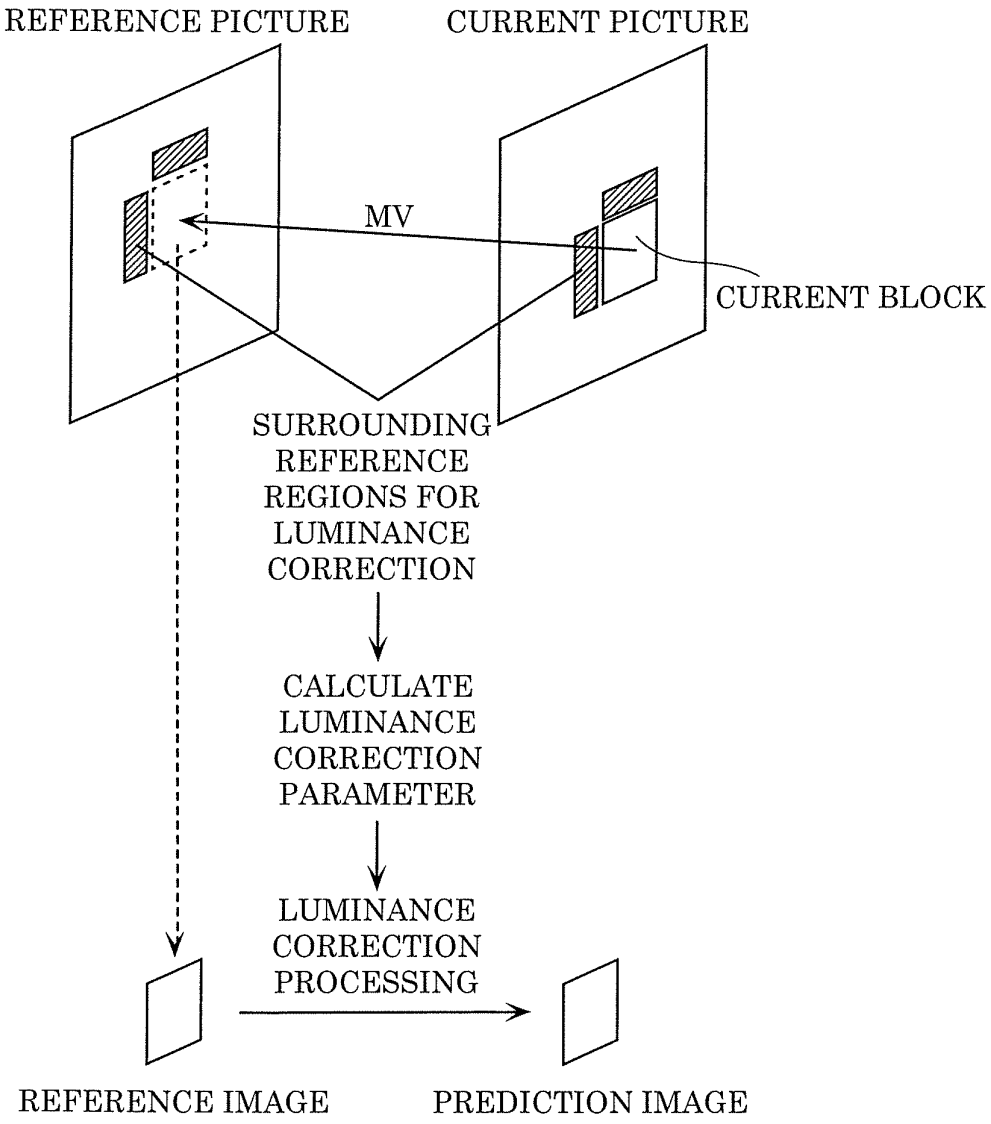

REFERENCE PICTURE
CURRENT PICTURE
MV
CURRENT BLOCK
SURROUNDING REFERENCE REGIONS FOR LUMINANCE CORRECTION
CALCULATE LUMINANCE CORRECTION PARAMETER
LUMINANCE CORRECTION PROCESSING
REFERENCE IMAGE
PREDICTION IMAGE

FIG. 10

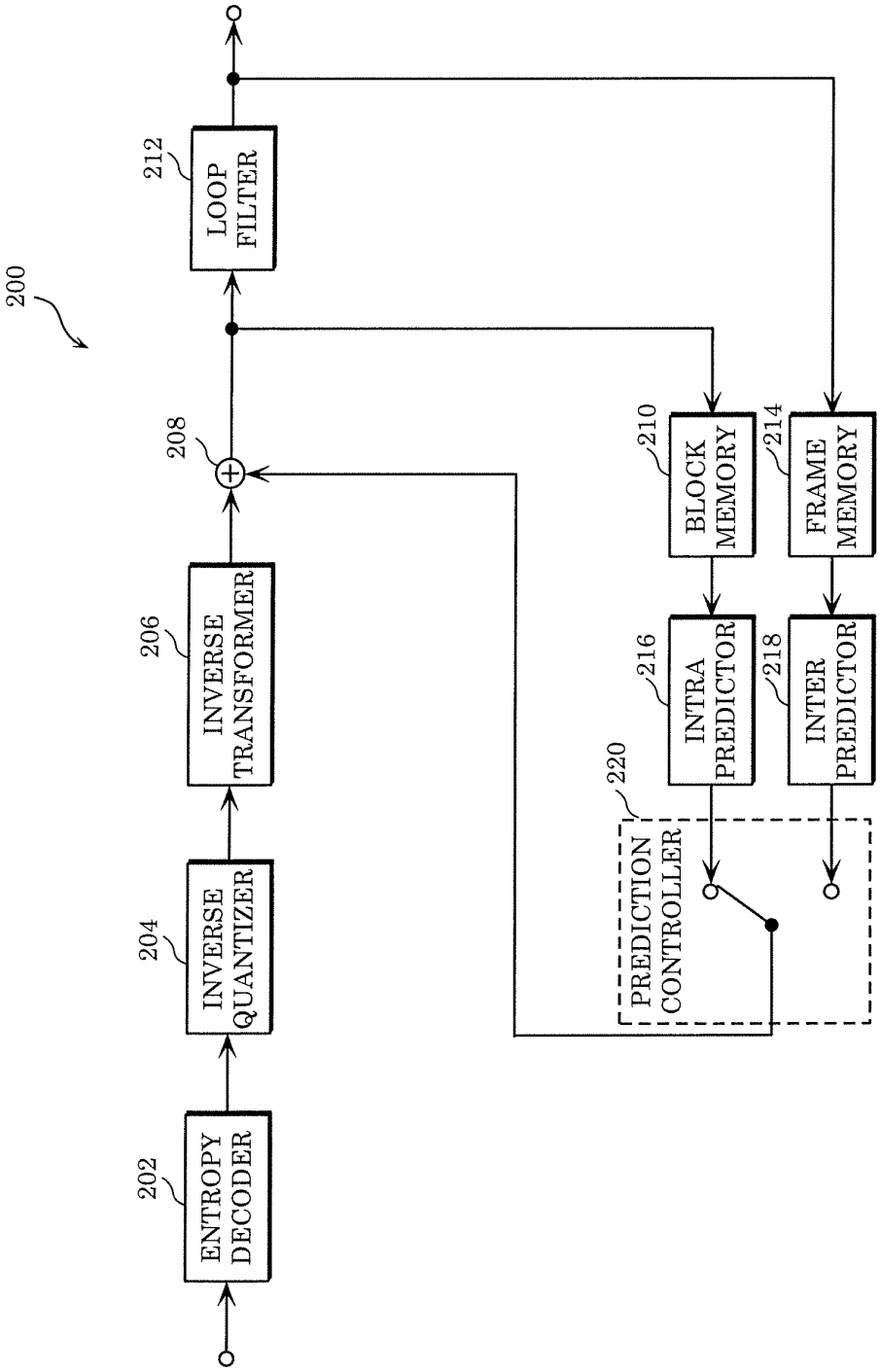

200
202
ENTROPY DECODER
204
INVERSE QUANTIZER
206
INVERSE TRANSFORMER
208
210
BLOCK MEMORY
212
LOOP FILTER
214
FRAME MEMORY
216
INTRA PREDICTOR
218
INTER PREDICTOR
220
PREDICTION CONTROLLER

FIG. 11

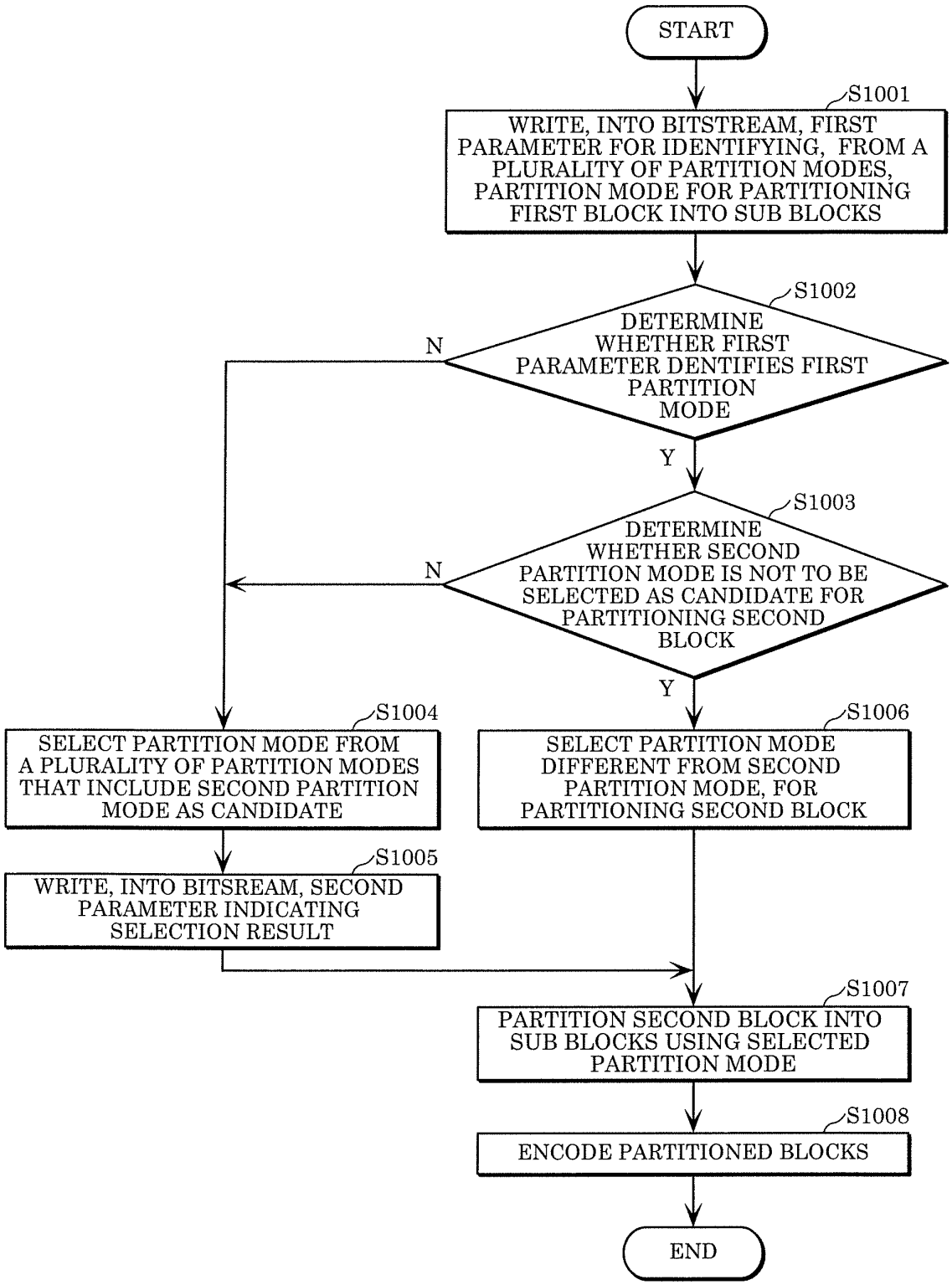

START
S1001
WRITE, INTO BITSTREAM, FIRST PARAMETER FOR IDENTIFYING, FROM A PLURALITY OF PARTITION MODES, PARTITION MODE FOR PARTITIONING FIRST BLOCK INTO SUB BLOCKS
S1002
DETERMINE WHETHER FIRST PARAMETER DENTIFIES FIRST PARTITION MODE
N
Y
S1003
DETERMINE WHETHER SECOND PARTITION MODE IS NOT TO BE SELECTED AS CANDIDATE FOR PARTITIONING SECOND BLOCK
N
Y
S1004
SELECT PARTITION MODE FROM A PLURALITY OF PARTITION MODES THAT INCLUDE SECOND PARTITION MODE AS CANDIDATE
S1005
WRITE, INTO BITSREAM, SECOND PARAMETER INDICATING SELECTION RESULT
S1006
SELECT PARTITION MODE DIFFERENT FROM SECOND PARTITION MODE, FOR PARTITIONING SECOND BLOCK
S1007
PARTITION SECOND BLOCK INTO SUB BLOCKS USING SELECTED PARTITION MODE
S1008
ENCODE PARTITIONED BLOCKS
END

FIG. 12

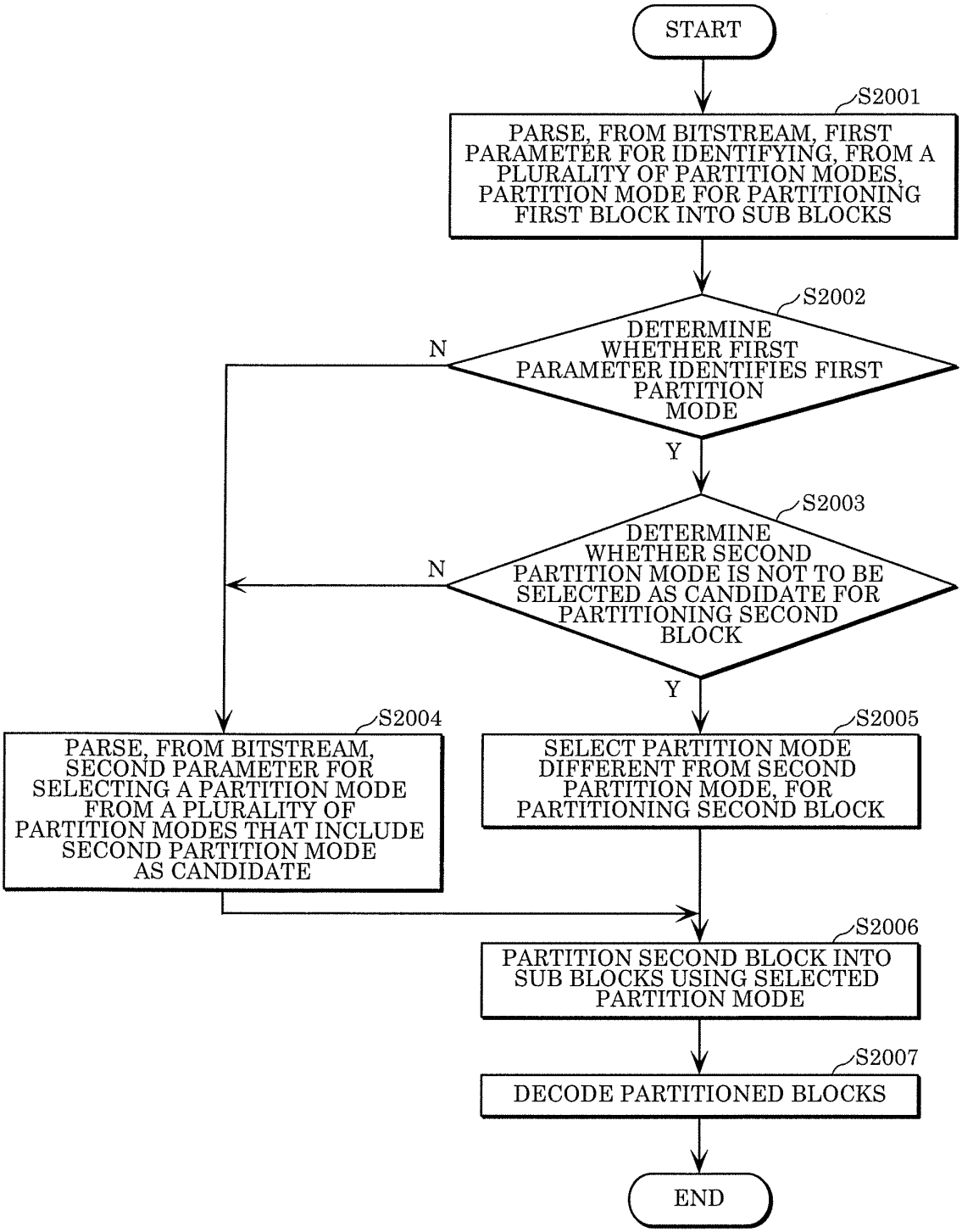

START
S2001
PARSE, FROM BITSTREAM, FIRST PARAMETER FOR IDENTIFYING, FROM A PLURALITY OF PARTITION MODES, PARTITION MODE FOR PARTITIONING FIRST BLOCK INTO SUB BLOCKS
S2002
DETERMINE WHETHER FIRST PARAMETER IDENTIFIES FIRST PARTITION MODE
N
Y
S2003
DETERMINE WHETHER SECOND PARTITION MODE IS NOT TO BE SELECTED AS CANDIDATE FOR PARTITIONING SECOND BLOCK
N
Y
S2004
PARSE, FROM BITSTREAM, SECOND PARAMETER FOR SELECTING A PARTITION MODE FROM A PLURALITY OF PARTITION MODES THAT INCLUDE SECOND PARTITION MODE AS CANDIDATE
S2005
SELECT PARTITION MODE DIFFERENT FROM SECOND PARTITION MODE, FOR PARTITIONING SECOND BLOCK
S2006
PARTITION SECOND BLOCK INTO SUB BLOCKS USING SELECTED PARTITION MODE
S2007
DECODE PARTITIONED BLOCKS
END

FIG. 13

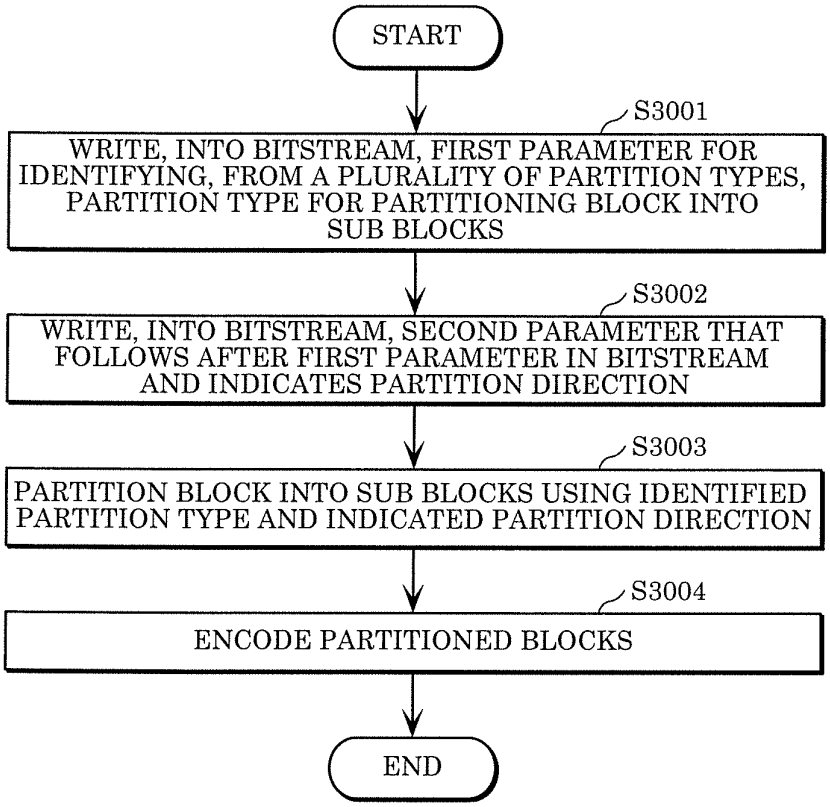

START
S3001
WRITE, INTO BITSTREAM, FIRST PARAMETER FOR IDENTIFYING, FROM A PLURALITY OF PARTITION TYPES, PARTITION TYPE FOR PARTITIONING BLOCK INTO SUB BLOCKS
S3002
WRITE, INTO BITSTREAM, SECOND PARAMETER THAT FOLLOWS AFTER FIRST PARAMETER IN BITSTREAM AND INDICATES PARTITION DIRECTION
S3003
PARTITION BLOCK INTO SUB BLOCKS USING IDENTIFIED PARTITION TYPE AND INDICATED PARTITION DIRECTION
S3004
ENCODE PARTITIONED BLOCKS
END

FIG. 14

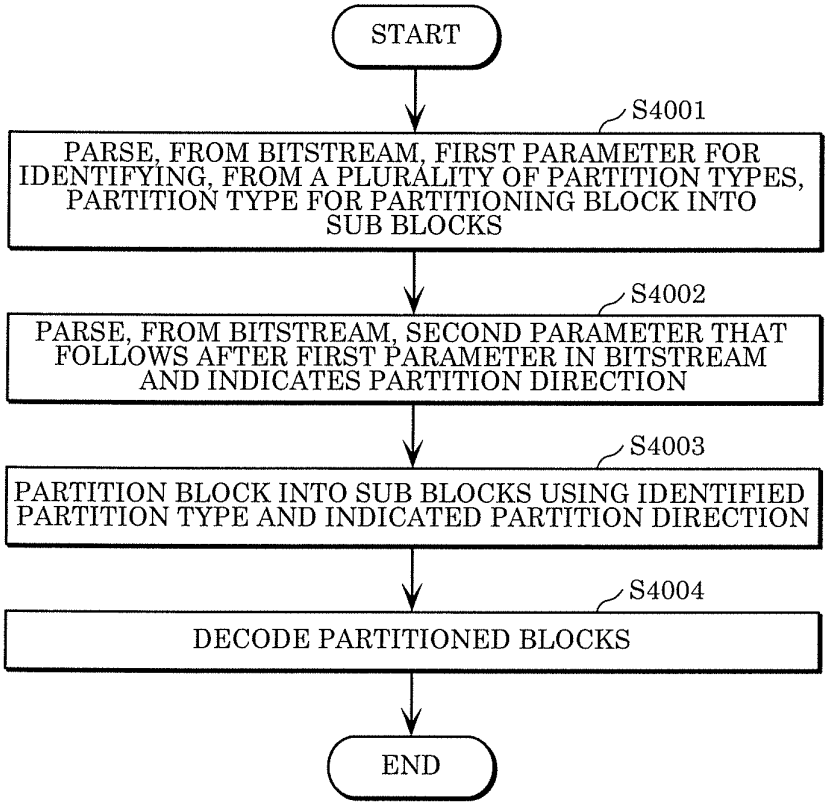

START
S4001
PARSE, FROM BITSTREAM, FIRST PARAMETER FOR IDENTIFYING, FROM A PLURALITY OF PARTITION TYPES, PARTITION TYPE FOR PARTITIONING BLOCK INTO SUB BLOCKS
S4002
PARSE, FROM BITSTREAM, SECOND PARAMETER THAT FOLLOWS AFTER FIRST PARAMETER IN BITSTREAM AND INDICATES PARTITION DIRECTION
S4003
PARTITION BLOCK INTO SUB BLOCKS USING IDENTIFIED PARTITION TYPE AND INDICATED PARTITION DIRECTION
S4004
DECODE PARTITIONED BLOCKS
END

FIG. 15

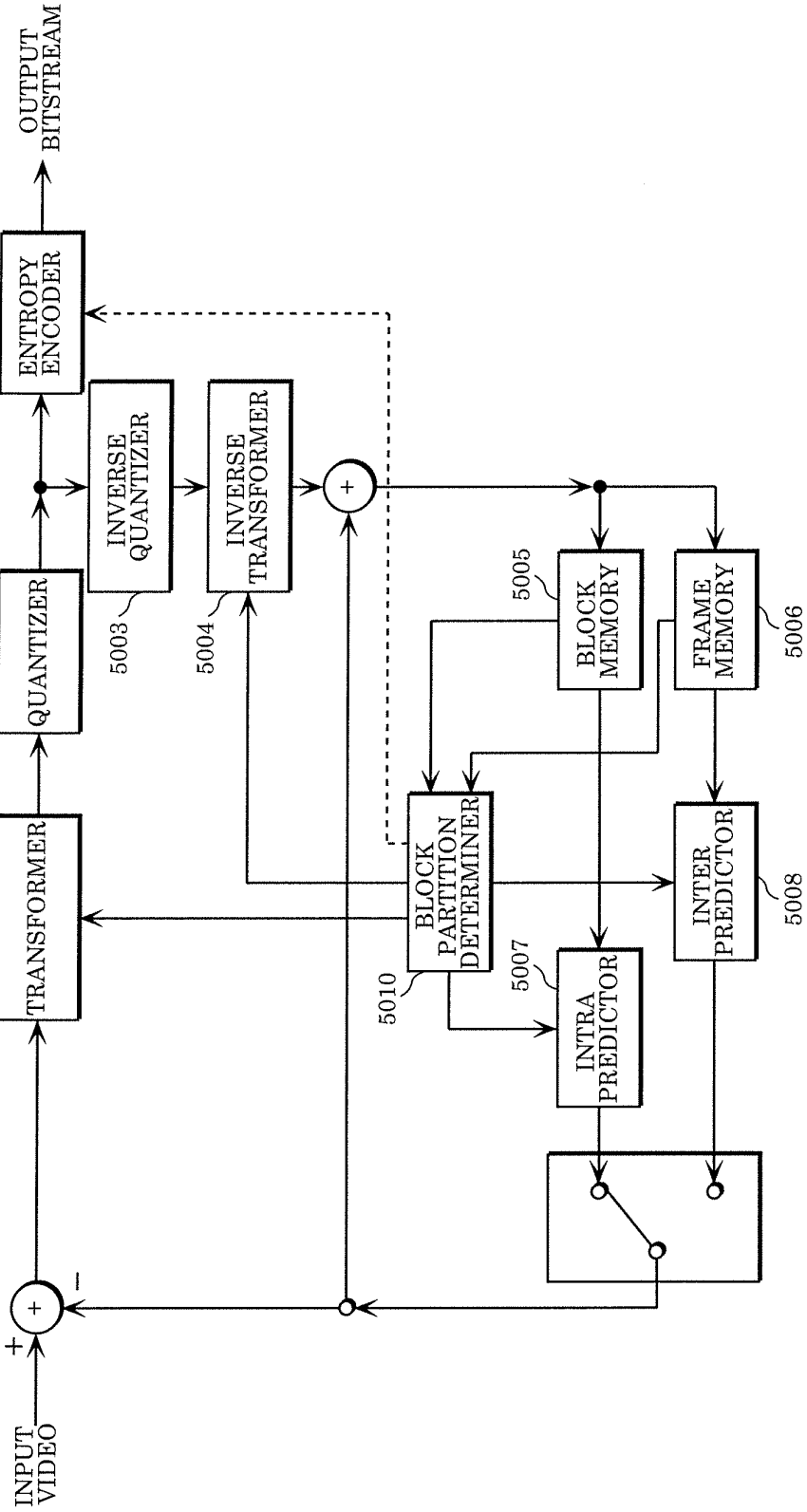

5000
INPUT VIDEO
TRANSFORMER
5001
QUANTIZER
5002
INVERSE QUANTIZER
5003
INVERSE TRANSFORMER
5004
ENTROPY ENCODER
5009
OUTPUT BITSTREAM
BLOCK PARTITION DETERMINER
5010
BLOCK MEMORY
5005
FRAME MEMORY
5006
INTRA PREDICTOR
5007
INTER PREDICTOR
5008

FIG. 16

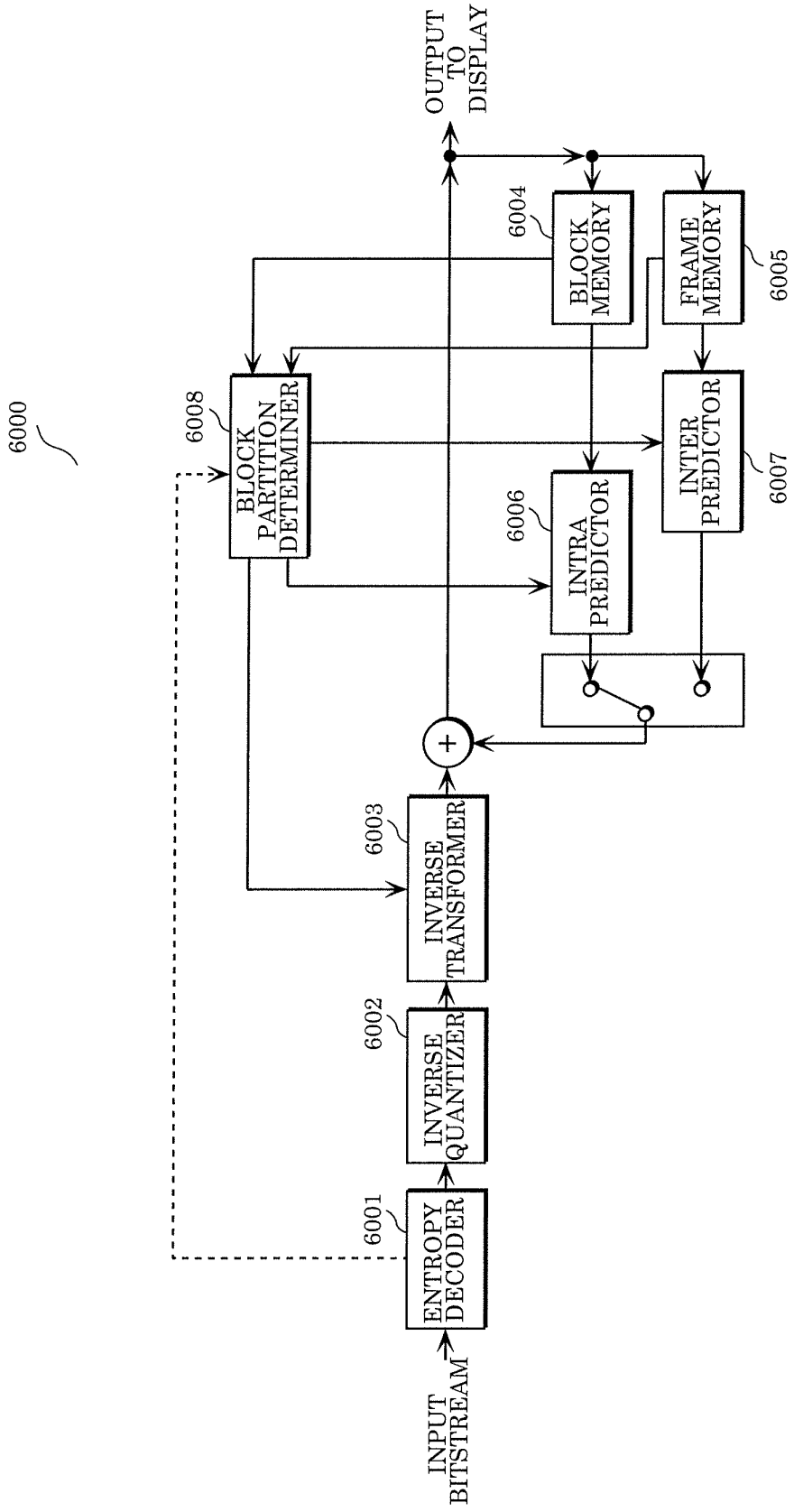

6000
INPUT BITSTREAM
ENTROPY DECODER
6001
INVERSE QUANTIZER
6002
INVERSE TRANSFORMER
6003
+
BLOCK PARTITION DETERMINER
6008
INTRA PREDICTOR
6006
INTER PREDICTOR
6007
BLOCK MEMORY
6004
FRAME MEMORY
6005
OUTPUT TO DISPLAY

FIG. 17

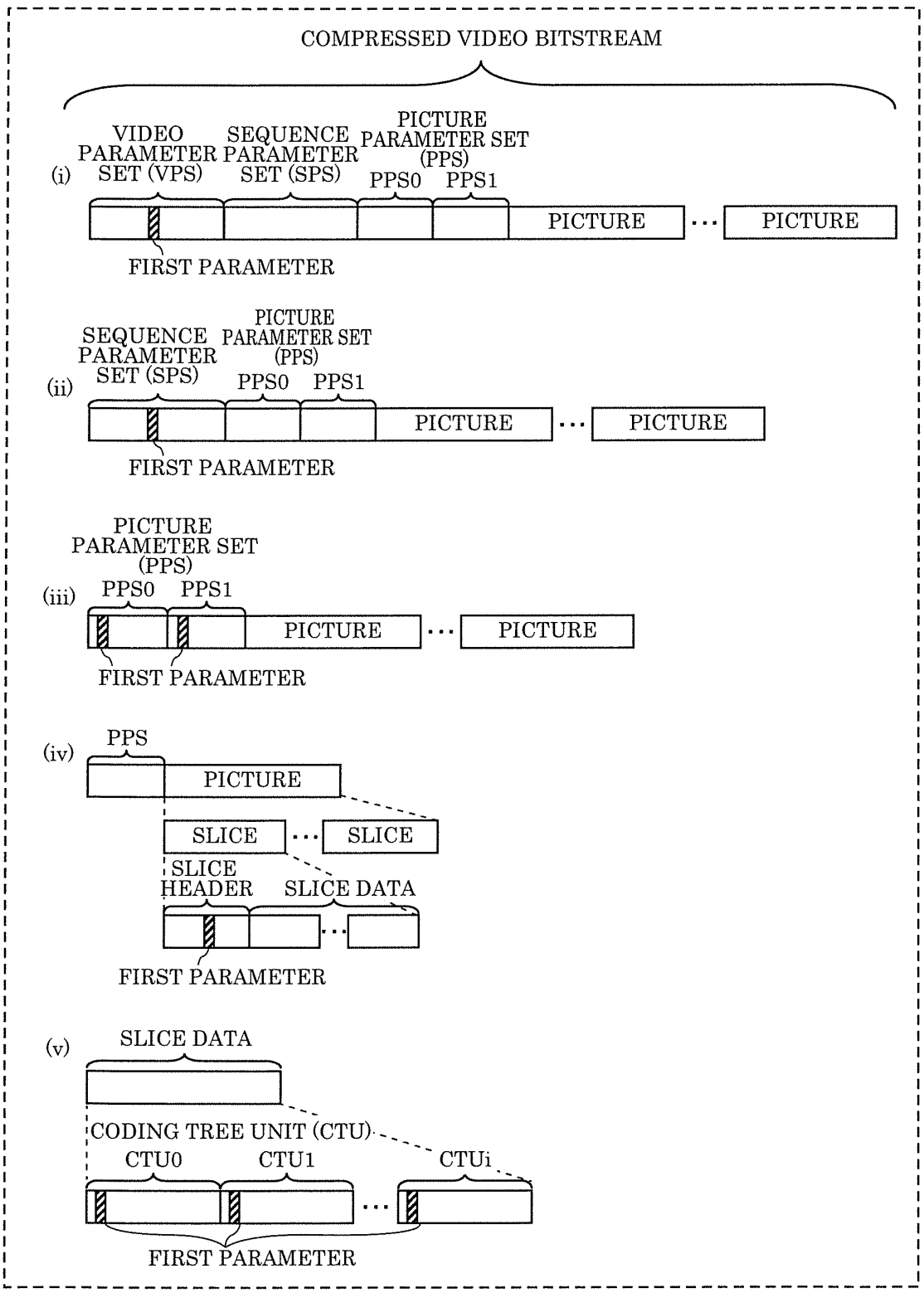

COMPRESSED VIDEO BITSTREAM
(i)
VIDEO PARAMETER SET (VPS)
SEQUENCE PARAMETER SET (SPS)
PICTURE PARAMETER SET (PPS)
PPS0
PPS1
PICTURE
PICTURE
FIRST PARAMETER
(ii)
SEQUENCE PARAMETER SET (SPS)
PICTURE PARAMETER SET (PPS)
PPS0
PPS1
PICTURE
PICTURE
FIRST PARAMETER
(iii)
PICTURE PARAMETER SET (PPS)
PPS0
PPS1
PICTURE
PICTURE
FIRST PARAMETER
(iv)
PPS
PICTURE
SLICE
SLICE
SLICE HEADER
SLICE DATA
FIRST PARAMETER
(v)
SLICE DATA
CODING TREE UNIT (CTU)
CTU0
CTU1
CTUi
FIRST PARAMETER

FIG. 18

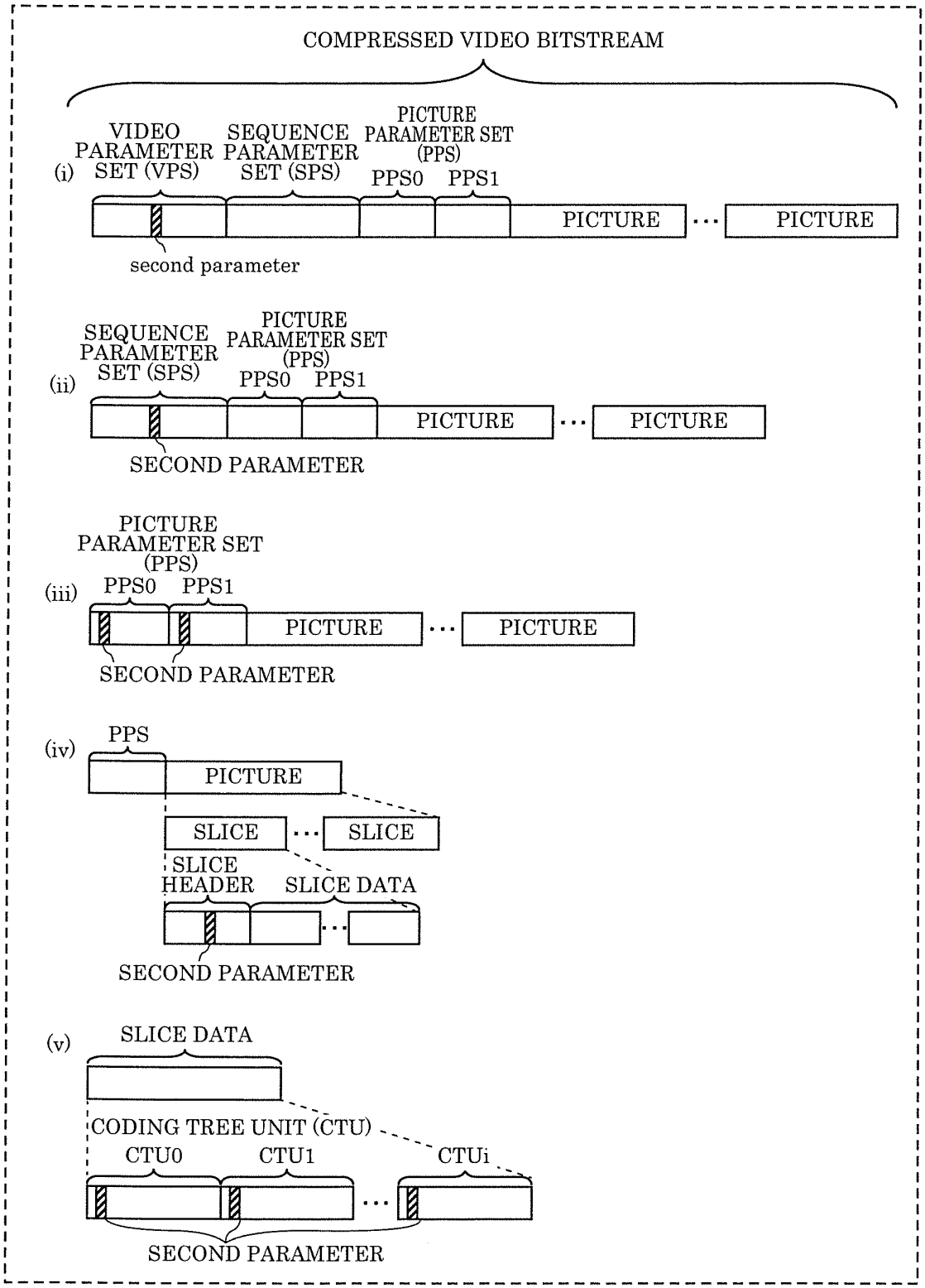

COMPRESSED VIDEO BITSTREAM
(i)
VIDEO PARAMETER SET (VPS)
SEQUENCE PARAMETER SET (SPS)
PICTURE PARAMETER SET (PPS)
PPS0
PPS1
PICTURE
PICTURE
second parameter
(ii)
SEQUENCE PARAMETER SET (SPS)
PICTURE PARAMETER SET (PPS)
PPS0
PPS1
PICTURE
PICTURE
SECOND PARAMETER
(iii)
PICTURE PARAMETER SET (PPS)
PPS0
PPS1
PICTURE
PICTURE
SECOND PARAMETER
(iv)
PPS
PICTURE
SLICE
SLICE
SLICE HEADER
SLICE DATA
SECOND PARAMETER
(v)
SLICE DATA
CODING TREE UNIT (CTU)
CTU0
CTU1
CTUi
SECOND PARAMETER

FIG. 19

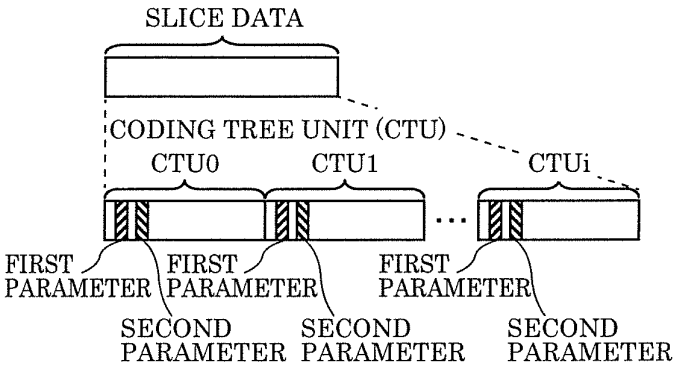

SLICE DATA
CODING TREE UNIT (CTU)
CTU0
CTU1
CTUi
FIRST PARAMETER
FIRST PARAMETER
FIRST PARAMETER
SECOND PARAMETER
SECOND PARAMETER
SECOND PARAMETER

FIG. 20

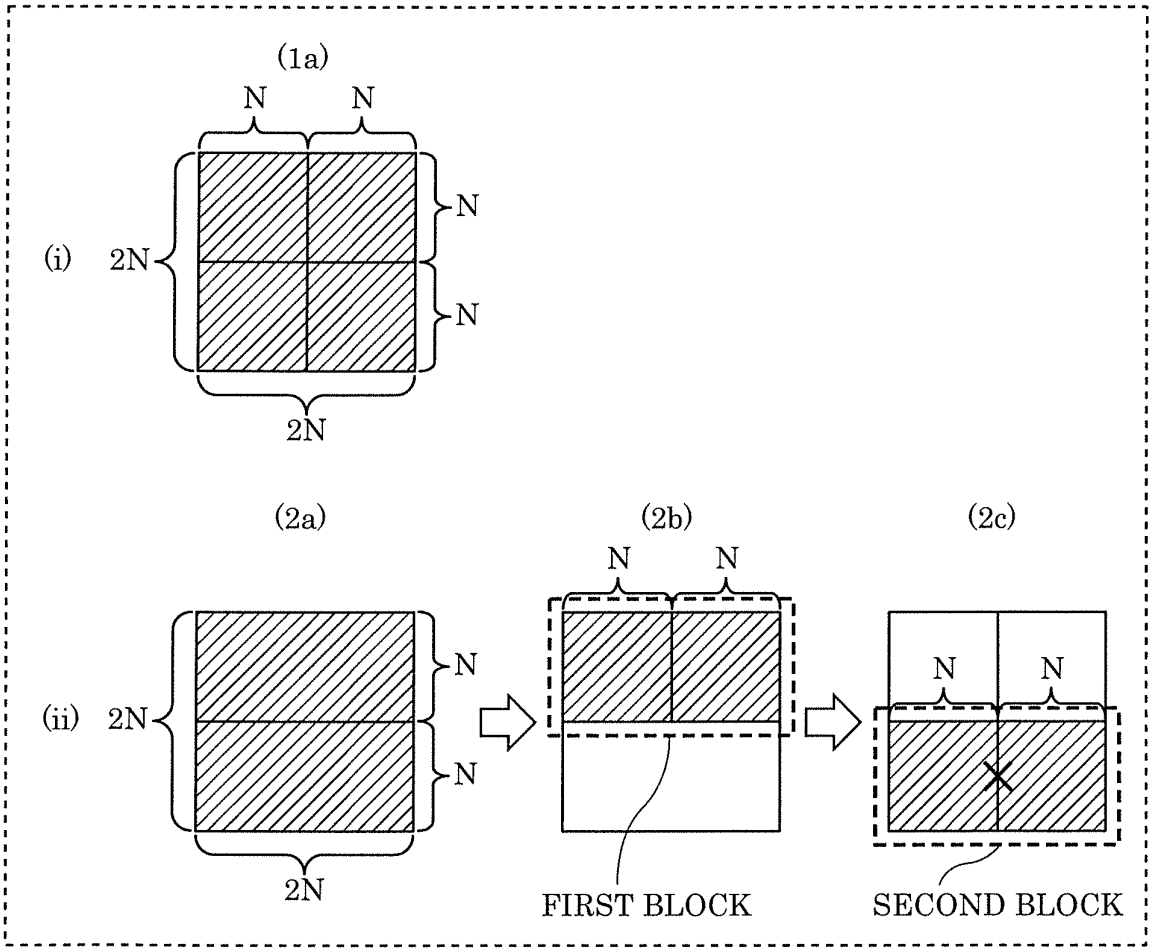

(1a)
N
N
(i)
2N
N
N
2N
(2a)
(2b)
(2c)
(ii)
2N
N
N
2N
N
N
N
N
FIRST BLOCK
SECOND BLOCK

FIG. 21

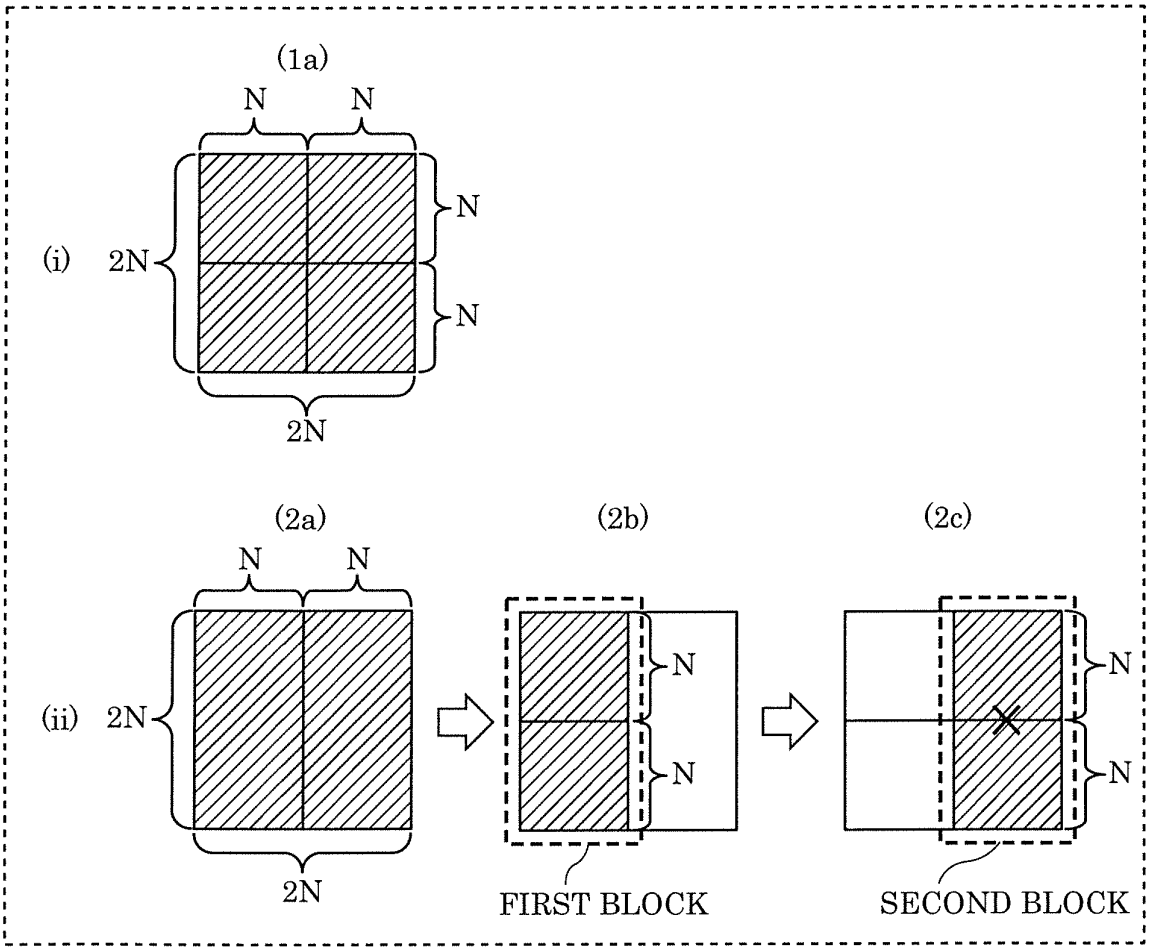

(1a)
N
N
(i)
2N
N
N
2N
(2a)
(2b)
(2c)
N
N
(ii)
2N
N
N
N
N
2N
FIRST BLOCK
SECOND BLOCK

FIG. 22

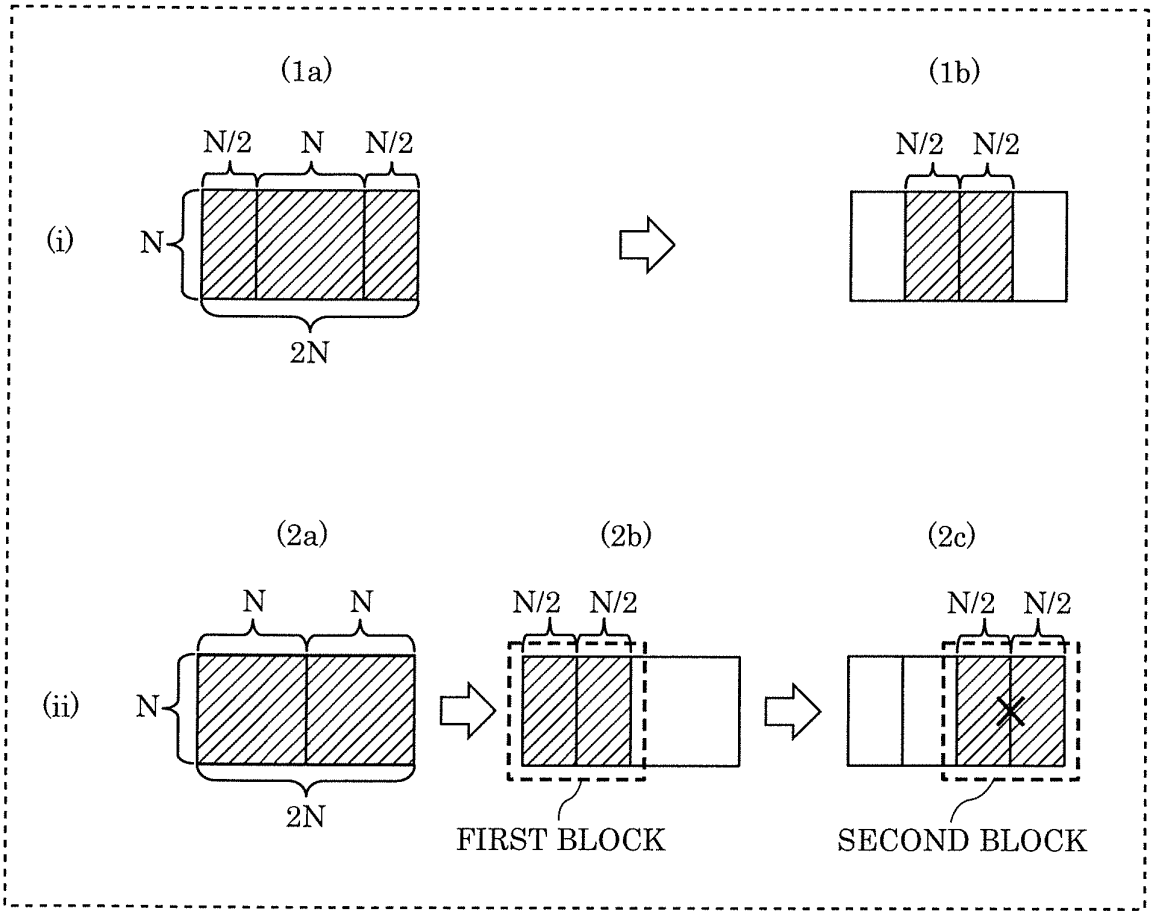

(1a)
(1b)
N/2
N
N/2
(i)
N
2N
N/2
N/2
(2a)
(2b)
(2c)
N
N
(ii)
N
2N
N/2
N/2
N/2
N/2
FIRST BLOCK
SECOND BLOCK

FIG. 23

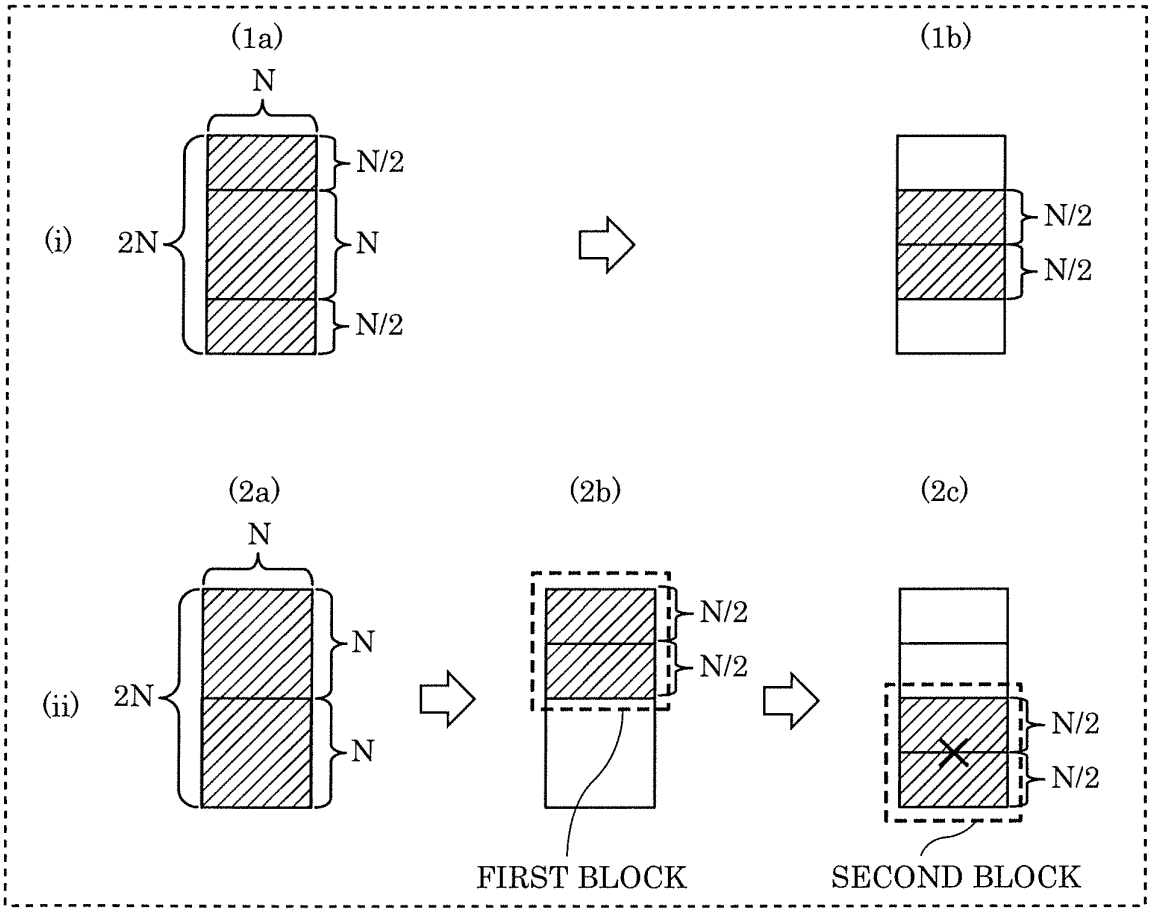

(1a)
(1b)
N
N/2
(i)
2N
N
N/2
N/2
N/2
(2a)
(2b)
(2c)
N
N
(ii)
2N
N
N/2
N/2
N/2
N/2
FIRST BLOCK
SECOND BLOCK

FIG. 24

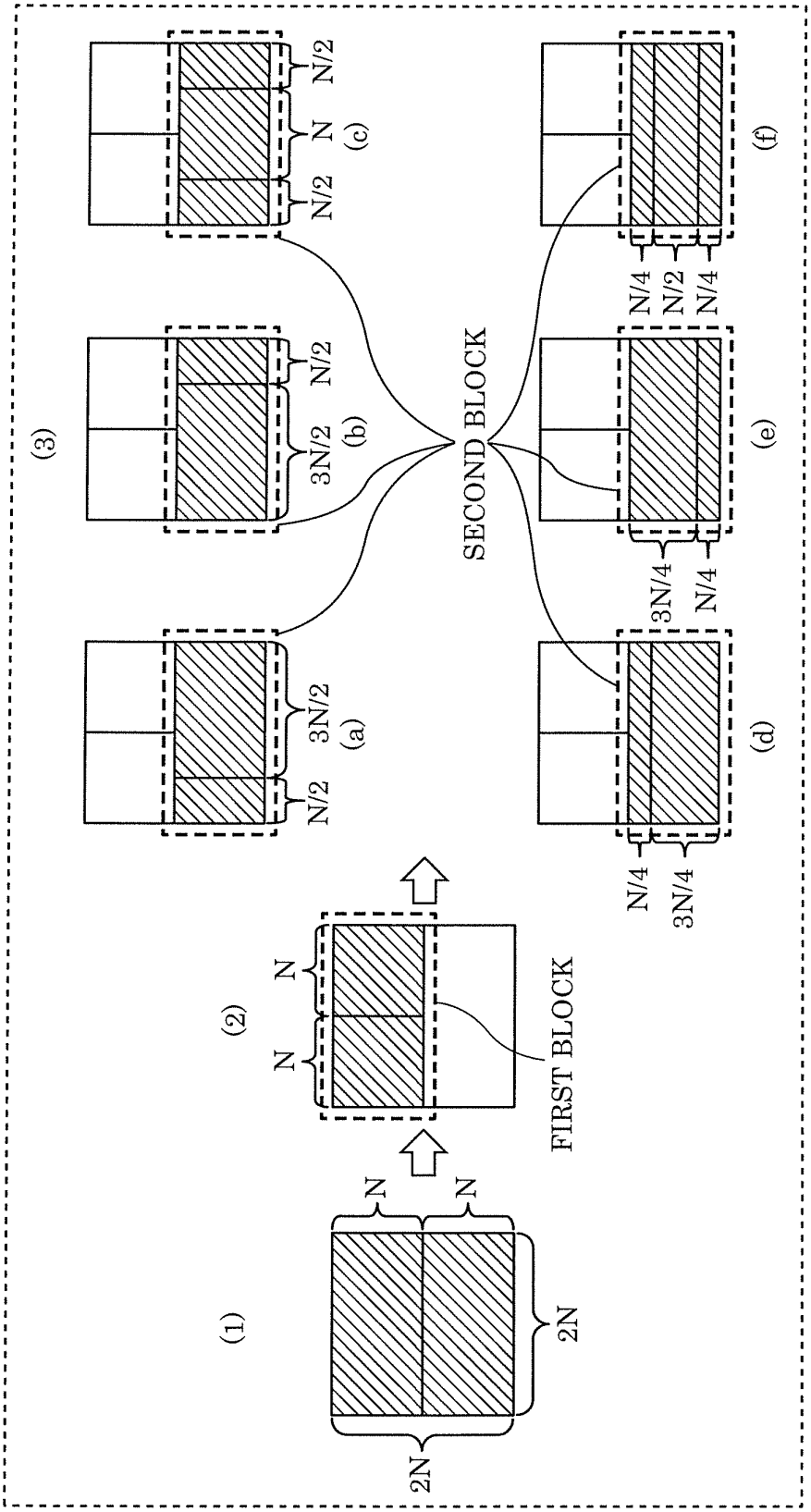

(1)
2N
2N
N
N
(2)
N
N
FIRST BLOCK
SECOND BLOCK
(3)
(a)
N/2
3N/2
(b)
3N/2
N/2
(c)
N/2
N
N/2
(d)
N/4
3N/4
(e)
3N/4
N/4
(f)
N/4
N/2
N/4

FIG. 25

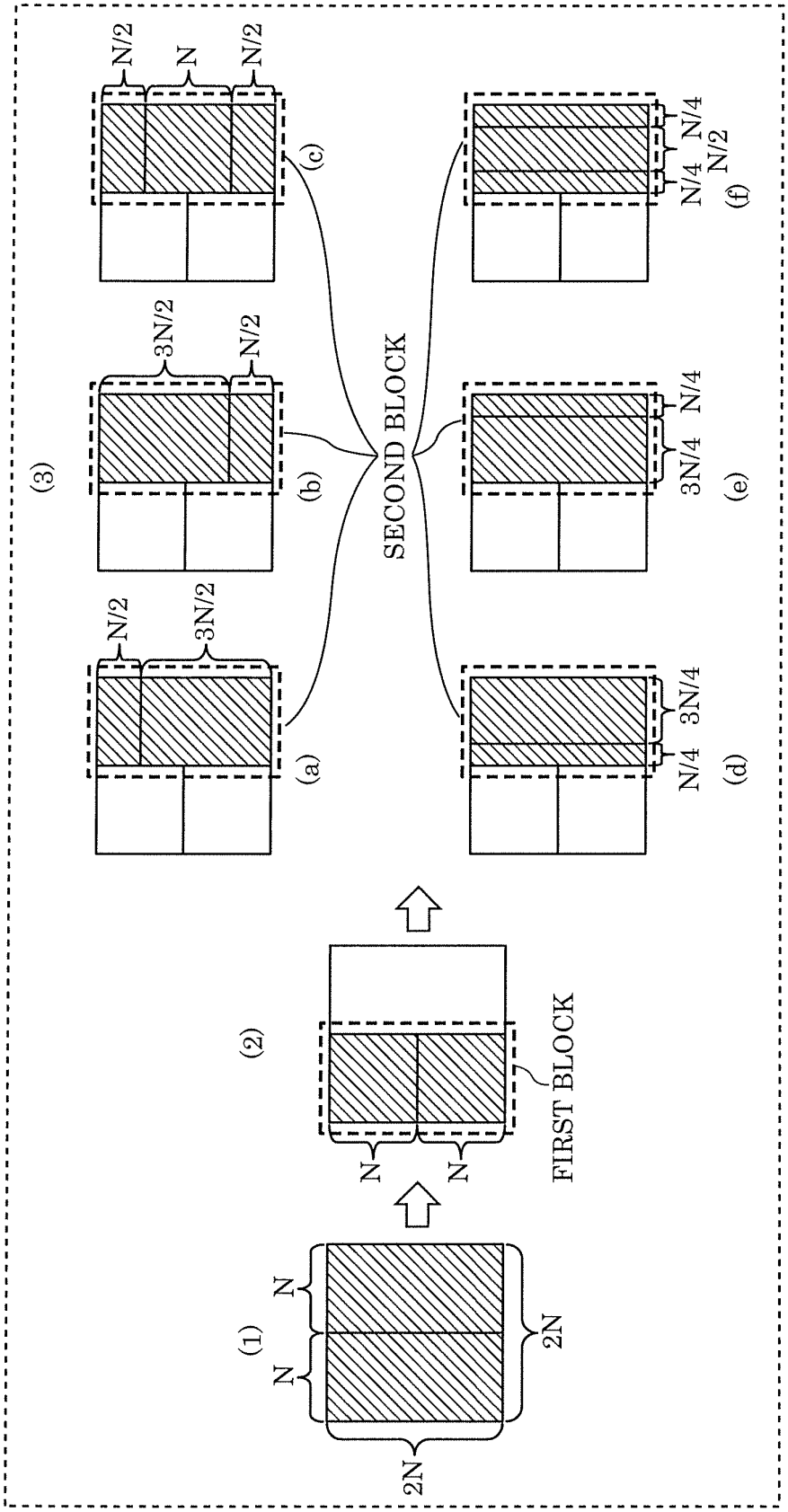

(1)
N
N
2N
2N
(2)
N
N
FIRST BLOCK
SECOND BLOCK
(3)
(a)
N/2
3N/2
(b)
3N/2
N/2
(c)
N/2
N
N/2
(d)
N/4
3N/4
(e)
3N/4
N/4
(f)
N/4
N/4
N/2

FIG. 26

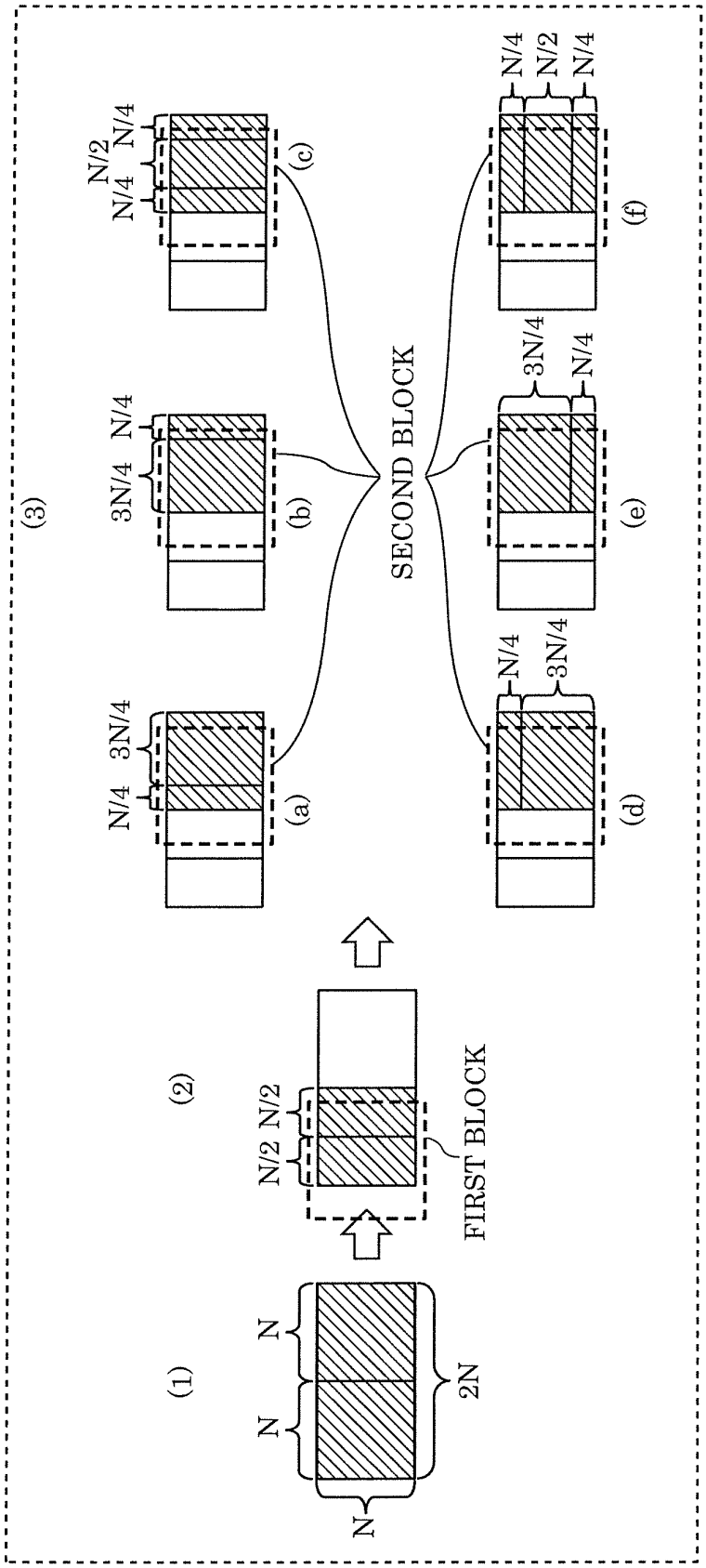

(1)
N
N
N
2N
(2)
N/2 N/2
FIRST BLOCK
SECOND BLOCK
(3)
N/4 3N/4
(a)
3N/4 N/4
(b)
N/2
N/4 N/4
(c)
N/4 3N/4
(d)
3N/4 N/4
(e)
N/4 N/2 N/4
(f)

FIG. 27

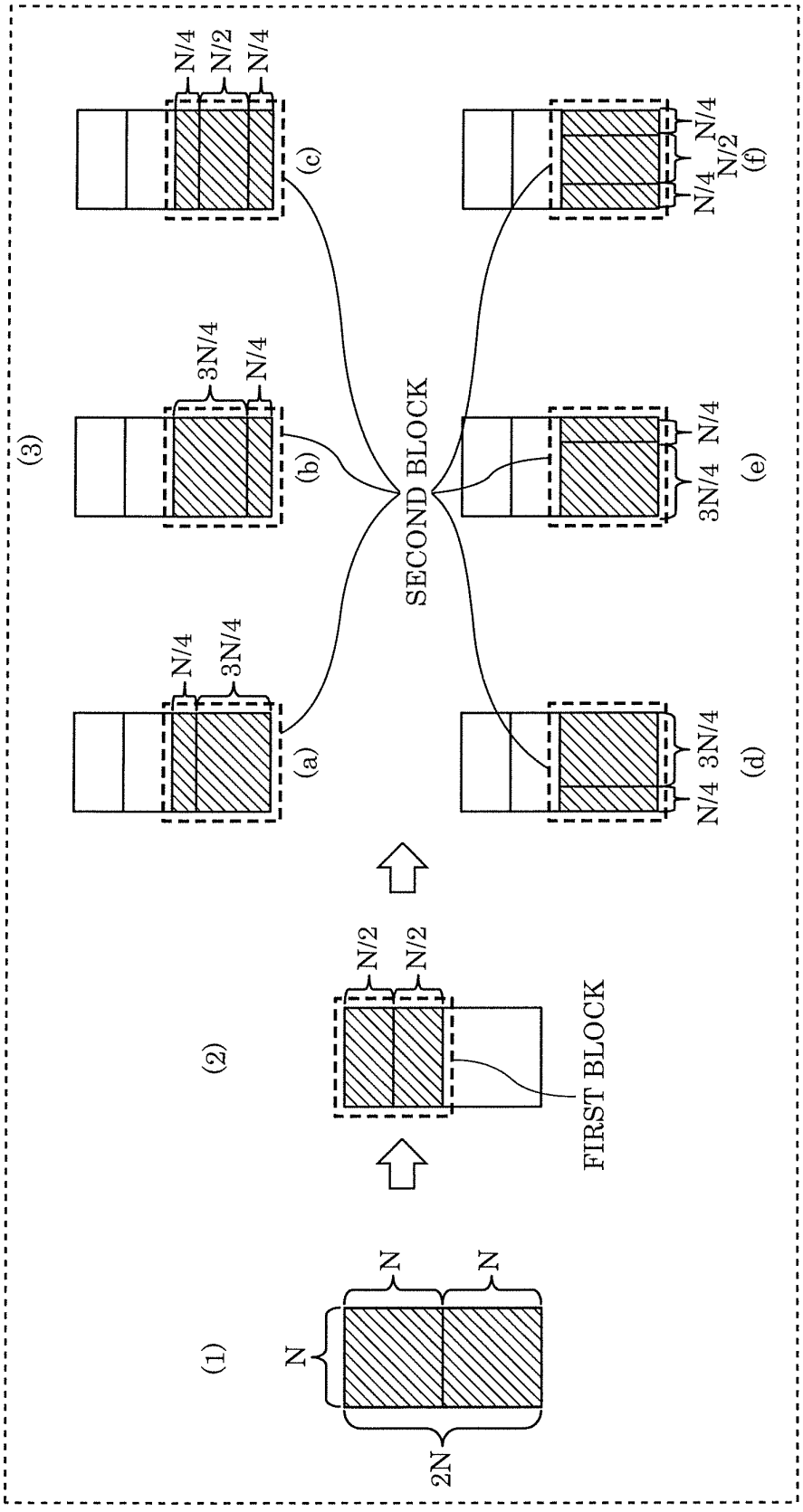

(1)
N
N
N
2N
(2)
N/2
N/2
FIRST BLOCK
(3)
N/4
3N/4
(a)
3N/4
N/4
(b)
N/4
N/2
N/4
(c)
SECOND BLOCK
N/4 3N/4
(d)
3N/4 N/4
(e)
N/4
N/2
N/4
(f)

FIG. 28

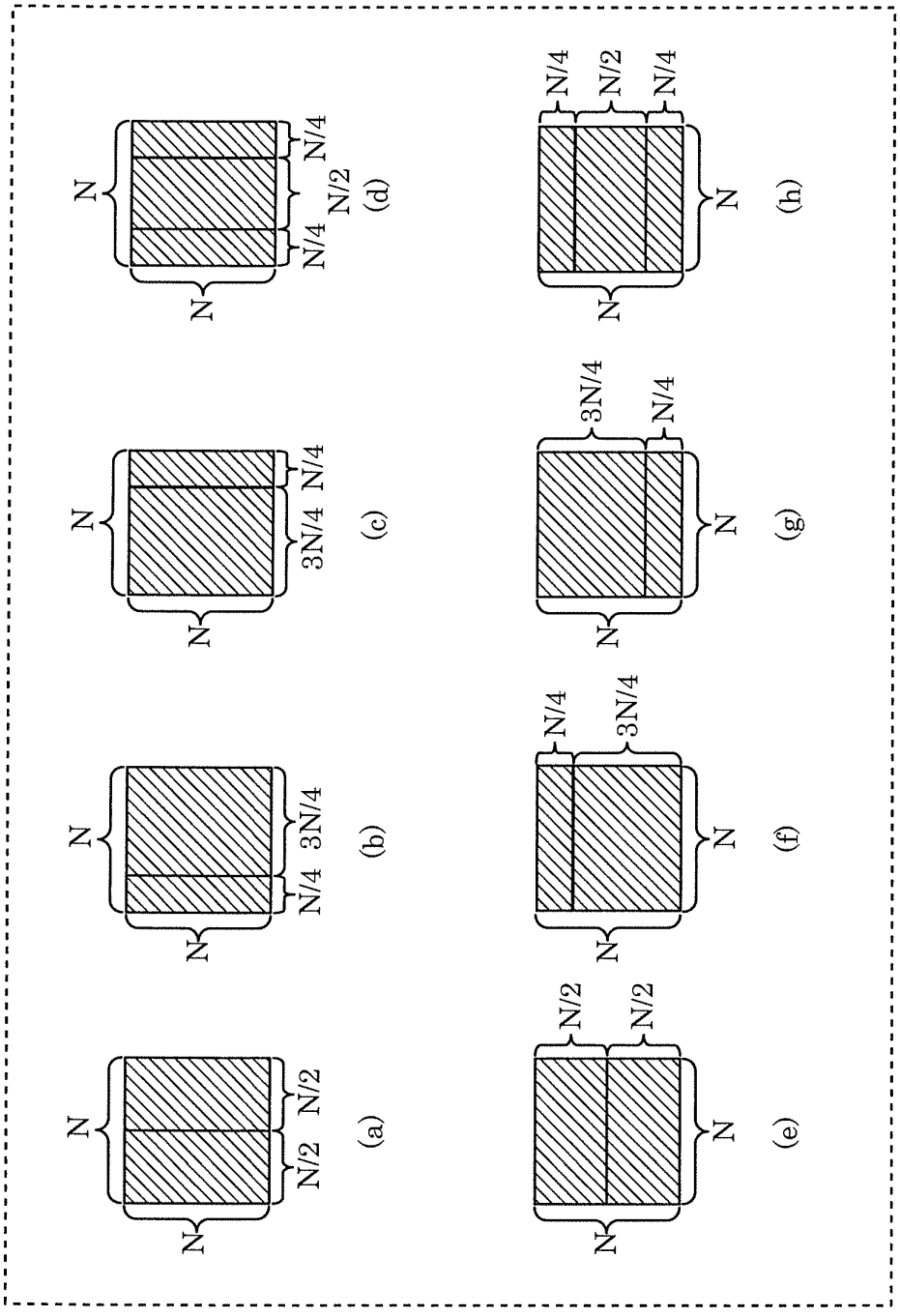

N
N
N/2
N/2
(a)
N
N
N/4
3N/4
(b)
N
N
3N/4
N/4
(c)
N
N
N/4
N/2
N/4
(d)
N
N
N/2
N/2
(e)
N
N
N/4
3N/4
(f)
N
N
3N/4
N/4
(g)
N
N
N/4
N/2
N/4
(h)

FIG. 29

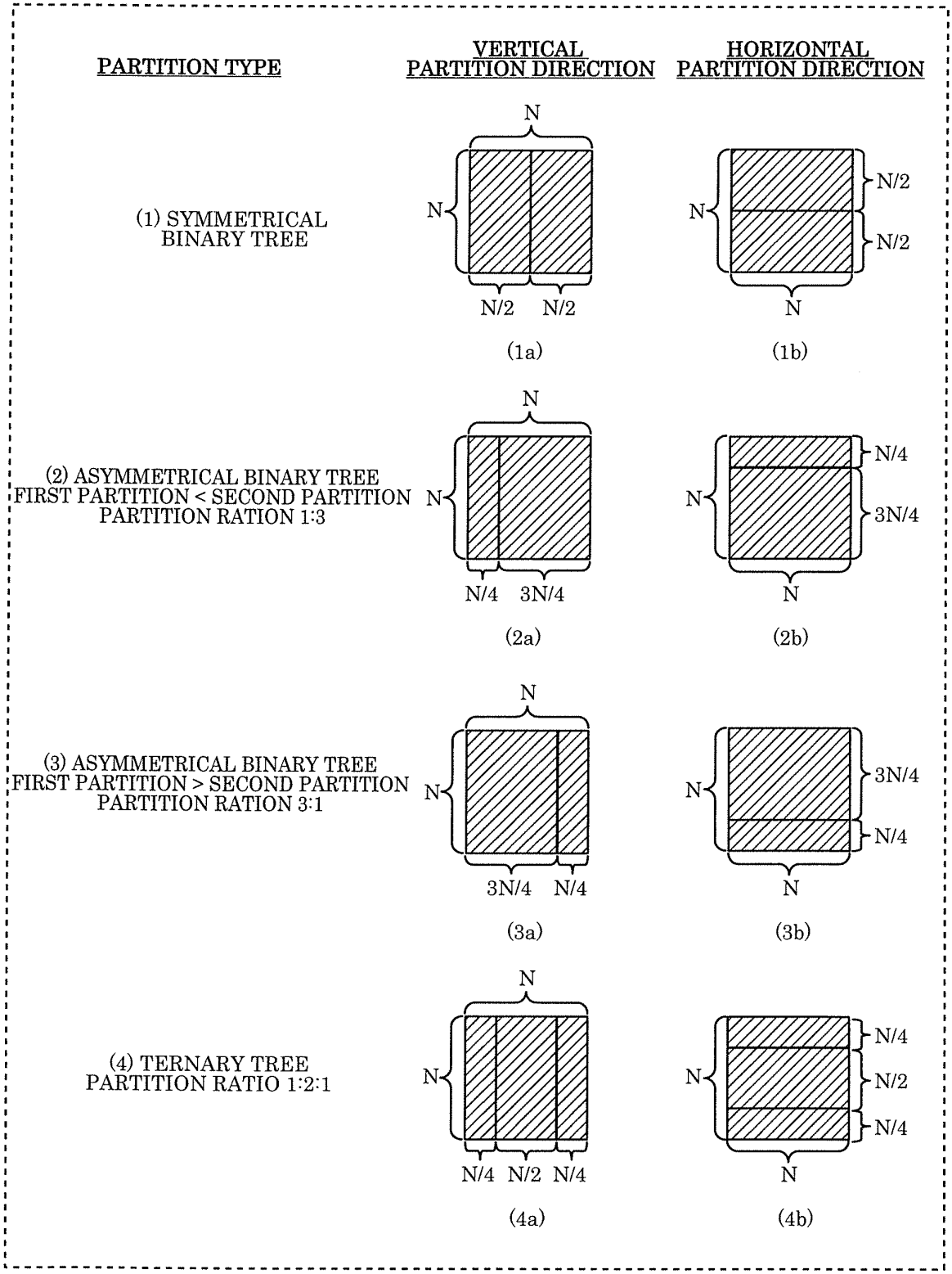

PARTITION TYPE
VERTICAL PARTITION DIRECTION
HORIZONTAL PARTITION DIRECTION
(1) SYMMETRICAL BINARY TREE
N
N
N/2
N/2
(1a)
N
N
N/2
N/2
(1b)
(2) ASYMMETRICAL BINARY TREE
FIRST PARTITION < SECOND PARTITION
PARTITION RATION 1:3
N
N
N/4
3N/4
(2a)
N
N
N/4
3N/4
(2b)
(3) ASYMMETRICAL BINARY TREE
FIRST PARTITION > SECOND PARTITION
PARTITION RATION 3:1
N
N
3N/4
N/4
(3a)
N
N
3N/4
N/4
(3b)
(4) TERNARY TREE
PARTITION RATIO 1:2:1
N
N
N/4
N/2
N/4
(4a)
N
N
N/4
N/2
N/4
(4b)

FIG. 30

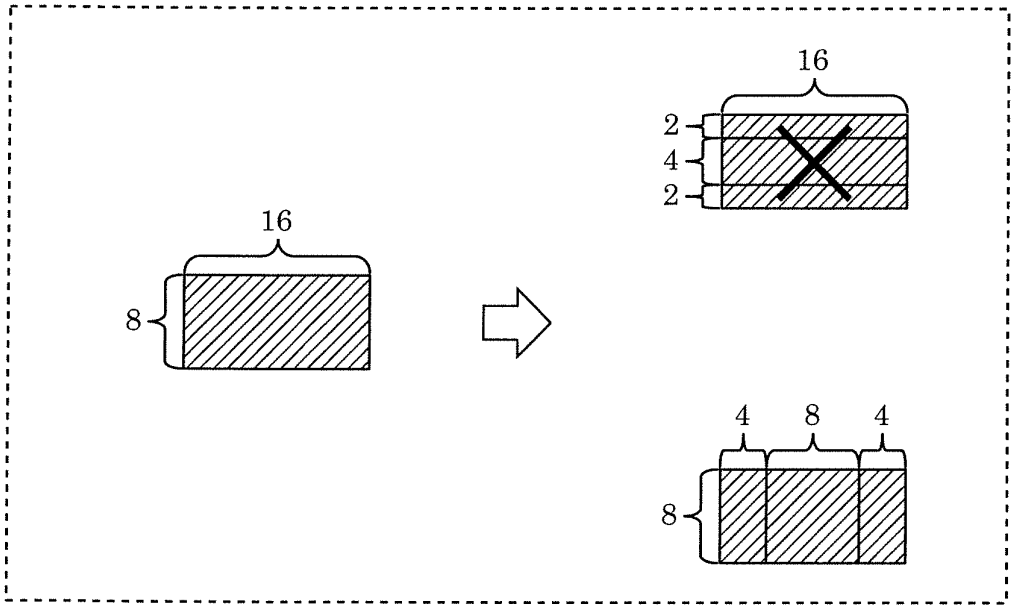


FIG. 31A

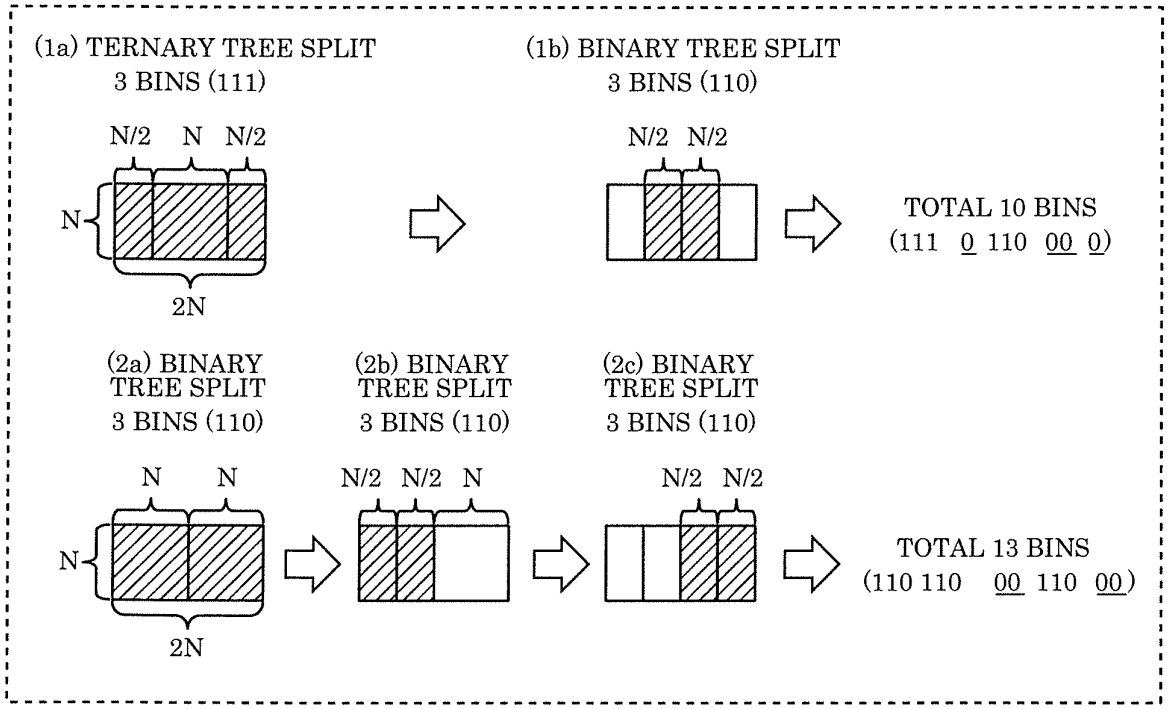


FIG. 31B

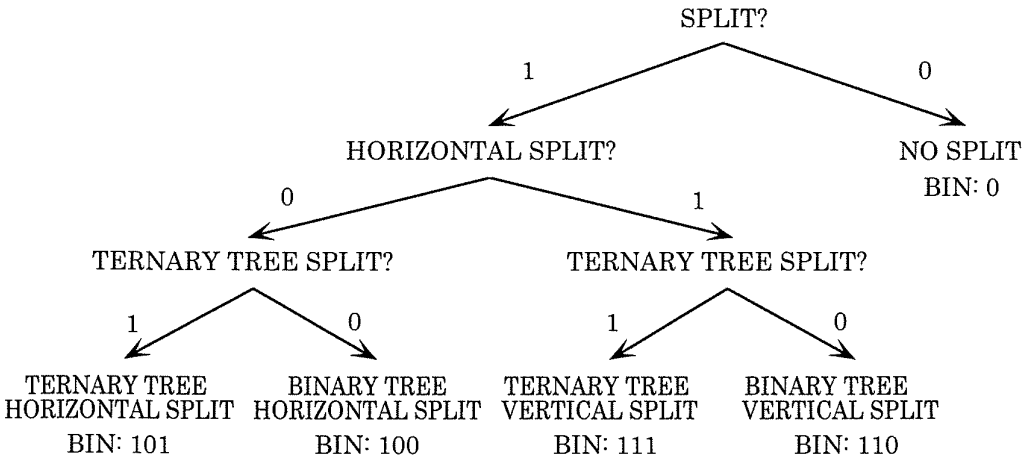


FIG. 32A

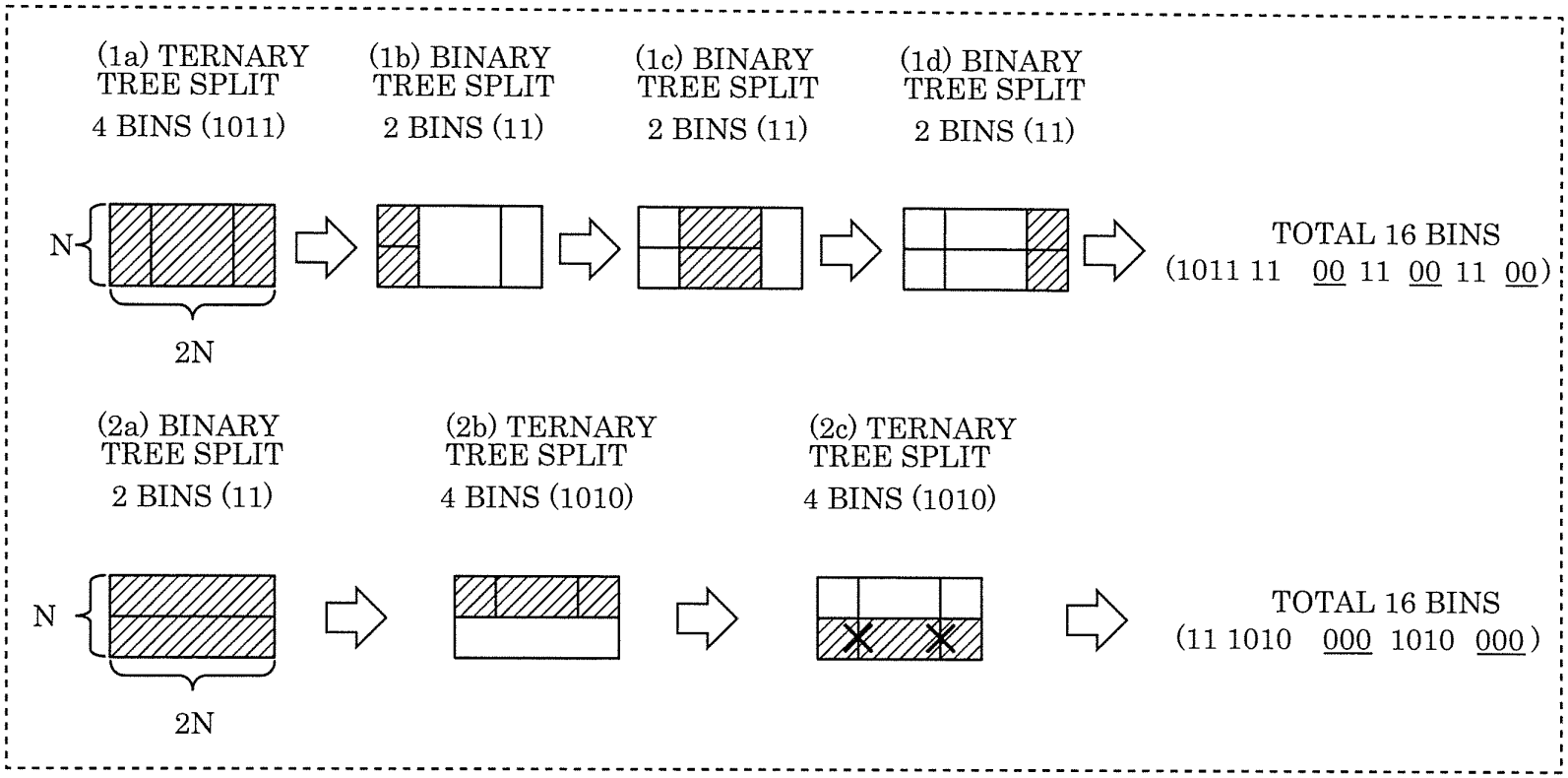

(1a) TERNARY TREE SPLIT
4 BINS (1011)
(1b) BINARY TREE SPLIT
2 BINS (11)
(1c) BINARY TREE SPLIT
2 BINS (11)
(1d) BINARY TREE SPLIT
2 BINS (11)
N
2N
TOTAL 16 BINS
(1011 11 00 11 00 11 00)
(2a) BINARY TREE SPLIT
2 BINS (11)
(2b) TERNARY TREE SPLIT
4 BINS (1010)
(2c) TERNARY TREE SPLIT
4 BINS (1010)
N
2N
TOTAL 16 BINS
(11 1010 000 1010 000)

FIG. 32B

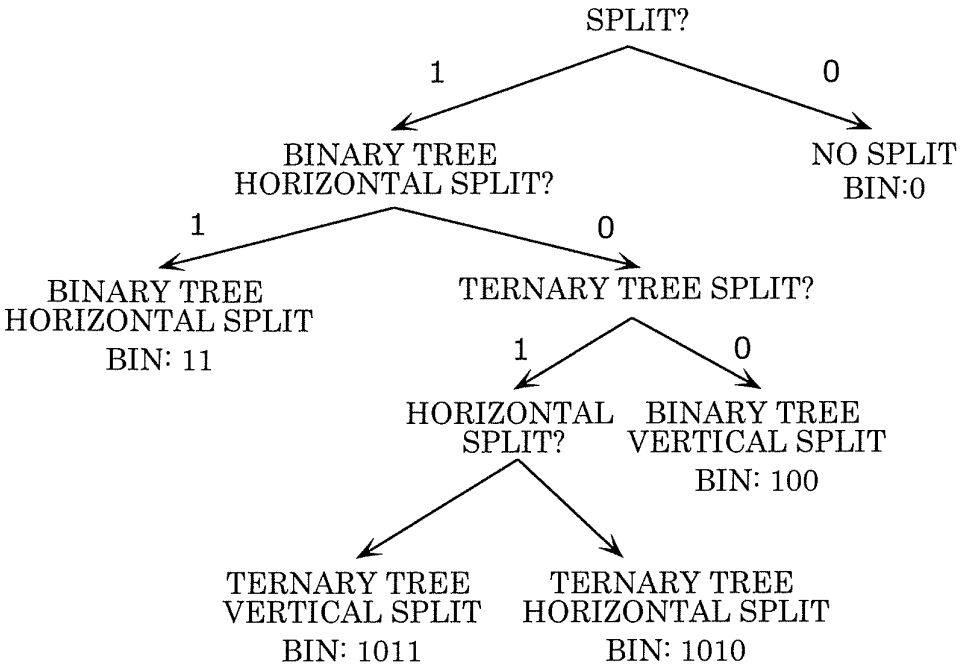


FIG. 32C

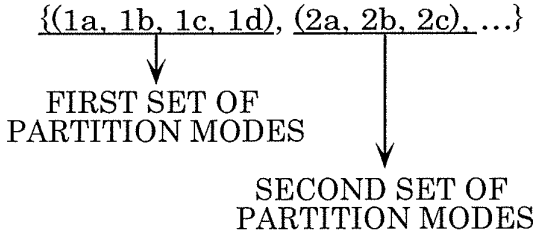


FIG. 33

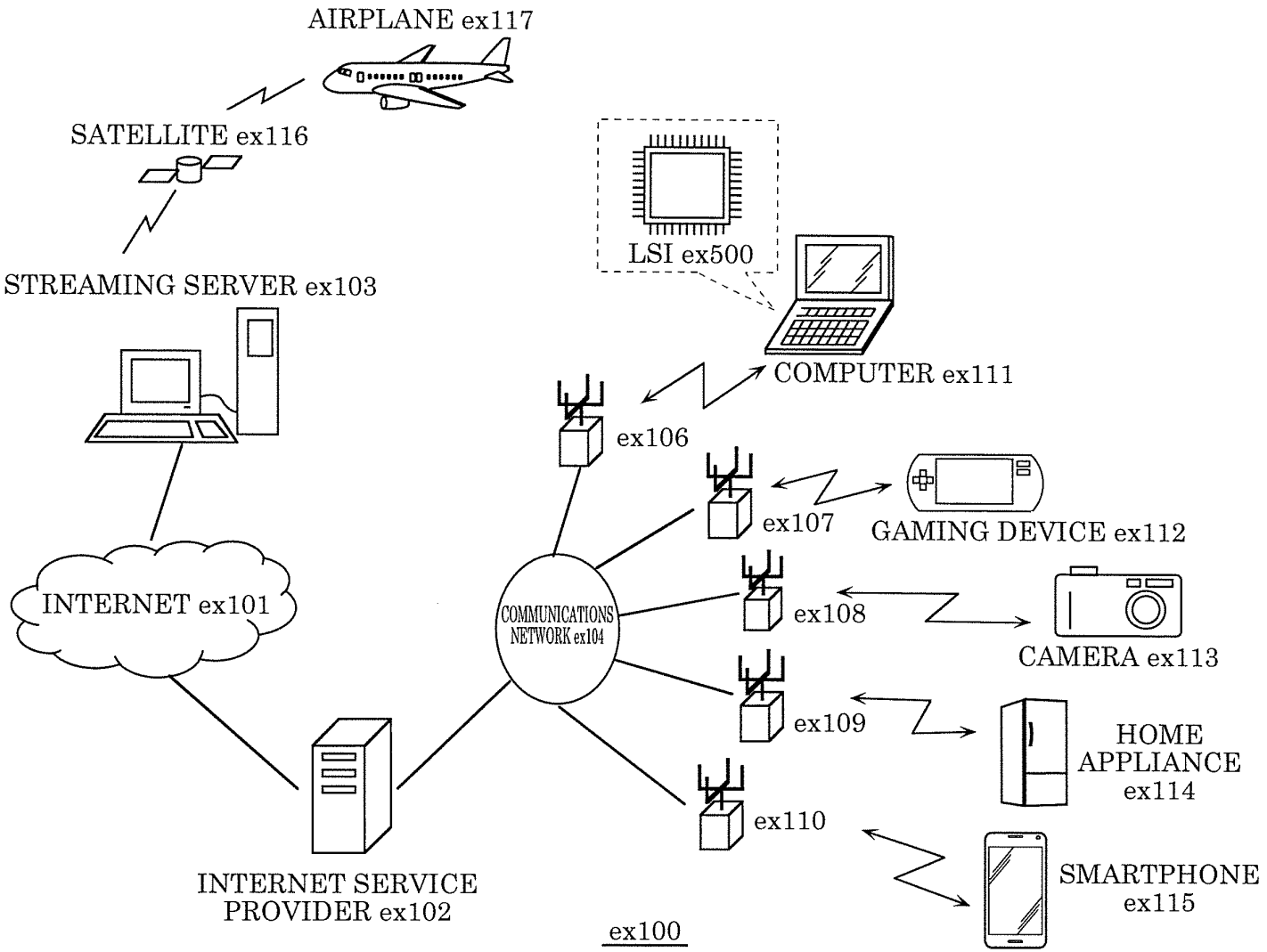

AIRPLANE ex117
SATELLITE ex116
STREAMING SERVER ex103
LSI ex500
COMPUTER ex111
ex106
ex107
GAMING DEVICE ex112
INTERNET ex101
COMMUNICATIONS NETWORK ex104
ex108
CAMERA ex113
ex109
HOME APPLIANCE ex114
ex110
SMARTPHONE ex115
INTERNET SERVICE PROVIDER ex102
ex100

FIG. 34

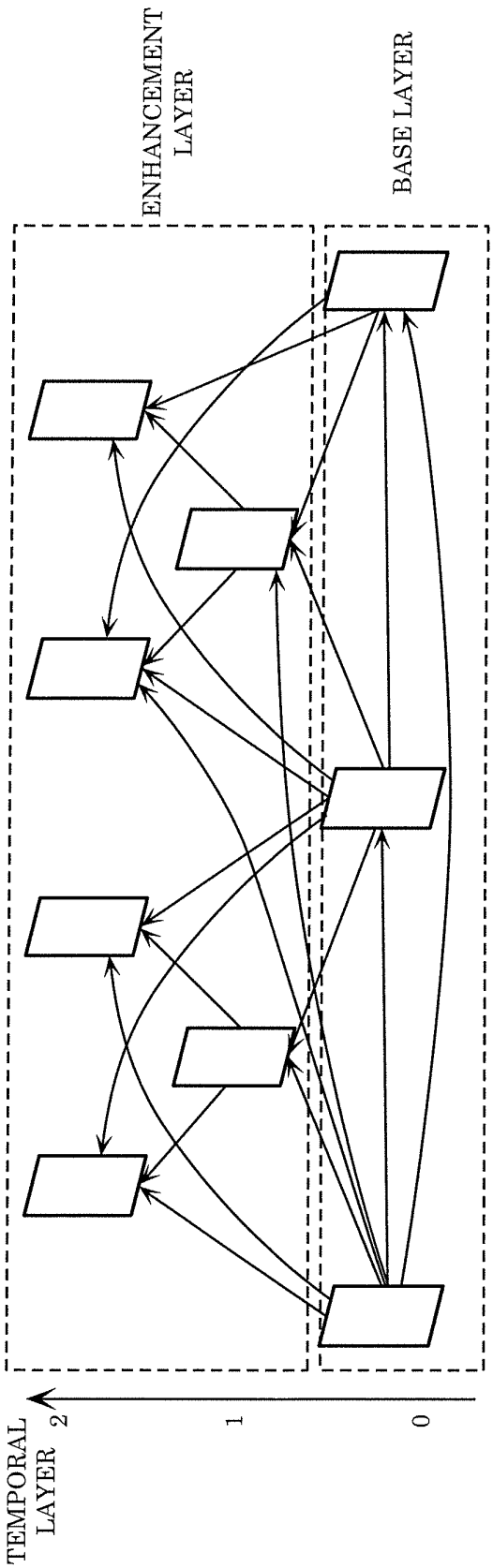


FIG. 35

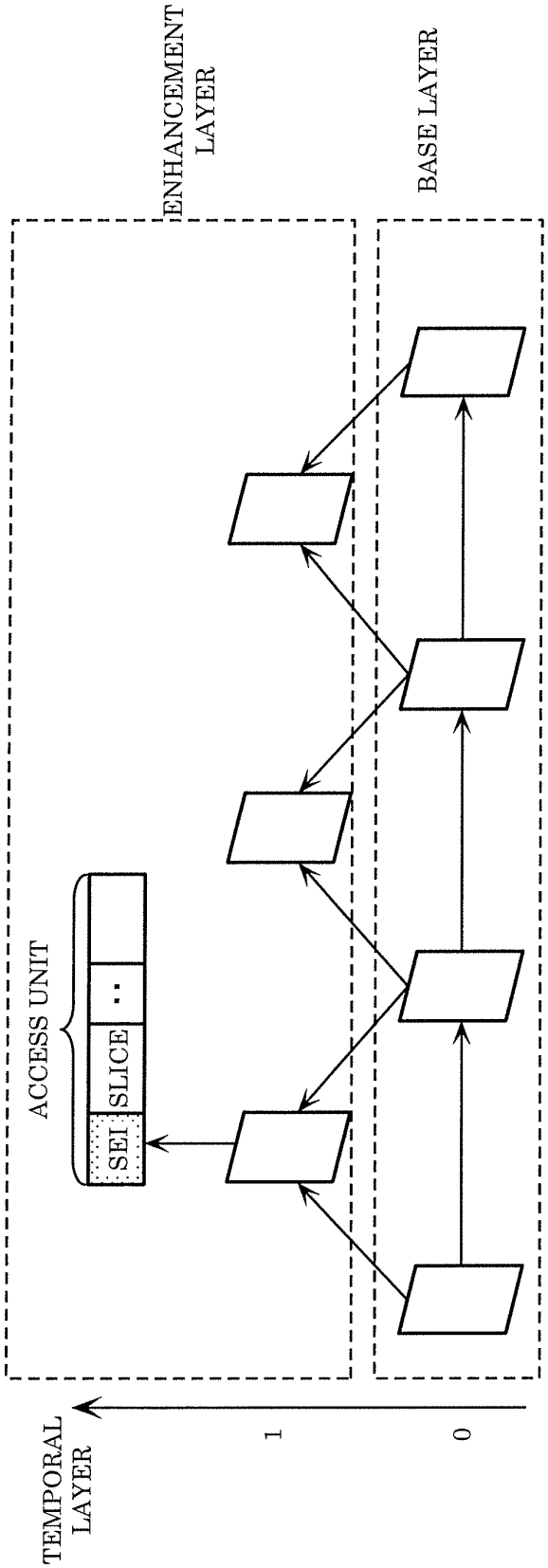

ENHANCEMENT LAYER
BASE LAYER
ACCESS UNIT
SEI
SLICE
TEMPORAL LAYER
1
0

FIG. 36

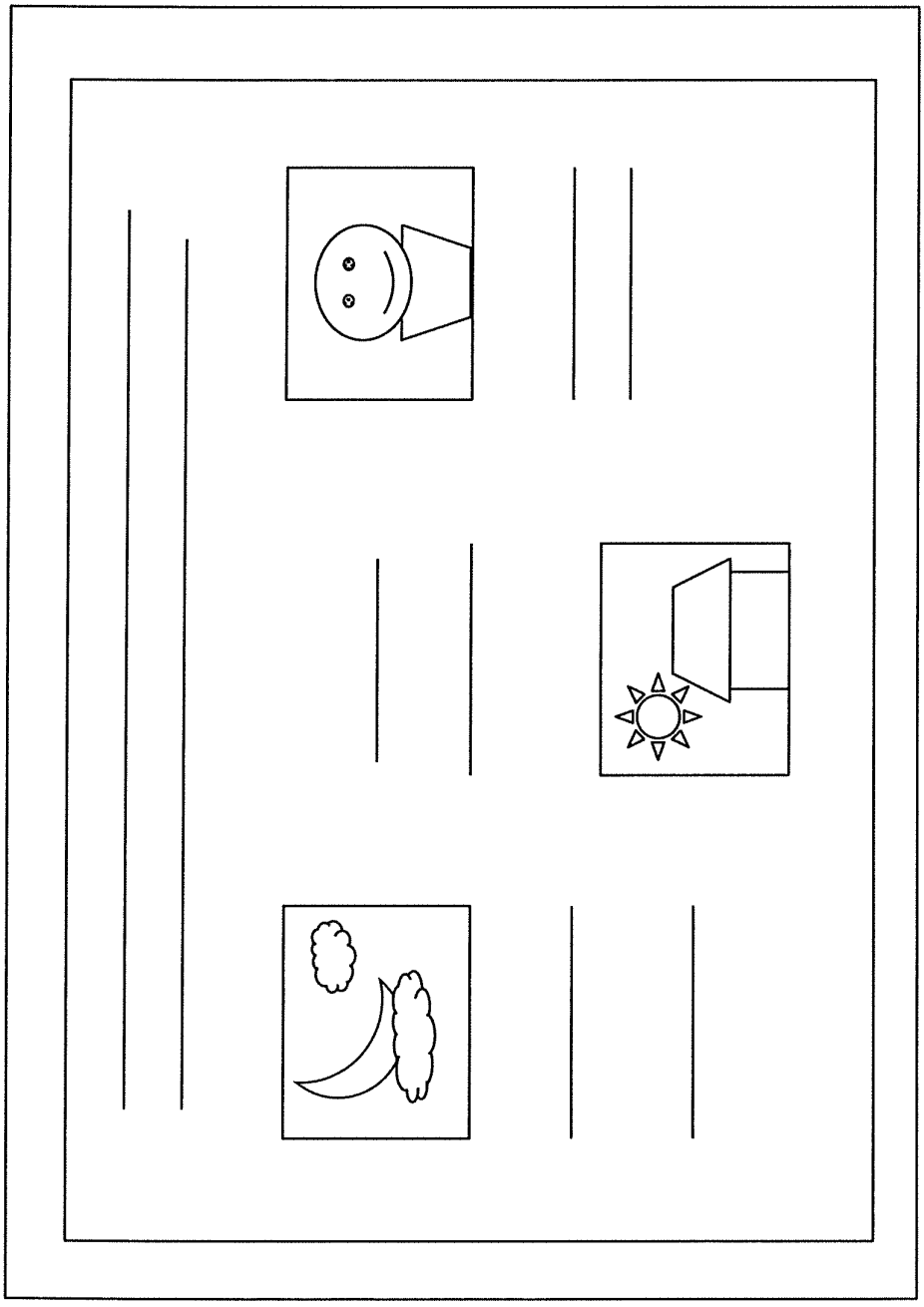


FIG. 37

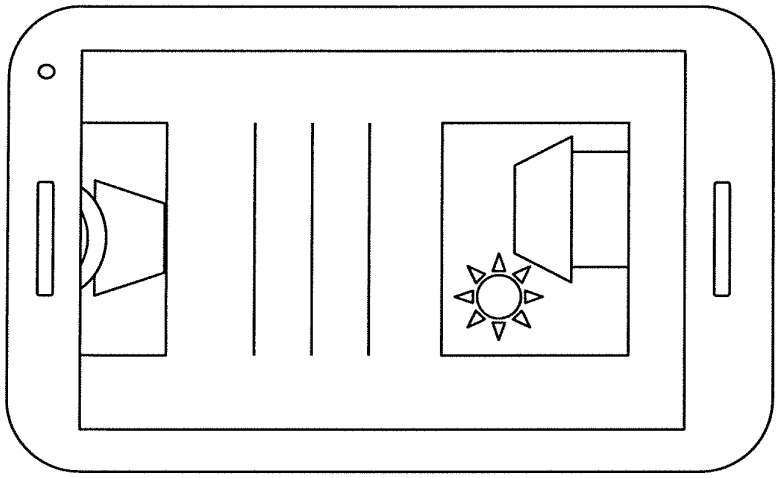


FIG. 38

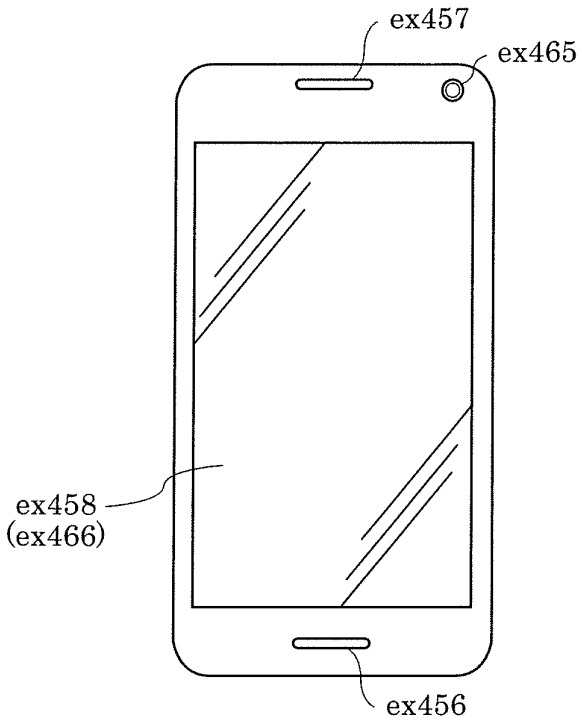

ex457
ex465
ex458
(ex466)
ex456
ex115

FIG. 39

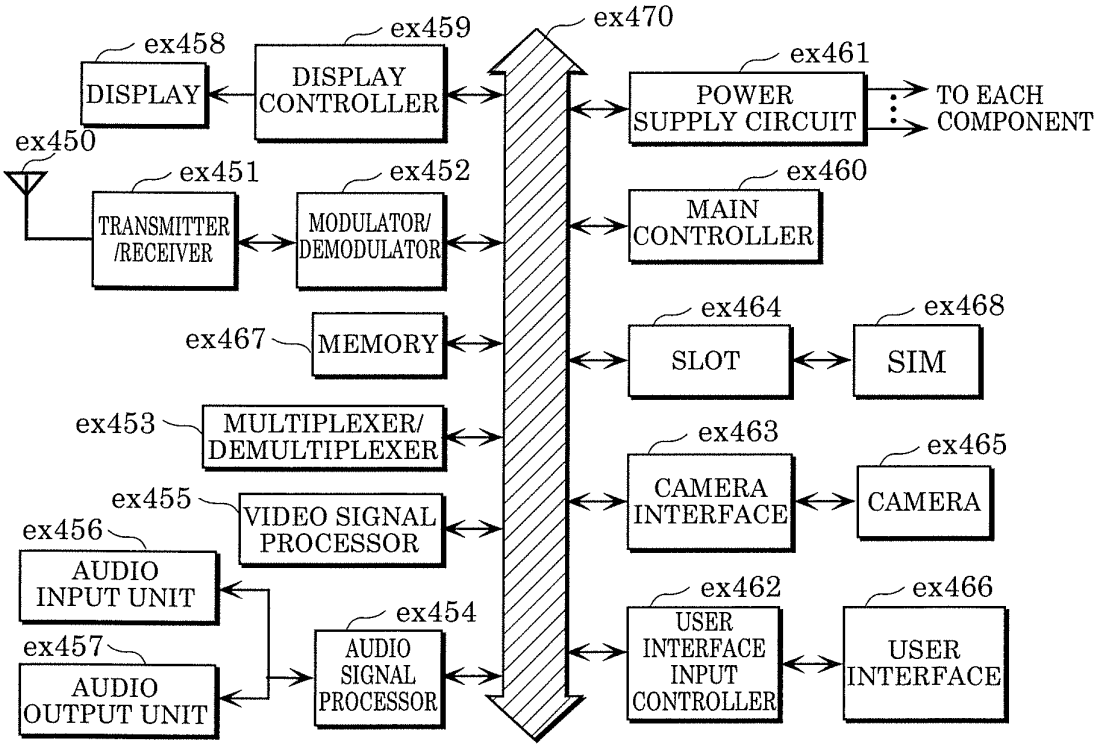

ex470
ex458
DISPLAY
ex459
DISPLAY CONTROLLER
ex461
POWER SUPPLY CIRCUIT
TO EACH COMPONENT
ex450
ex451
TRANSMITTER /RECEIVER
ex452
MODULATOR/ DEMODULATOR
ex460
MAIN CONTROLLER
ex467
MEMORY
ex464
SLOT
ex468
SIM
ex453
MULTIPLEXER/ DEMULTIPLEXER
ex463
CAMERA INTERFACE
ex465
CAMERA
ex455
VIDEO SIGNAL PROCESSOR
ex456
AUDIO INPUT UNIT
ex462
USER INTERFACE INPUT CONTROLLER
ex466
USER INTERFACE
ex454
AUDIO SIGNAL PROCESSOR
ex457
AUDIO OUTPUT UNIT

FIG. 40

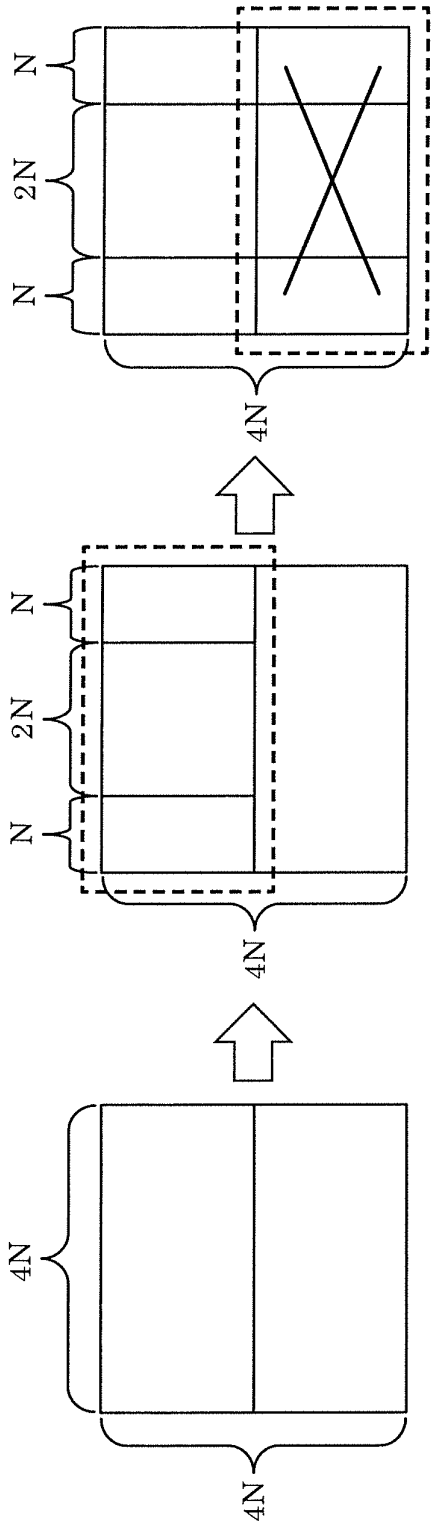


FIG. 41

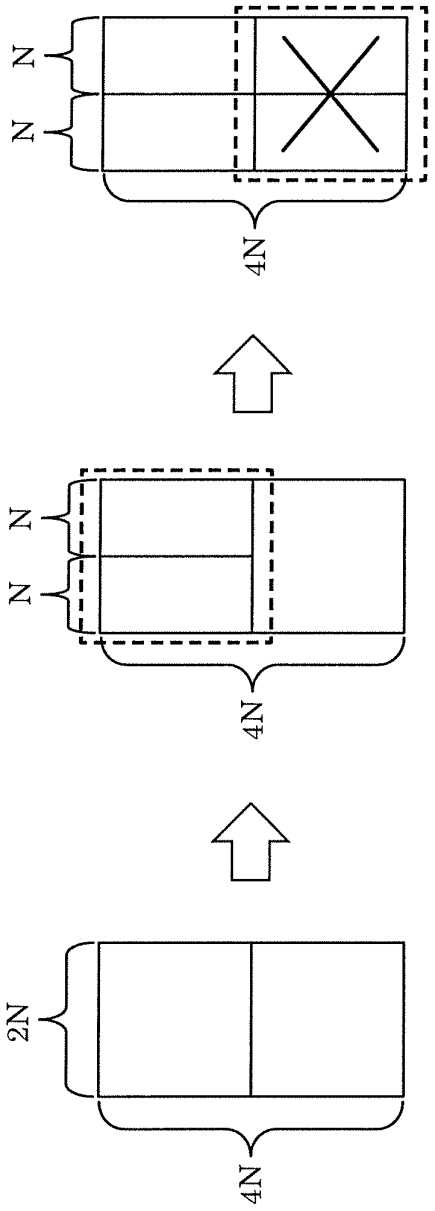


FIG. 42

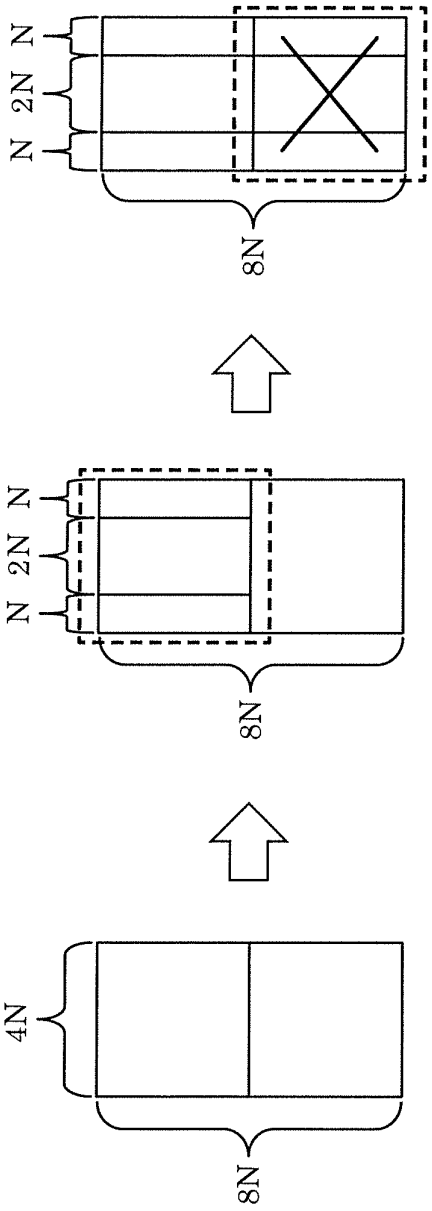


FIG. 43

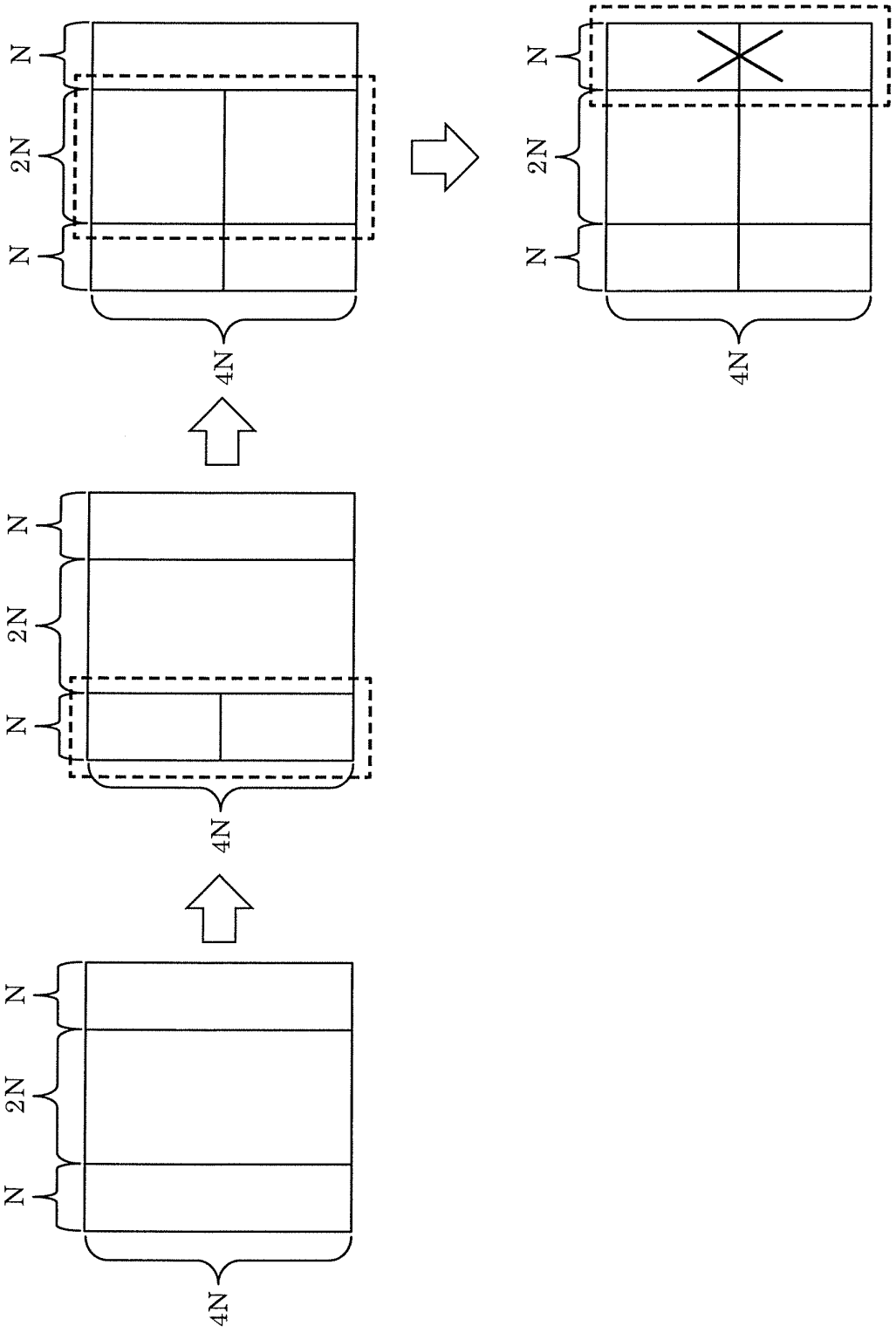


FIG. 44

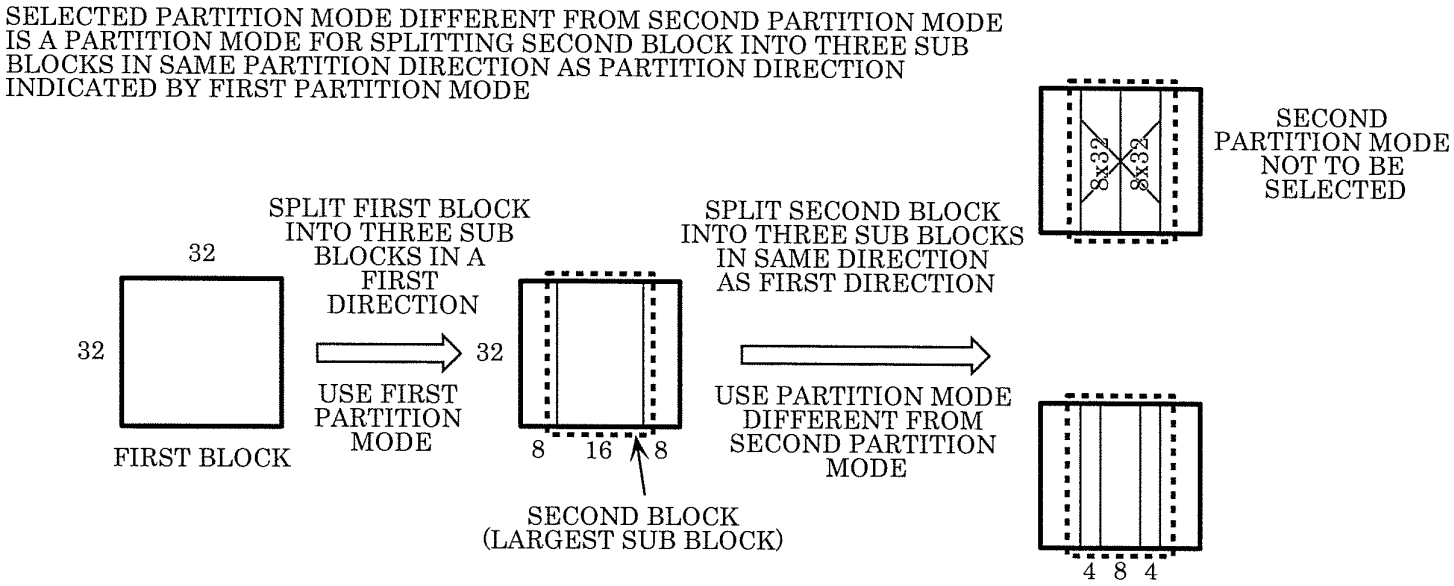
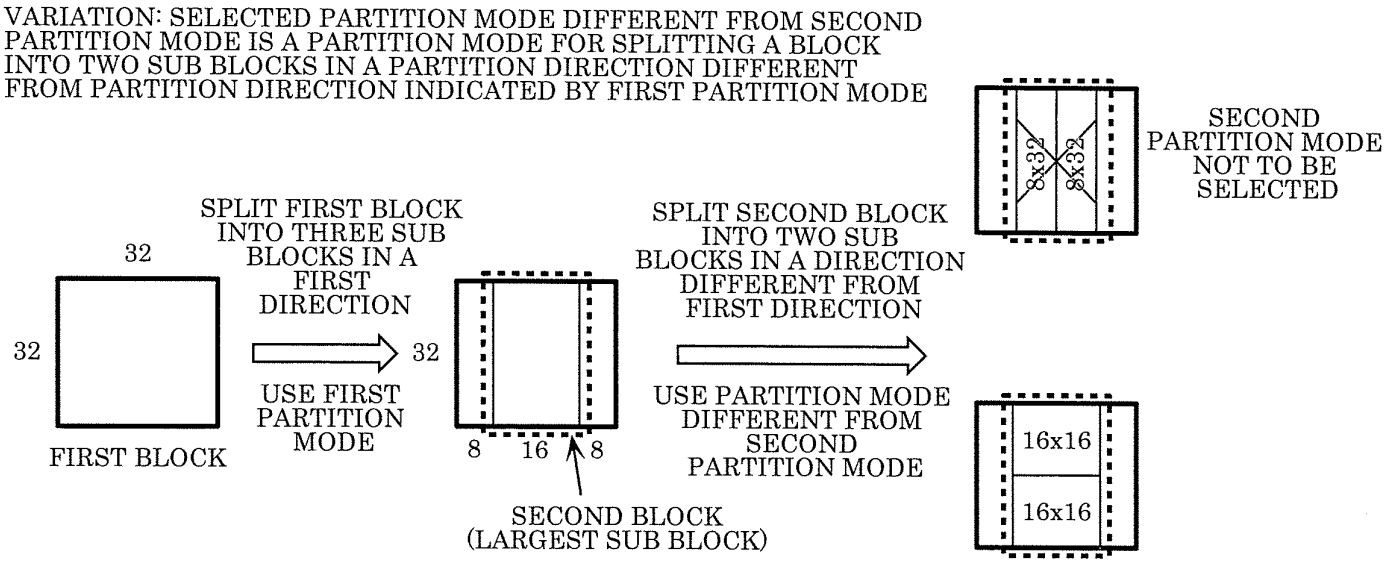

SELECTED PARTITION MODE DIFFERENT FROM SECOND PARTITION MODE IS A PARTITION MODE FOR SPLITTING SECOND BLOCK INTO THREE SUB BLOCKS IN SAME PARTITION DIRECTION AS PARTITION DIRECTION INDICATED BY FIRST PARTITION MODE
32
32
FIRST BLOCK
SPLIT FIRST BLOCK INTO THREE SUB BLOCKS IN A FIRST DIRECTION
USE FIRST PARTITION MODE
32
8
16
8
SECOND BLOCK (LARGEST SUB BLOCK)
SPLIT SECOND BLOCK INTO THREE SUB BLOCKS IN SAME DIRECTION AS FIRST DIRECTION
8x32
8x32
SECOND PARTITION MODE NOT TO BE SELECTED
USE PARTITION MODE DIFFERENT FROM SECOND PARTITION MODE
4
8
4

FIG. 45


VARIATION: SELECTED PARTITION MODE DIFFERENT FROM SECOND PARTITION MODE IS A PARTITION MODE FOR SPLITTING A BLOCK INTO TWO SUB BLOCKS IN A PARTITION DIRECTION DIFFERENT FROM PARTITION DIRECTION INDICATED BY FIRST PARTITION MODE
32
32
FIRST BLOCK
SPLIT FIRST BLOCK INTO THREE SUB BLOCKS IN A FIRST DIRECTION
USE FIRST PARTITION MODE
32
8
16
8
SECOND BLOCK (LARGEST SUB BLOCK)
SPLIT SECOND BLOCK INTO TWO SUB BLOCKS IN A DIRECTION DIFFERENT FROM FIRST DIRECTION
USE PARTITION MODE DIFFERENT FROM SECOND PARTITION MODE
8x32
8x32
SECOND PARTITION MODE NOT TO BE SELECTED
16x16
16x16