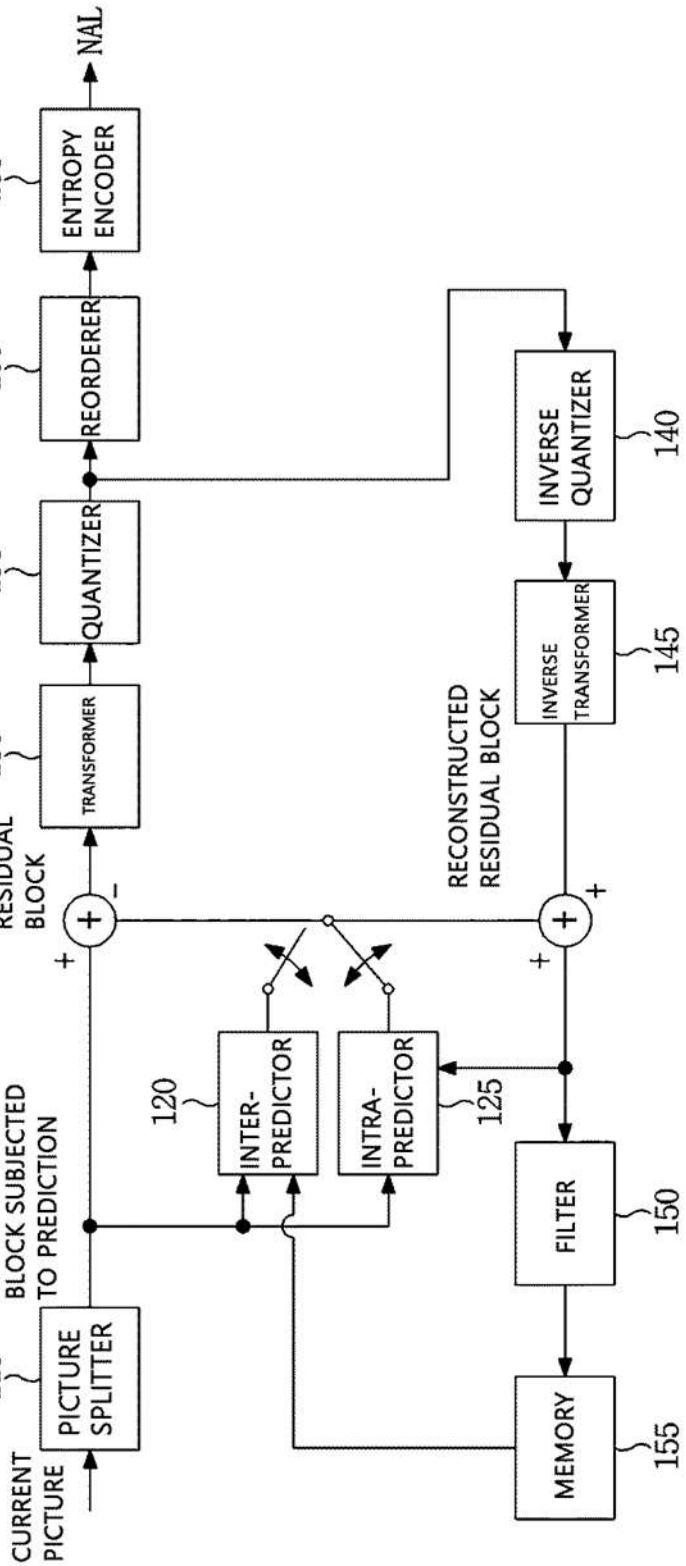

CURRENT PICTURE
110
PICTURE SPLITTER
BLOCK SUBJECTED TO PREDICTION
120
INTER-PREDICTOR
125
INTRA-PREDICTOR
RESIDUAL BLOCK
130
TRANSFORMER
135
QUANTIZER
160
REORDERER
165
ENTROPY ENCODER
NAL
RECONSTRUCTED RESIDUAL BLOCK
140
INVERSE QUANTIZER
145
INVERSE TRANSFORMER
150
FILTER
155
MEMORY

FIG. 1

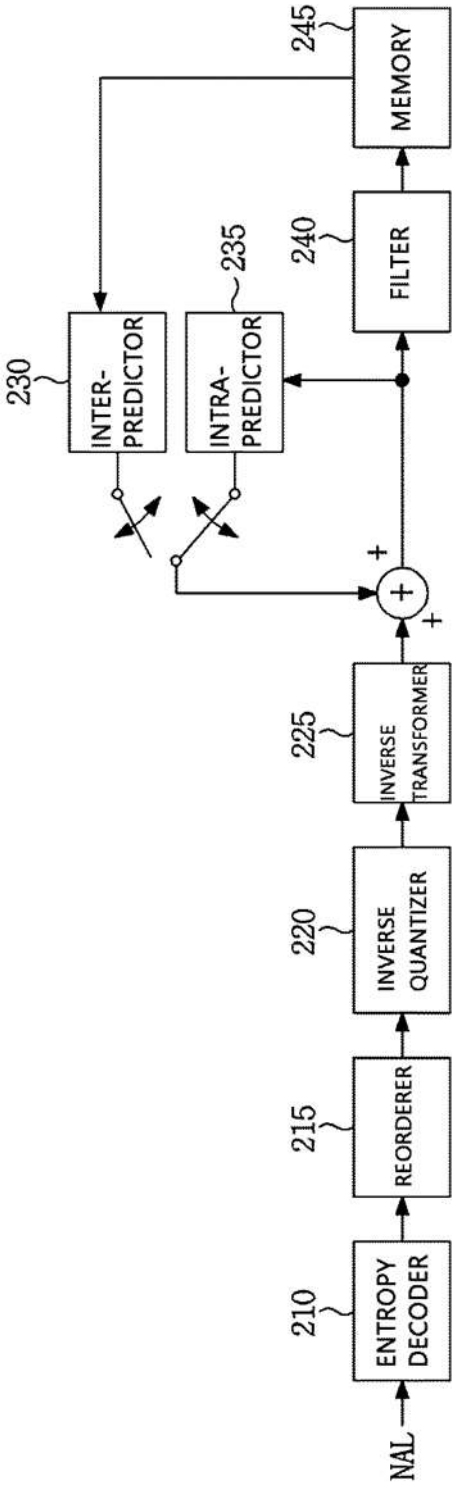

NAL
210
ENTROPY DECODER
215
REORDERER
220
INVERSE QUANTIZER
225
INVERSE TRANSFORMER
+
+
230
INTER-PREDICTOR
235
INTRA-PREDICTOR
240
FILTER
245
MEMORY

FIG. 2

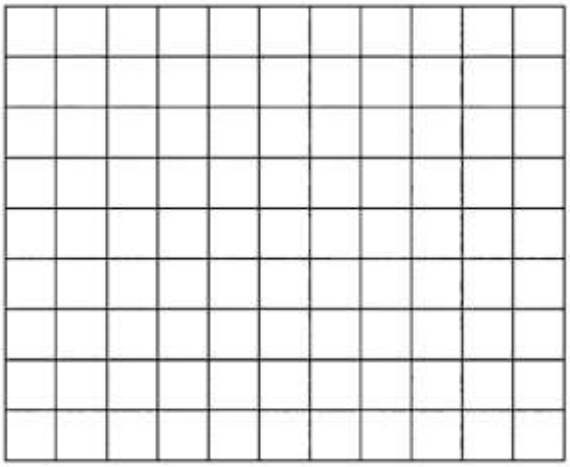


FIG. 3



FIG. 4

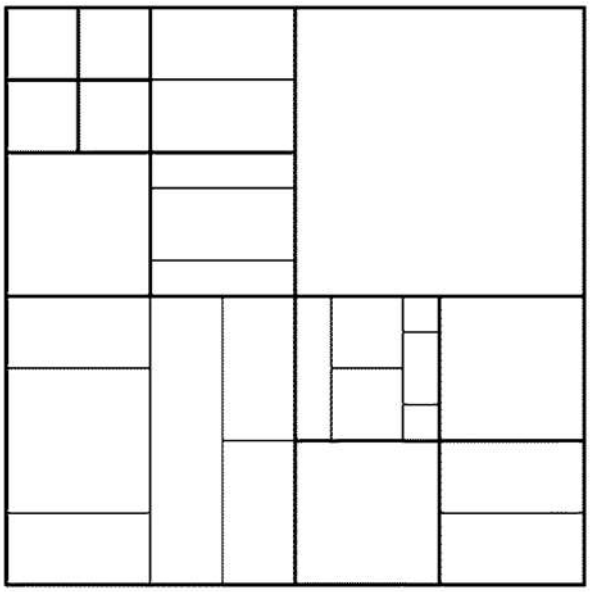


FIG. 5

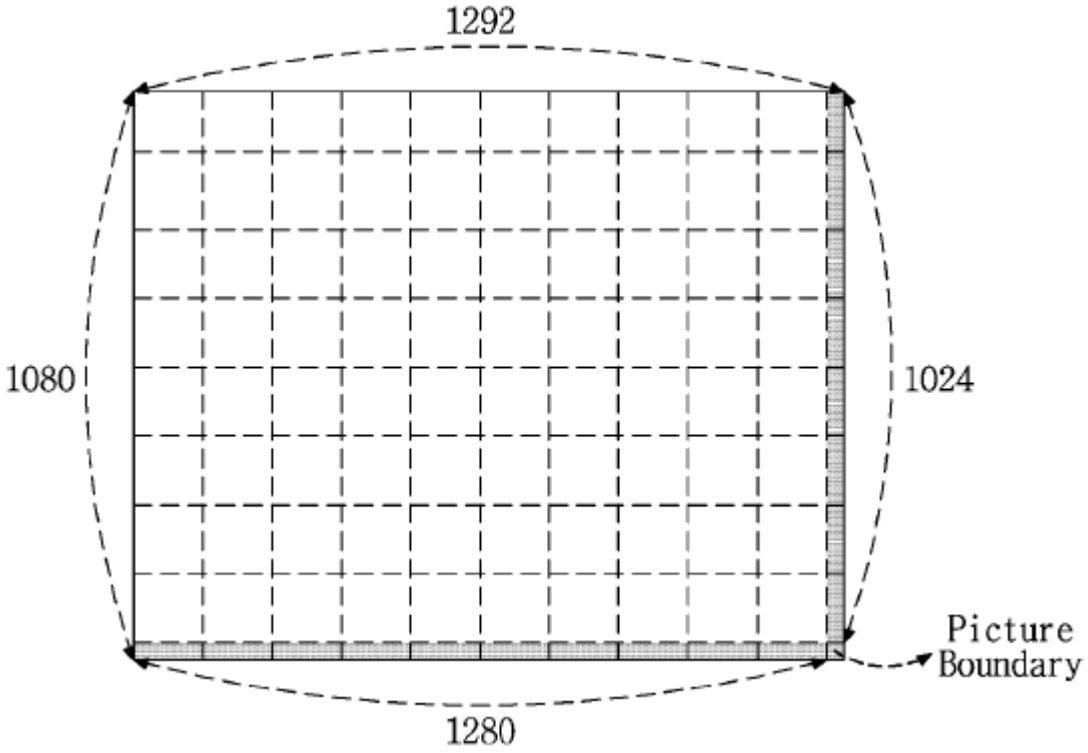


FIG. 6

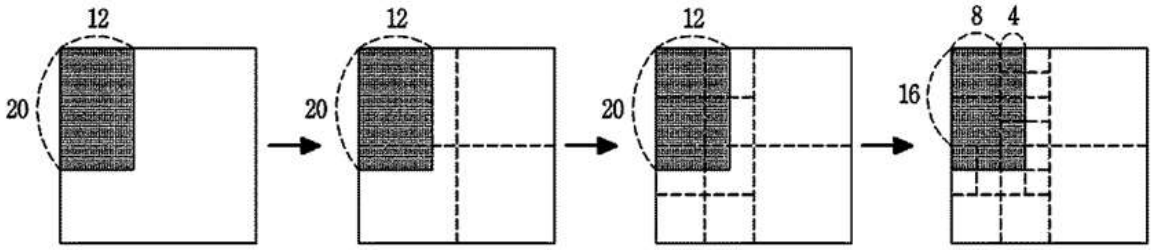


FIG. 7

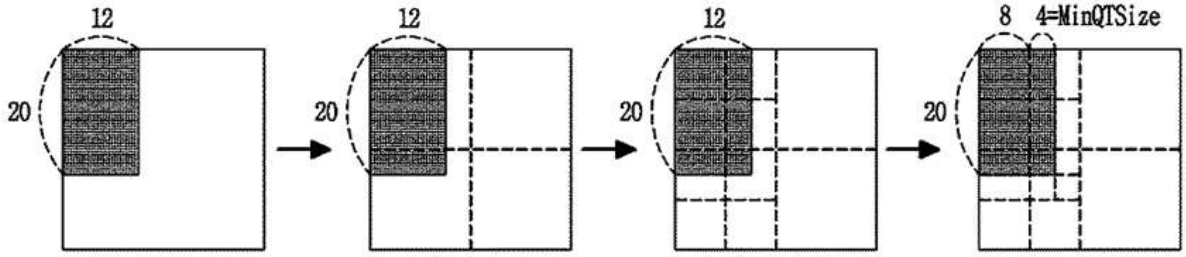


FIG. 8

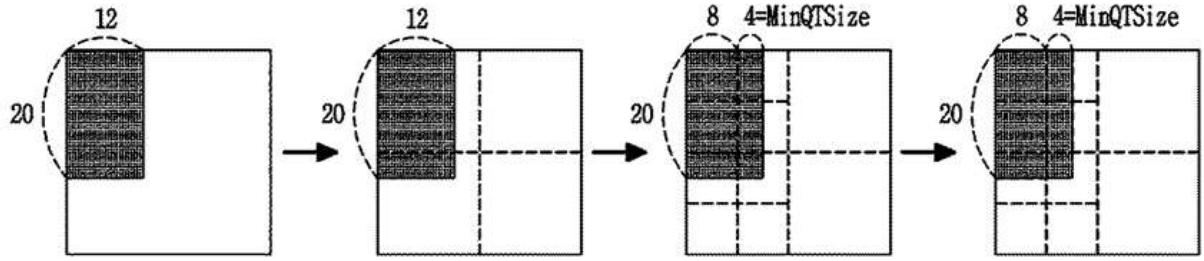


FIG. 9

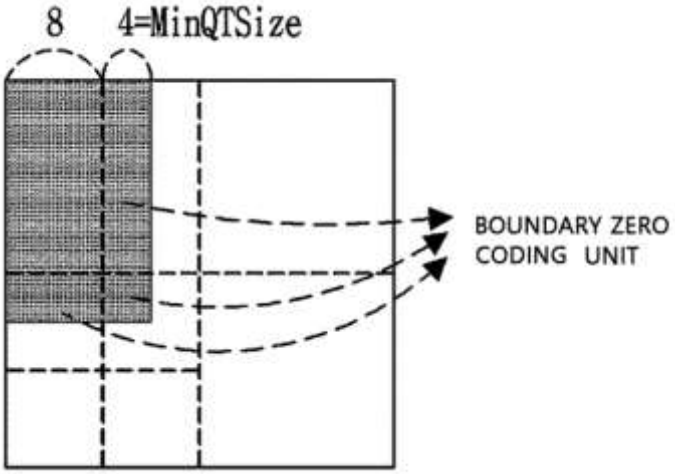


FIG. 10

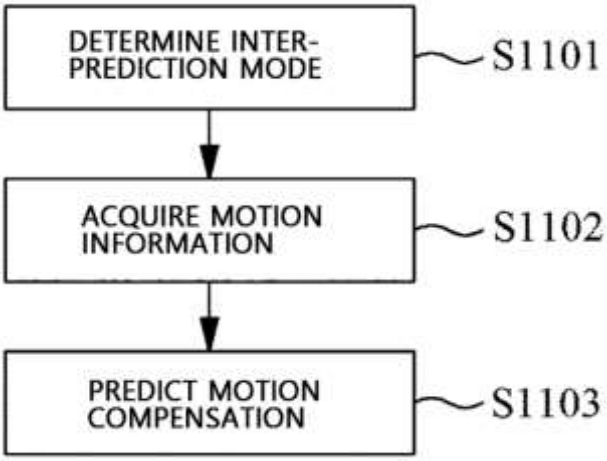


FIG. 11

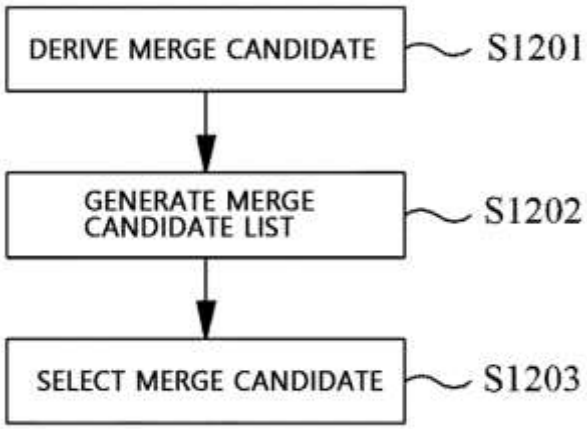


FIG. 12

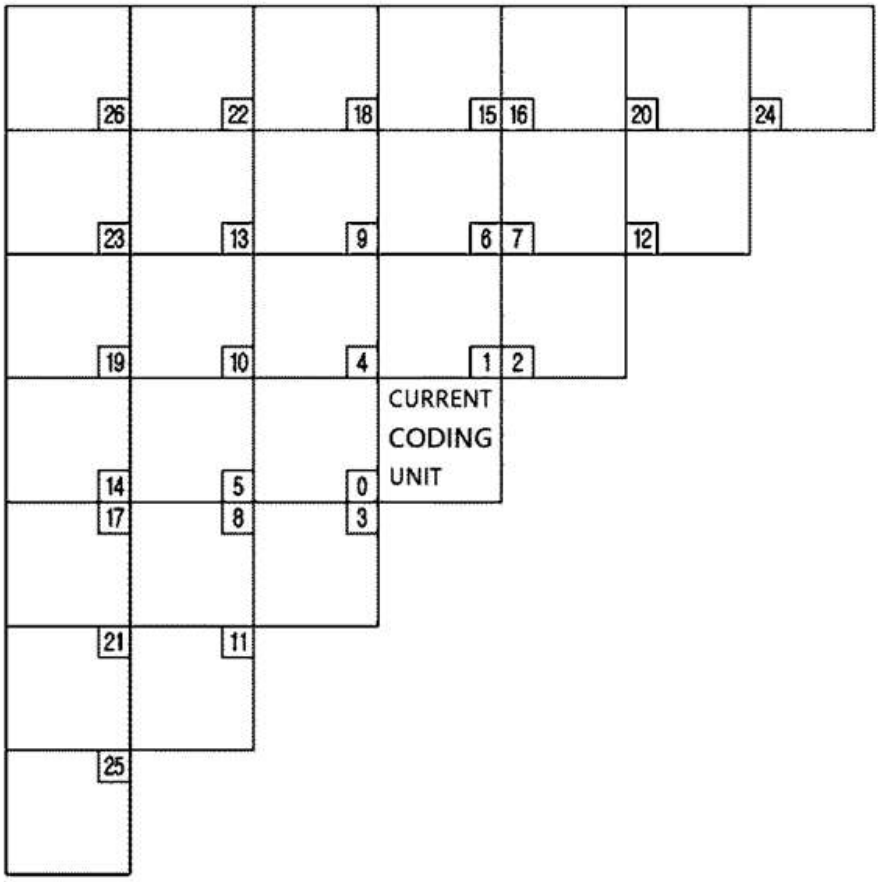

26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
1
2
CURRENT
CODING
UNIT
14
5
0
17
8
3
21
11
25

FIG. 13

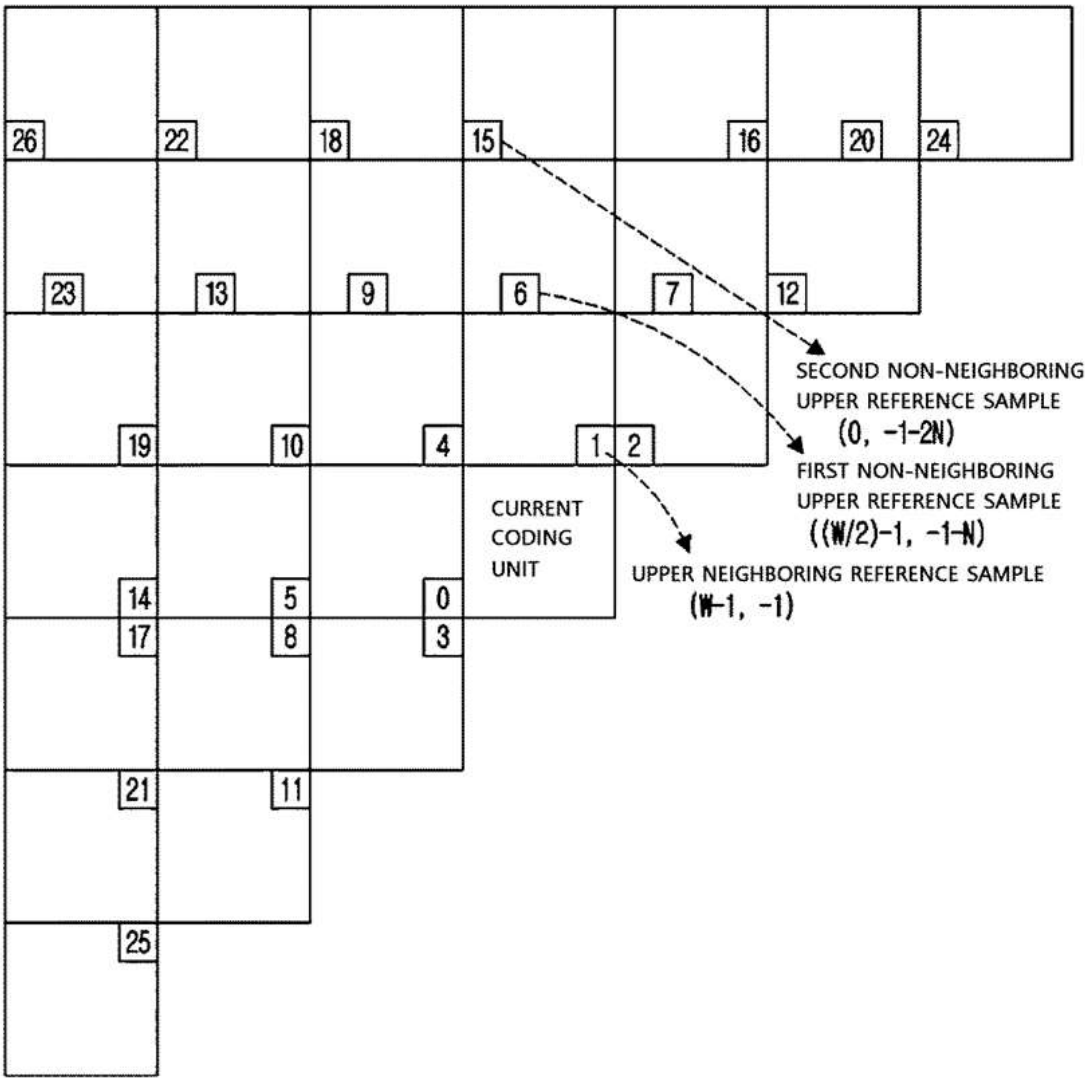

26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
1
2
14
5
0
17
8
3
21
11
25
SECOND NON-NEIGHBORING
UPPER REFERENCE SAMPLE
(0, -1-2N)
FIRST NON-NEIGHBORING
UPPER REFERENCE SAMPLE
((W/2)-1, -1-N)
CURRENT
CODING
UNIT
UPPER NEIGHBORING REFERENCE SAMPLE
(W-1, -1)

FIG. 14

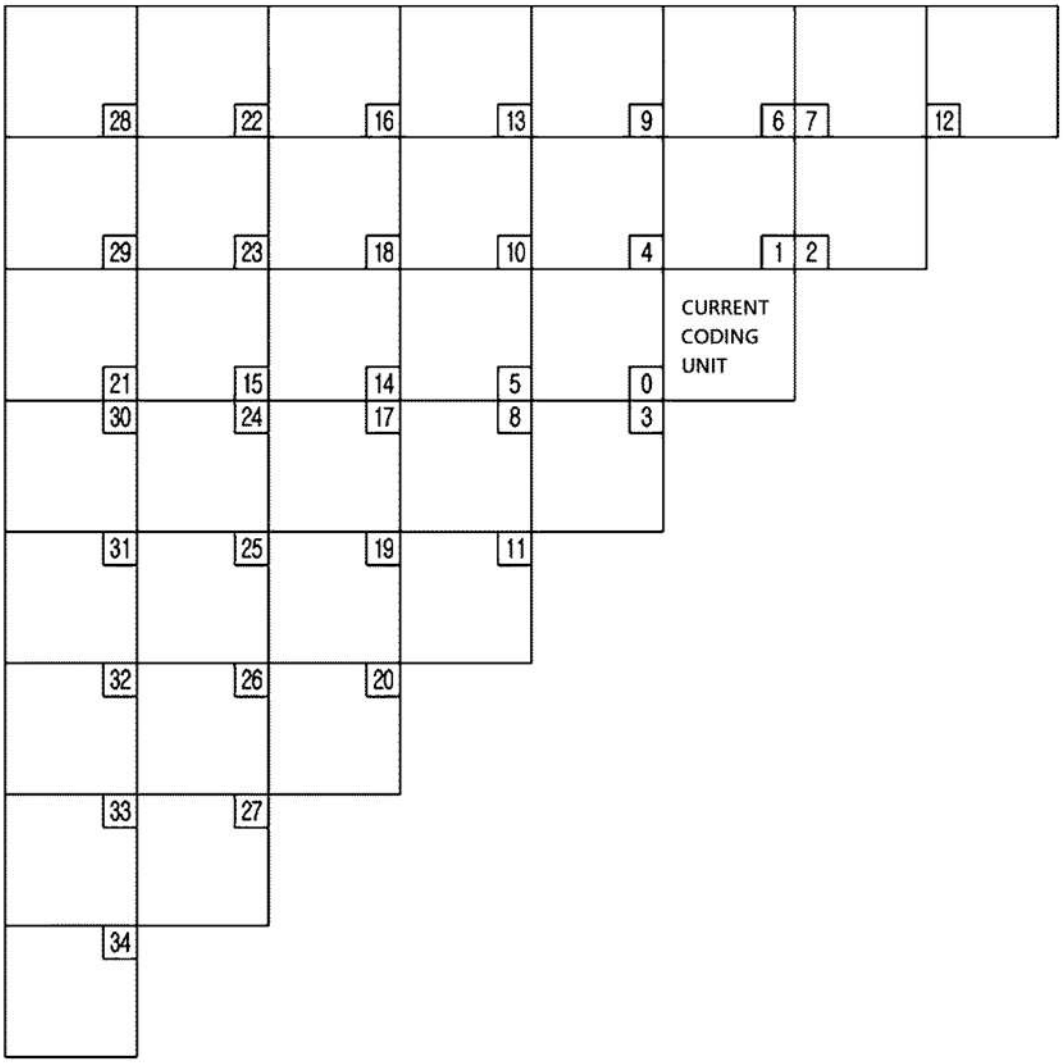

28
22
16
13
9
6
7
12
29
23
18
10
4
1
2
CURRENT
CODING
UNIT
21
15
14
5
0
30
24
17
8
3
31
25
19
11
32
26
20
33
27
34

FIG. 15

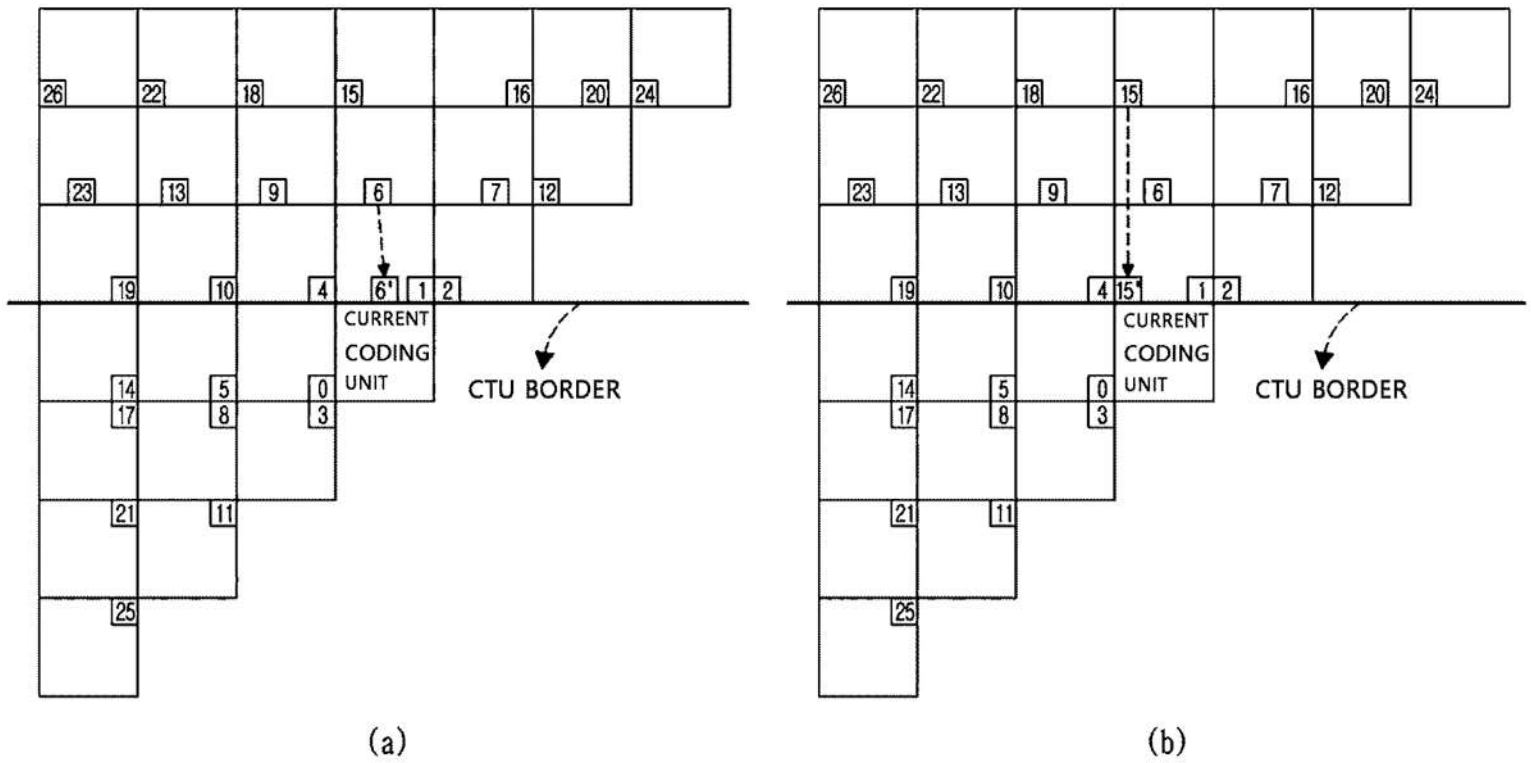

26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
6'
1
2
CURRENT
CODING
UNIT
CTU BORDER
14
5
0
17
8
3
21
11
25
(a)
26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
15'
1
2
CURRENT
CODING
UNIT
CTU BORDER
14
5
0
17
8
3
21
11
25
(b)

FIG. 16

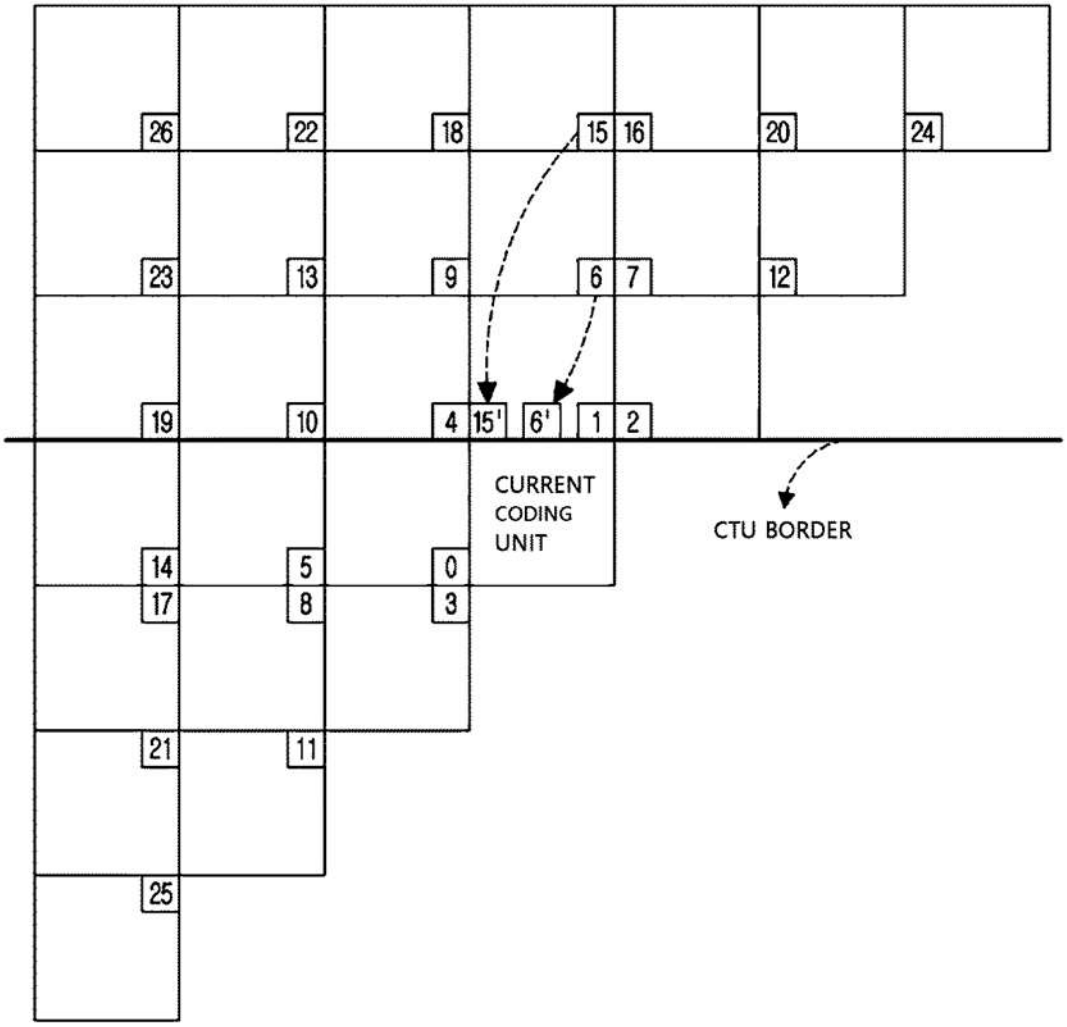

26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
15'
6'
1
2
CURRENT
CODING
UNIT
CTU BORDER
14
5
0
17
8
3
21
11
25

FIG. 17

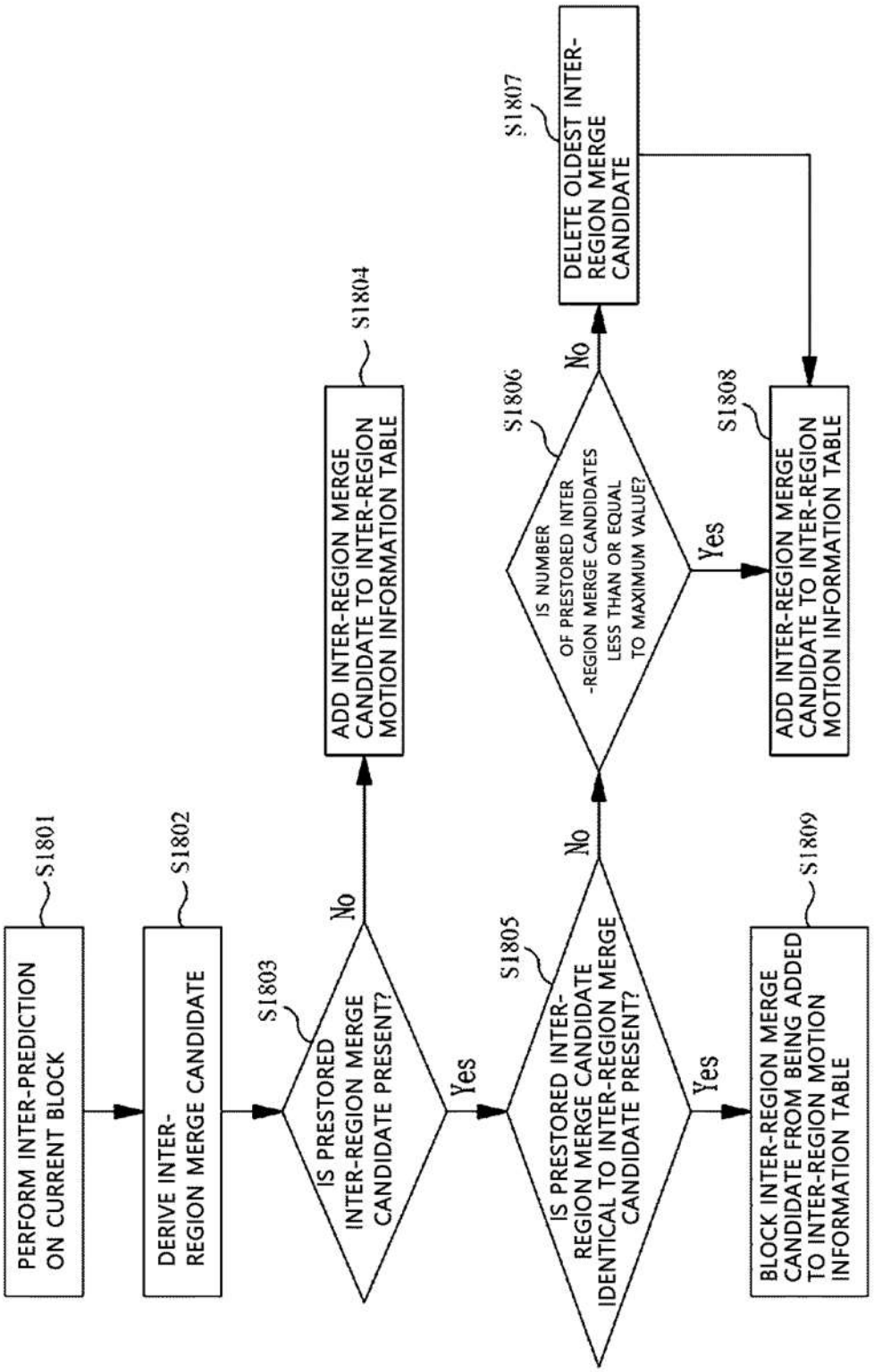

S1801
PERFORM INTER-PREDICTION ON CURRENT BLOCK
S1802
DERIVE INTER-REGION MERGE CANDIDATE
S1803
IS PRESTORED INTER-REGION MERGE CANDIDATE PRESENT?
No
Yes
S1804
ADD INTER-REGION MERGE CANDIDATE TO INTER-REGION MOTION INFORMATION TABLE
S1805
IS PRESTORED INTER-REGION MERGE CANDIDATE IDENTICAL TO INTER-REGION MERGE CANDIDATE PRESENT?
No
Yes
S1806
IS NUMBER OF PRESTORED INTER-REGION MERGE CANDIDATES LESS THAN OR EQUAL TO MAXIMUM VALUE?
No
Yes
S1807
DELETE OLDEST INTER-REGION MERGE CANDIDATE
S1808
ADD INTER-REGION MERGE CANDIDATE TO INTER-REGION MOTION INFORMATION TABLE
S1809
BLOCK INTER-REGION MERGE CANDIDATE FROM BEING ADDED TO INTER-REGION MOTION INFORMATION TABLE

FIG. 18

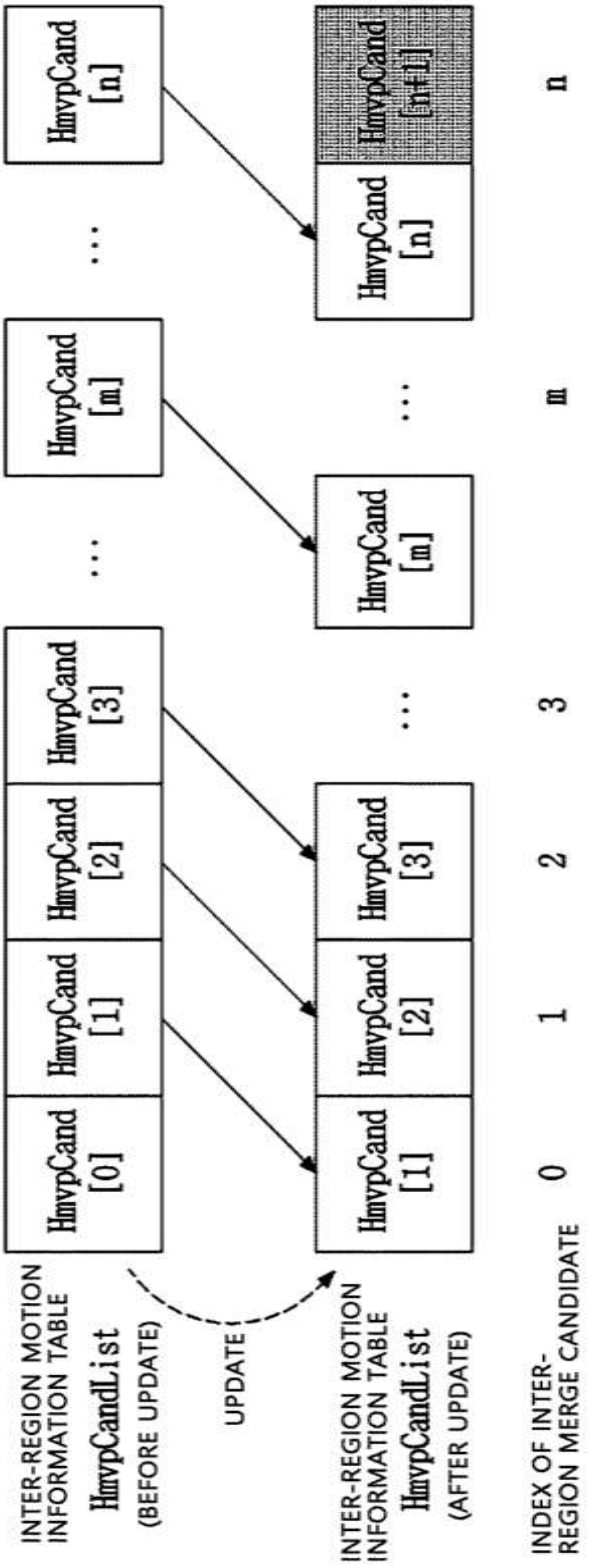

INTER-REGION MOTION INFORMATION TABLE
HmvpCandList
(BEFORE UPDATE)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
...
HmvpCand [m]
HmvpCand [n]
UPDATE
INTER-REGION MOTION INFORMATION TABLE
HmvpCandList
(AFTER UPDATE)
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
...
HmvpCand [m]
HmvpCand [n]
HmvpCand [n+1]
INDEX OF INTER-REGION MERGE CANDIDATE
0
1
2
3
...
m
n

FIG. 19

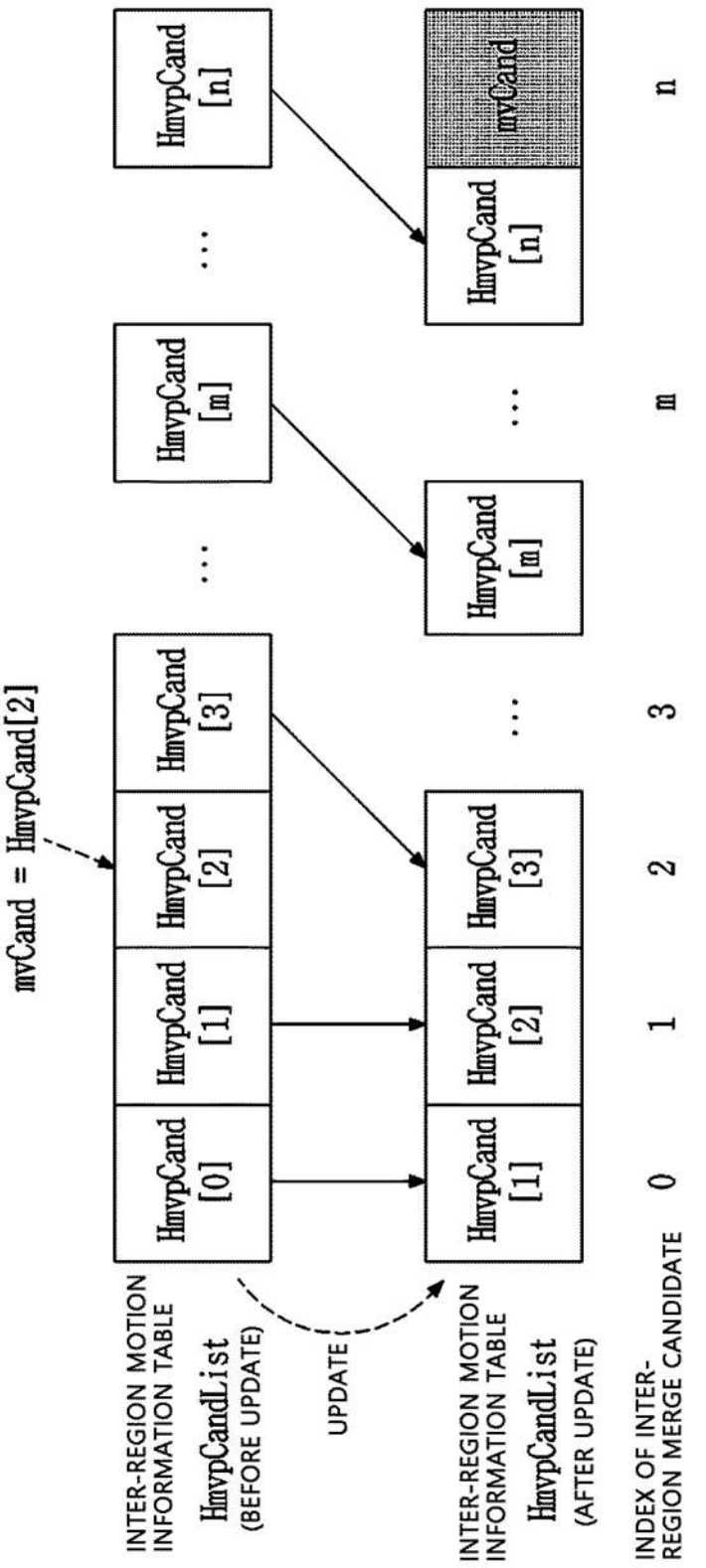

mvCand = HmvpCand[2]
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n]
INTER-REGION MOTION INFORMATION TABLE
HmvpCandList (BEFORE UPDATE)
UPDATE
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n]
mvCand
INTER-REGION MOTION INFORMATION TABLE
HmvpCandList (AFTER UPDATE)
INDEX OF INTER-REGION MERGE CANDIDATE
0
1
2
3
m
n

FIG. 20

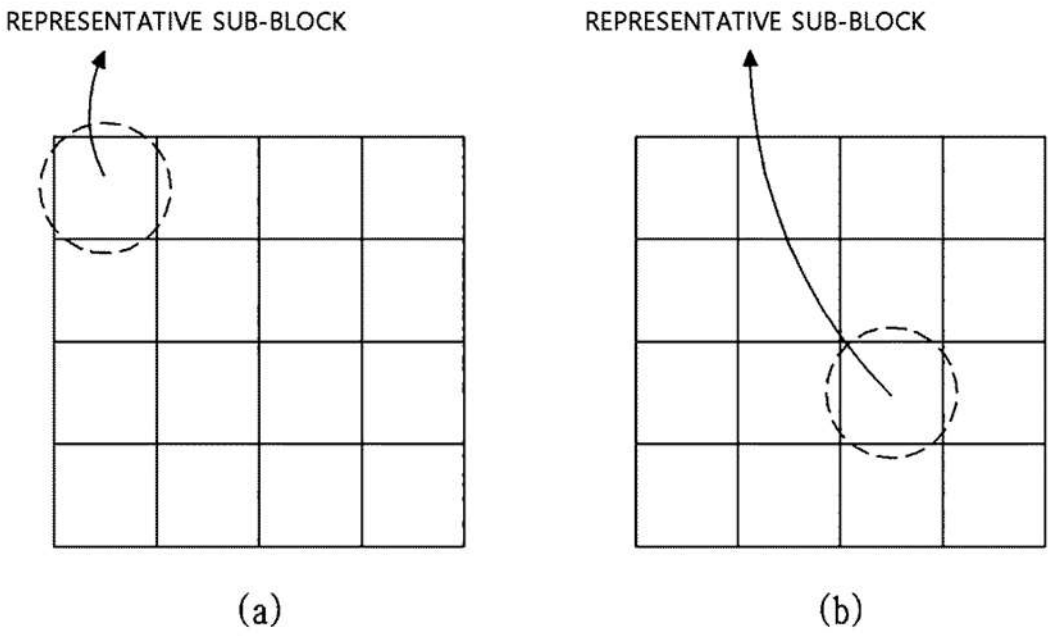


FIG. 21

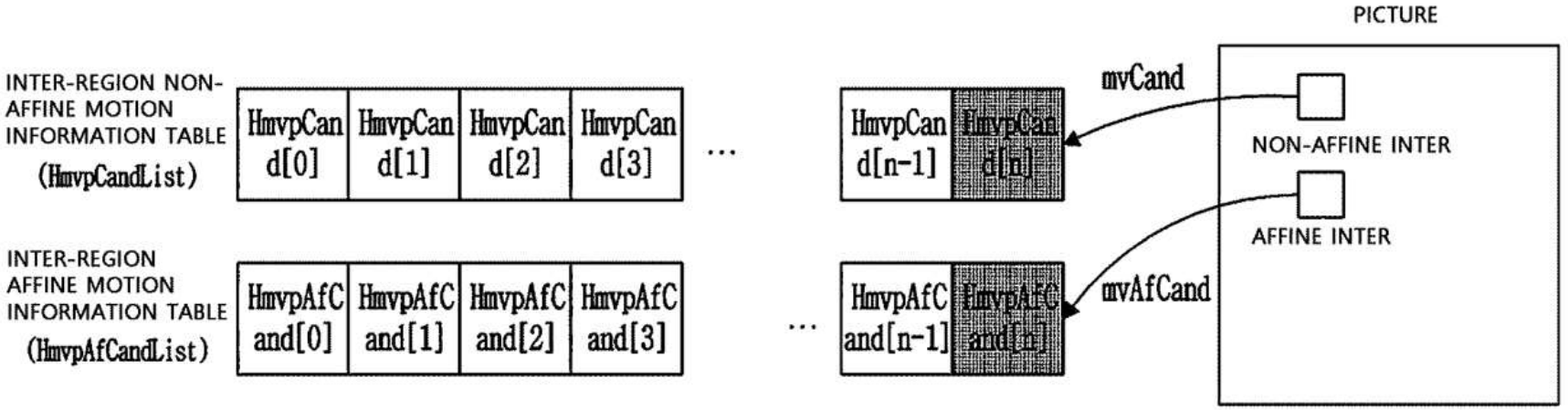

INTER-REGION NON-AFFINE MOTION INFORMATION TABLE
(HmvpCandList)
HmvpCand[0]
HmvpCand[1]
HmvpCand[2]
HmvpCand[3]
HmvpCand[n-1]
HmvpCand[n]
INTER-REGION AFFINE MOTION INFORMATION TABLE
(HmvpAfCandList)
HmvpAfCand[0]
HmvpAfCand[1]
HmvpAfCand[2]
HmvpAfCand[3]
HmvpAfCand[n-1]
HmvpAfCand[n]
mvCand
mvAfCand
PICTURE
NON-AFFINE INTER
AFFINE INTER

FIG. 22

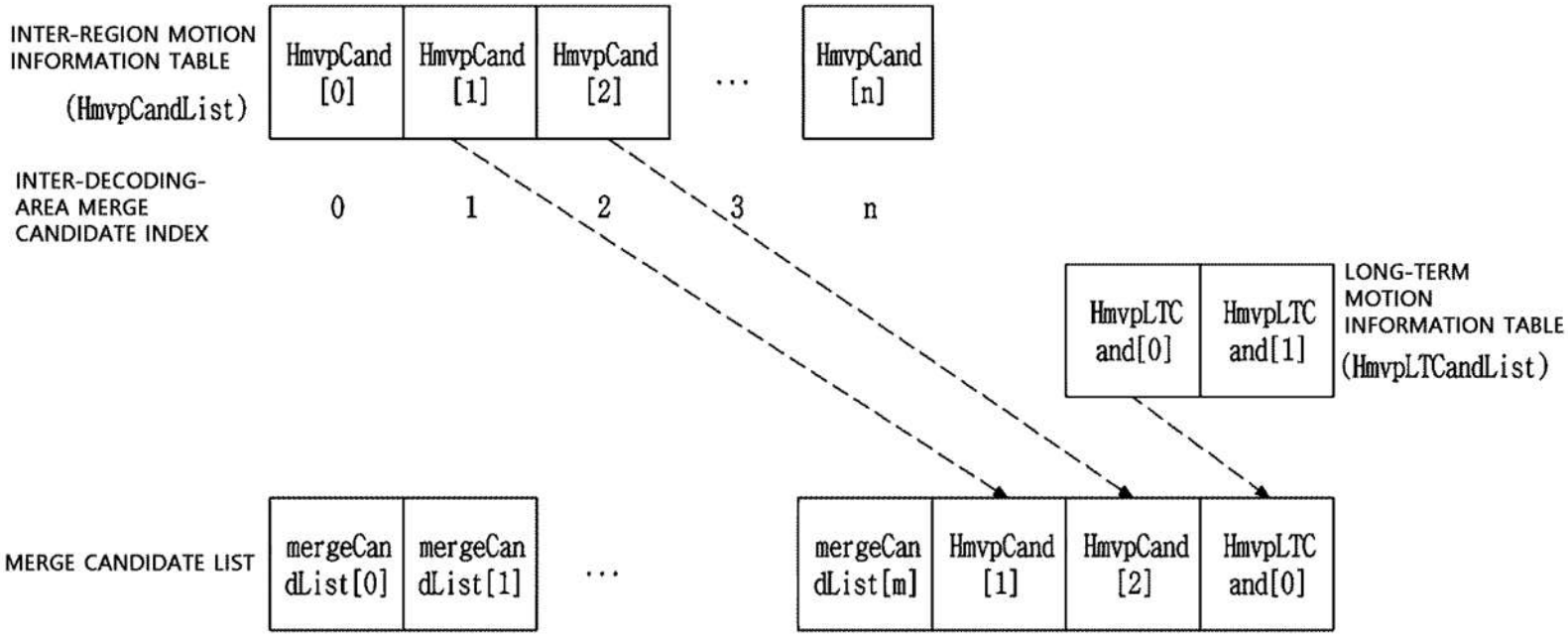

INTER-REGION MOTION INFORMATION TABLE
(HmvpCandList)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
...
HmvpCand [n]
INTER-DECODING-AREA MERGE CANDIDATE INDEX
0
1
2
3
n
HmvpLTCand[0]
HmvpLTCand[1]
LONG-TERM MOTION INFORMATION TABLE
(HmvpLTCandList)
MERGE CANDIDATE LIST
mergeCandList[0]
mergeCandList[1]
...
mergeCandList[m]
HmvpCand [1]
HmvpCand [2]
HmvpLTCand[0]

FIG. 23

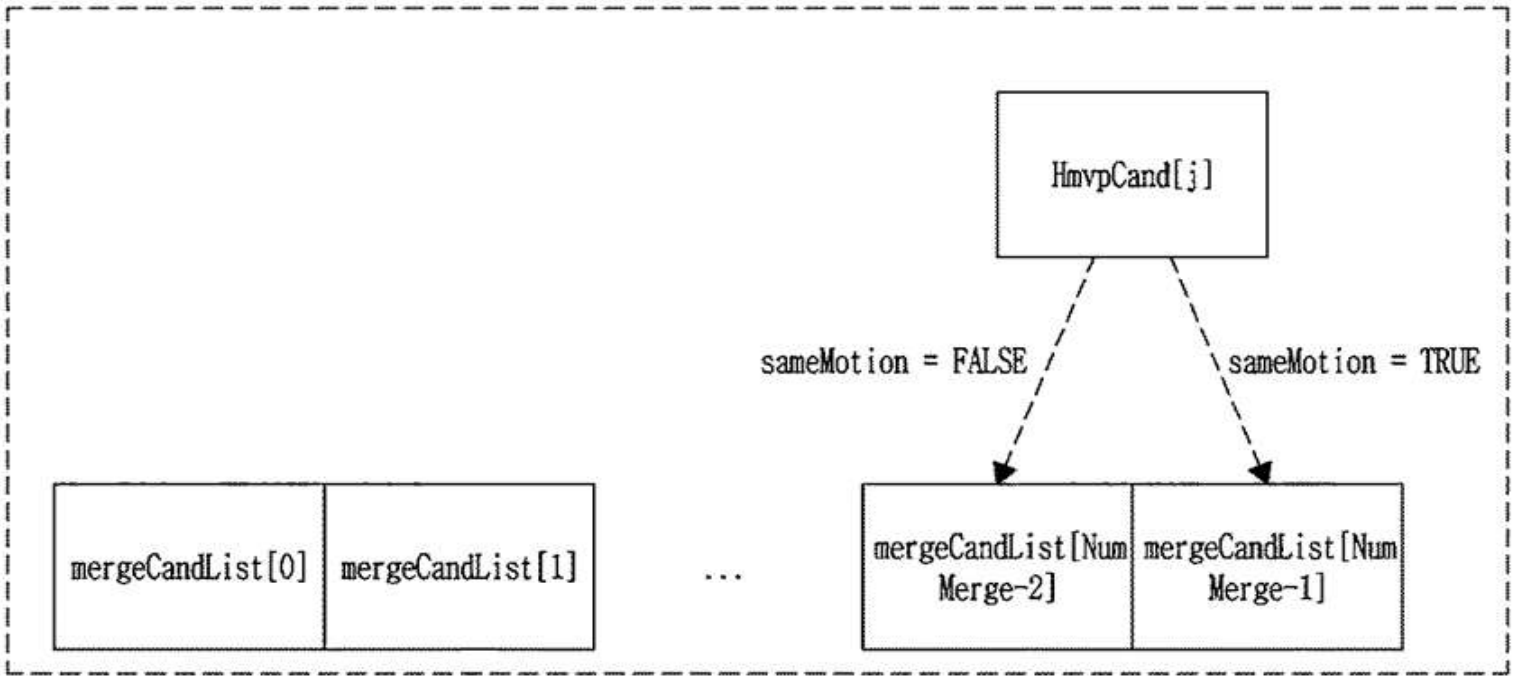

HmvpCand[j]
sameMotion = FALSE
sameMotion = TRUE
mergeCandList[0]
mergeCandList[1]
...
mergeCandList[NumMerge-2]
mergeCandList[NumMerge-1]

FIG. 24

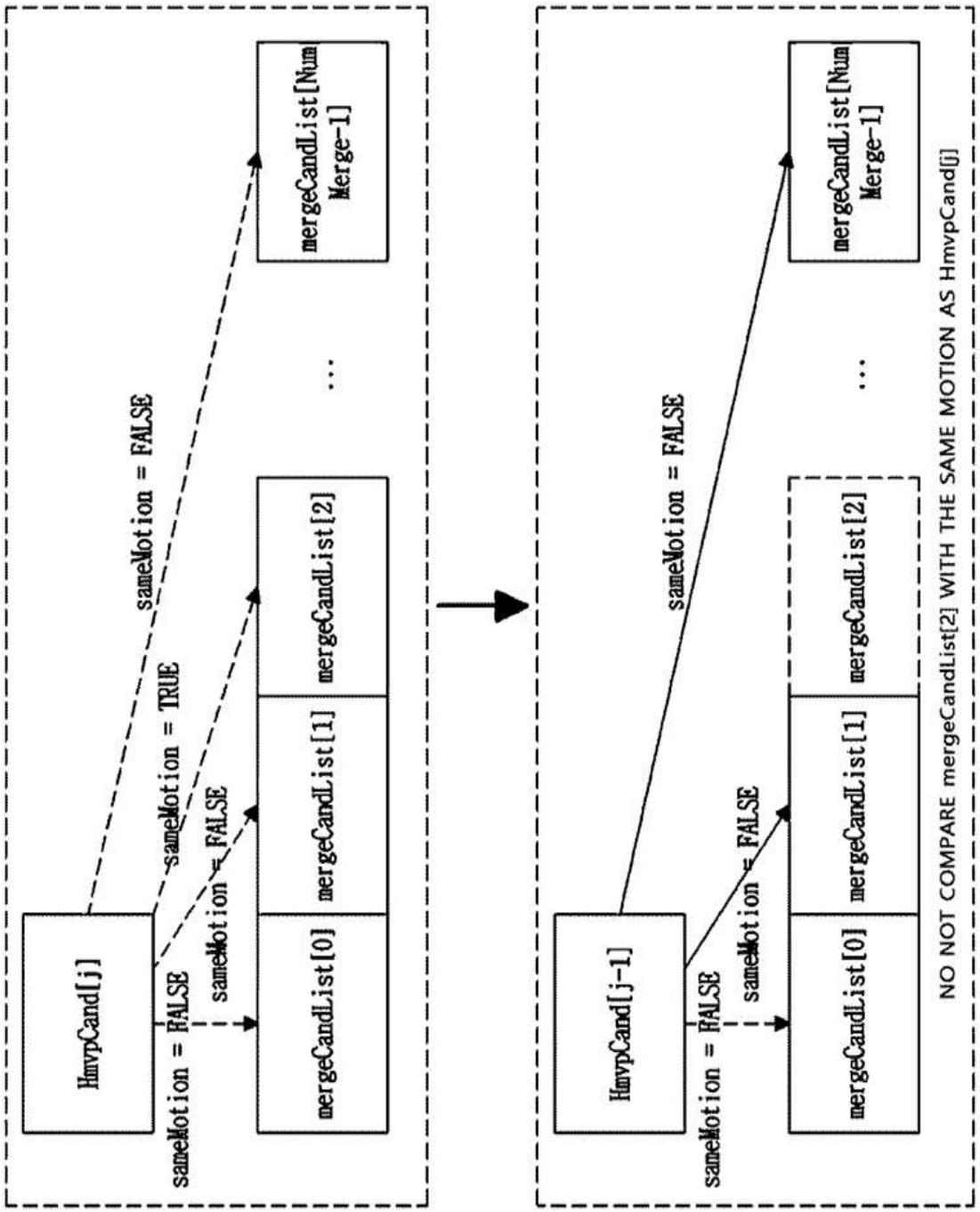

HmvpCand[j]
sameMotion = FALSE
sameMotion = TRUE
sameMotion = FALSE
sameMotion = FALSE
mergeCandList[0]
mergeCandList[1]
mergeCandList[2]
...
mergeCandList[NumMerge-1]
HmvpCand[j-1]
sameMotion = FALSE
sameMotion = FALSE
sameMotion = FALSE
mergeCandList[0]
mergeCandList[1]
mergeCandList[2]
...
mergeCandList[NumMerge-1]
NO NOT COMPARE mergeCandList[2] WITH THE SAME MOTION AS HmvpCand[j]

FIG. 25

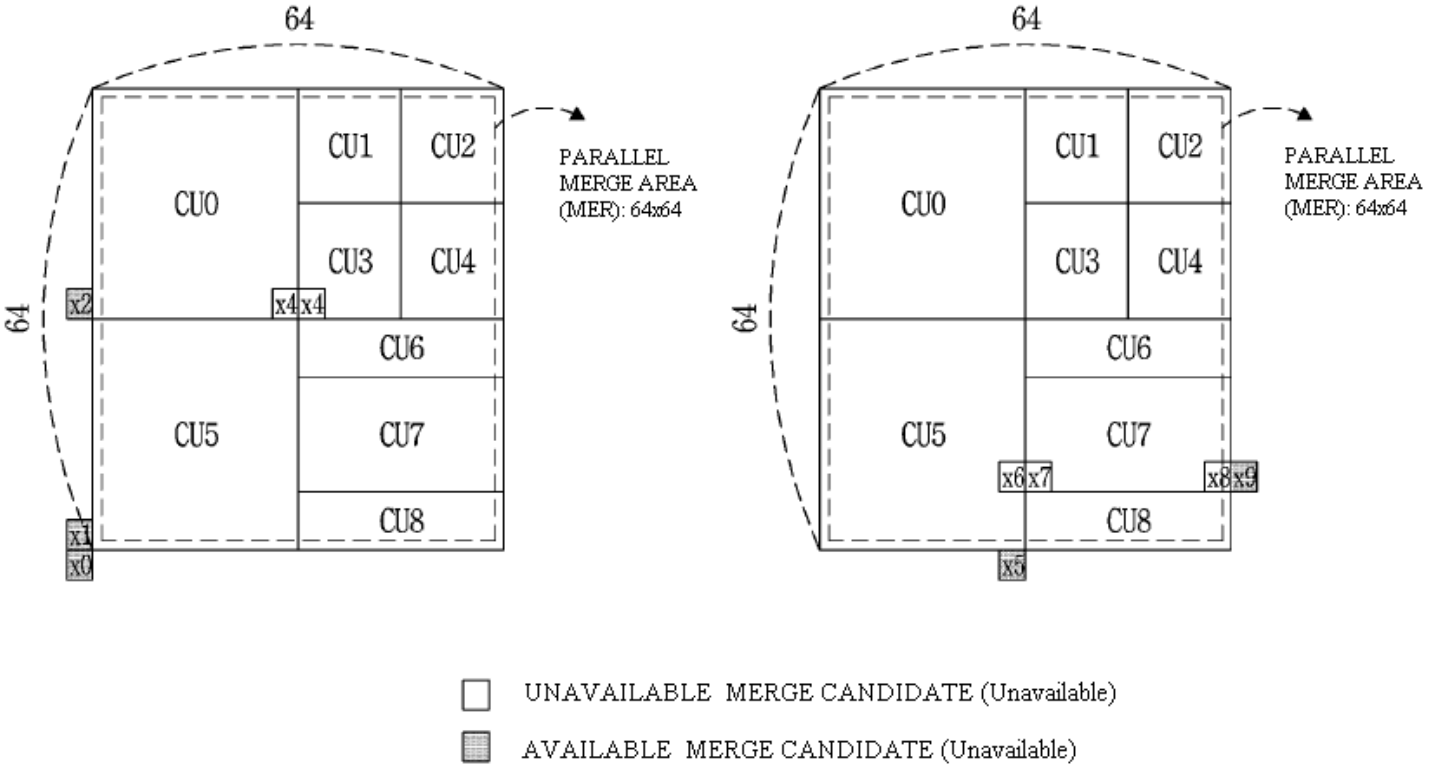

64
64
CU0
CU1
CU2
CU3
CU4
CU5
CU6
CU7
CU8
PARALLEL
MERGE AREA
(MER): 64x64
x0
x1
x2
x4
x4
x5
x6
x7
x8
x9
UNAVAILABLE MERGE CANDIDATE (Unavailable)
AVAILABLE MERGE CANDIDATE (Unavailable)

FIG. 26

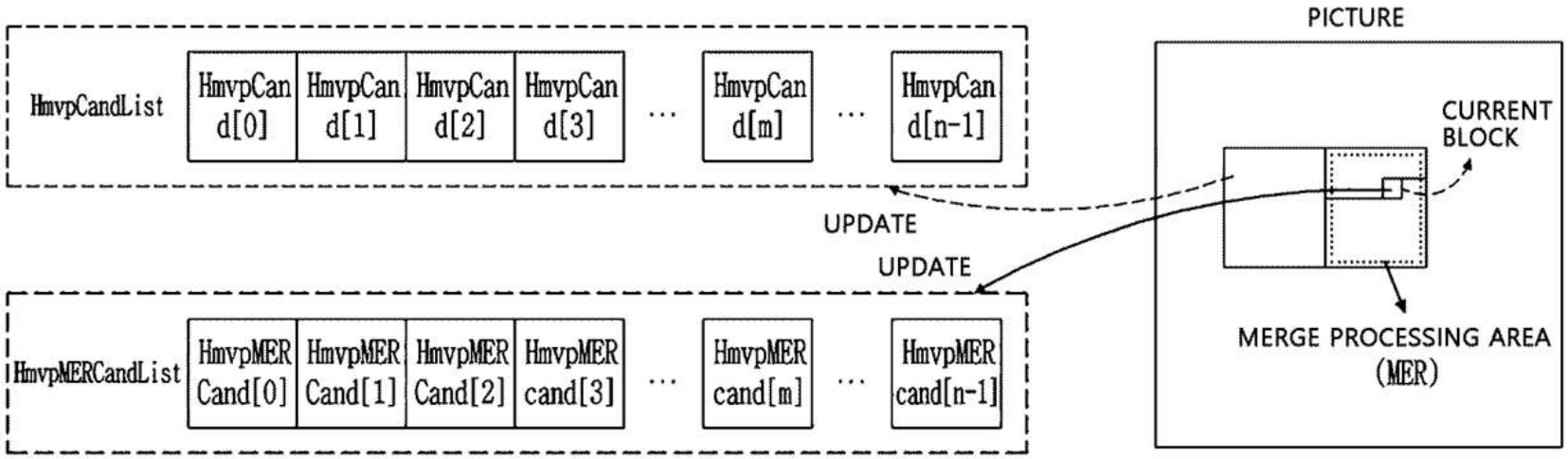

HmvpCandList
HmvpCand d[0]
HmvpCand d[1]
HmvpCand d[2]
HmvpCand d[3]
HmvpCand d[m]
HmvpCand d[n-1]
UPDATE
UPDATE
HmvpMERCandList
HmvpMER Cand[0]
HmvpMER Cand[1]
HmvpMER Cand[2]
HmvpMER cand[3]
HmvpMER cand[m]
HmvpMER cand[n-1]
PICTURE
CURRENT BLOCK
MERGE PROCESSING AREA (MER)

FIG. 27

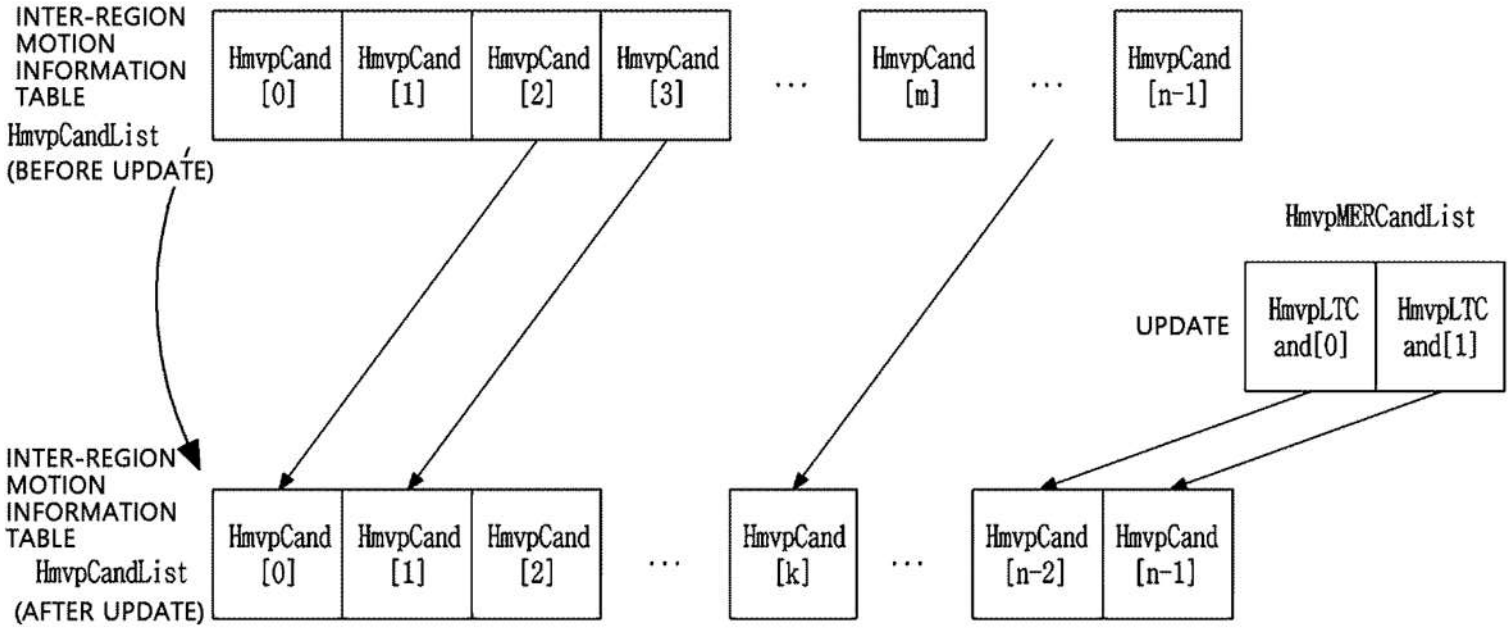

INTER-REGION MOTION INFORMATION TABLE
HmvpCandList (BEFORE UPDATE)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n-1]
HmvpMERCandList
UPDATE
HmvpLTC and[0]
HmvpLTC and[1]
INTER-REGION MOTION INFORMATION TABLE
HmvpCandList (AFTER UPDATE)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [k]
HmvpCand [n-2]
HmvpCand [n-1]

FIG. 28

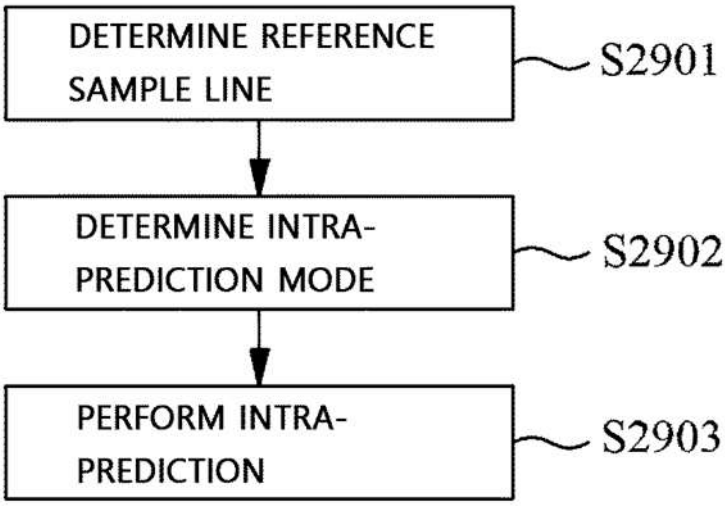

DETERMINE REFERENCE SAMPLE LINE
S2901
DETERMINE INTRA-PREDICTION MODE
S2902
PERFORM INTRA-PREDICTION
S2903

FIG. 29

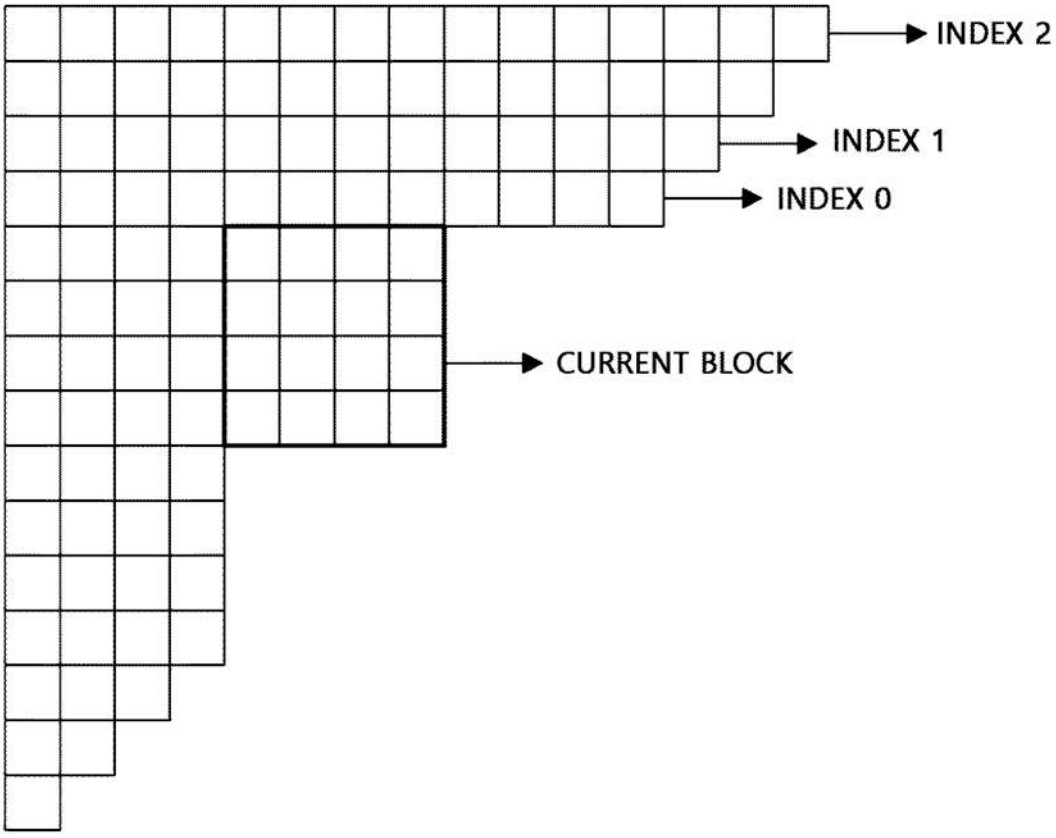

INDEX 2
INDEX 1
INDEX 0
CURRENT BLOCK

FIG. 30

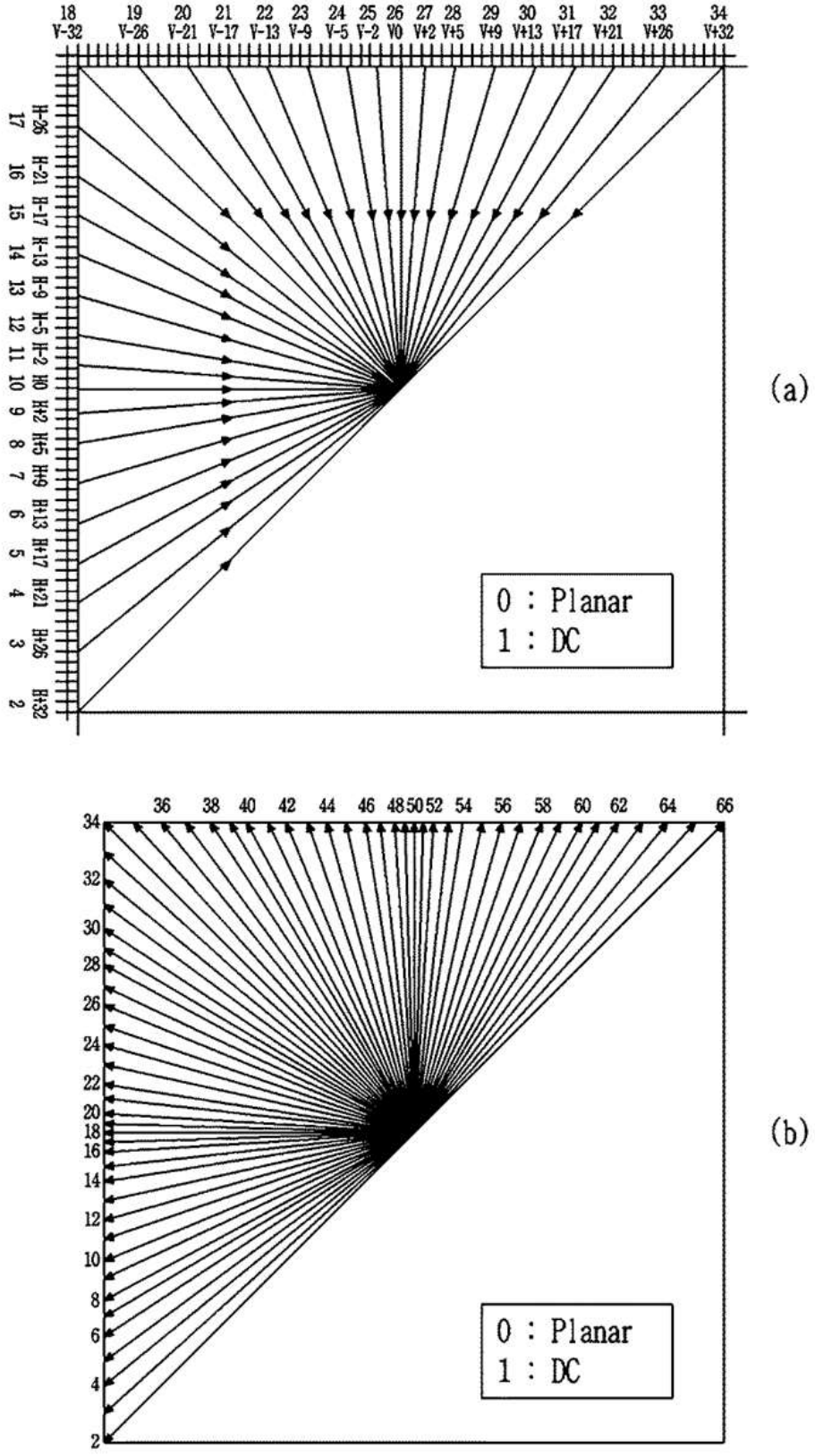

18 V-32
19 V-26
20 V-21
21 V-17
22 V-13
23 V-9
24 V-5
25 V-2
26 V0
27 V+2
28 V+5
29 V+9
30 V+13
31 V+17
32 V+21
33 V+26
34 V+32
17 H-26
16 H-21
15 H-17
14 H-13
13 H-9
12 H-5
11 H-2
10 H0
9 H+2
8 H+5
7 H+9
6 H+13
5 H+17
4 H+21
3 H+26
2 H+32
0 : Planar
1 : DC
(a)
36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66
34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2
0 : Planar
1 : DC
(b)

FIG. 31

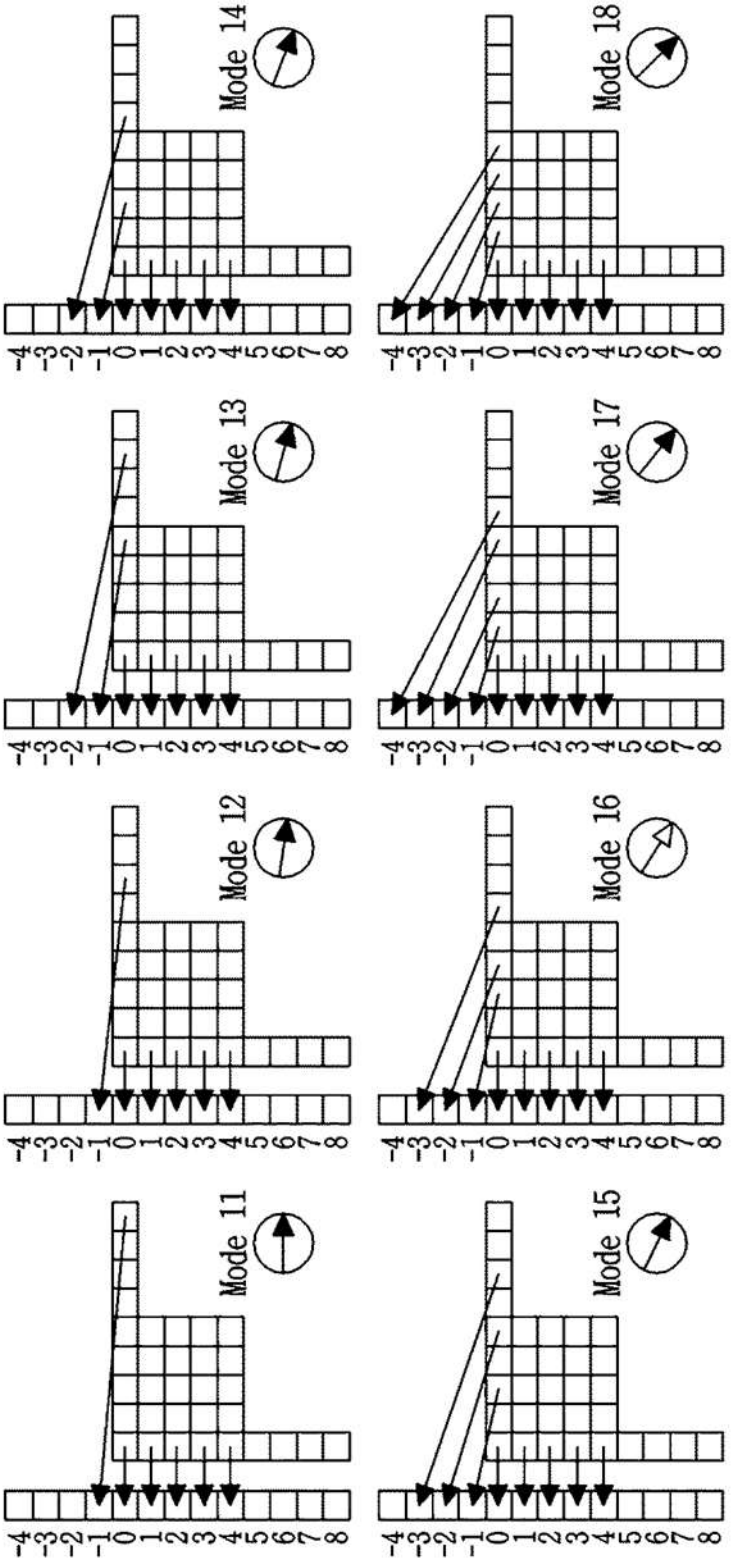


FIG. 32

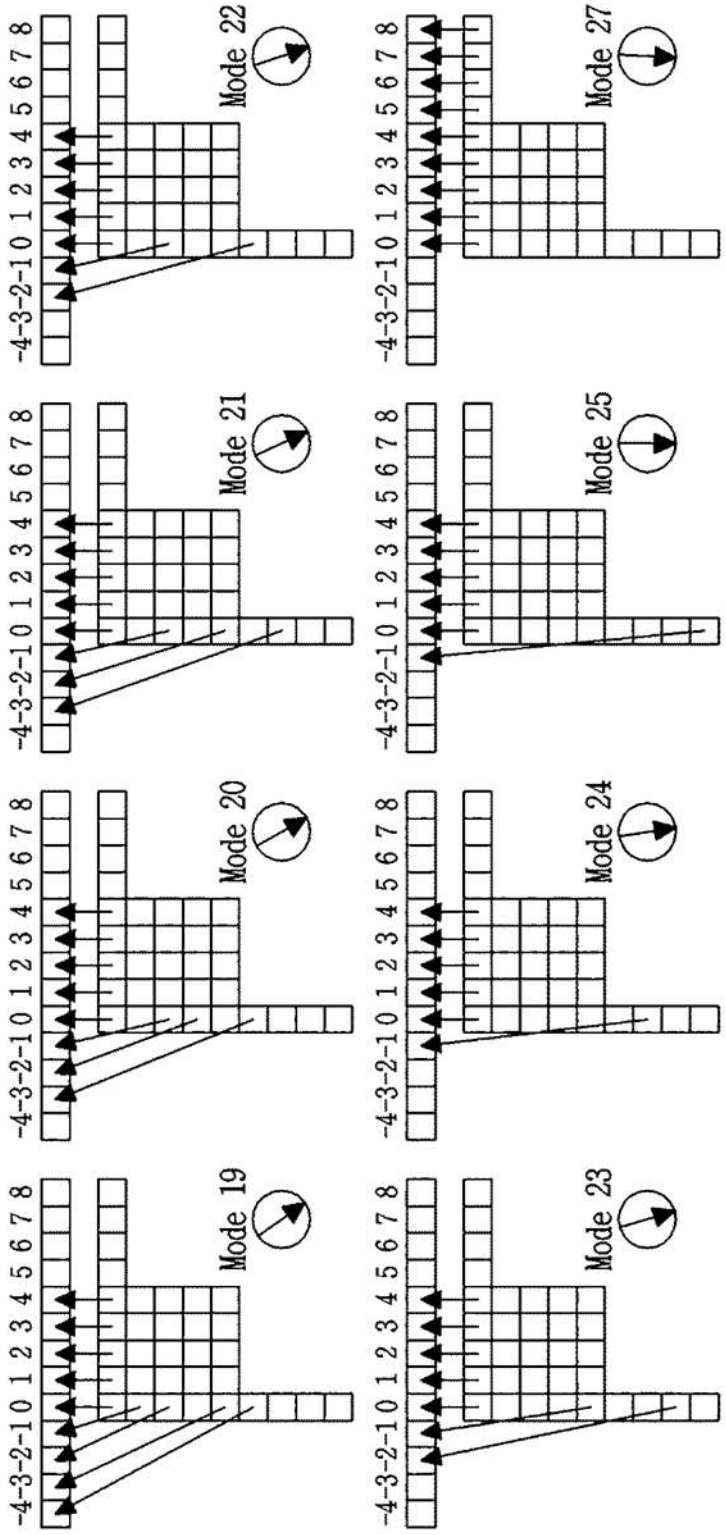

Mode 19
Mode 20
Mode 21
Mode 22
Mode 23
Mode 24
Mode 25
Mode 27
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8

FIG. 33

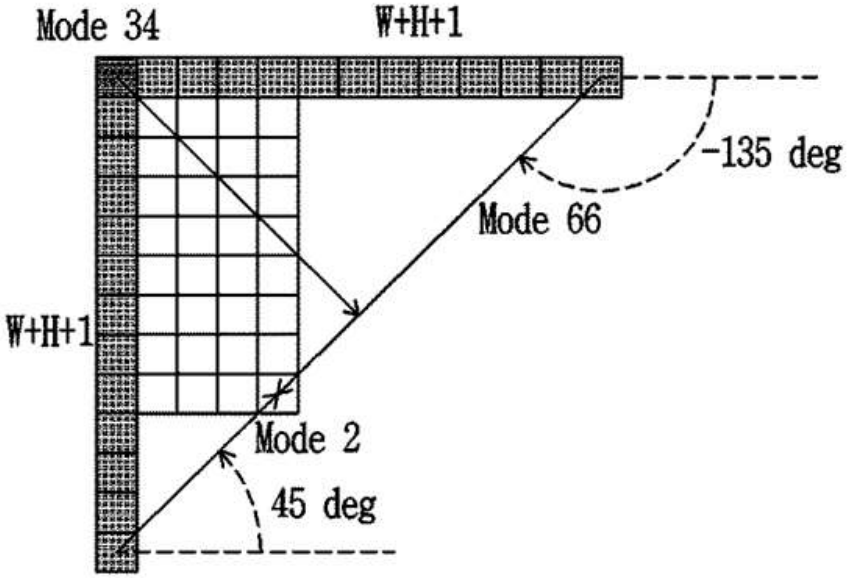


FIG. 34

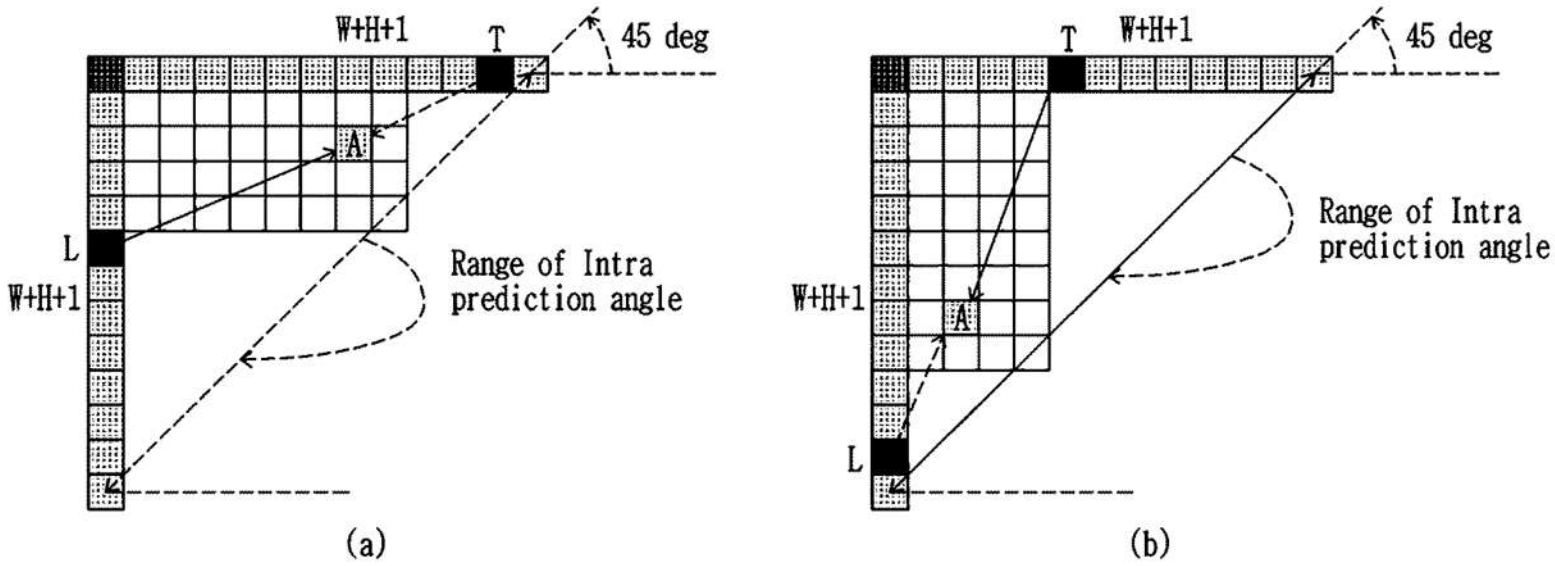

W+H+1
T
45 deg
A
L
W+H+1
Range of Intra
prediction angle
(a)
T
W+H+1
45 deg
Range of Intra
prediction angle
W+H+1
A
L
(b)

FIG. 35

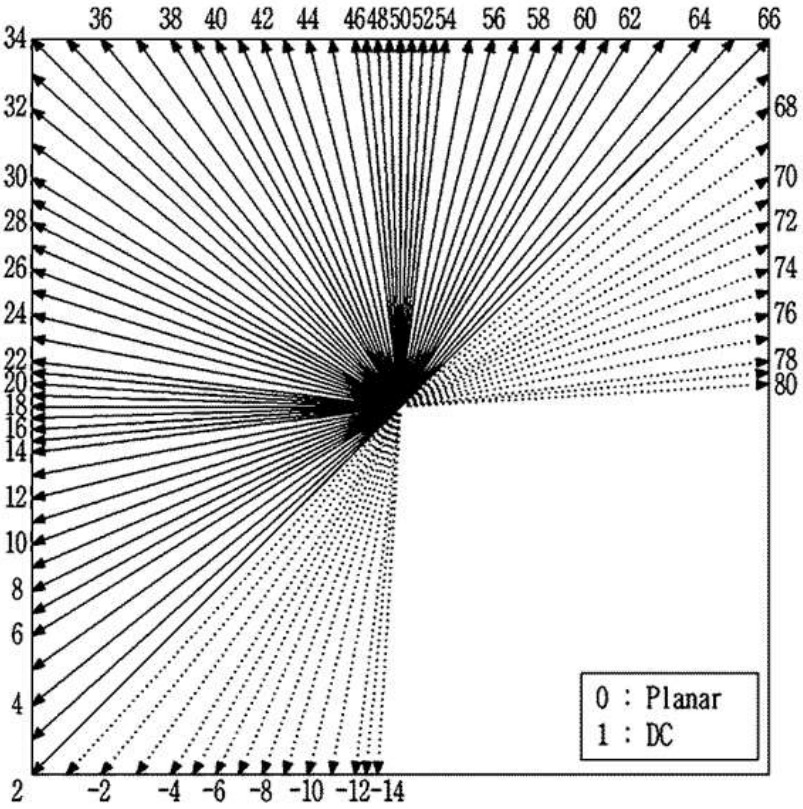

36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66
34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2
68 70 72 74 76 78 80
-2 -4 -6 -8 -10 -12 -14
0 : Planar
1 : DC

FIG. 36

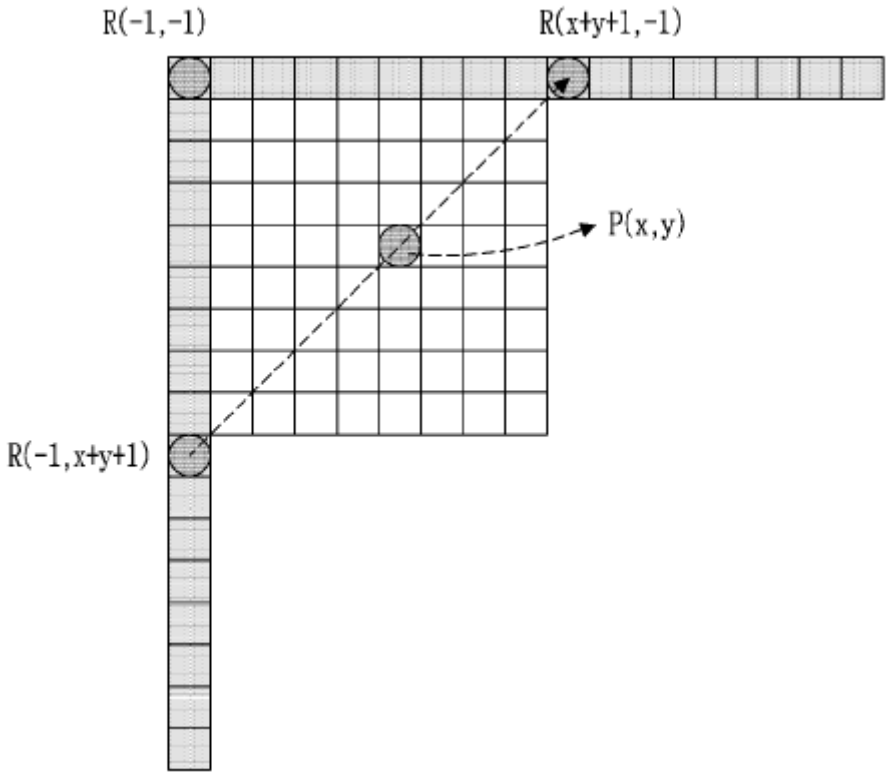

R(-1,-1)
R(x+y+1,-1)
P(x,y)
R(-1,x+y+1)

FIG. 37

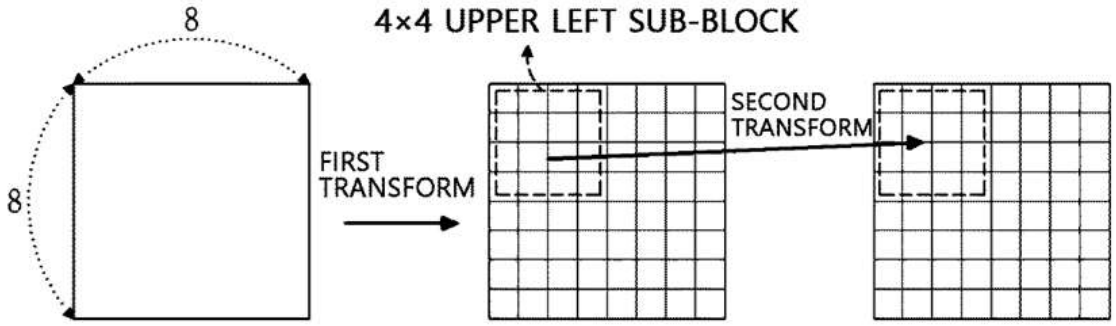

8
8
4×4 UPPER LEFT SUB-BLOCK
FIRST
TRANSFORM
SECOND
TRANSFORM

FIG. 38

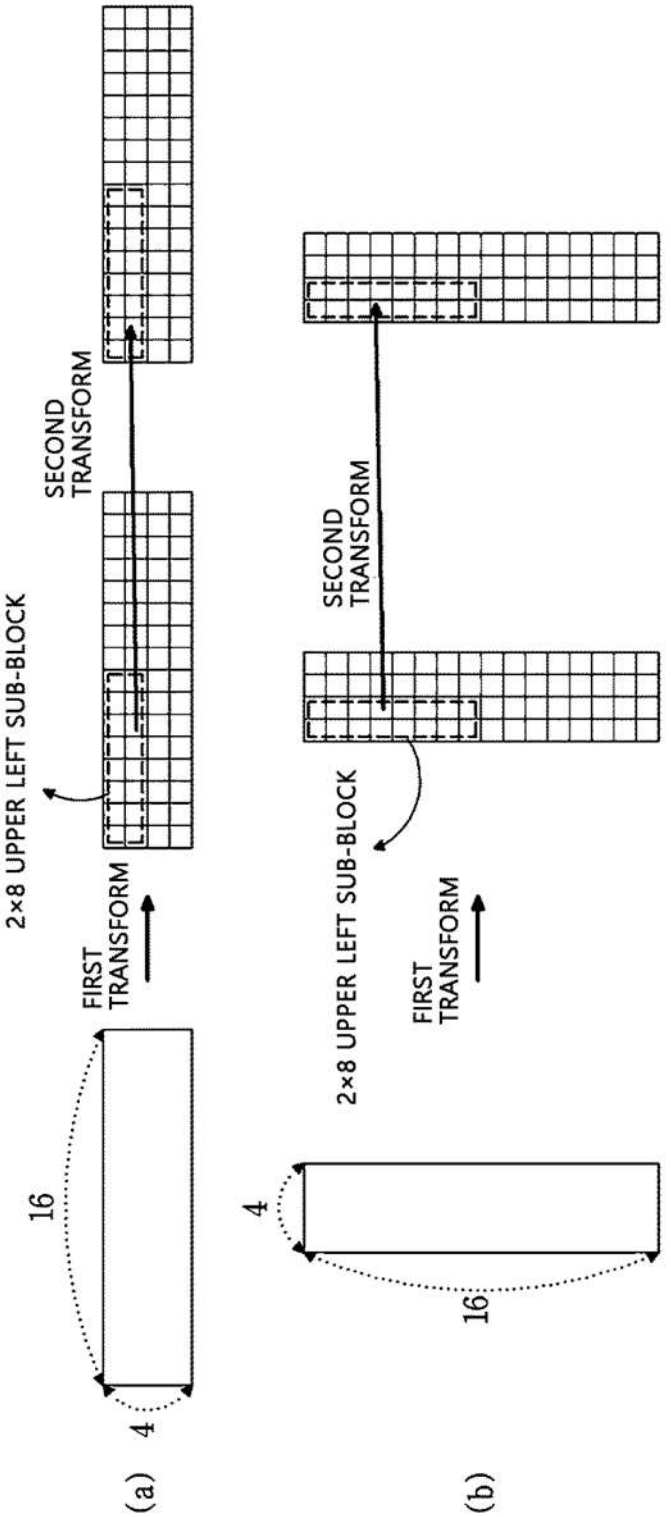

(a)
16
4
FIRST TRANSFORM
2×8 UPPER LEFT SUB-BLOCK
SECOND TRANSFORM
(b)
4
16
FIRST TRANSFORM
2×8 UPPER LEFT SUB-BLOCK
SECOND TRANSFORM

FIG. 39

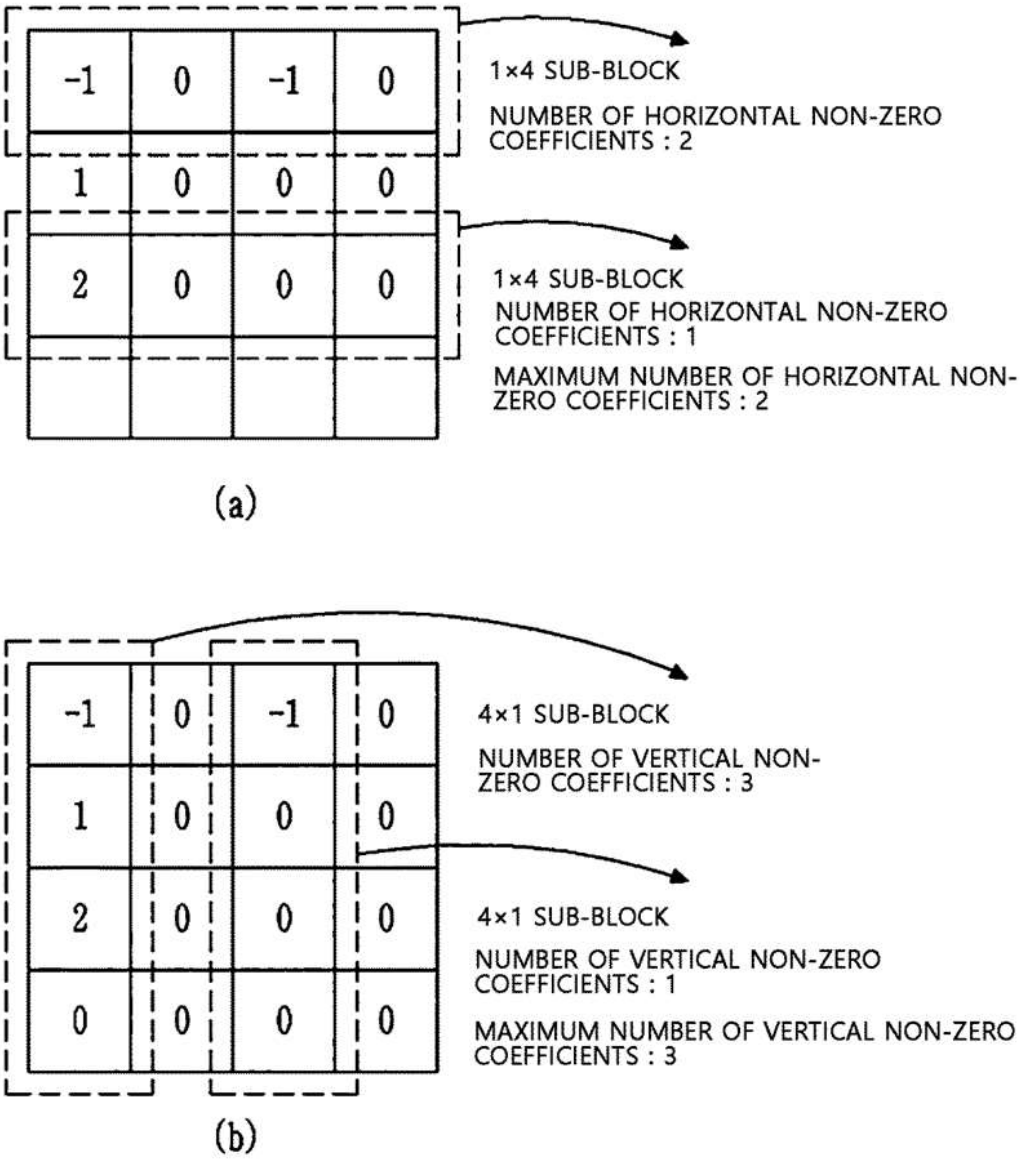

-1
0
-1
0
1
0
0
0
2
0
0
0
1×4 SUB-BLOCK
NUMBER OF HORIZONTAL NON-ZERO COEFFICIENTS : 2
1×4 SUB-BLOCK
NUMBER OF HORIZONTAL NON-ZERO COEFFICIENTS : 1
MAXIMUM NUMBER OF HORIZONTAL NON-ZERO COEFFICIENTS : 2
(a)
-1
0
-1
0
1
0
0
0
2
0
0
0
0
0
0
0
4×1 SUB-BLOCK
NUMBER OF VERTICAL NON-ZERO COEFFICIENTS : 3
4×1 SUB-BLOCK
NUMBER OF VERTICAL NON-ZERO COEFFICIENTS : 1
MAXIMUM NUMBER OF VERTICAL NON-ZERO COEFFICIENTS : 3
(b)

FIG. 40

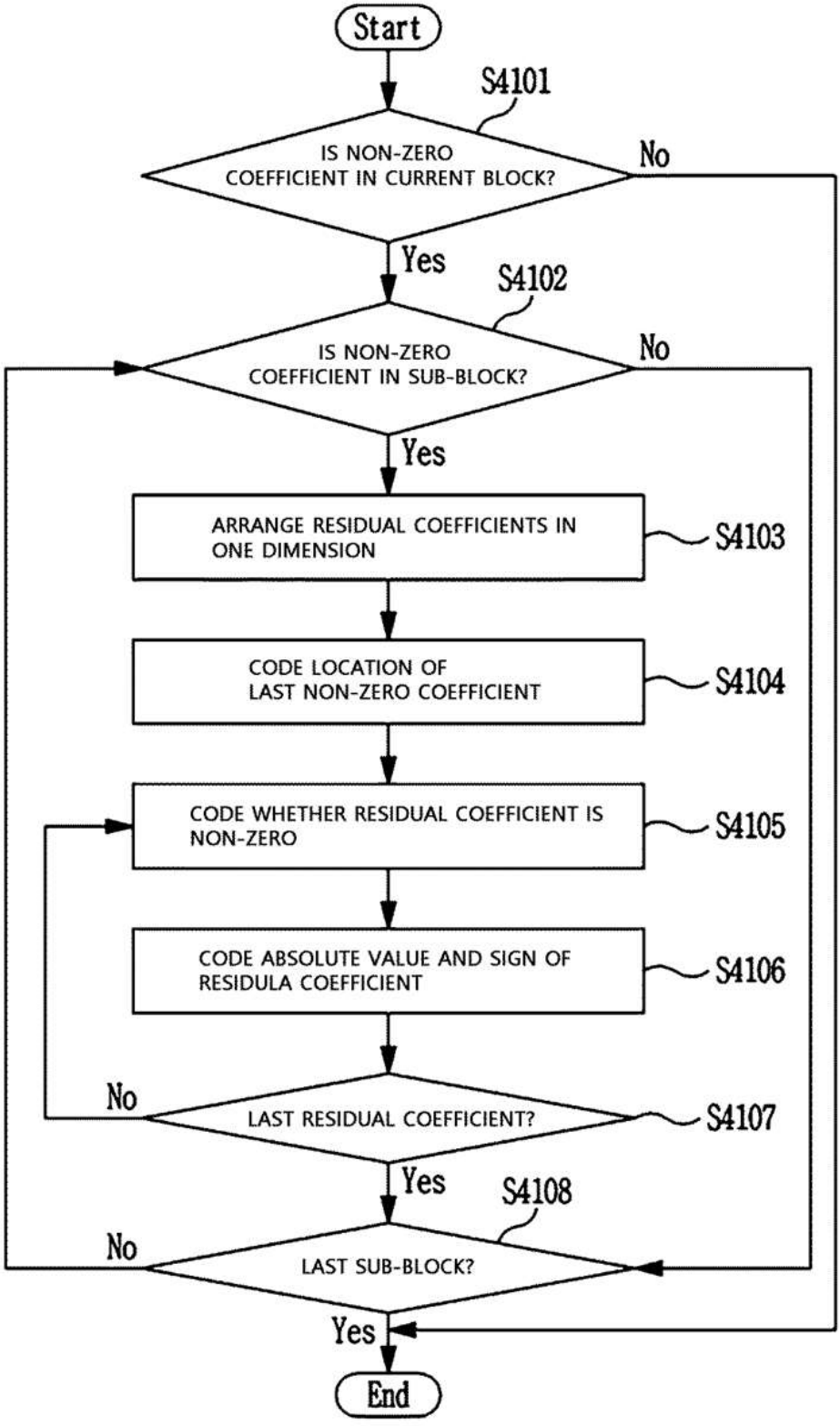

Start
S4101
IS NON-ZERO COEFFICIENT IN CURRENT BLOCK?
No
Yes
S4102
IS NON-ZERO COEFFICIENT IN SUB-BLOCK?
No
Yes
ARRANGE RESIDUAL COEFFICIENTS IN ONE DIMENSION
S4103
CODE LOCATION OF LAST NON-ZERO COEFFICIENT
S4104
CODE WHETHER RESIDUAL COEFFICIENT IS NON-ZERO
S4105
CODE ABSOLUTE VALUE AND SIGN OF RESIDULA COEFFICIENT
S4106
No
LAST RESIDUAL COEFFICIENT?
S4107
Yes
S4108
No
LAST SUB-BLOCK?
Yes
End

FIG. 41

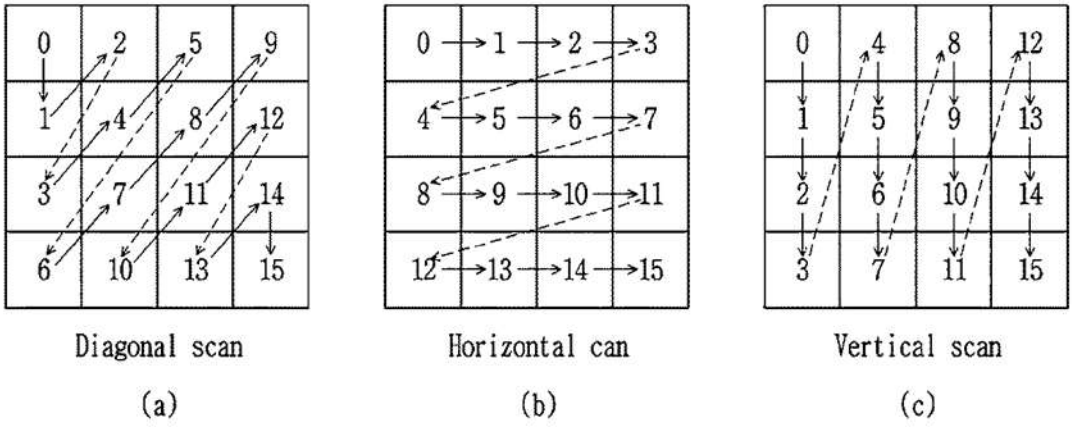


FIG. 42

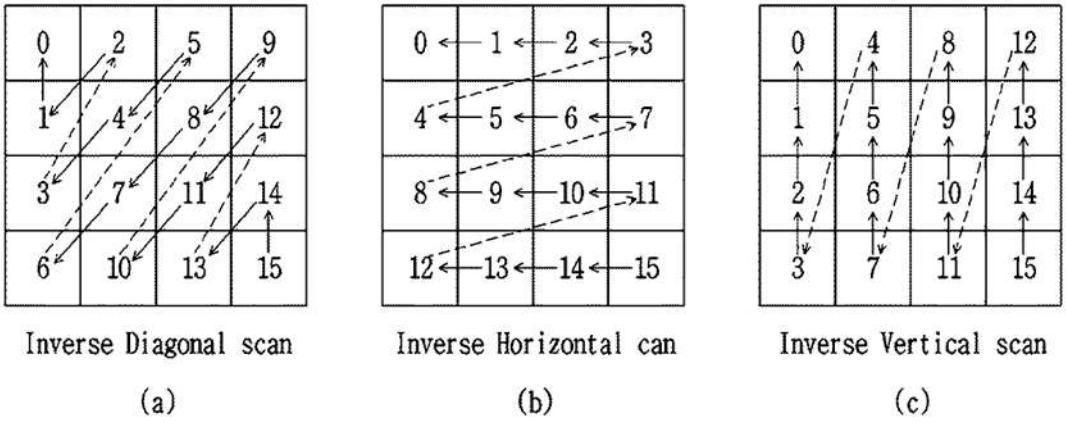


FIG. 43

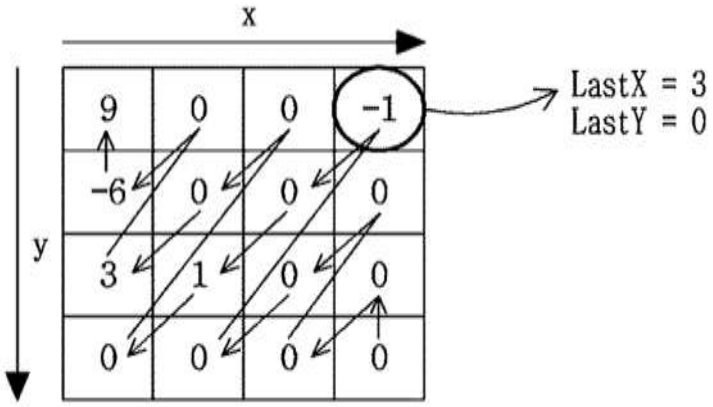


FIG. 44

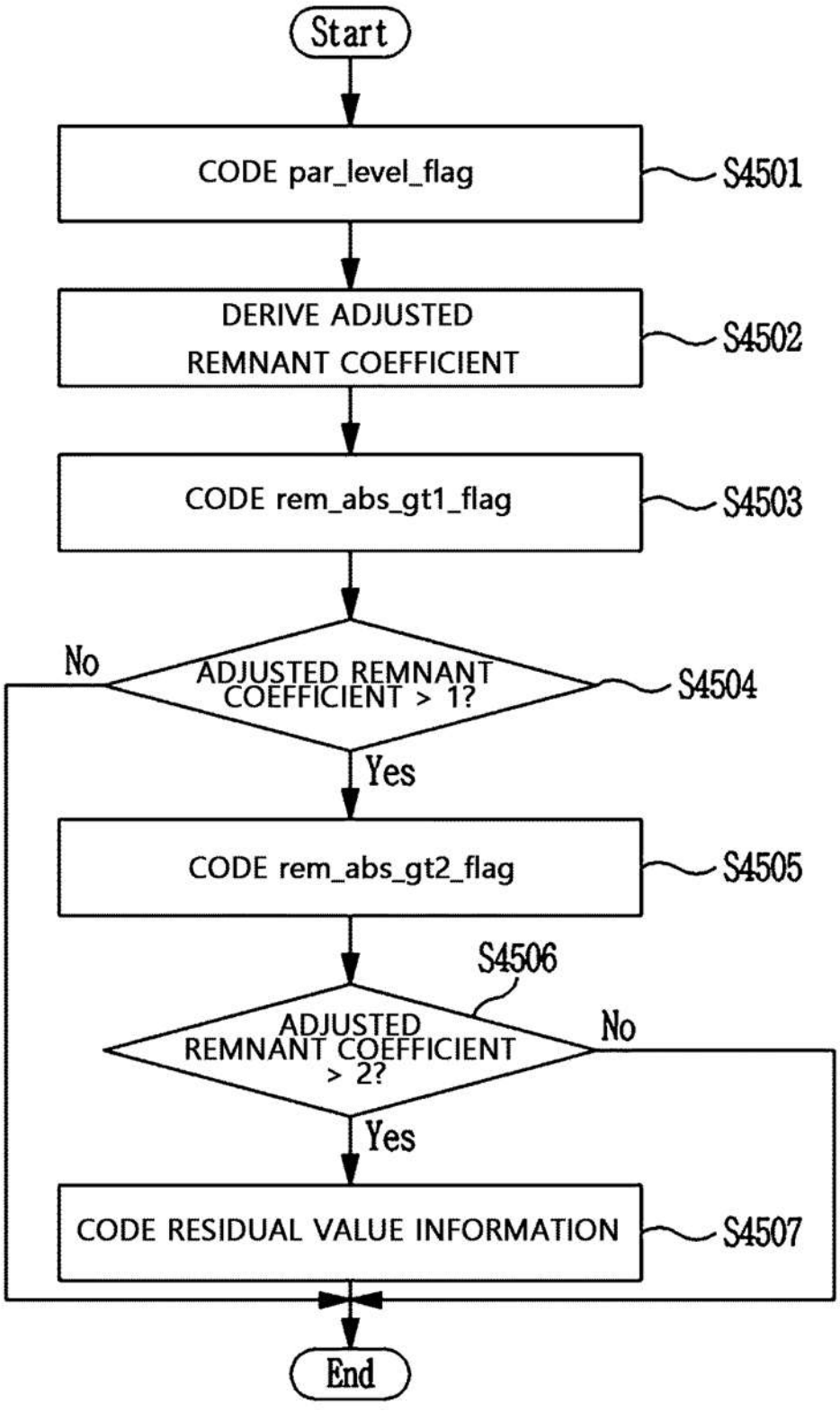

Start
CODE par_level_flag
S4501
DERIVE ADJUSTED REMNANT COEFFICIENT
S4502
CODE rem_abs_gt1_flag
S4503
No
ADJUSTED REMNANT COEFFICIENT > 1?
S4504
Yes
CODE rem_abs_gt2_flag
S4505
S4506
ADJUSTED REMNANT COEFFICIENT > 2?
No
Yes
CODE RESIDUAL VALUE INFORMATION
S4507
End

FIG. 45

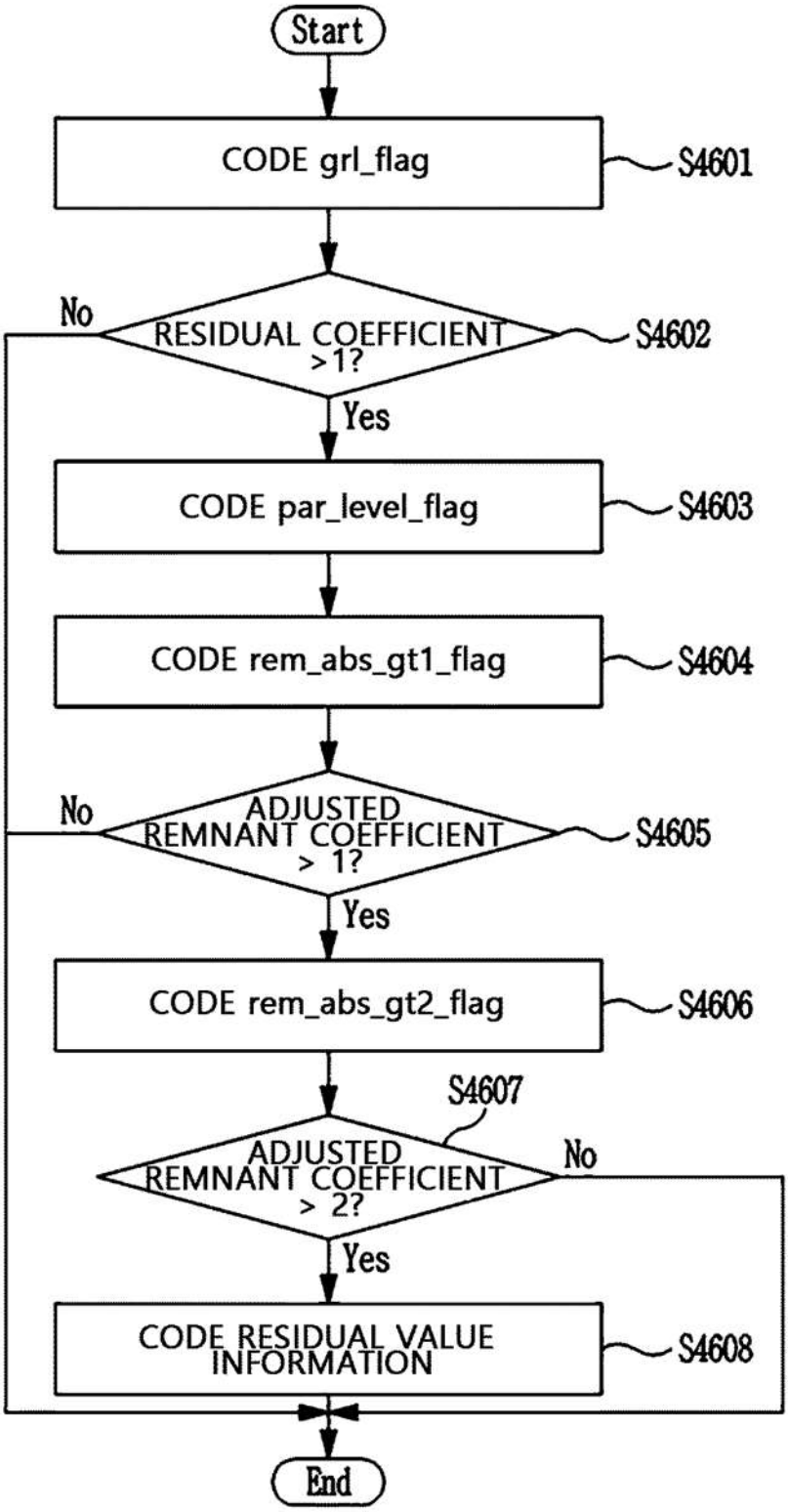

Start
CODE grl_flag
S4601
No
RESIDUAL COEFFICIENT >1?
S4602
Yes
CODE par_level_flag
S4603
CODE rem_abs_gt1_flag
S4604
No
ADJUSTED REMNANT COEFFICIENT > 1?
S4605
Yes
CODE rem_abs_gt2_flag
S4606
S4607
ADJUSTED REMNANT COEFFICIENT > 2?
No
Yes
CODE RESIDUAL VALUE INFORMATION
S4608
End

FIG. 46

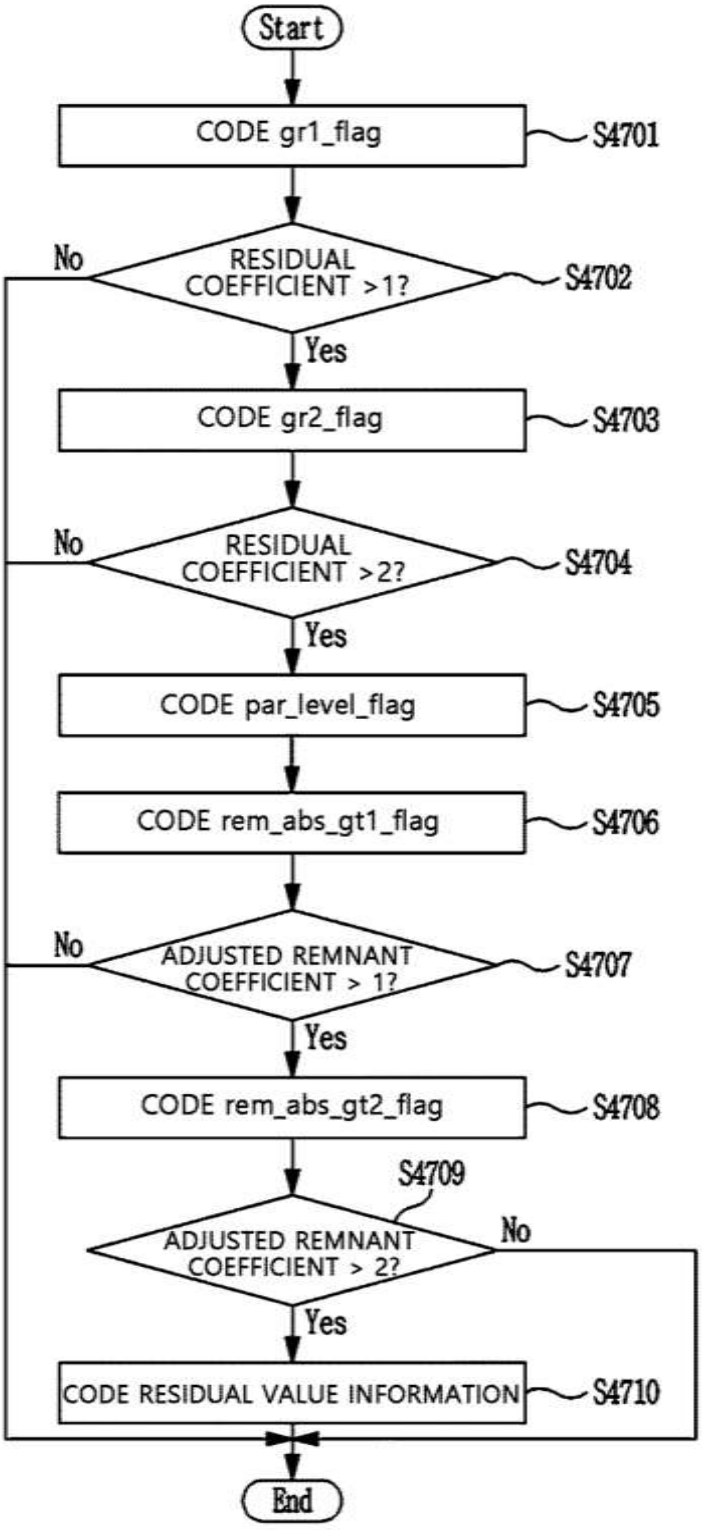

Start
CODE gr1_flag
S4701
RESIDUAL COEFFICIENT >1?
S4702
No
Yes
CODE gr2_flag
S4703
RESIDUAL COEFFICIENT >2?
S4704
No
Yes
CODE par_level_flag
S4705
CODE rem_abs_gt1_flag
S4706
ADJUSTED REMNANT COEFFICIENT > 1?
S4707
No
Yes
CODE rem_abs_gt2_flag
S4708
S4709
ADJUSTED REMNANT COEFFICIENT > 2?
No
Yes
CODE RESIDUAL VALUE INFORMATION
S4710
End

FIG. 47

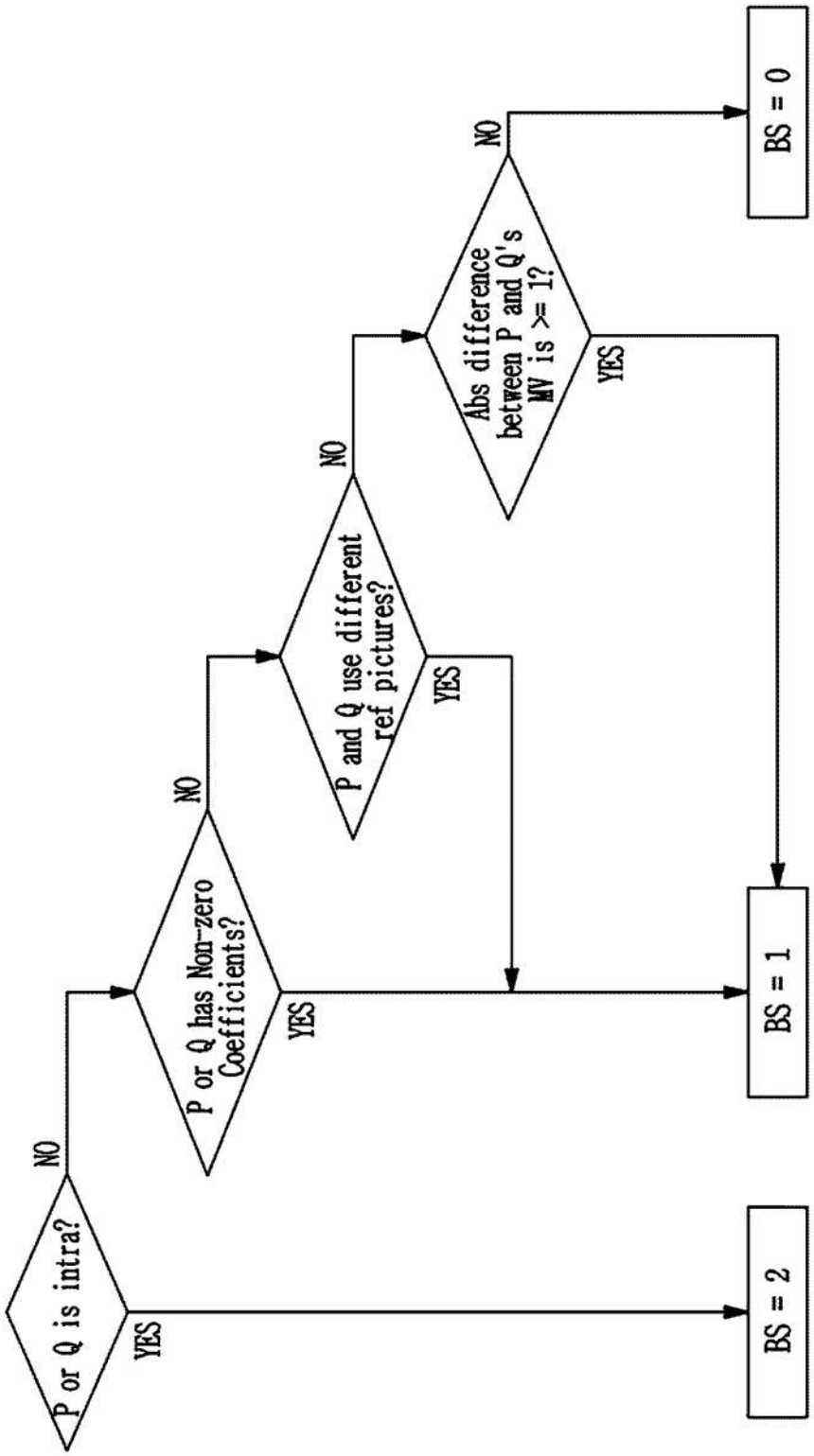

P or Q is intra?
NO
YES
P or Q has Non-zero Coefficients?
NO
YES
P and Q use different ref pictures?
NO
YES
Abs difference between P and Q's MV is >= 1?
NO
YES
BS = 2
BS = 1
BS = 0

FIG. 48

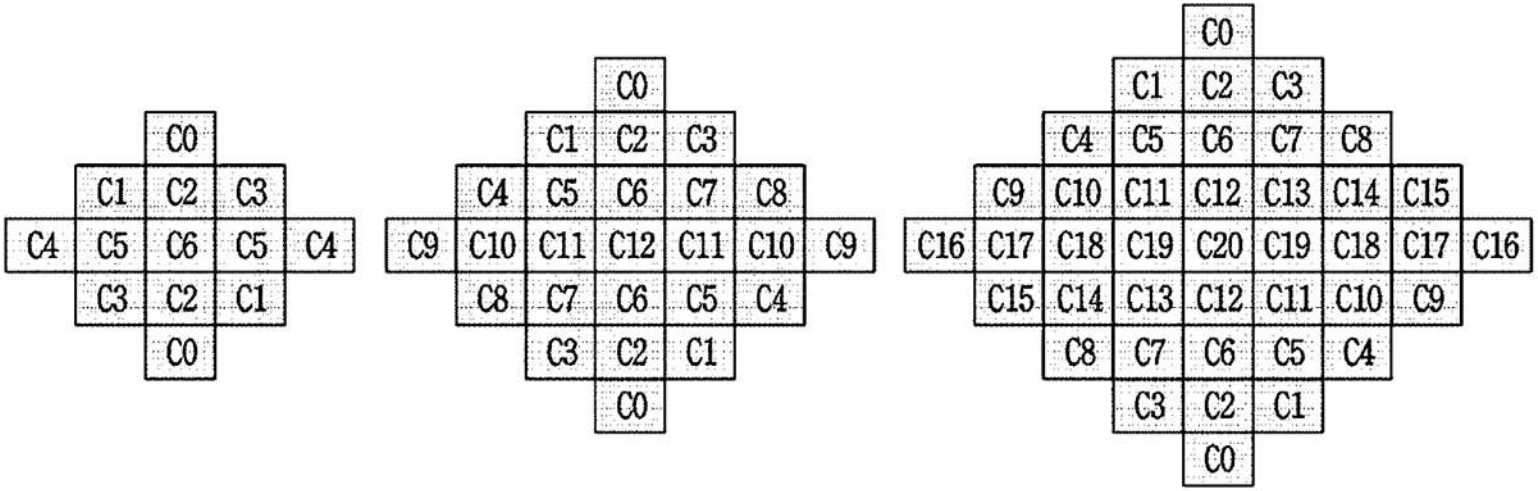

C0
C1 C2 C3
C4 C5 C6 C5 C4
C3 C2 C1
C0
C0
C1 C2 C3
C4 C5 C6 C7 C8
C9 C10 C11 C12 C11 C10 C9
C8 C7 C6 C5 C4
C3 C2 C1
C0
C0
C1 C2 C3
C4 C5 C6 C7 C8
C9 C10 C11 C12 C13 C14 C15
C16 C17 C18 C19 C20 C19 C18 C17 C16
C15 C14 C13 C12 C11 C10 C9
C8 C7 C6 C5 C4
C3 C2 C1
C0

FIG. 49