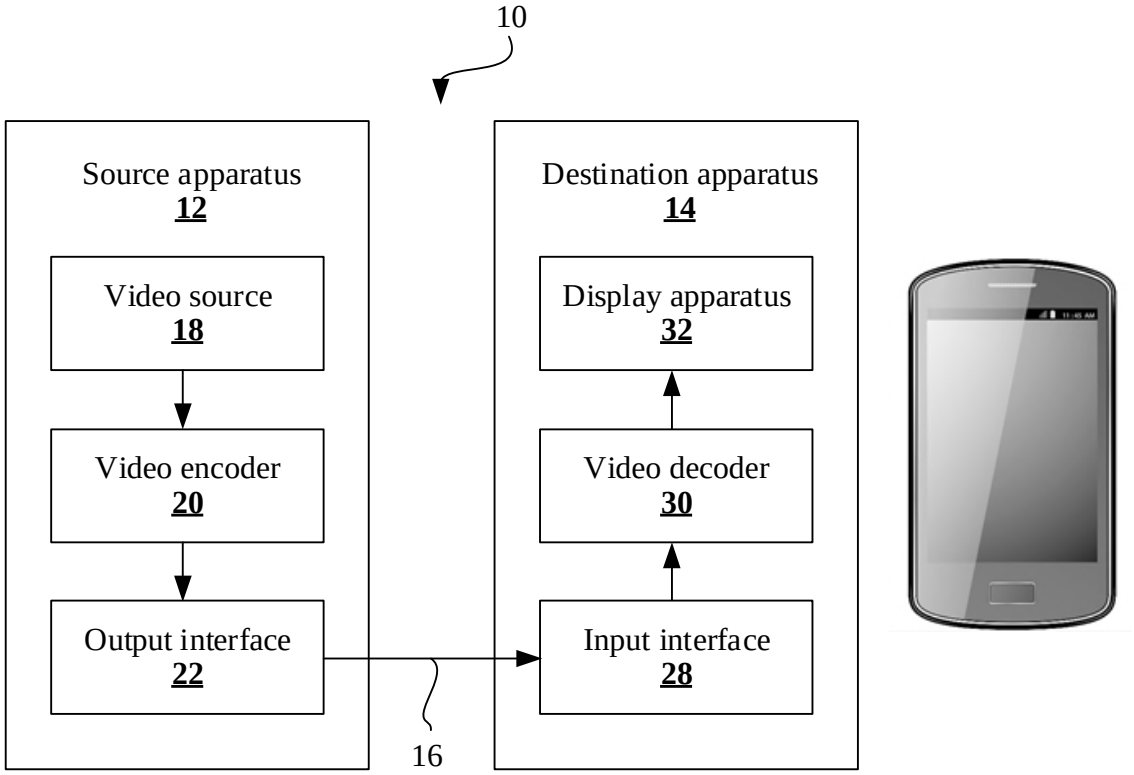

10
Source apparatus
12
Video source
18
Video encoder
20
Output interface
22
16
Destination apparatus
14
Display apparatus
32
Video decoder
30
Input interface
28

FIG. 1

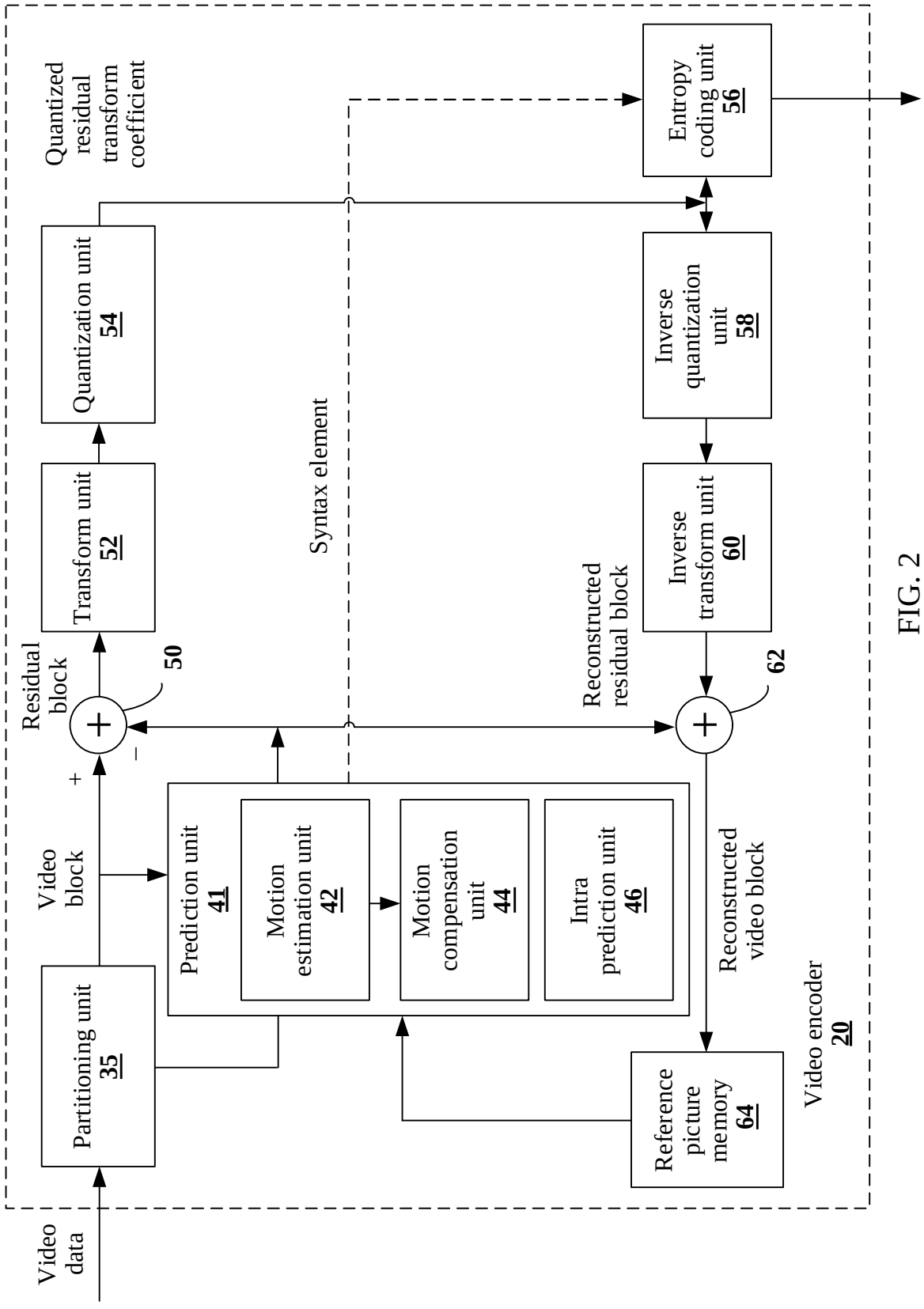

Video data
Video encoder 20
Partitioning unit 35
Prediction unit 41
Motion estimation unit 42
Motion compensation unit 44
Intra prediction unit 46
Reference picture memory 64
Video block
Residual block
50
Transform unit 52
Quantization unit 54
Quantized residual transform coefficient
Entropy coding unit 56
Syntax element
Inverse quantization unit 58
Inverse transform unit 60
Reconstructed residual block
62
Reconstructed video block

FIG. 2

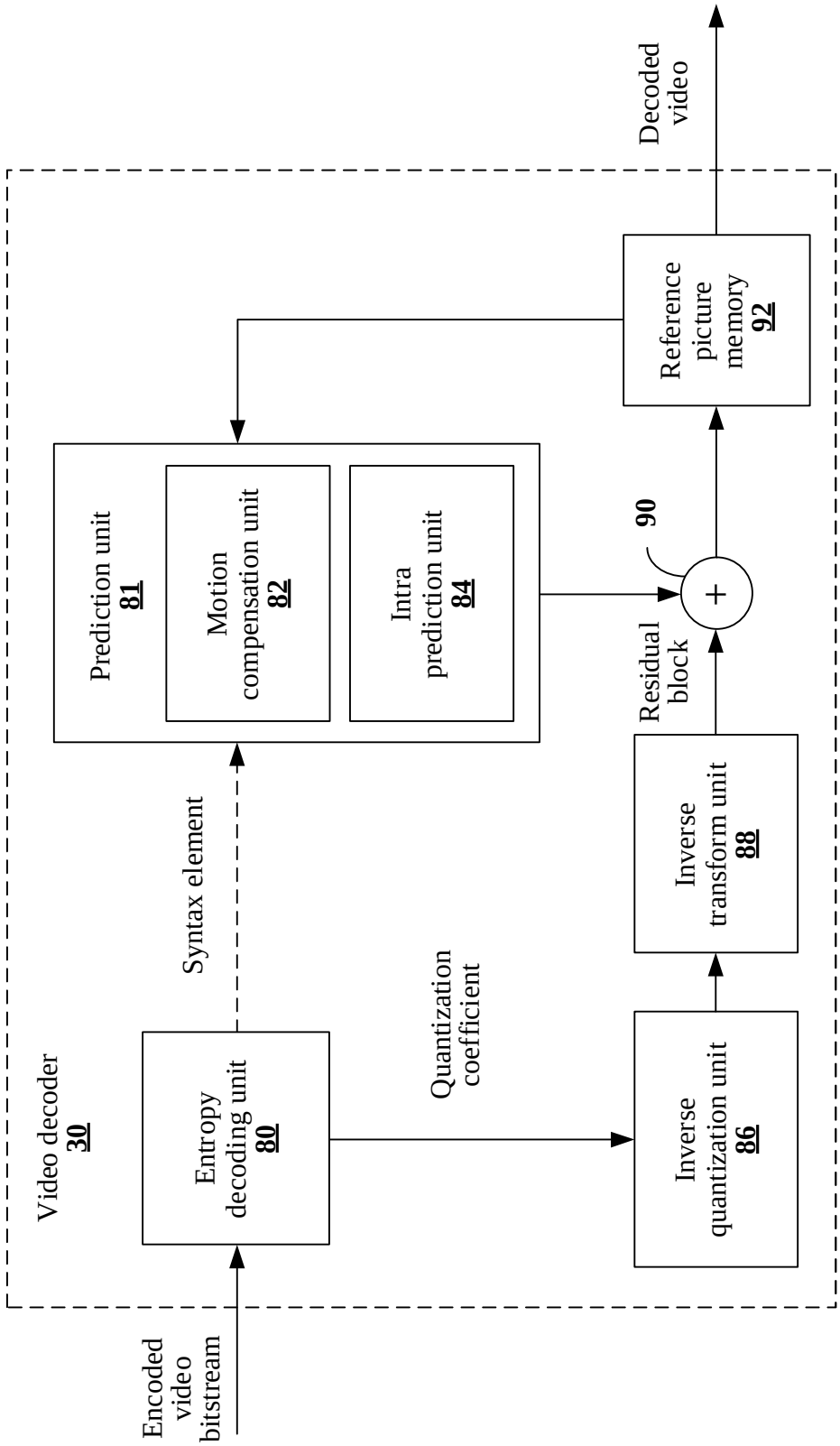

Encoded video bitstream
Video decoder 30
Entropy decoding unit 80
Syntax element
Quantization coefficient
Inverse quantization unit 86
Inverse transform unit 88
Residual block
90
Prediction unit 81
Motion compensation unit 82
Intra prediction unit 84
Reference picture memory 92
Decoded video

FIG. 3

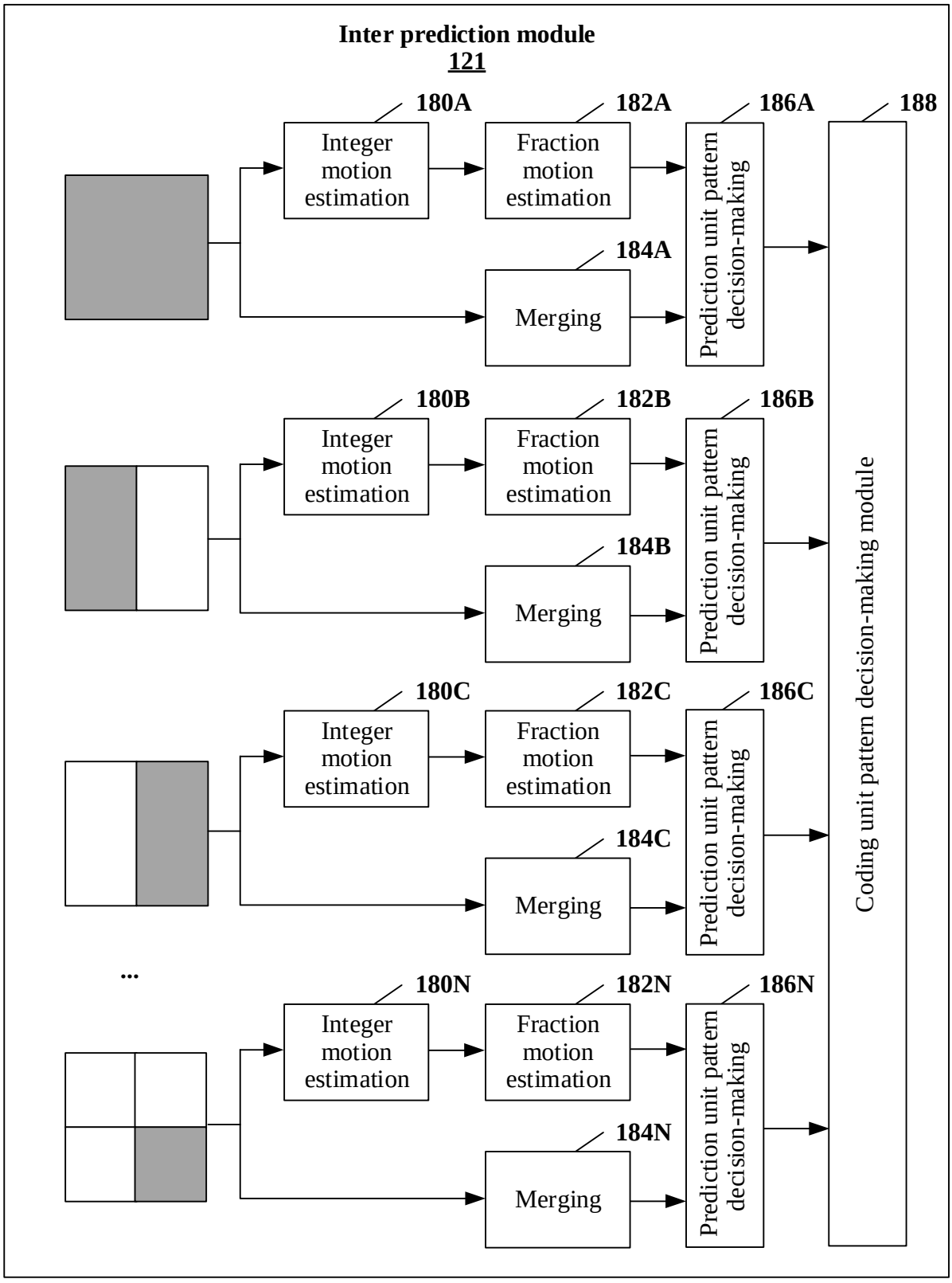

Inter prediction module
121
180A
Integer motion estimation
182A
Fraction motion estimation
186A
Prediction unit pattern decision-making
188
184A
Merging
180B
Integer motion estimation
182B
Fraction motion estimation
186B
Prediction unit pattern decision-making
184B
Merging
180C
Integer motion estimation
182C
Fraction motion estimation
186C
Prediction unit pattern decision-making
184C
Merging
...
180N
Integer motion estimation
182N
Fraction motion estimation
186N
Prediction unit pattern decision-making
184N
Merging
Coding unit pattern decision-making module

FIG. 4

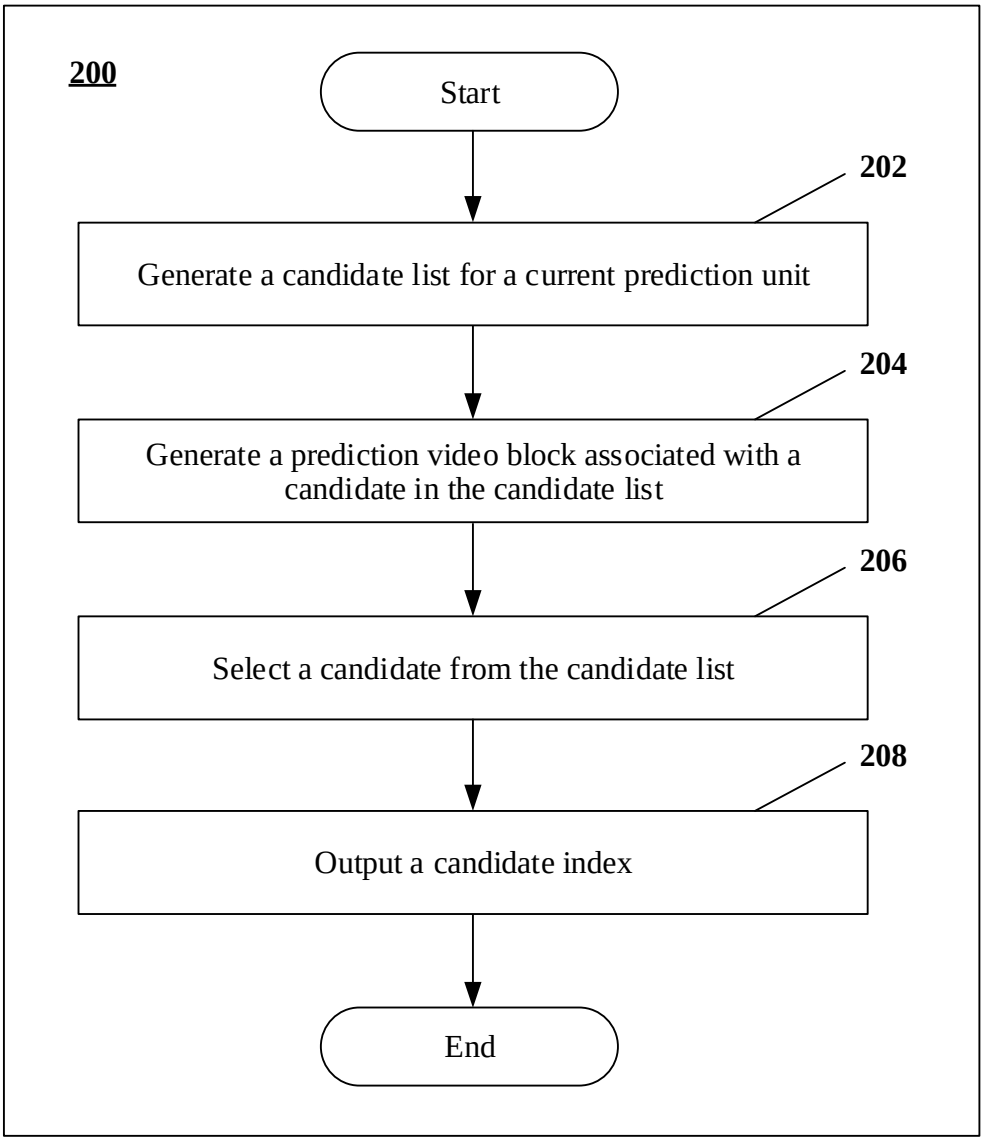

200
Start
202
Generate a candidate list for a current prediction unit
204
Generate a prediction video block associated with a candidate in the candidate list
206
Select a candidate from the candidate list
208
Output a candidate index
End

FIG. 5

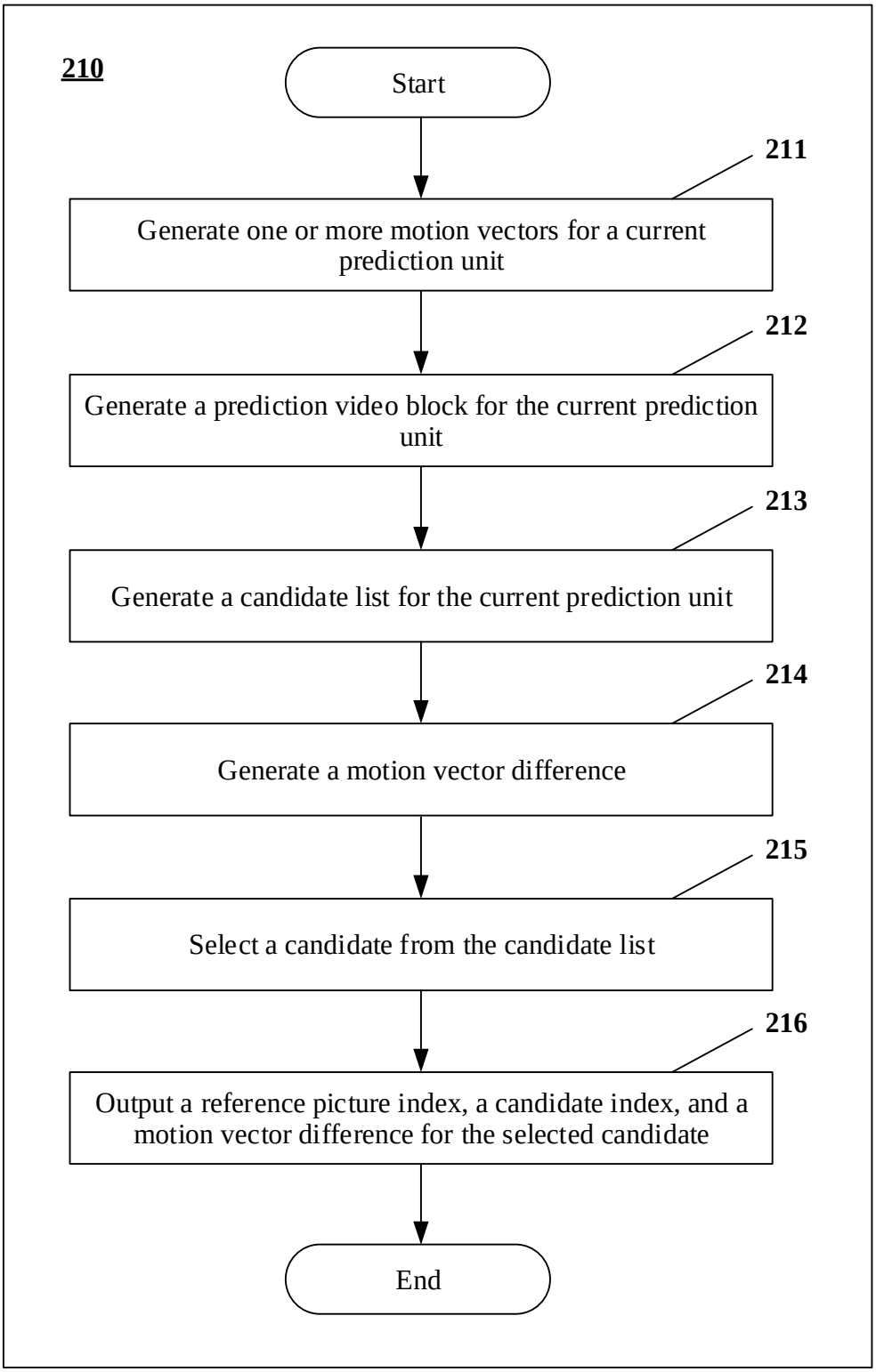

210
Start
211
Generate one or more motion vectors for a current prediction unit
212
Generate a prediction video block for the current prediction unit
213
Generate a candidate list for the current prediction unit
214
Generate a motion vector difference
215
Select a candidate from the candidate list
216
Output a reference picture index, a candidate index, and a motion vector difference for the selected candidate
End

FIG. 6

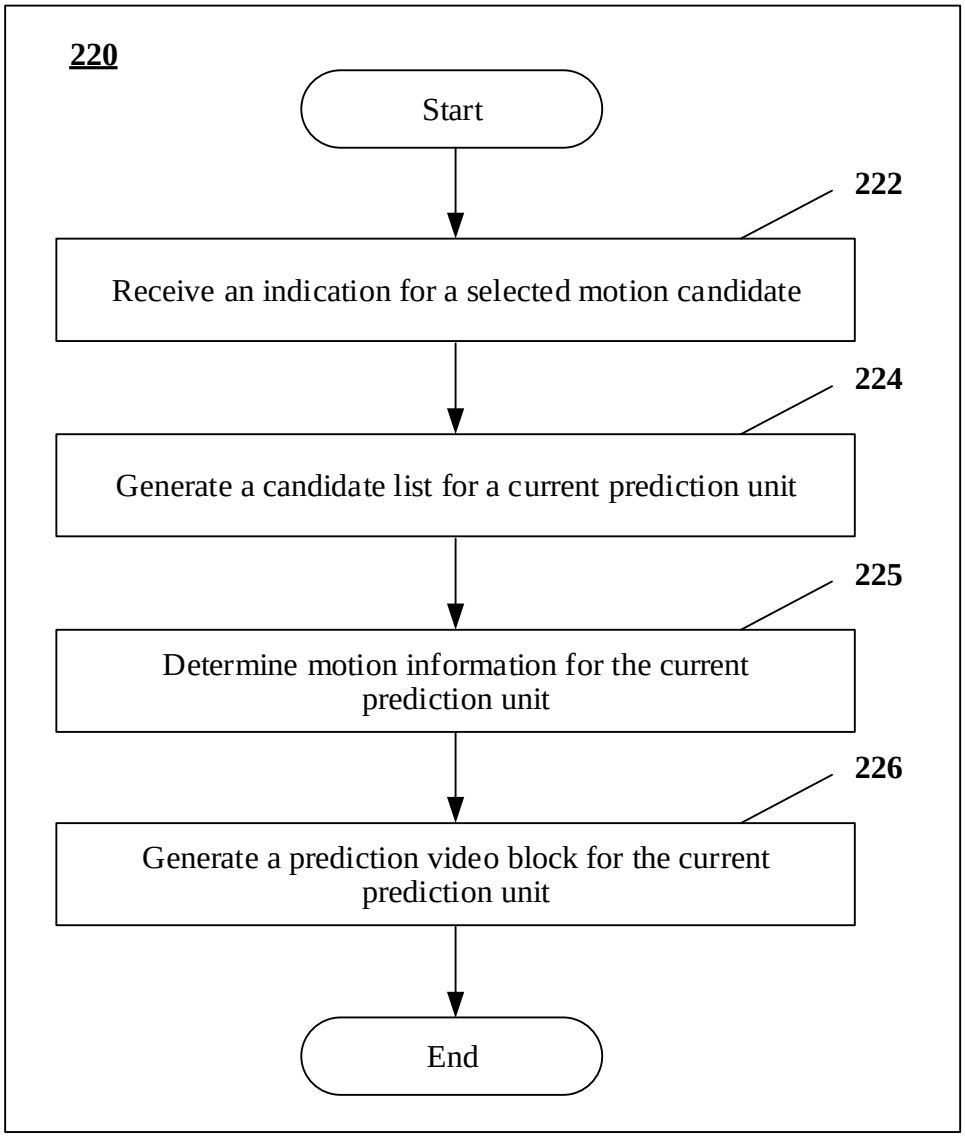

220
Start
222
Receive an indication for a selected motion candidate
224
Generate a candidate list for a current prediction unit
225
Determine motion information for the current prediction unit
226
Generate a prediction video block for the current prediction unit
End

FIG. 7

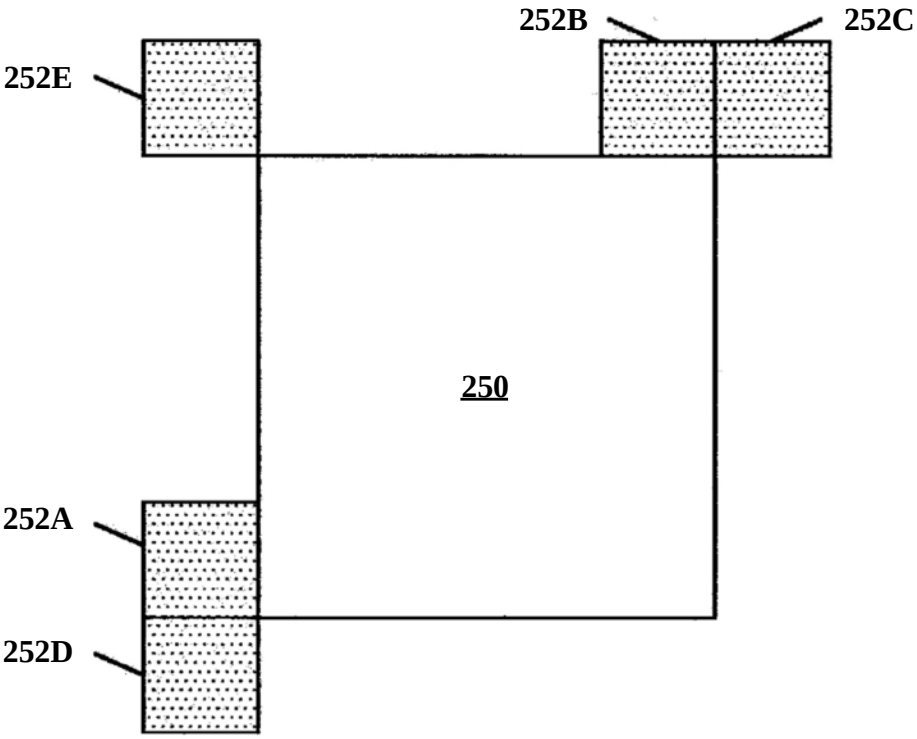


FIG. 8

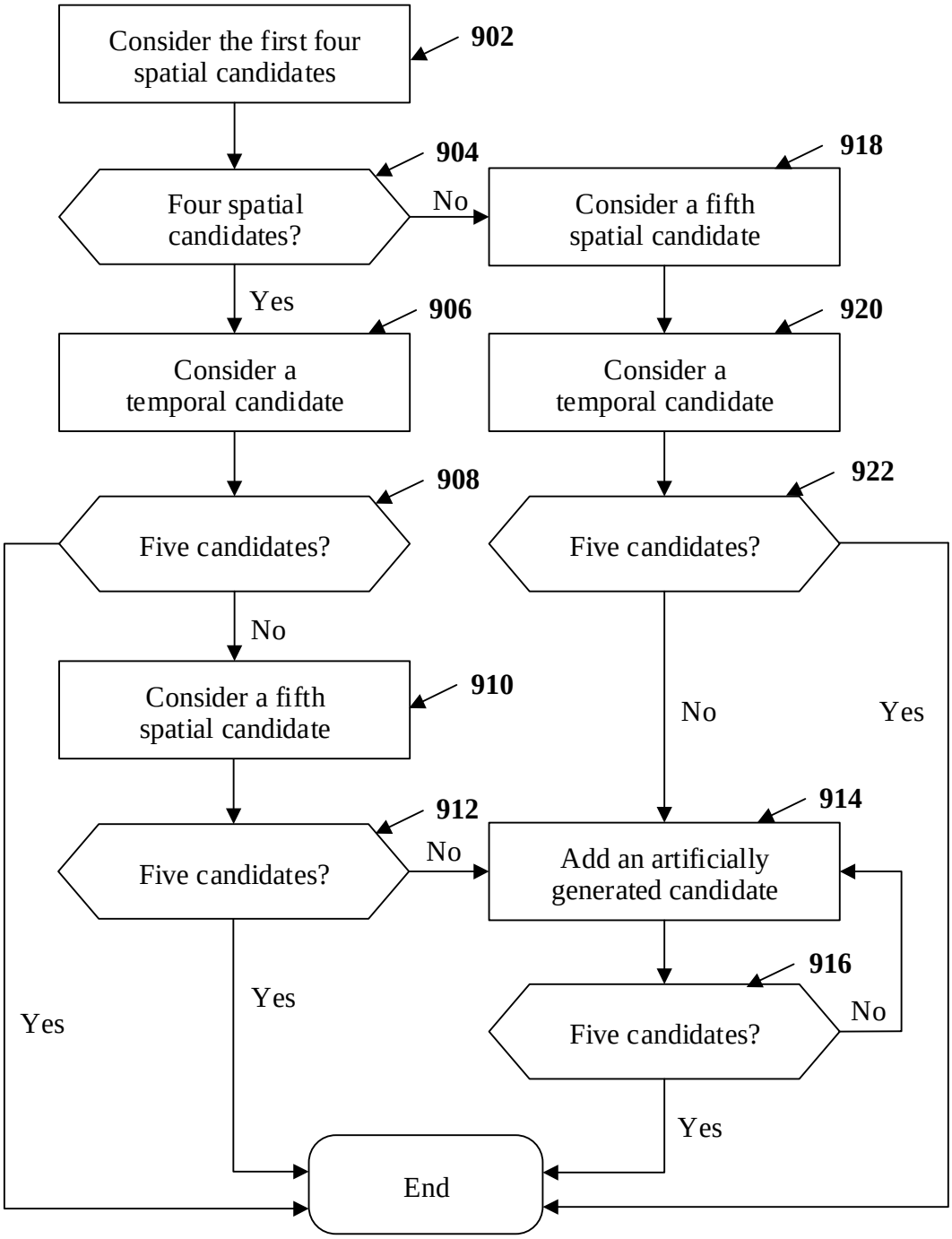

Consider the first four spatial candidates
902
Four spatial candidates?
904
No
Yes
Consider a fifth spatial candidate
918
Consider a temporal candidate
906
Consider a temporal candidate
920
Five candidates?
908
Five candidates?
922
No
Consider a fifth spatial candidate
910
No
Yes
Five candidates?
912
No
Add an artificially generated candidate
914
Yes
Yes
Five candidates?
916
No
Yes
End

FIG. 9

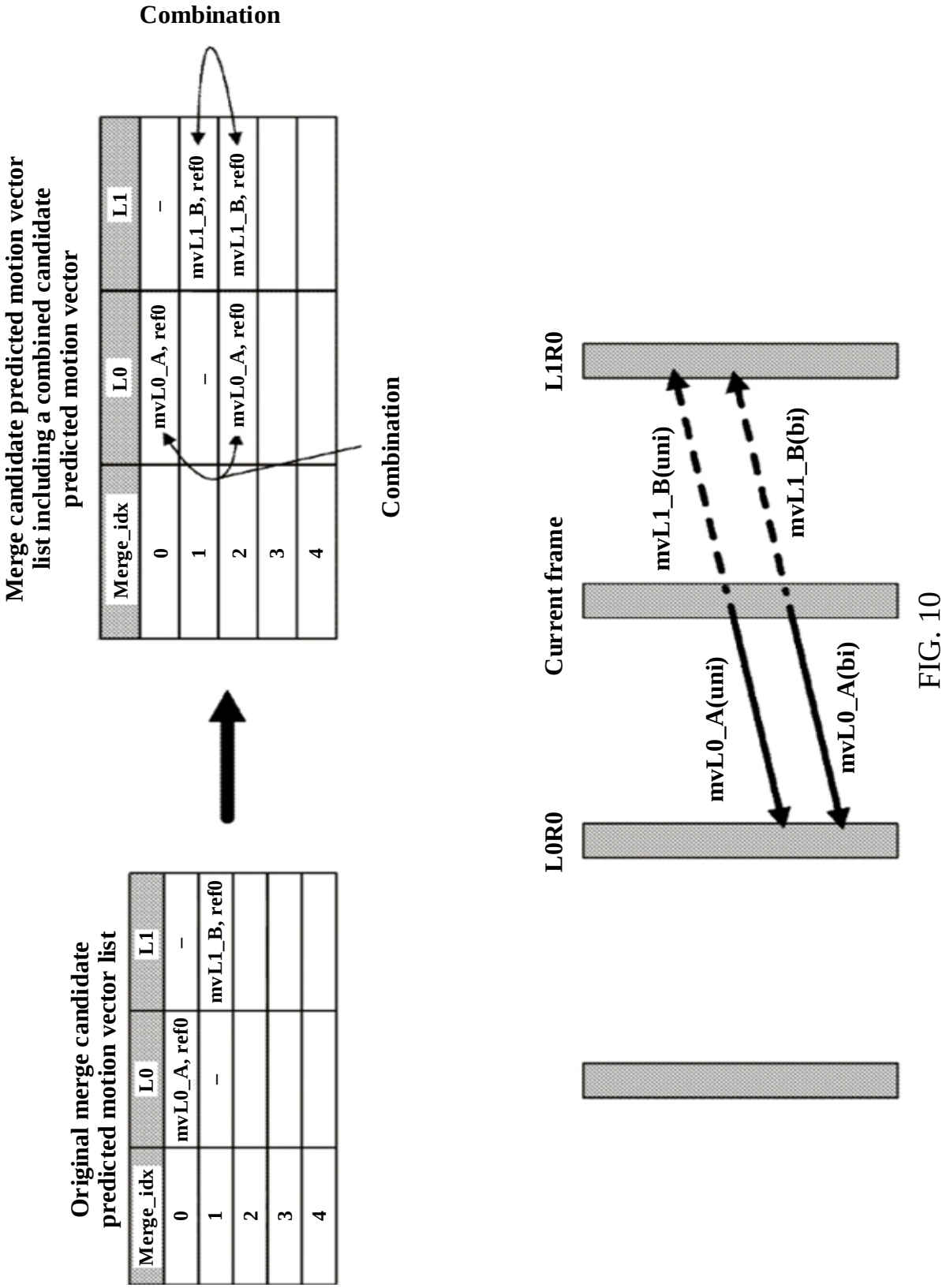

Original merge candidate predicted motion vector list
Merge_idx
L0
L1
0
mvL0_A, ref0
–
1
–
mvL1_B, ref0
2
3
4
Combination
Merge candidate predicted motion vector list including a combined candidate predicted motion vector
Merge_idx
L0
L1
0
mvL0_A, ref0
–
1
–
mvL1_B, ref0
2
mvL0_A, ref0
mvL1_B, ref0
3
4
Combination
L1R0
Current frame
L0R0
mvL1_B(uni)
mvL1_B(bi)
mvL0_A(uni)
mvL0_A(bi)

FIG. 10

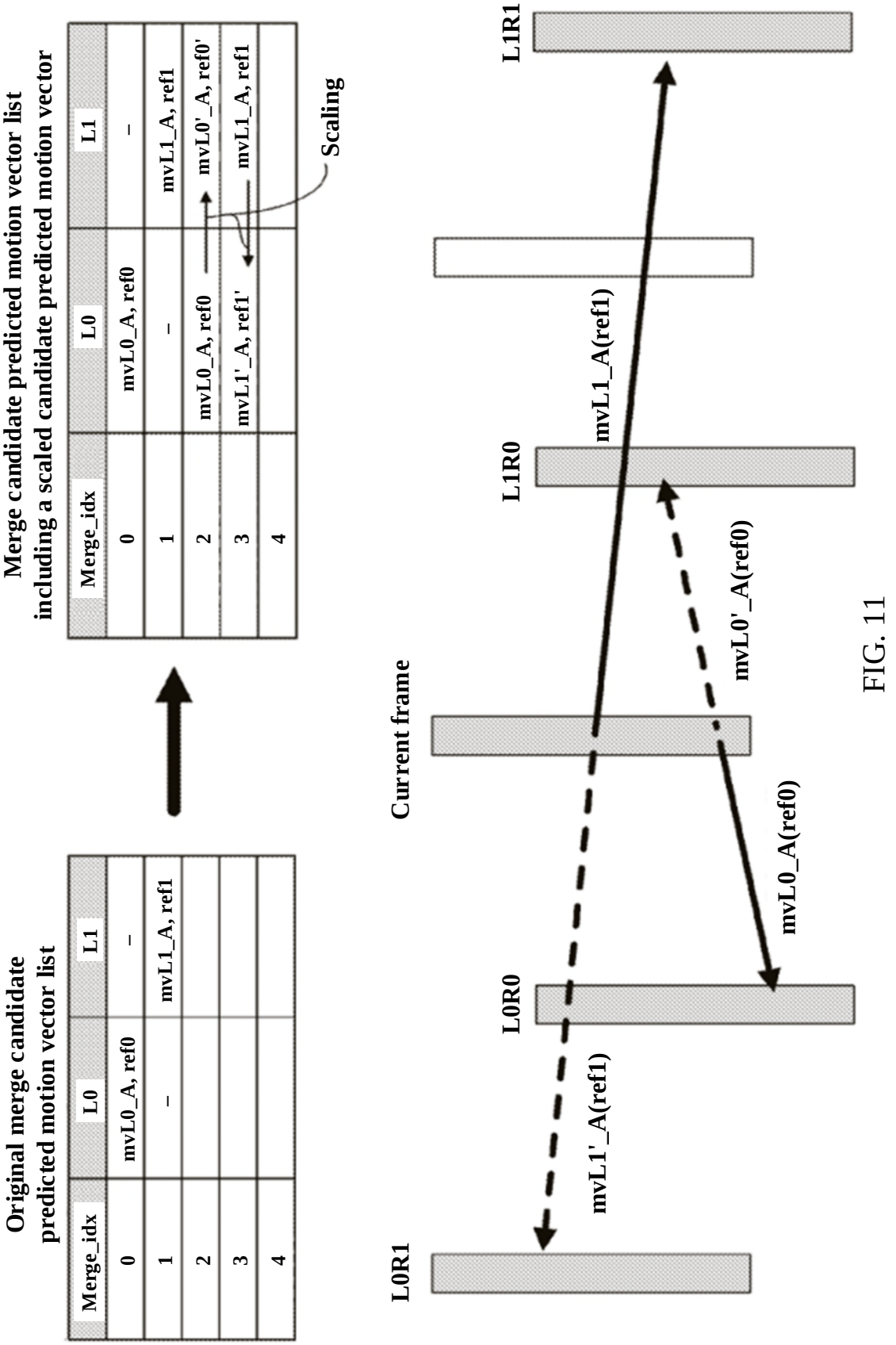

Original merge candidate predicted motion vector list
Merge_idx
L0
L1
0
mvL0_A, ref0
–
1
–
mvL1_A, ref1
2
3
4
Merge candidate predicted motion vector list including a scaled candidate predicted motion vector
Merge_idx
L0
L1
0
mvL0_A, ref0
–
1
–
mvL1_A, ref1
2
mvL0_A, ref0
mvL0'_A, ref0'
3
mvL1'_A, ref1'
mvL1_A, ref1
4
Scaling
Current frame
L0R1
L0R0
L1R0
L1R1
mvL1'_A(ref1)
mvL0_A(ref0)
mvL0'_A(ref0)
mvL1_A(ref1)

FIG. 11

Original merge candidate predicted motion vector list

Merge_idx	L0	L1
0	mvL0_A, ref0	–
1	–	mvL1_B, ref0
2	mvL0_A, ref0	mvL1_B, ref0
3	–	–
4	–	–

Add a "0" motion vector



Candidate predicted motion vector list including the added "0" motion vector

Merge_idx	L0	L1
0	mvL0_A, ref0	–
1	–	mvL1_B, ref0
2	mvL0_A, ref0	mvL1_B, ref0
3	(0, 0), ref0	(0, 0), ref0
4	(0, 0), ref1	(0, 0), ref1

FIG. 12

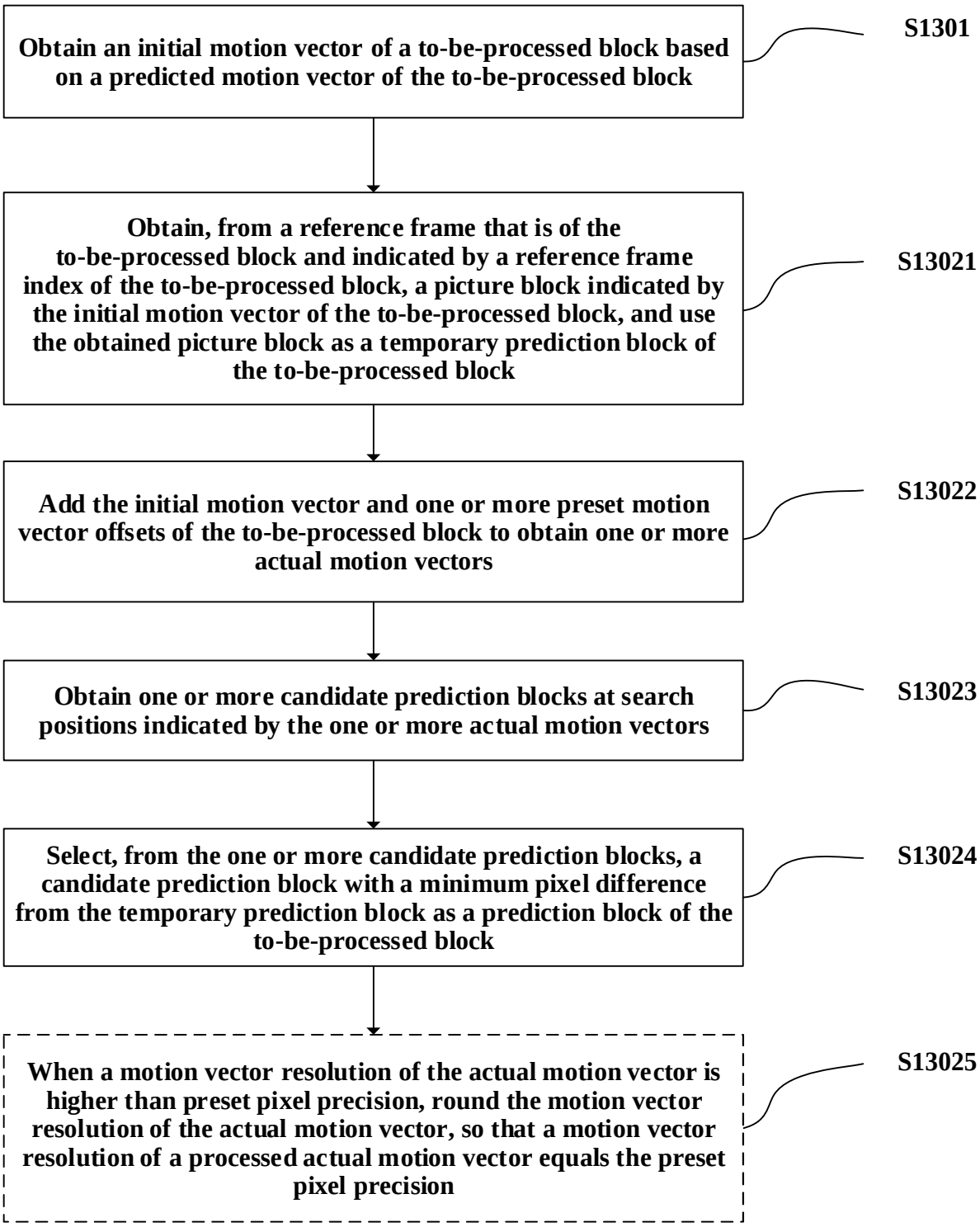

Obtain an initial motion vector of a to-be-processed block based on a predicted motion vector of the to-be-processed block
S1301
Obtain, from a reference frame that is of the to-be-processed block and indicated by a reference frame index of the to-be-processed block, a picture block indicated by the initial motion vector of the to-be-processed block, and use the obtained picture block as a temporary prediction block of the to-be-processed block
S13021
Add the initial motion vector and one or more preset motion vector offsets of the to-be-processed block to obtain one or more actual motion vectors
S13022
Obtain one or more candidate prediction blocks at search positions indicated by the one or more actual motion vectors
S13023
Select, from the one or more candidate prediction blocks, a candidate prediction block with a minimum pixel difference from the temporary prediction block as a prediction block of the to-be-processed block
S13024
When a motion vector resolution of the actual motion vector is higher than preset pixel precision, round the motion vector resolution of the actual motion vector, so that a motion vector resolution of a processed actual motion vector equals the preset pixel precision
S13025

FIG. 13

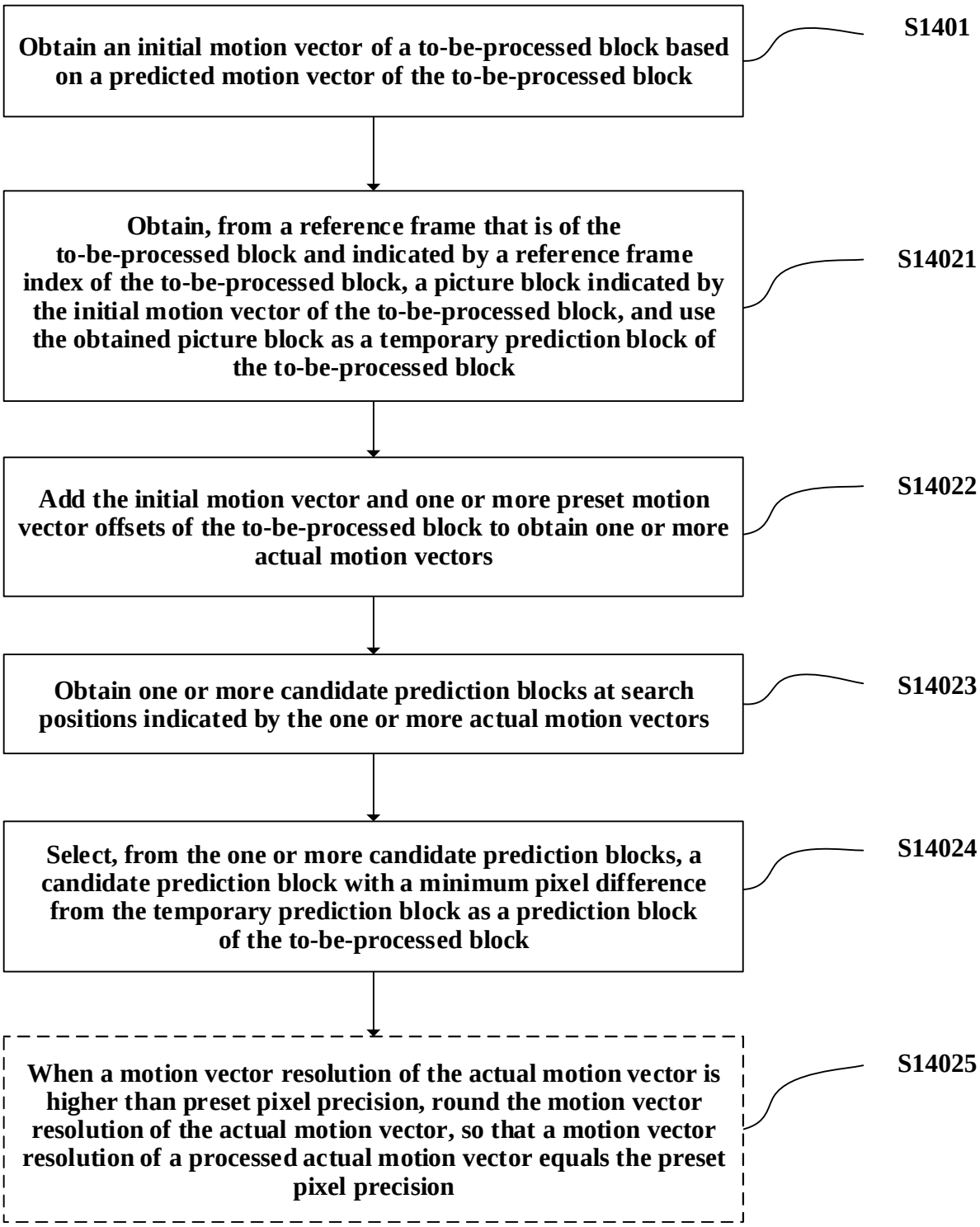

Obtain an initial motion vector of a to-be-processed block based on a predicted motion vector of the to-be-processed block
S1401
Obtain, from a reference frame that is of the to-be-processed block and indicated by a reference frame index of the to-be-processed block, a picture block indicated by the initial motion vector of the to-be-processed block, and use the obtained picture block as a temporary prediction block of the to-be-processed block
S14021
Add the initial motion vector and one or more preset motion vector offsets of the to-be-processed block to obtain one or more actual motion vectors
S14022
Obtain one or more candidate prediction blocks at search positions indicated by the one or more actual motion vectors
S14023
Select, from the one or more candidate prediction blocks, a candidate prediction block with a minimum pixel difference from the temporary prediction block as a prediction block of the to-be-processed block
S14024
When a motion vector resolution of the actual motion vector is higher than preset pixel precision, round the motion vector resolution of the actual motion vector, so that a motion vector resolution of a processed actual motion vector equals the preset pixel precision
S14025

FIG. 14

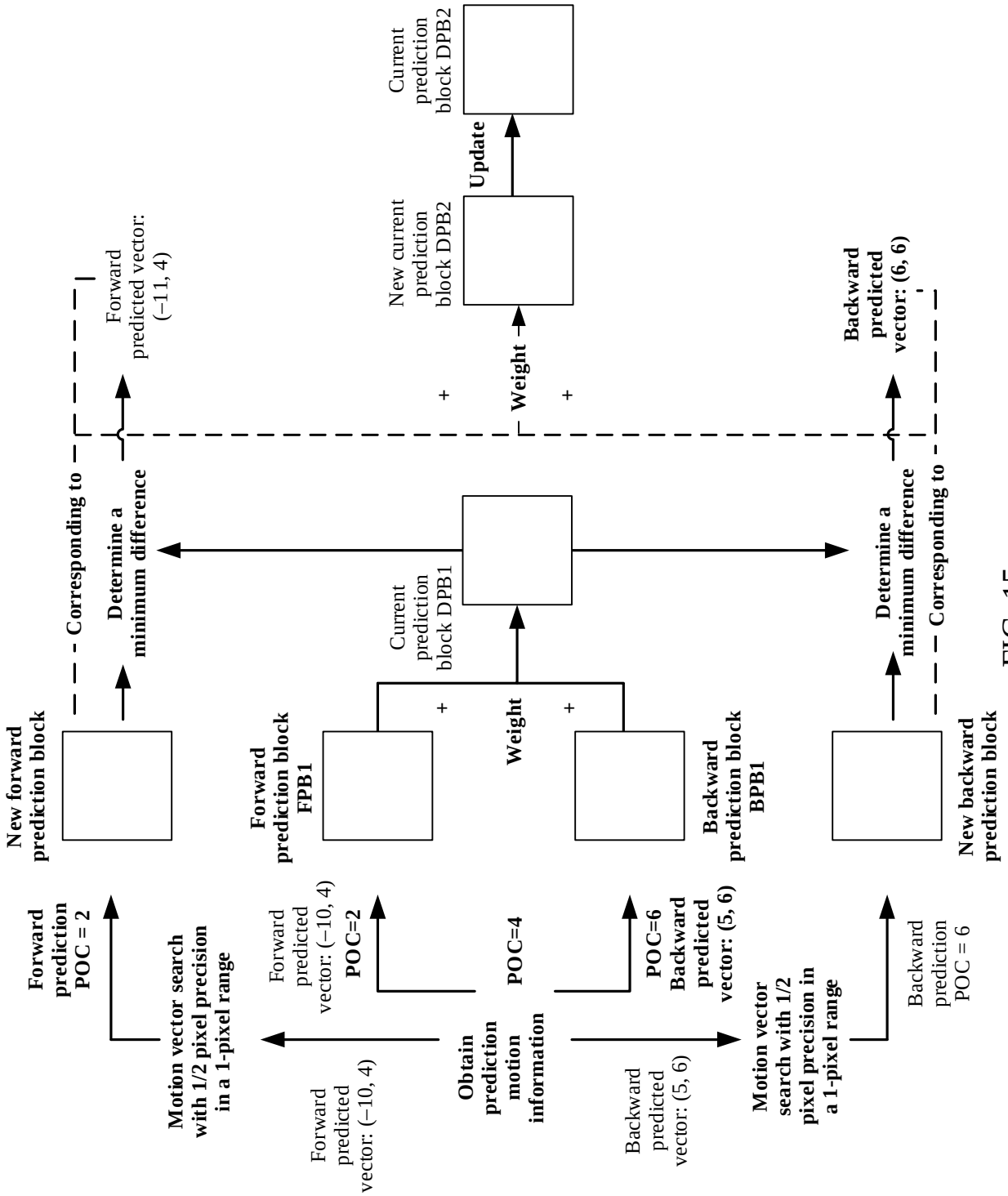

Forward prediction POC = 2
Motion vector search with 1/2 pixel precision in a 1-pixel range
Forward predicted vector: (–10, 4)
POC=2
Forward predicted vector: (–10, 4)
Obtain prediction motion information
POC=4
POC=6
Backward predicted vector: (5, 6)
Backward predicted vector: (5, 6)
Motion vector search with 1/2 pixel precision in a 1-pixel range
Backward prediction POC = 6
New forward prediction block
Determine a minimum difference
Corresponding to
Forward predicted vector: (–11, 4)
Forward prediction block FPB1
+
Current prediction block DPB1
Weight
+
Backward prediction block BPB1
Determine a minimum difference
Corresponding to
Backward predicted vector: (6, 6)
New backward prediction block
+
New current prediction block DPB2
Weight
+
Update
Current prediction block DPB2

FIG. 15

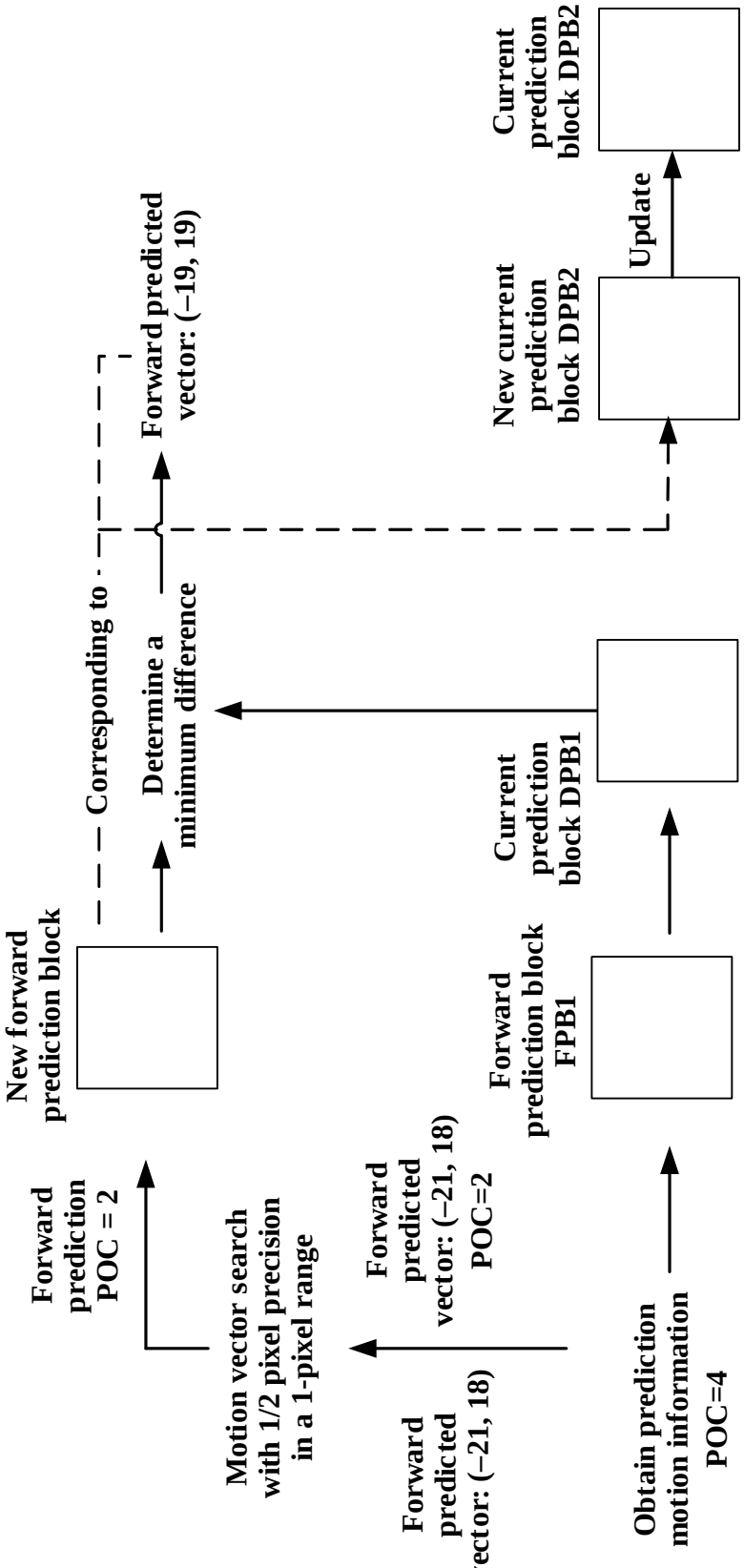

Current prediction block DPB2
Update
New current prediction block DPB2
Forward predicted vector: (–19, 19)
Corresponding to
Determine a minimum difference
Current prediction block DPB1
Forward prediction block FPB1
New forward prediction block
Forward prediction POC = 2
Motion vector search with 1/2 pixel precision in a 1-pixel range
Forward predicted vector: (–21, 18)
POC=2
Forward predicted vector: (–21, 18)
Obtain prediction motion information
POC=4

FIG. 16

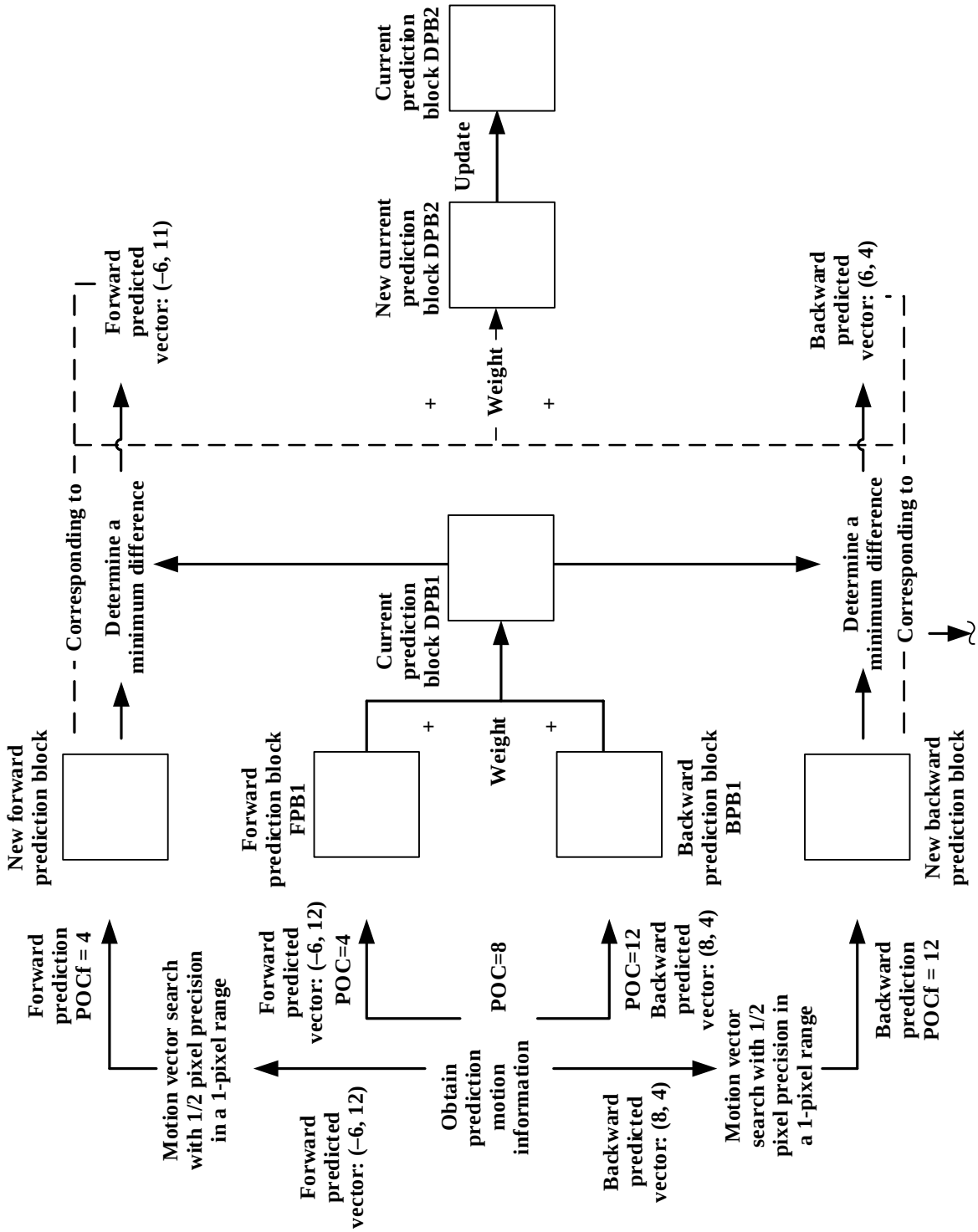

Forward prediction POCf = 4
Motion vector search with 1/2 pixel precision in a 1-pixel range
Forward predicted vector: (–6, 12)
Forward predicted vector: (–6, 12) POC=4
Obtain prediction motion information
POC=8
Backward predicted vector: (8, 4)
POC=12 Backward predicted vector: (8, 4)
Motion vector search with 1/2 pixel precision in a 1-pixel range
Backward prediction POCf = 12
New forward prediction block
Forward prediction block FPB1
Current prediction block DPB1
Backward prediction block BPB1
New backward prediction block
Determine a minimum difference
Corresponding to
Forward predicted vector: (–6, 11)
Determine a minimum difference
Corresponding to
Backward predicted vector: (6, 4)
Weight
Weight
New current prediction block DPB2
Update
Current prediction block DPB2
TO FIG. 17B

FIG. 17A

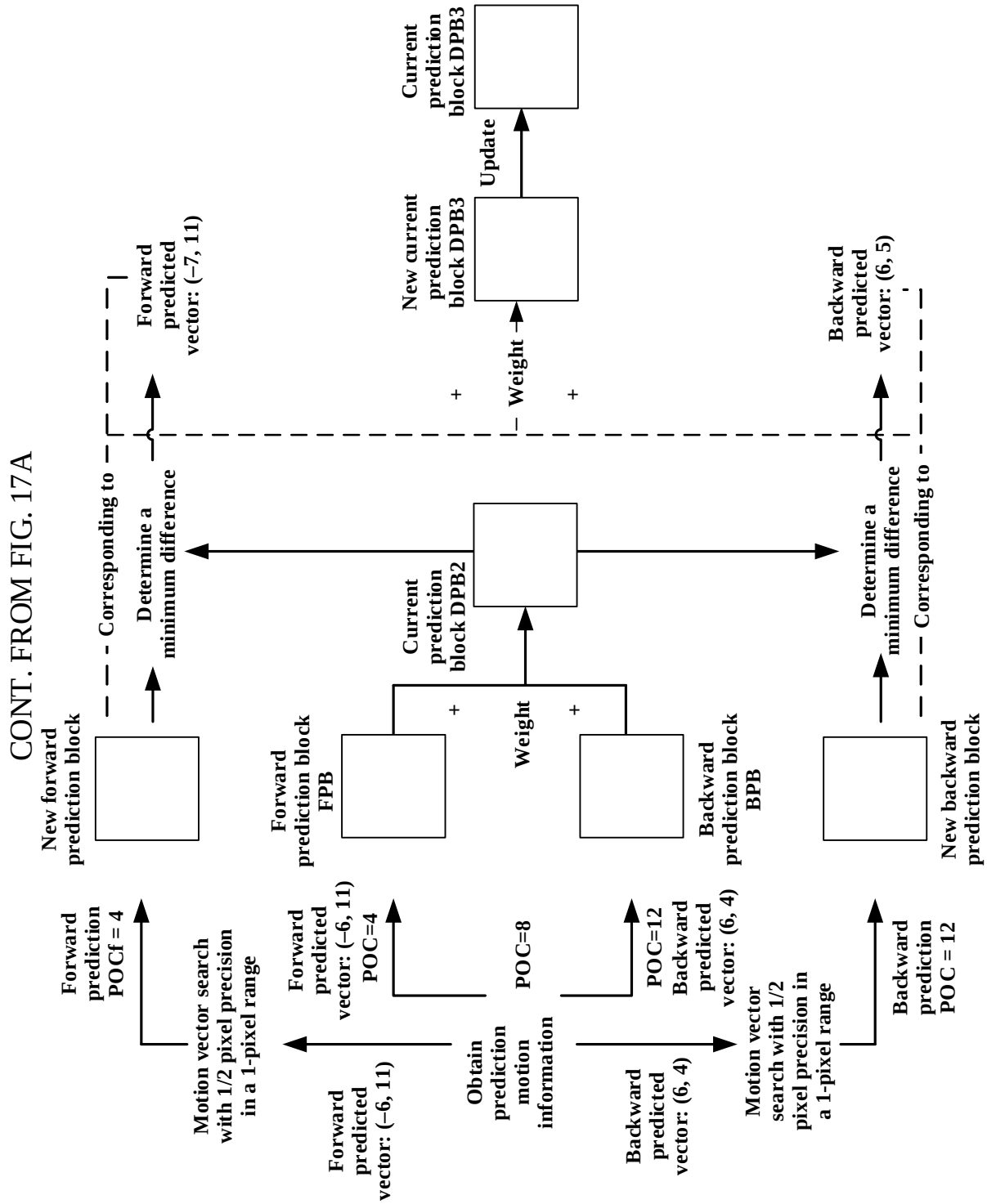

CONT. FROM FIG. 17A
Forward prediction POCf = 4
Motion vector search with 1/2 pixel precision in a 1-pixel range
Forward predicted vector: (–6, 11)
Forward predicted vector: (–6, 11) POC=4
Obtain prediction motion information
POC=8
POC=12 Backward predicted vector: (6, 4)
Backward predicted vector: (6, 4)
Motion vector search with 1/2 pixel precision in a 1-pixel range
Backward prediction POC = 12
New forward prediction block
Forward prediction block FPB
Backward prediction block BPB
New backward prediction block
Determine a minimum difference
Corresponding to
Forward predicted vector: (–7, 11)
Backward predicted vector: (6, 5)
Current prediction block DPB2
Weight
New current prediction block DPB3
Update
Current prediction block DPB3

FIG. 17B

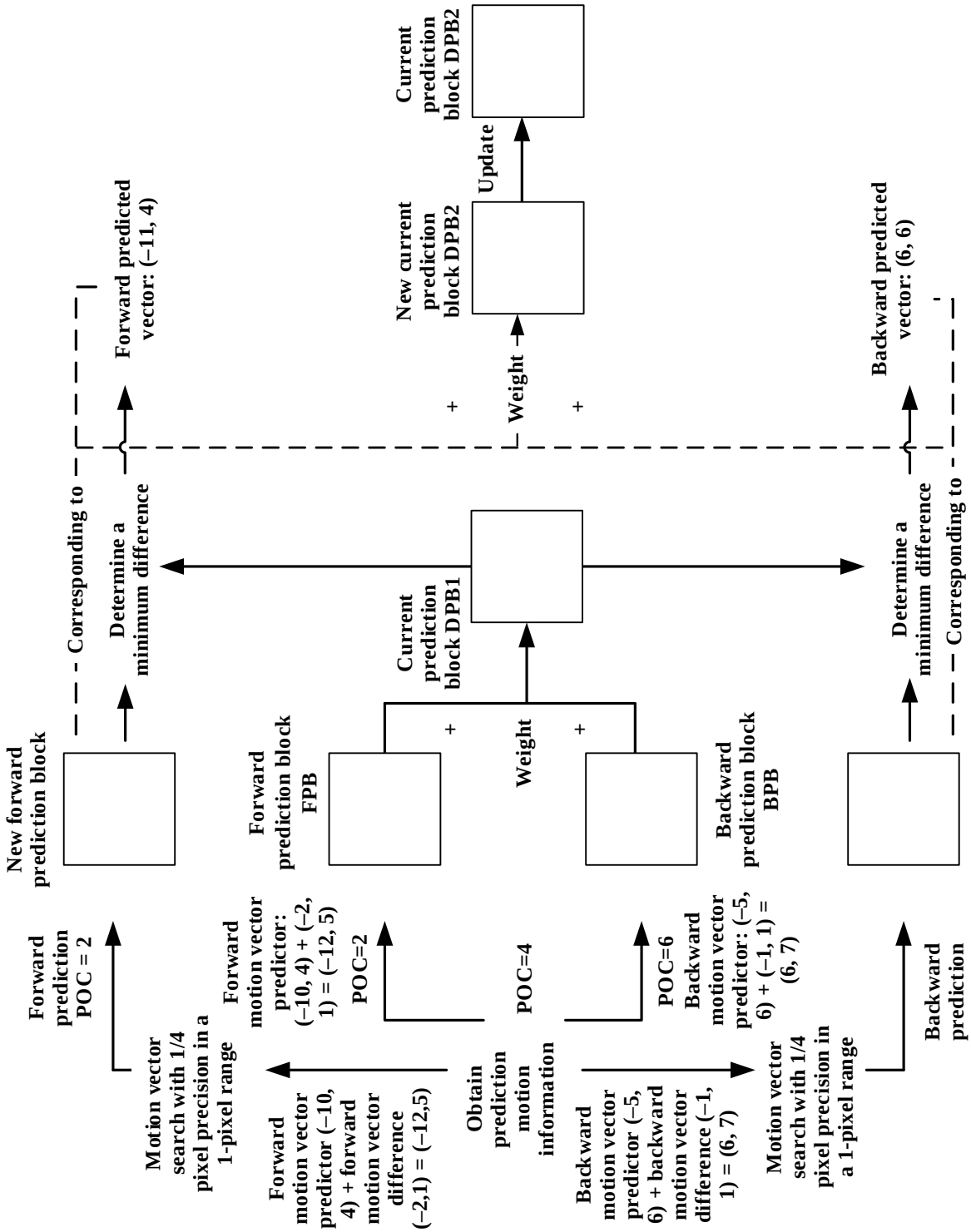

Forward prediction POC = 2
Motion vector search with 1/4 pixel precision in a 1-pixel range
Forward motion vector predictor: (–10, 4) + (–2, 1) = (–12, 5)
POC=2
Forward motion vector predictor (–10, 4) + forward motion vector difference (–2,1) = (–12,5)
Obtain prediction motion information
POC=4
Backward motion vector predictor (–5, 6) + backward motion vector difference (–1, 1) = (6, 7)
POC=6
Backward motion vector predictor: (–5, 6) + (–1, 1) = (6, 7)
Motion vector search with 1/4 pixel precision in a 1-pixel range
Backward prediction POC = 6
New forward prediction block
Forward prediction block FPB
Backward prediction block BPB
New backward prediction block
Corresponding to
Determine a minimum difference
Forward predicted vector: (–11, 4)
Backward predicted vector: (6, 6)
Current prediction block DPB1
New current prediction block DPB2
Weight
Update
Current prediction block DPB2

FIG. 18

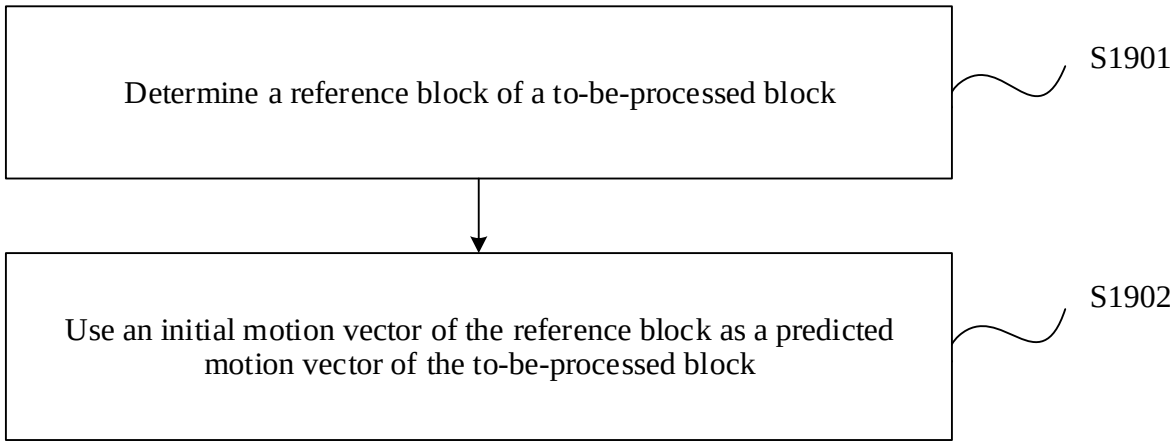

Determine a reference block of a to-be-processed block
S1901
Use an initial motion vector of the reference block as a predicted motion vector of the to-be-processed block
S1902

FIG. 19

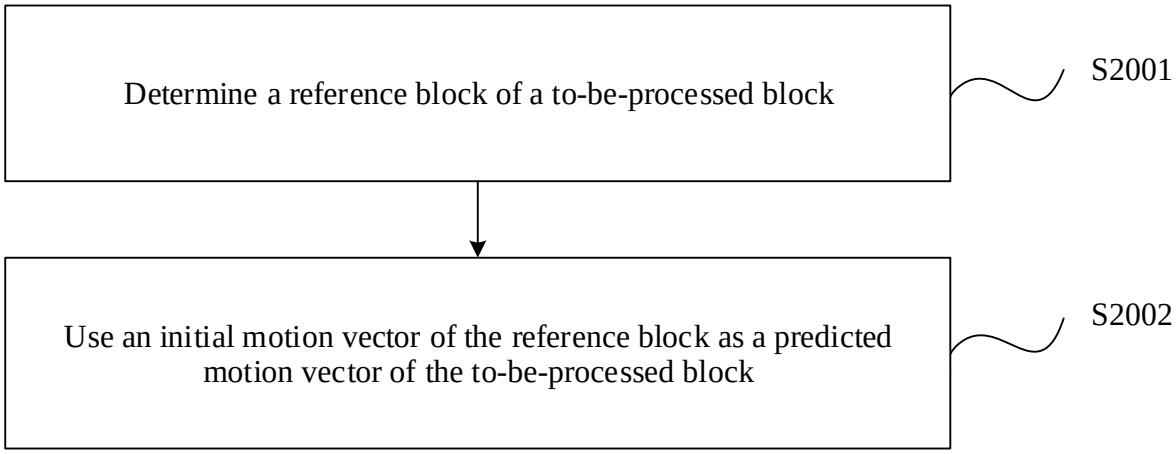

Determine a reference block of a to-be-processed block
S2001
Use an initial motion vector of the reference block as a predicted motion vector of the to-be-processed block
S2002

FIG. 20

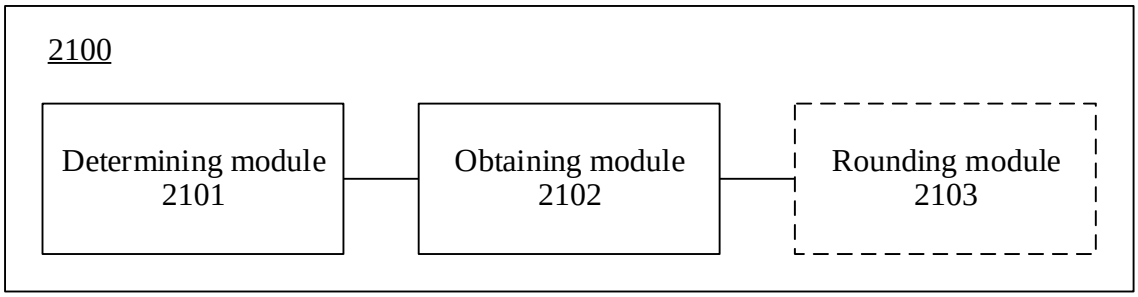

2100
Determining module 2101
Obtaining module 2102
Rounding module 2103

FIG. 21

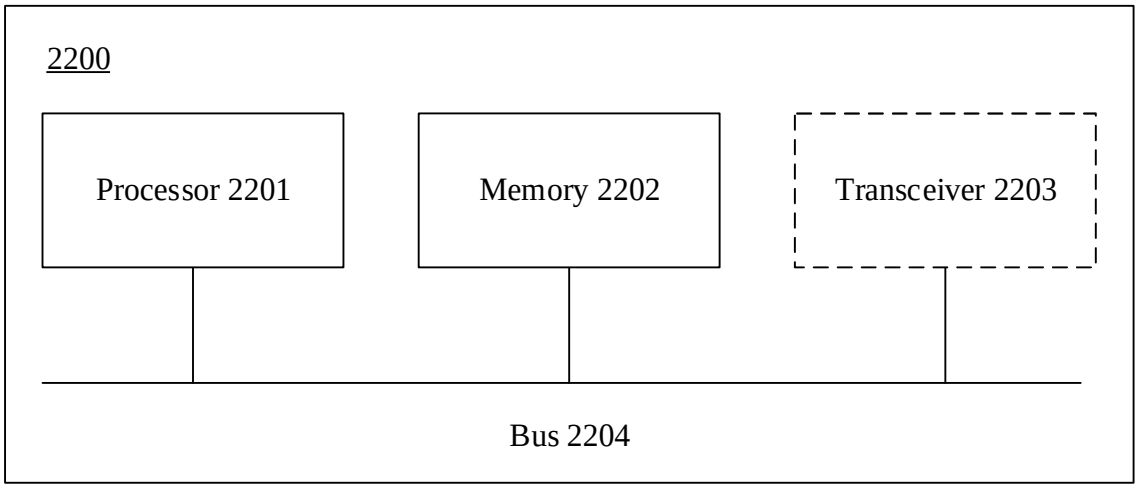

2200
Processor 2201
Memory 2202
Transceiver 2203
Bus 2204

FIG. 22