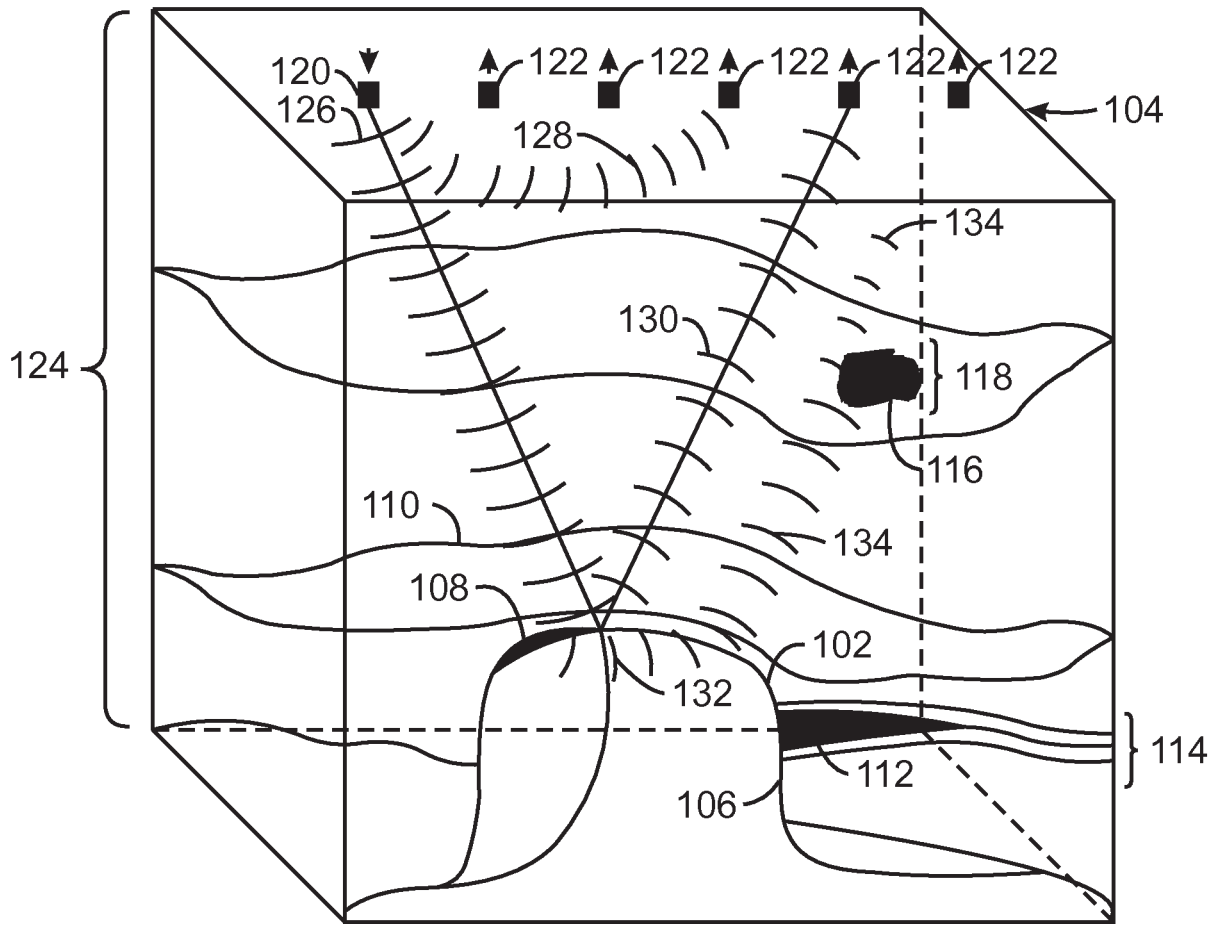
120
126
122
122
122
122
122
104
128
134
130
118
116
124
110
134
108
102
132
114
112
106

100

FIG. 1

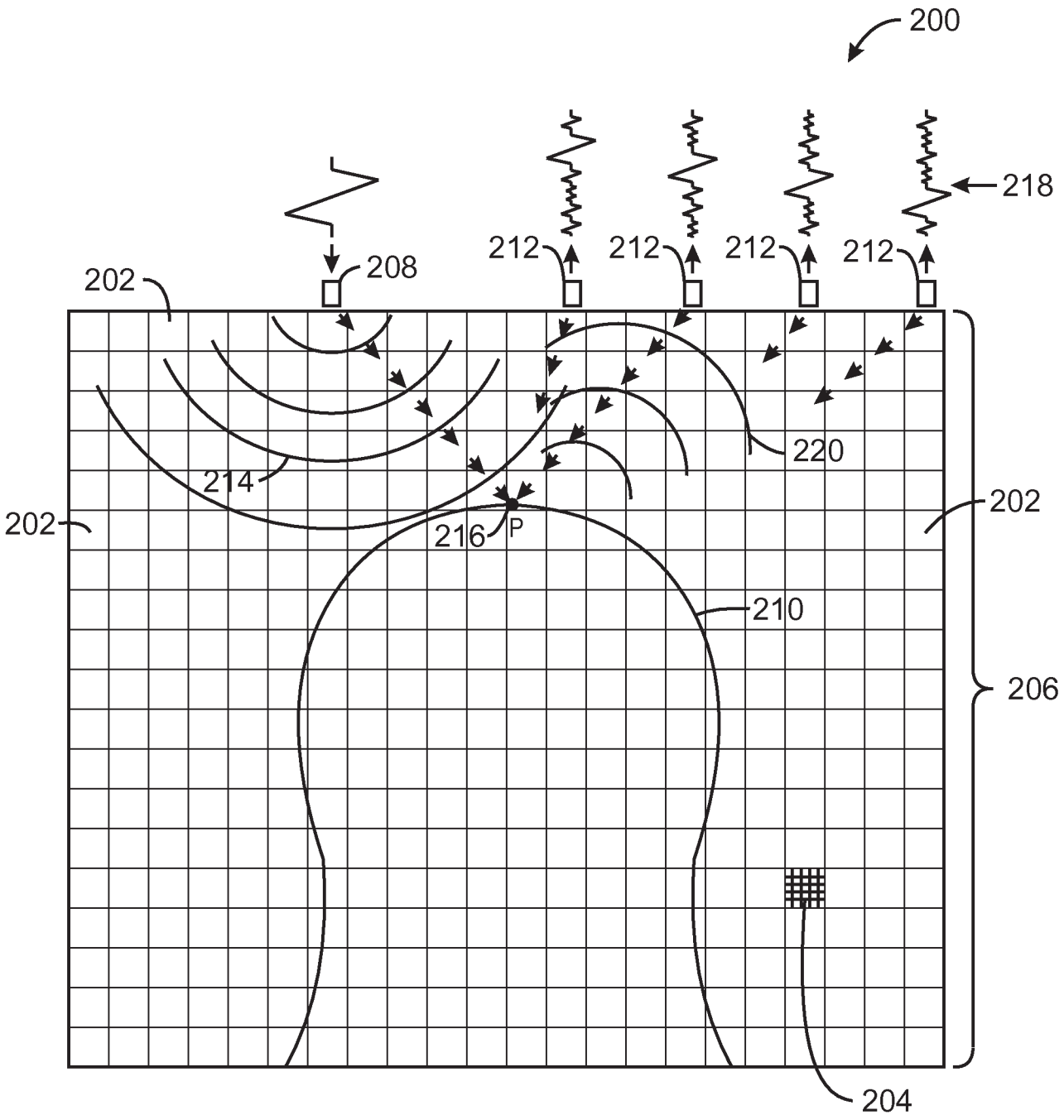

FIG. 2

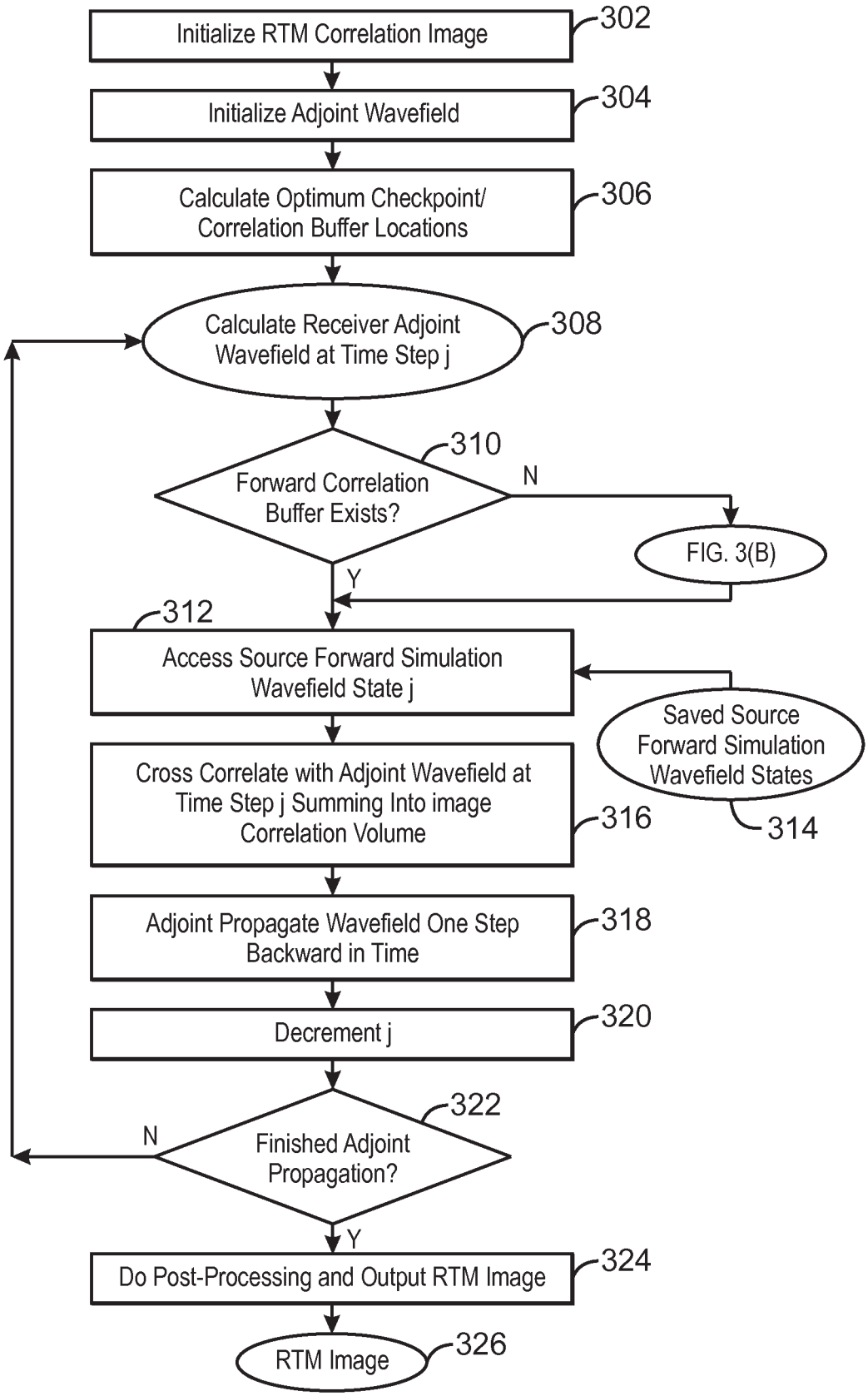
Initialize RTM Correlation Image
302
Initialize Adjoint Wavefield
304
Calculate Optimum Checkpoint/ Correlation Buffer Locations
306
Calculate Receiver Adjoint Wavefield at Time Step j
308
Forward Correlation Buffer Exists?
310
N
FIG. 3(B)
Y
312
Access Source Forward Simulation Wavefield State j
Saved Source Forward Simulation Wavefield States
314
Cross Correlate with Adjoint Wavefield at Time Step j Summing Into image Correlation Volume
316
Adjoint Propagate Wavefield One Step Backward in Time
318
Decrement j
320
Finished Adjoint Propagation?
322
N
Y
Do Post-Processing and Output RTM Image
324
RTM Image
326

FIG. 3A

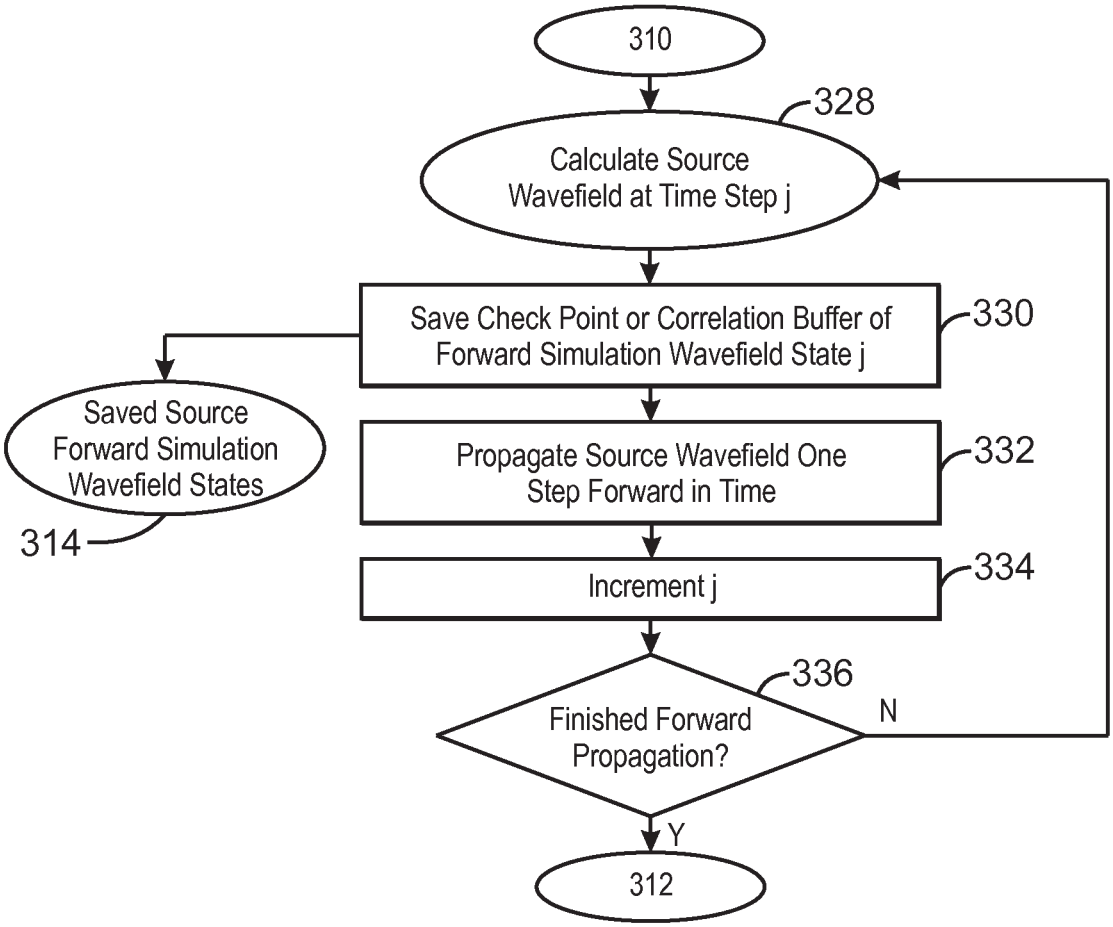
310
328
Calculate Source Wavefield at Time Step j
Save Check Point or Correlation Buffer of Forward Simulation Wavefield State j
330
Saved Source Forward Simulation Wavefield States
314
Propagate Source Wavefield One Step Forward in Time
332
Increment j
334
336
Finished Forward Propagation?
N
Y
312

FIG. 3B

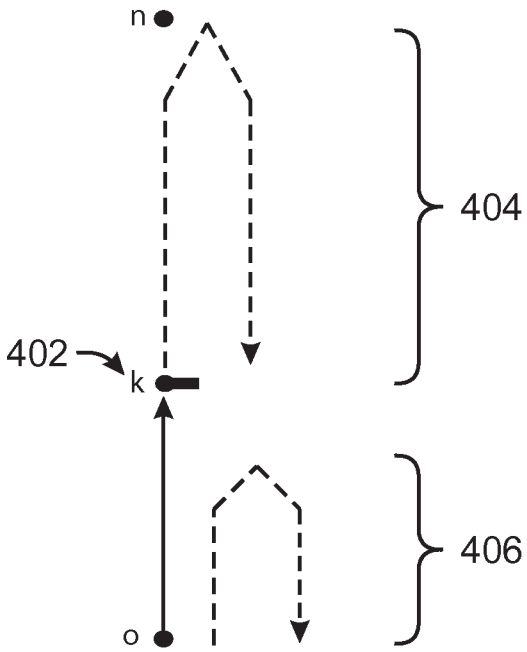

FIG. 4

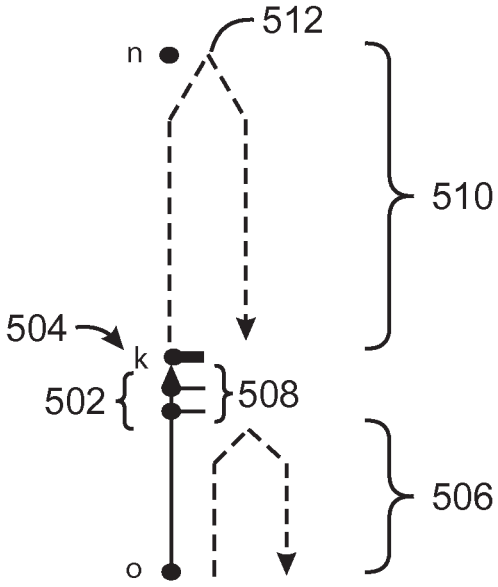

FIG. 5A

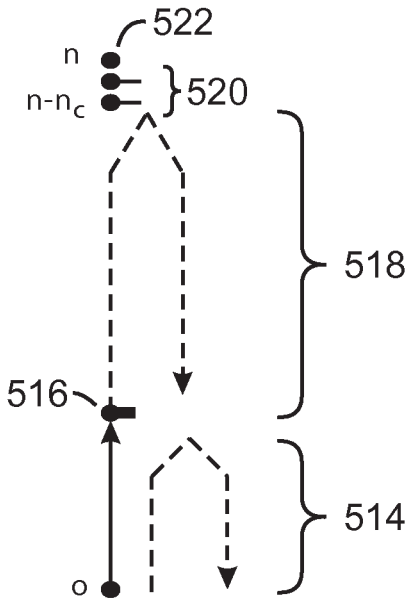

FIG. 5B

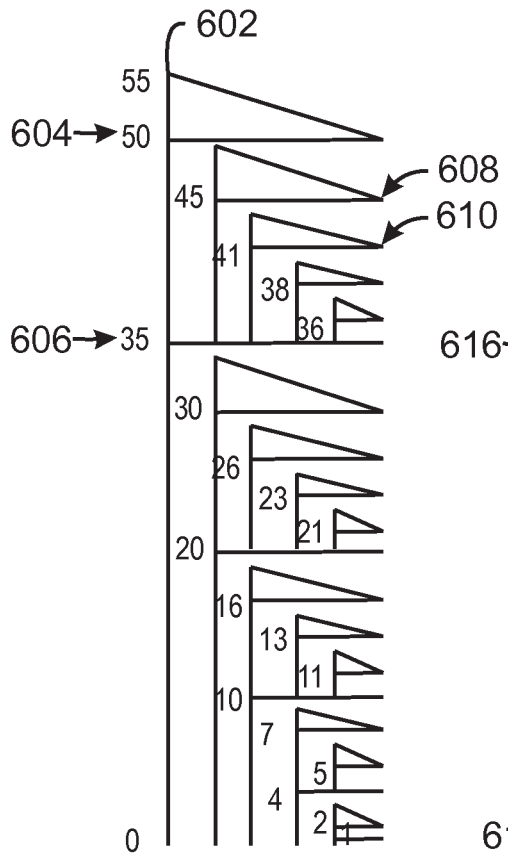

FIG. 6A

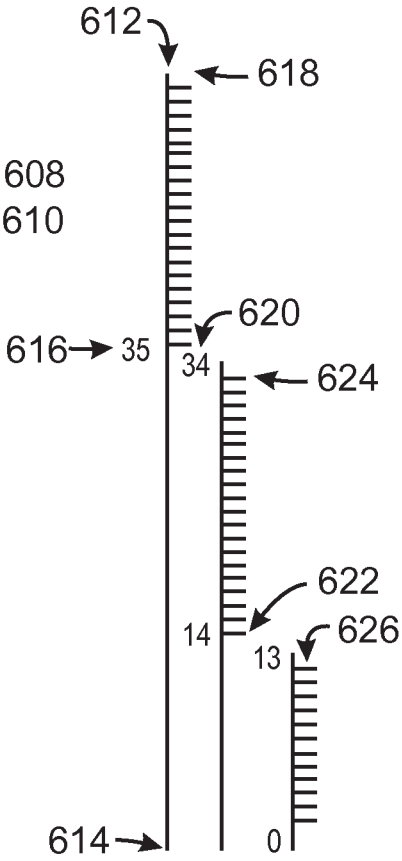

FIG. 6B

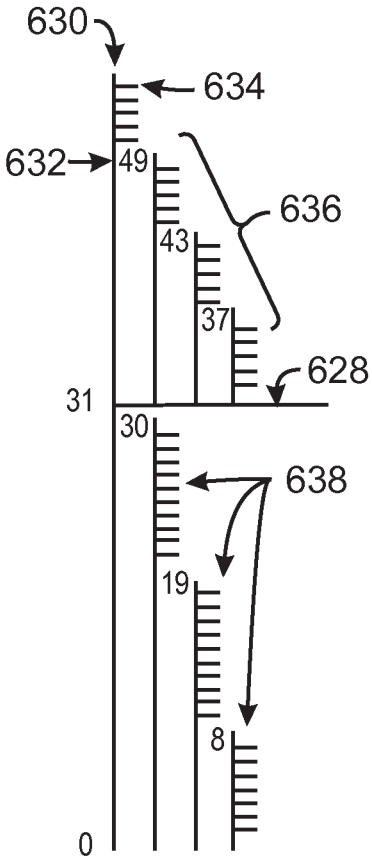

FIG. 6C

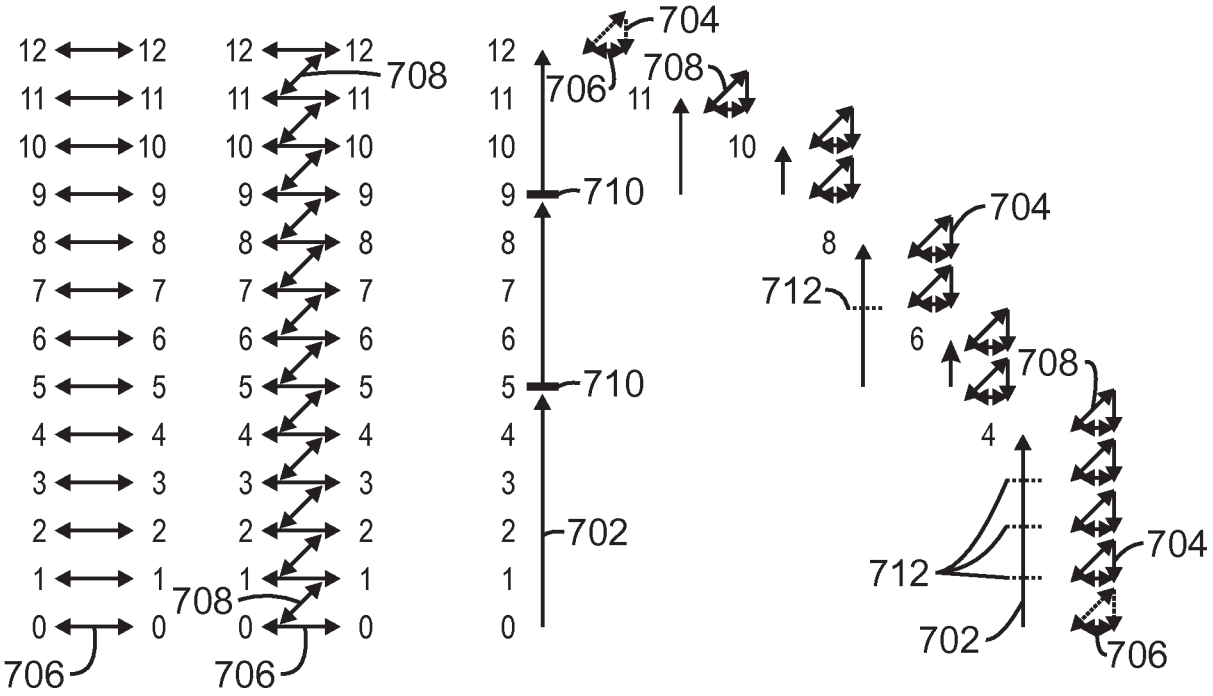

FIG. 7A FIG. 7B FIG. 7C

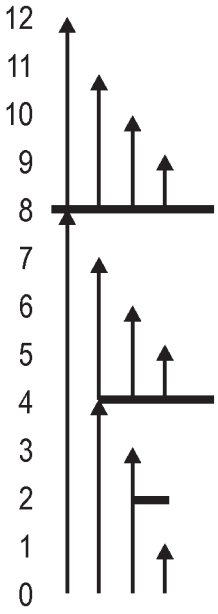

FIG. 8A

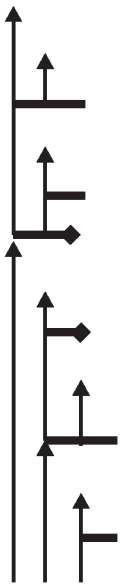

FIG. 8B

FIG. 8C

FIG. 8D

FIG. 8E

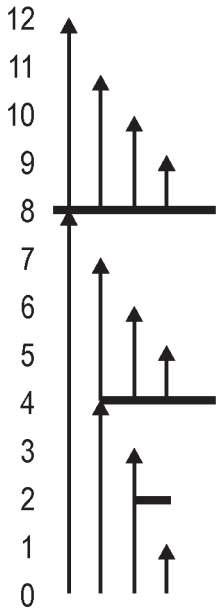

FIG. 9A

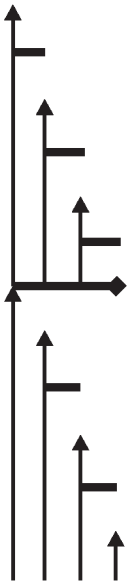

FIG. 9B

FIG. 9C

FIG. 9D

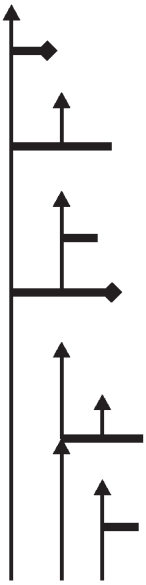

FIG. 9E

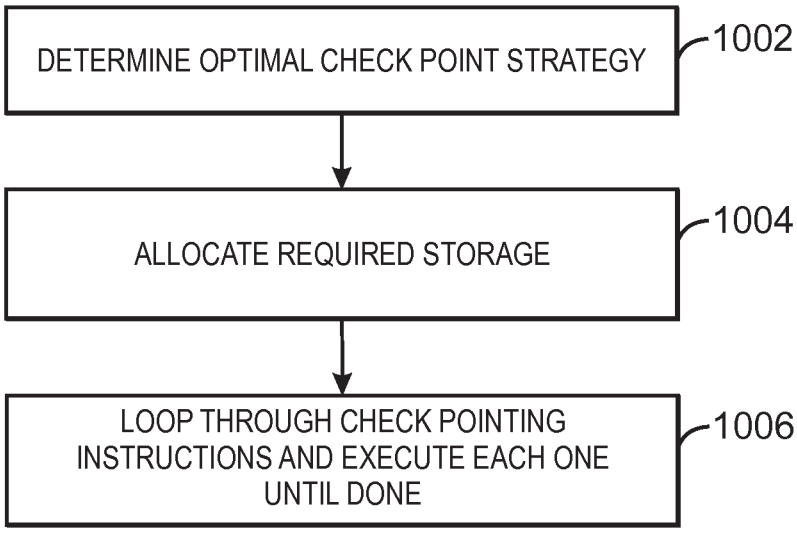
DETERMINE OPTIMAL CHECK POINT STRATEGY
1002
ALLOCATE REQUIRED STORAGE
1004
LOOP THROUGH CHECK POINTING INSTRUCTIONS AND EXECUTE EACH ONE UNTIL DONE
1006

FIG. 10

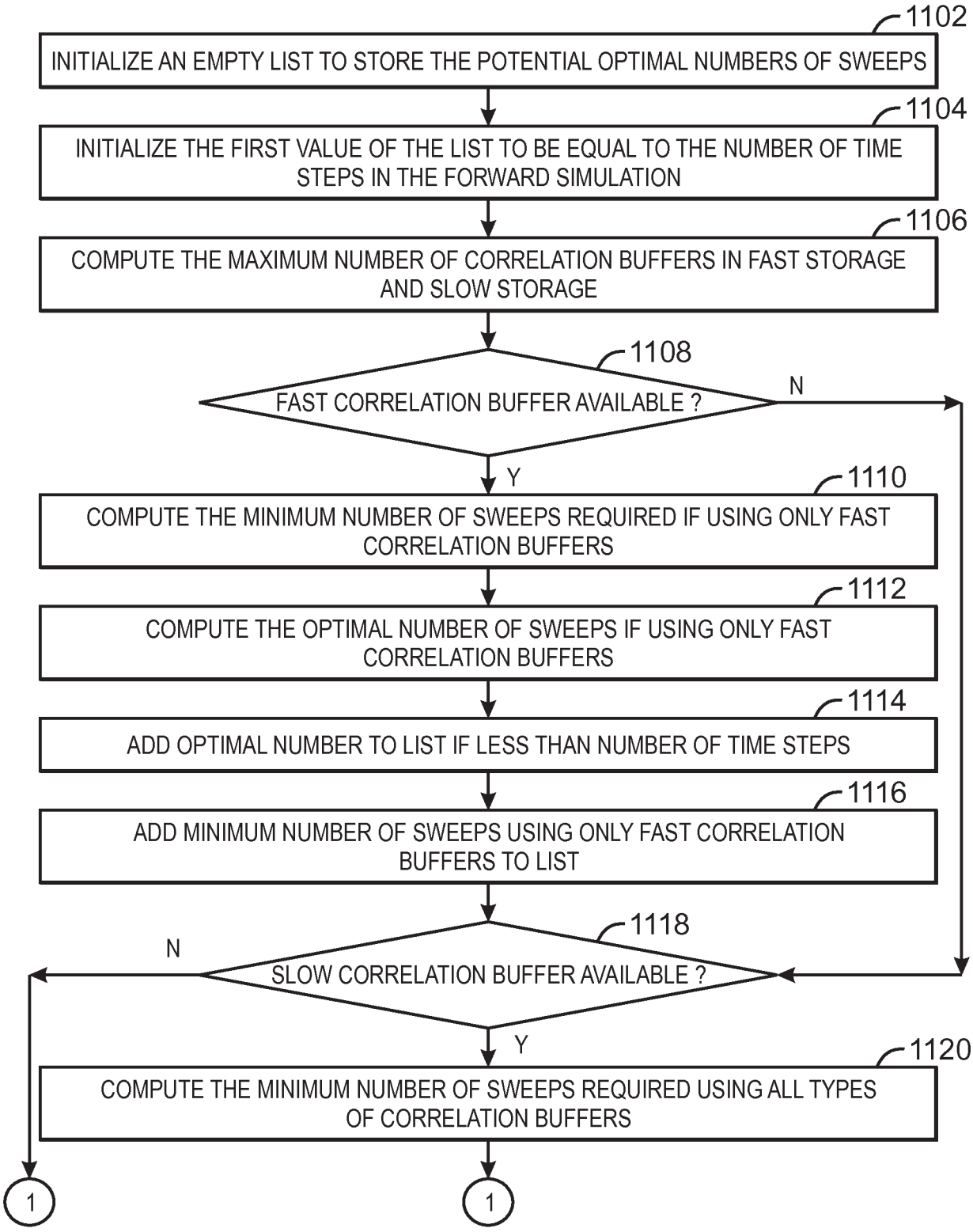

FIG. 11A

FIG. 11
FIG. 11A
FIG. 11B

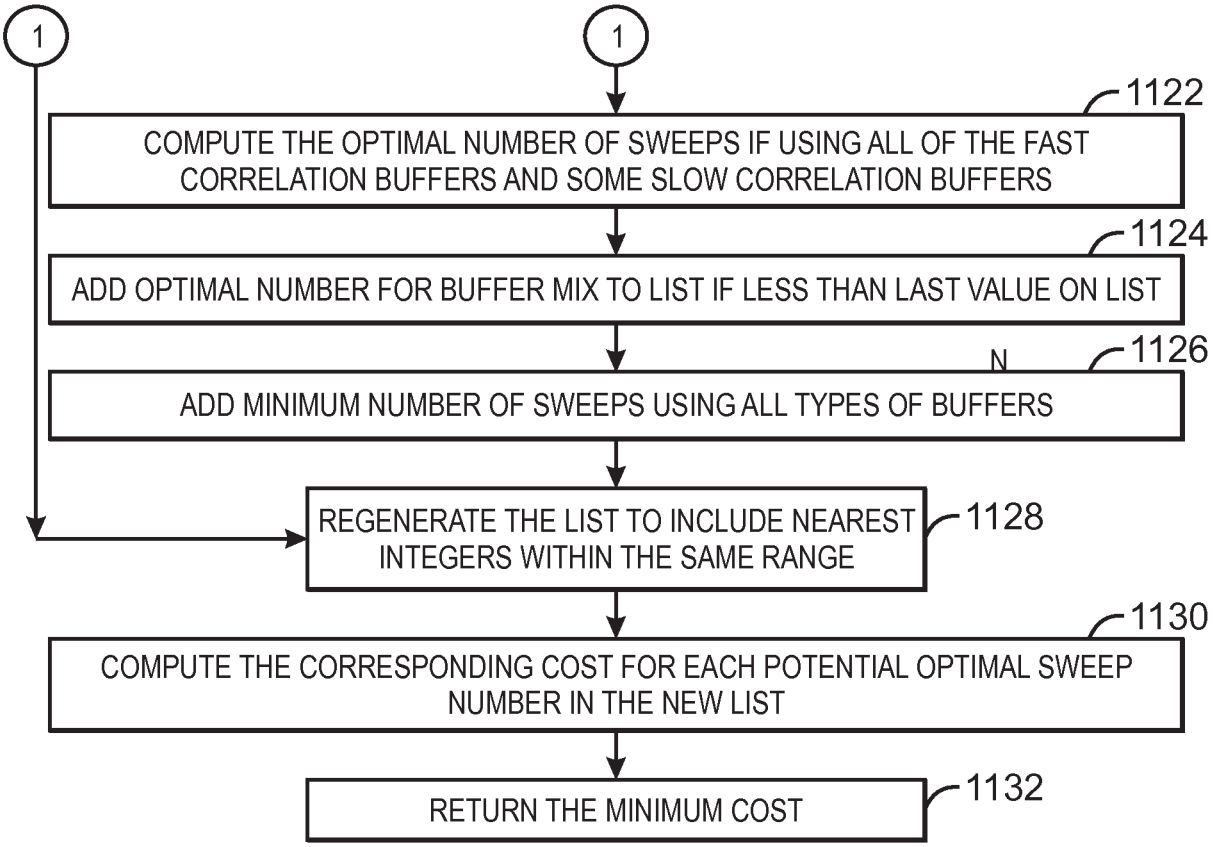
1
1
1122
COMPUTE THE OPTIMAL NUMBER OF SWEEPS IF USING ALL OF THE FAST CORRELATION BUFFERS AND SOME SLOW CORRELATION BUFFERS
1124
ADD OPTIMAL NUMBER FOR BUFFER MIX TO LIST IF LESS THAN LAST VALUE ON LIST
N
1126
ADD MINIMUM NUMBER OF SWEEPS USING ALL TYPES OF BUFFERS
REGENERATE THE LIST TO INCLUDE NEAREST INTEGERS WITHIN THE SAME RANGE
1128
1130
COMPUTE THE CORRESPONDING COST FOR EACH POTENTIAL OPTIMAL SWEEP NUMBER IN THE NEW LIST
RETURN THE MINIMUM COST
1132

FIG. 11B

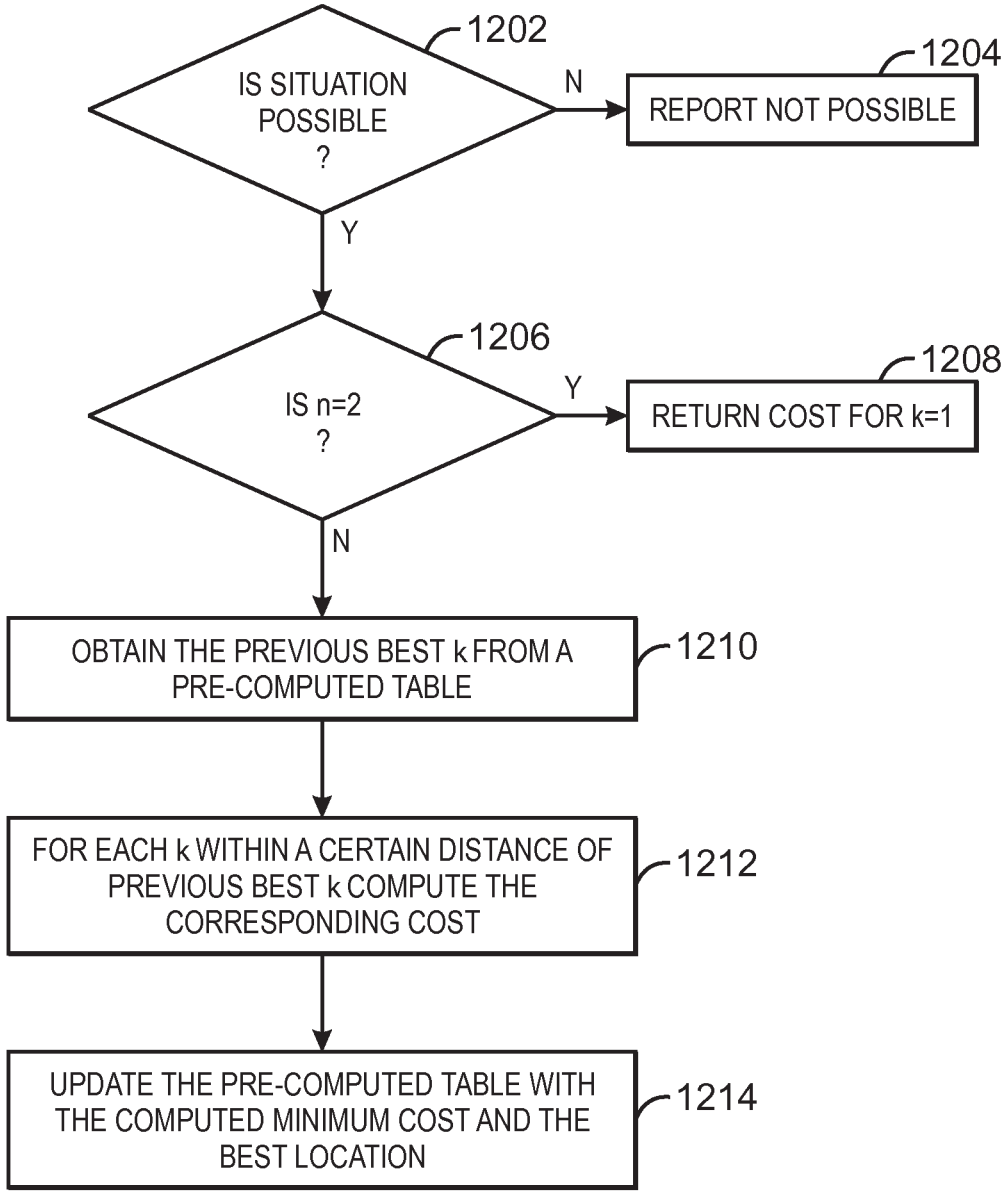
1202
IS SITUATION POSSIBLE ?
N
1204
REPORT NOT POSSIBLE
Y
1206
IS n=2 ?
Y
1208
RETURN COST FOR k=1
N
OBTAIN THE PREVIOUS BEST k FROM A PRE-COMPUTED TABLE
1210
FOR EACH k WITHIN A CERTAIN DISTANCE OF PREVIOUS BEST k COMPUTE THE CORRESPONDING COST
1212
UPDATE THE PRE-COMPUTED TABLE WITH THE COMPUTED MINIMUM COST AND THE BEST LOCATION
1214

FIG. 12

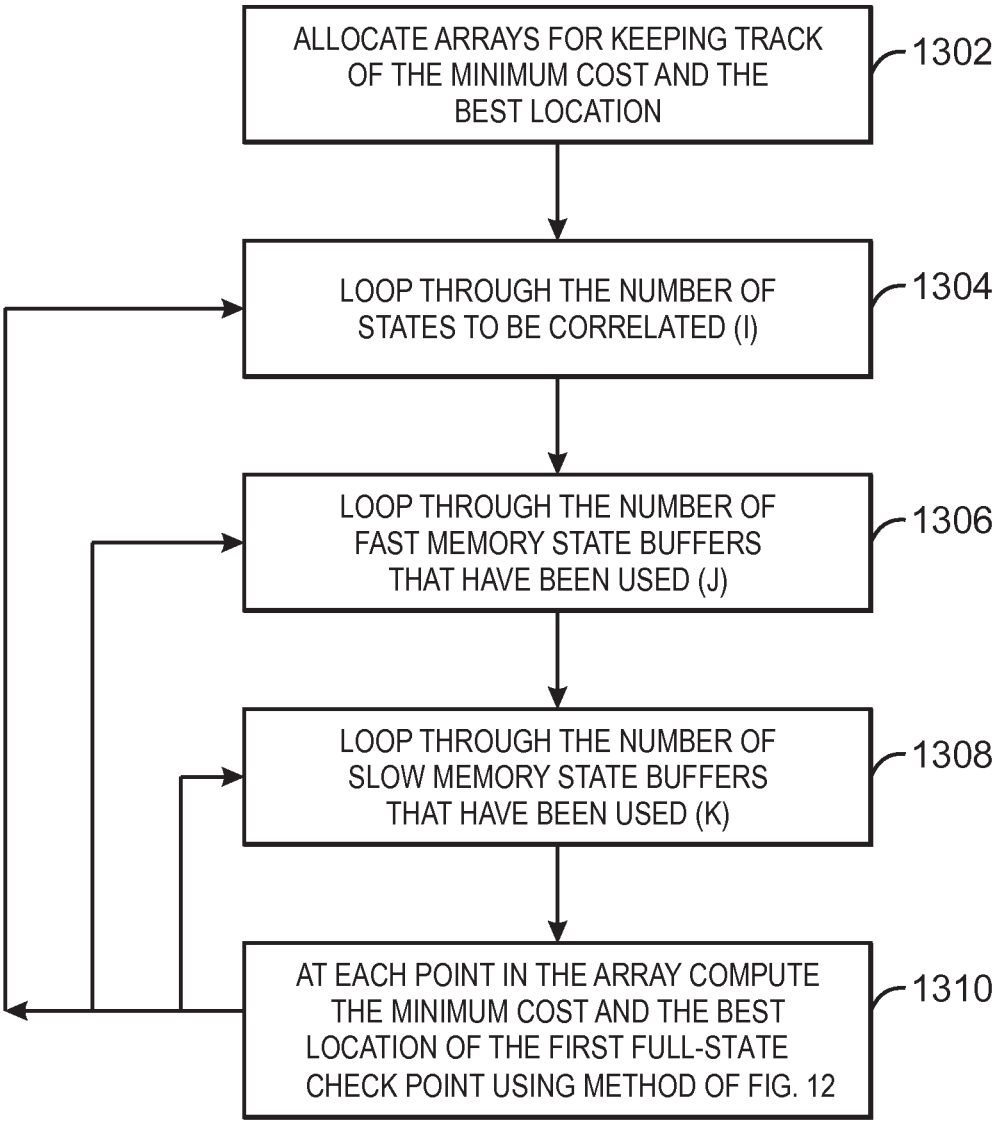
ALLOCATE ARRAYS FOR KEEPING TRACK OF THE MINIMUM COST AND THE BEST LOCATION
1302
LOOP THROUGH THE NUMBER OF STATES TO BE CORRELATED (I)
1304
LOOP THROUGH THE NUMBER OF FAST MEMORY STATE BUFFERS THAT HAVE BEEN USED (J)
1306
LOOP THROUGH THE NUMBER OF SLOW MEMORY STATE BUFFERS THAT HAVE BEEN USED (K)
1308
AT EACH POINT IN THE ARRAY COMPUTE THE MINIMUM COST AND THE BEST LOCATION OF THE FIRST FULL-STATE CHECK POINT USING METHOD OF FIG. 12
1310

FIG. 13

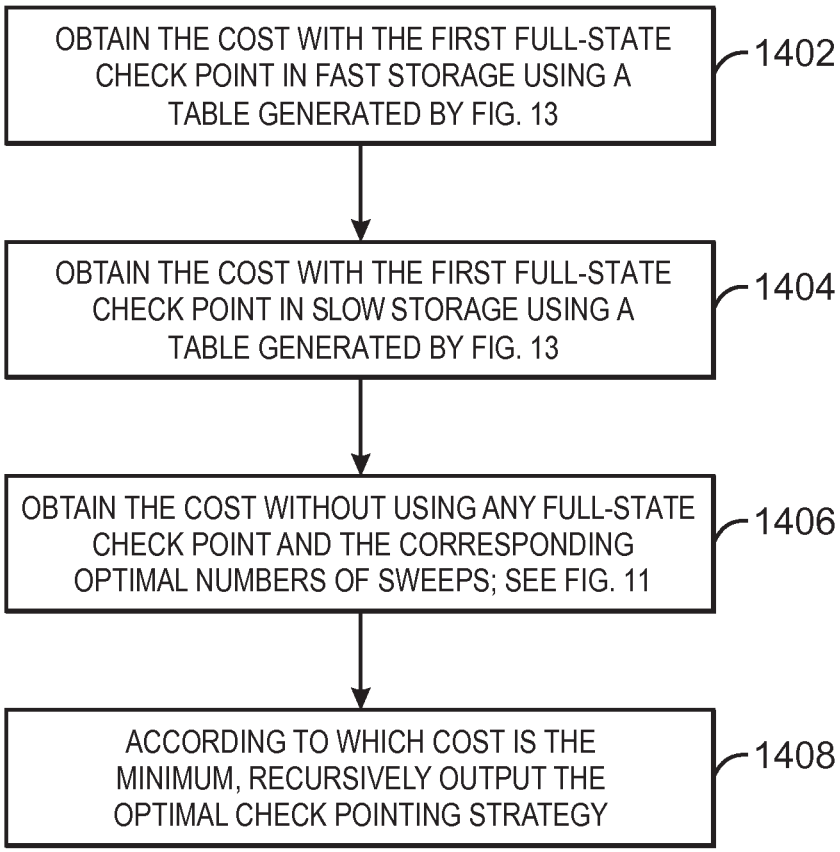
OBTAIN THE COST WITH THE FIRST FULL-STATE CHECK POINT IN FAST STORAGE USING A TABLE GENERATED BY FIG. 13
1402
OBTAIN THE COST WITH THE FIRST FULL-STATE CHECK POINT IN SLOW STORAGE USING A TABLE GENERATED BY FIG. 13
1404
OBTAIN THE COST WITHOUT USING ANY FULL-STATE CHECK POINT AND THE CORRESPONDING OPTIMAL NUMBERS OF SWEEPS; SEE FIG. 11
1406
ACCORDING TO WHICH COST IS THE MINIMUM, RECURSIVELY OUTPUT THE OPTIMAL CHECK POINTING STRATEGY
1408

FIG. 14

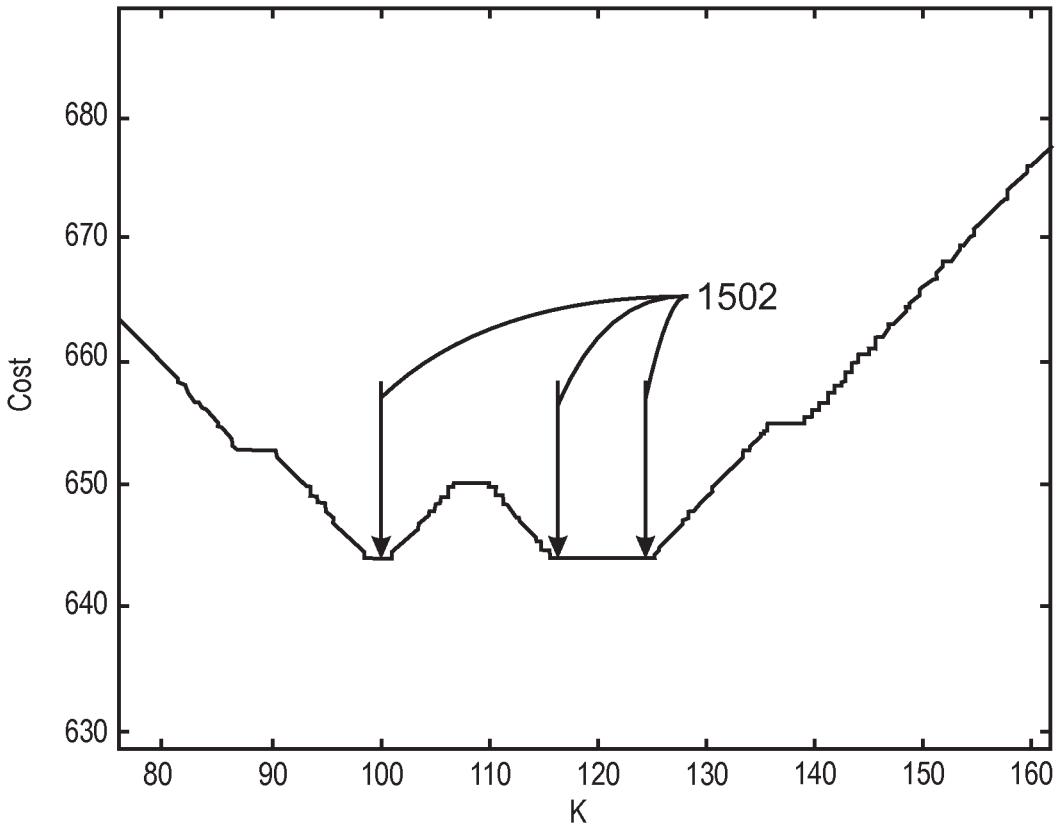
680
670
660
650
640
630
Cost
1502
80
90
100
110
120
130
140
150
160
K

FIG. 15

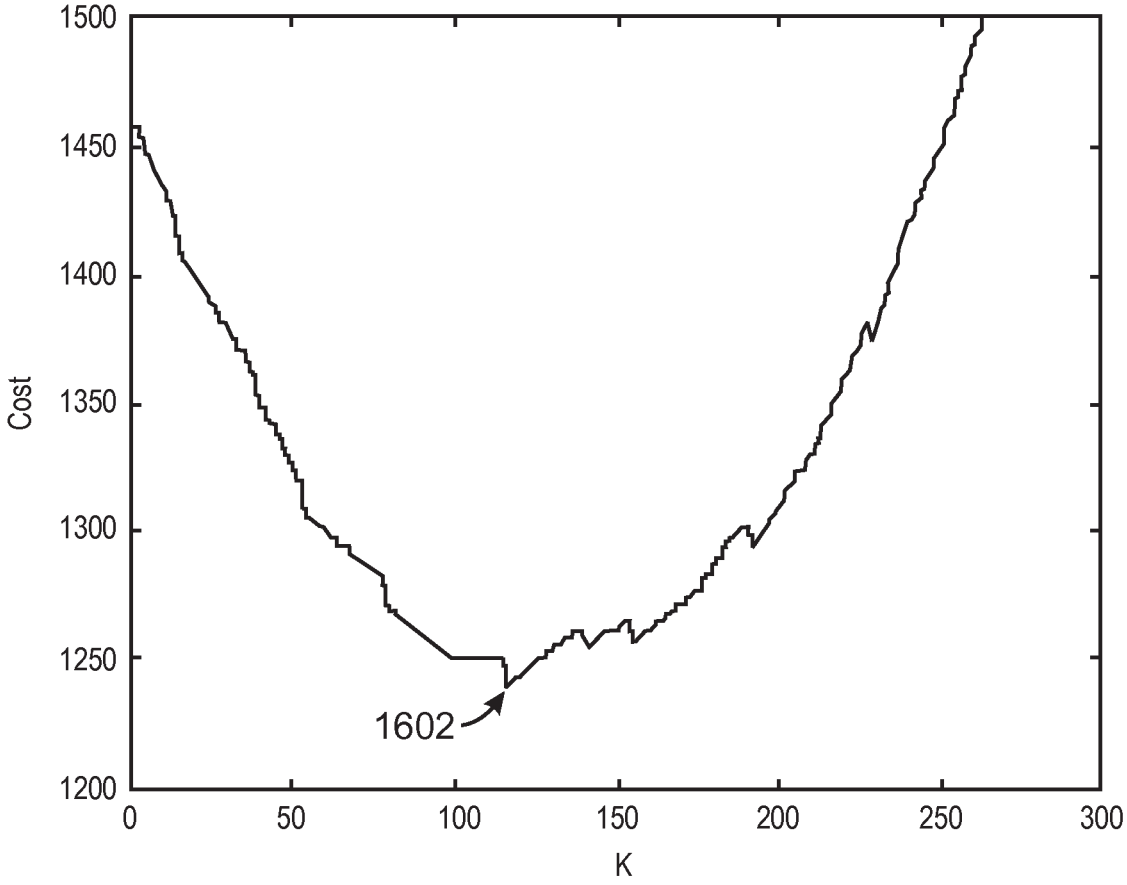
1500
1450
1400
1350
1300
1250
1200
Cost
0
50
100
150
200
250
300
K
1602

FIG. 16

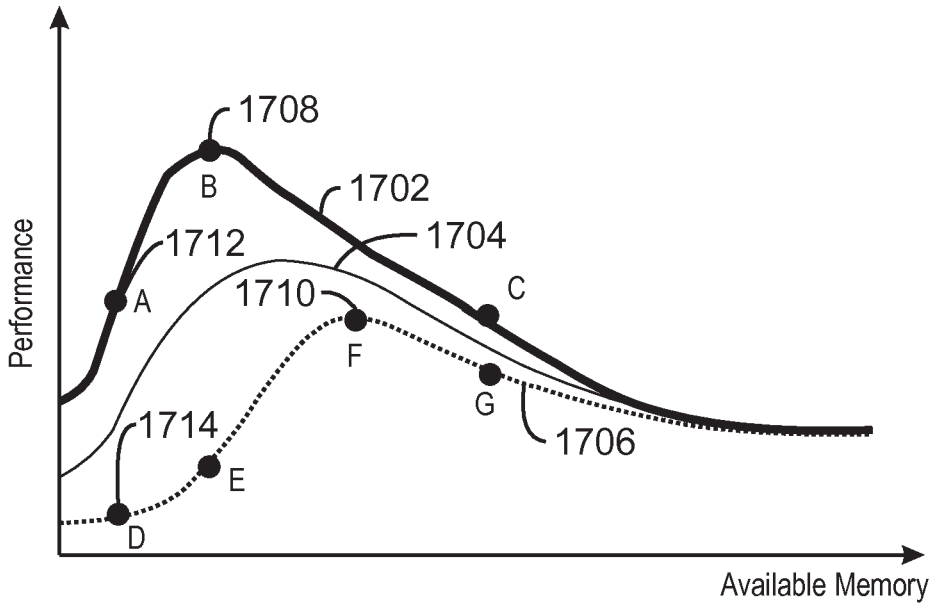
1708
B
1702
1712
1704
A
1710
C
F
G
1706
1714
E
D
Performance
Available Memory

FIG. 17

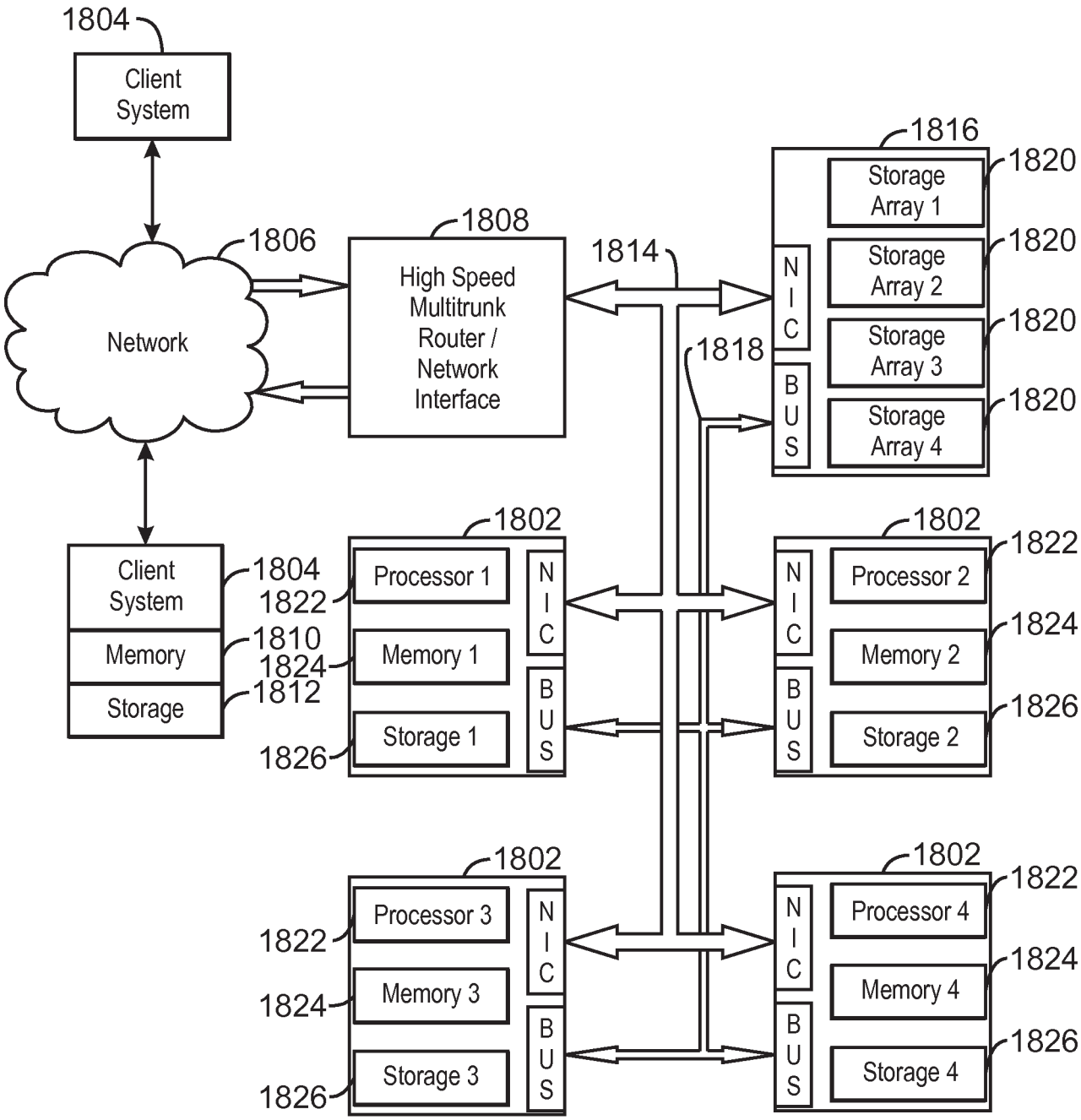
1804
Client System
1806
Network
1808
High Speed Multitrunk Router / Network Interface
1814
1816
1818
NIC
BUS
Storage Array 1
Storage Array 2
Storage Array 3
Storage Array 4
1820
1802
Processor 1
Memory 1
Storage 1
1822
1824
1826
Processor 2
Memory 2
Storage 2
Processor 3
Memory 3
Storage 3
Processor 4
Memory 4
Storage 4
Client System
Memory
Storage
1810
1812

FIG. 18