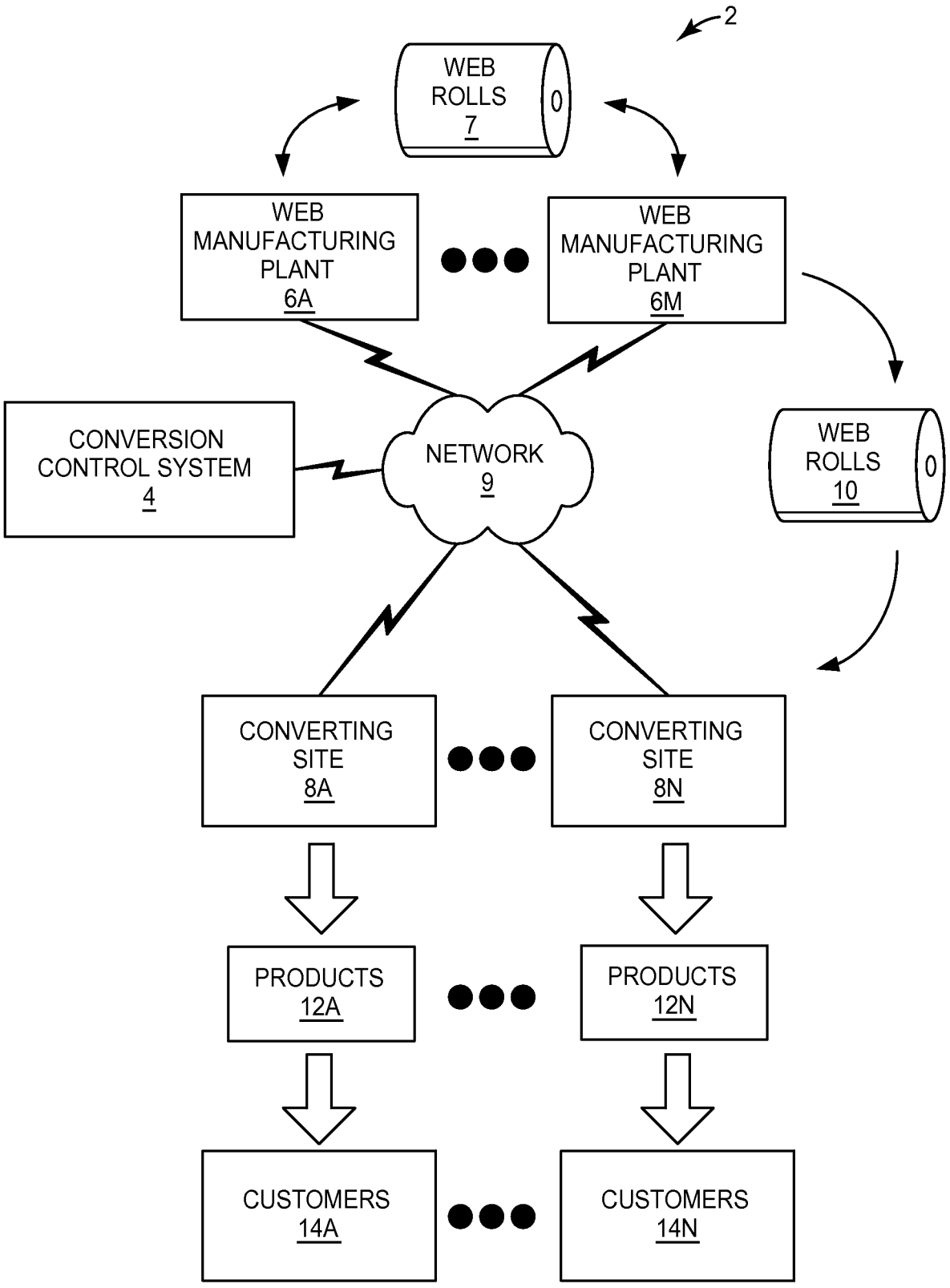

2
WEB ROLLS 7
WEB MANUFACTURING PLANT 6A
WEB MANUFACTURING PLANT 6M
CONVERSION CONTROL SYSTEM 4
NETWORK 9
WEB ROLLS 10
CONVERTING SITE 8A
CONVERTING SITE 8N
PRODUCTS 12A
PRODUCTS 12N
CUSTOMERS 14A
CUSTOMERS 14N

FIG. 1

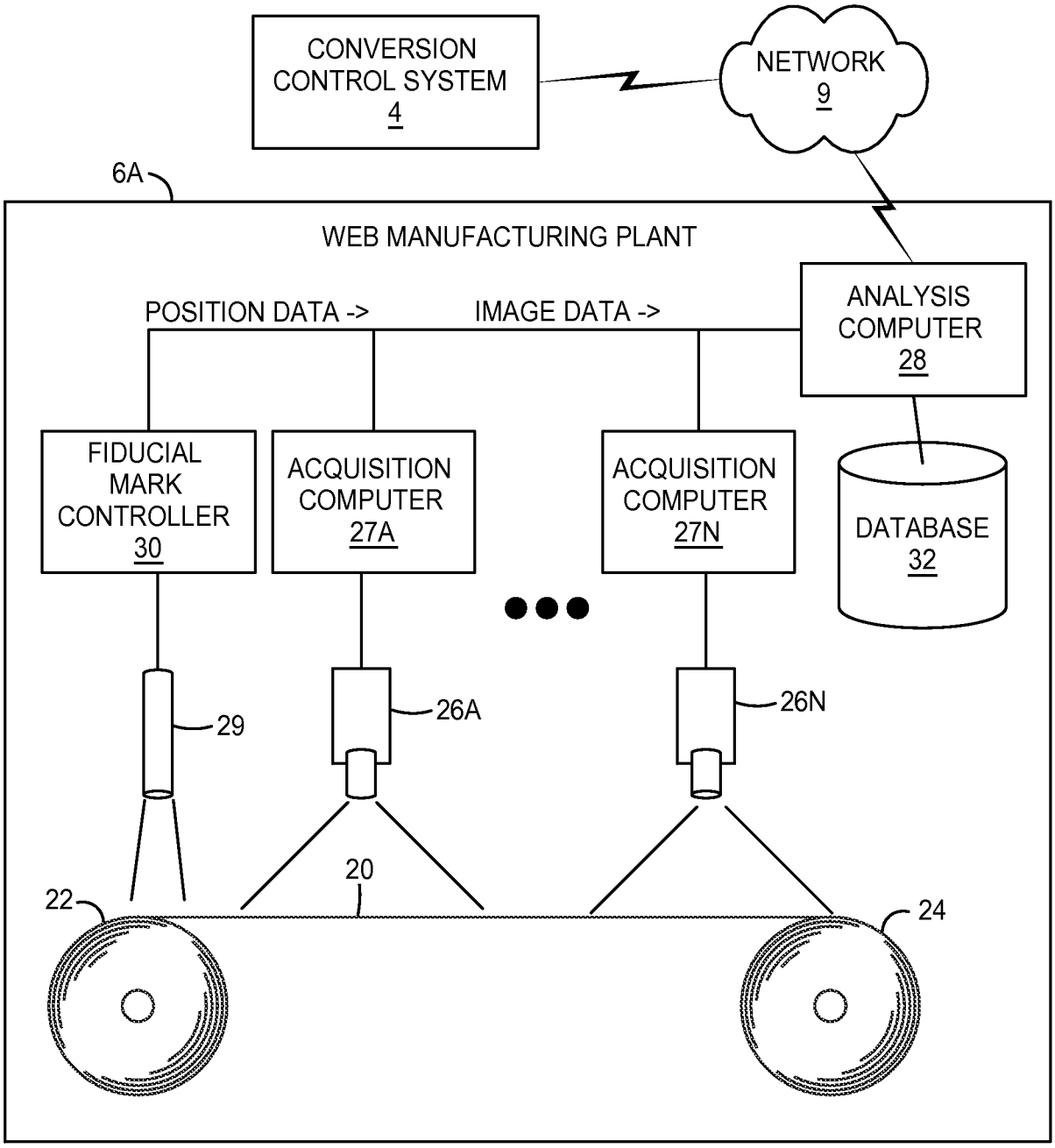

CONVERSION CONTROL SYSTEM 4
NETWORK 9
6A
WEB MANUFACTURING PLANT
POSITION DATA ->
IMAGE DATA ->
ANALYSIS COMPUTER 28
FIDUCIAL MARK CONTROLLER 30
ACQUISITION COMPUTER 27A
ACQUISITION COMPUTER 27N
DATABASE 32
29
26A
26N
20
22
24

FIG. 2

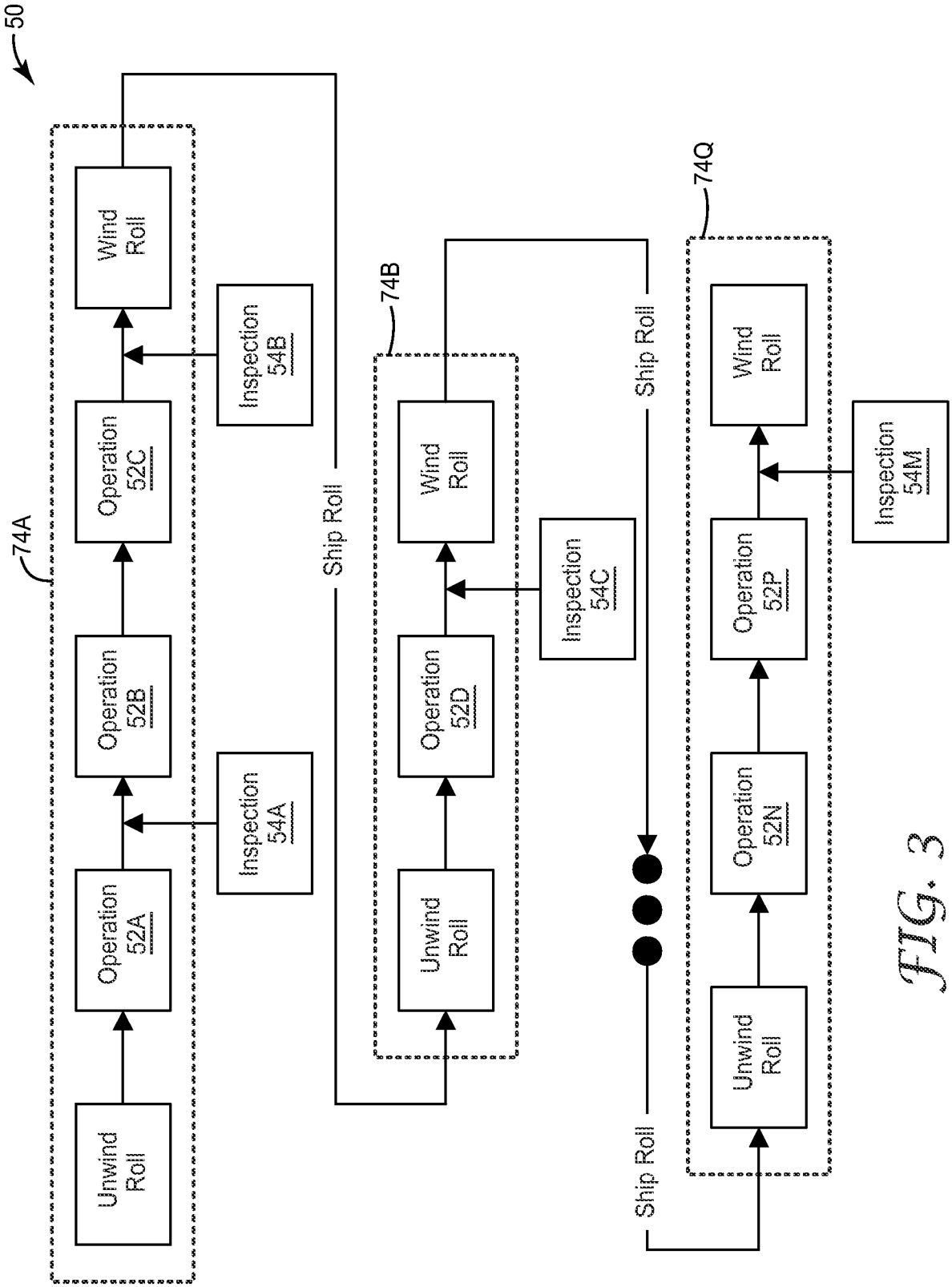

50
74A
Unwind Roll
Operation 52A
Operation 52B
Operation 52C
Wind Roll
Inspection 54A
Inspection 54B
Ship Roll
74B
Unwind Roll
Operation 52D
Wind Roll
Inspection 54C
Ship Roll
74Q
Unwind Roll
Operation 52N
Operation 52P
Wind Roll
Inspection 54M
Ship Roll

FIG. 3

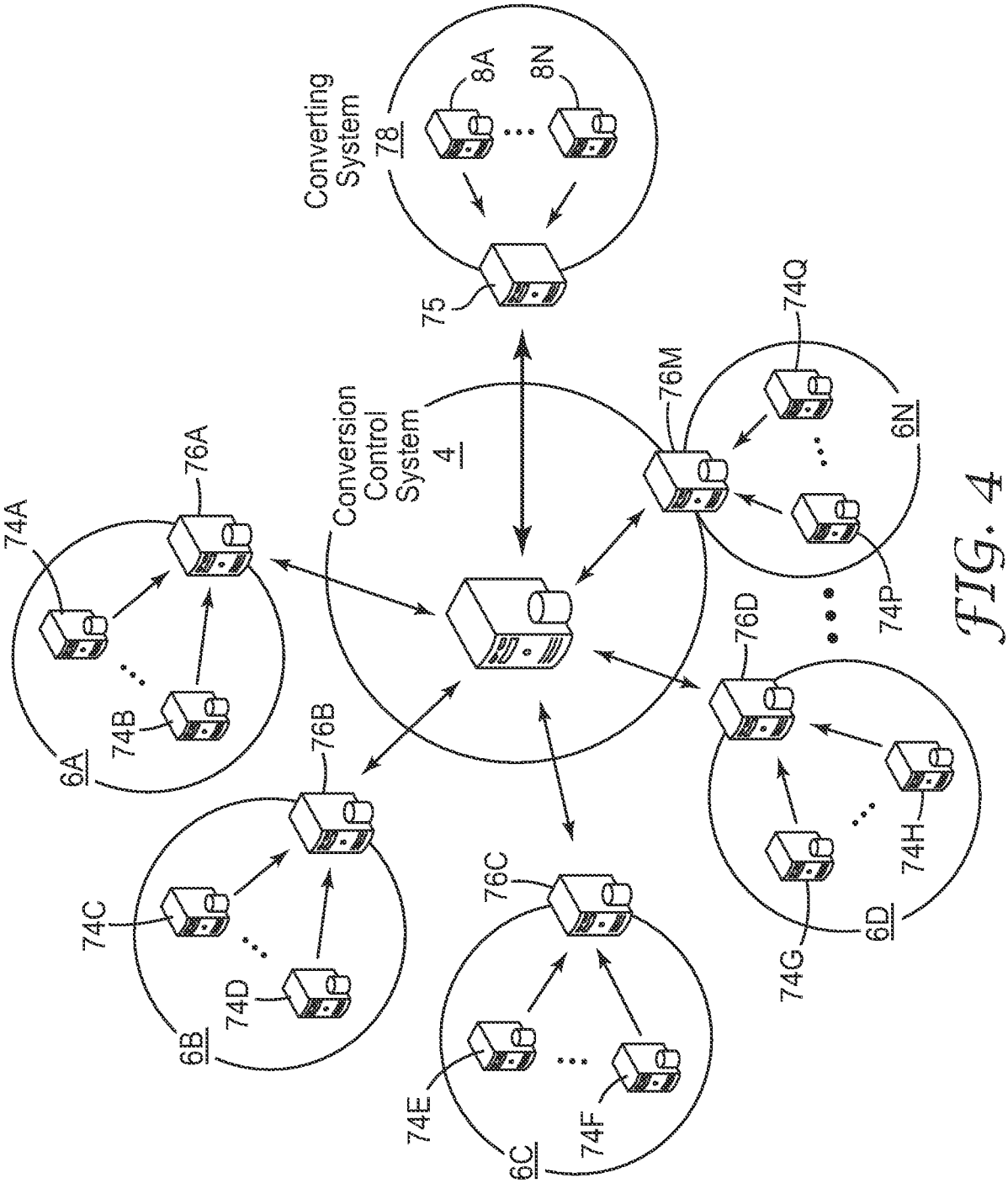

Converting System 78
8A
8N
75
Conversion Control System 4
76A
74A
74B
6A
76B
74C
74D
6B
76C
74E
74F
6C
76M
74Q
6N
74P
76D
74G
74H
6D

FIG. 4

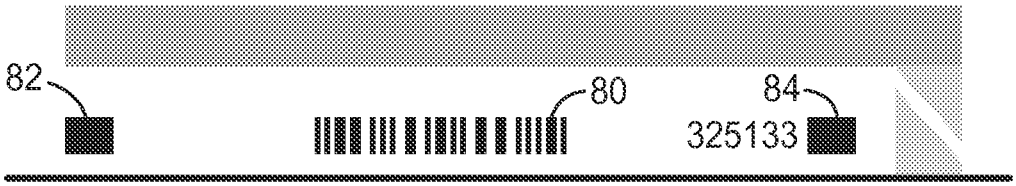


FIG. 5A

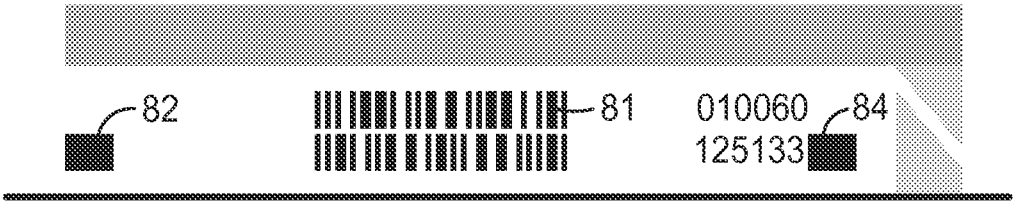


FIG. 5B

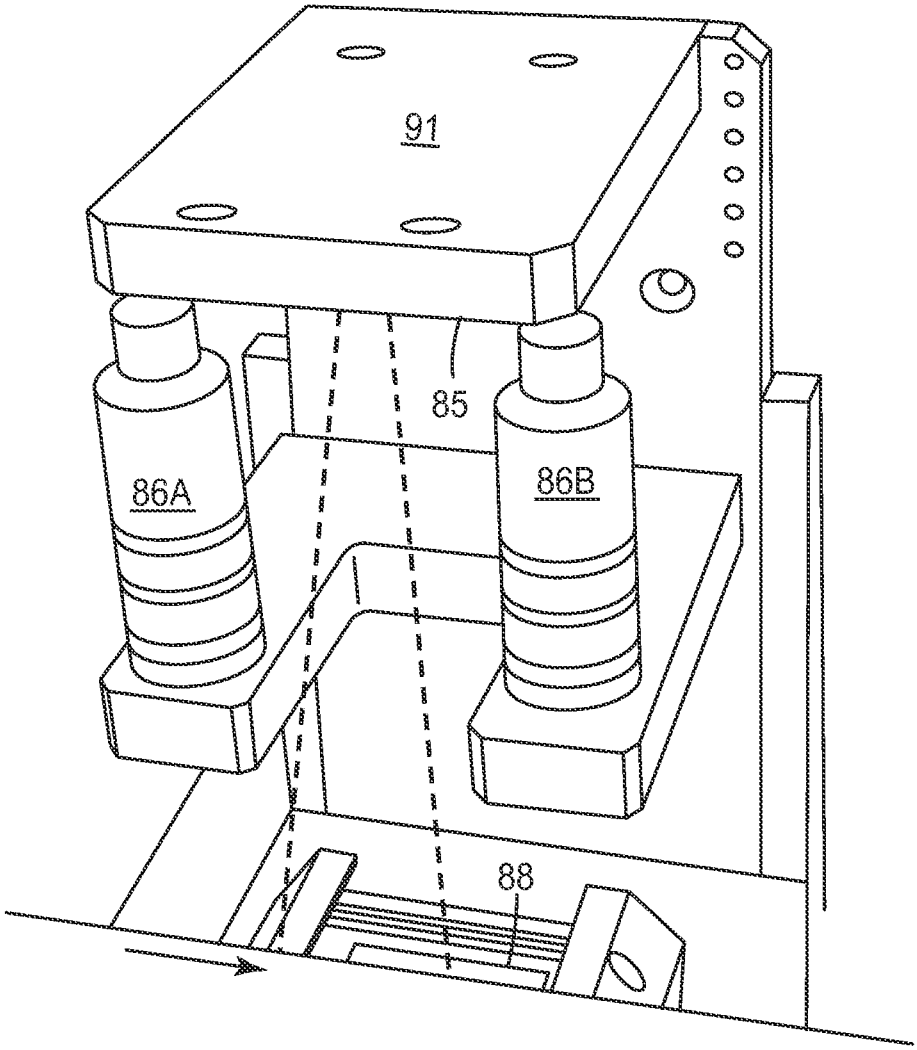


FIG. 6

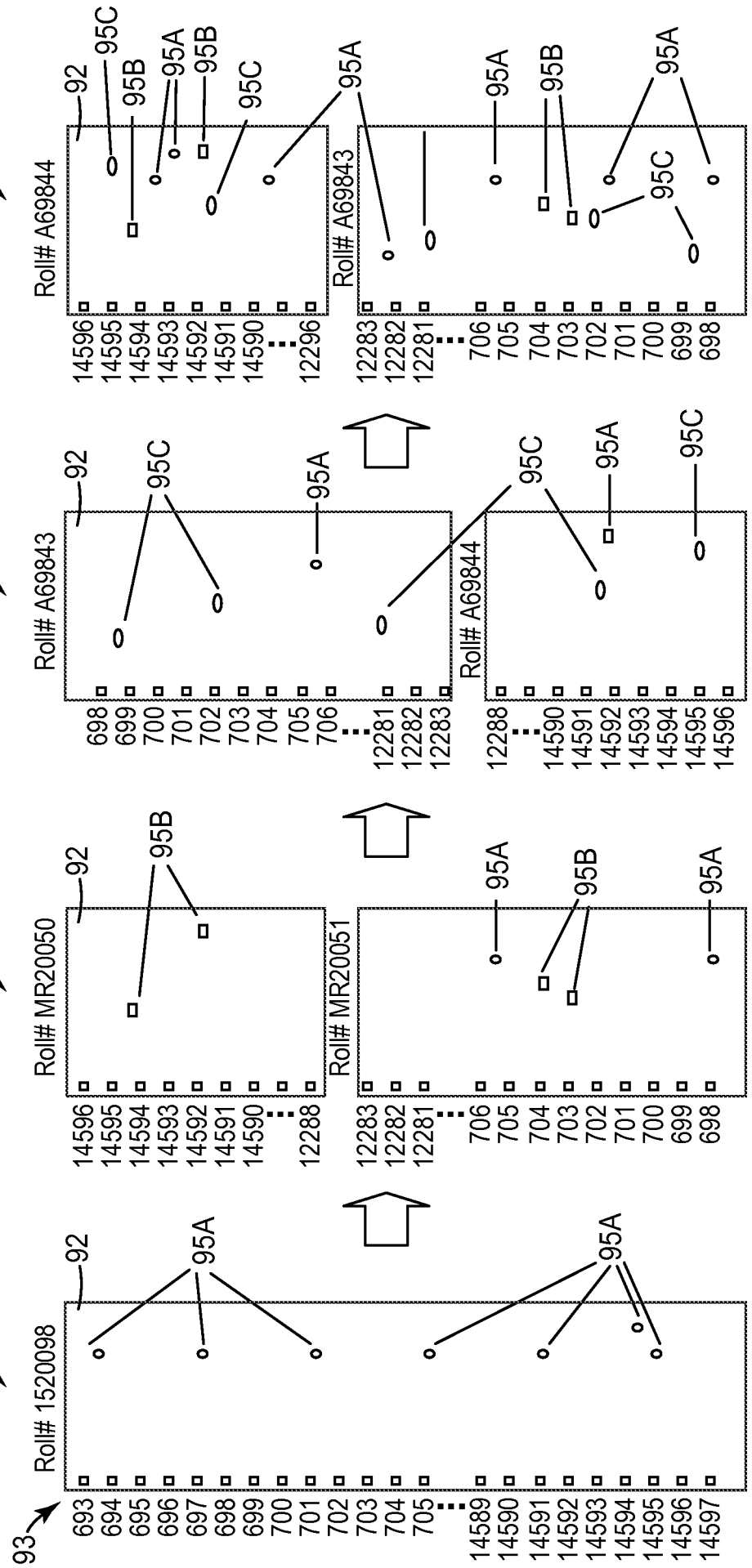

93
90A
Roll# 1520098
92
95A
693 694 695 696 697 698 699 700 701 702 703 704 705 ... 14589 14590 14591 14592 14593 14594 14595 14596 14597
90B
Roll# MR20050
Roll# MR20051
95B
95A
14596 14595 14594 14593 14592 14591 14590 ... 12288
12283 12282 12281 ... 706 705 704 703 702 701 700 699 698
90C
Roll# A69843
Roll# A69844
95C
698 699 700 701 702 703 704 705 706 ... 12281 12282 12283
12288 ... 14590 14591 14592 14593 14594 14595 14596
94
Roll# A69844
Roll# A69843
14596 14595 14594 14593 14592 14591 14590 ... 12296
12283 12282 12281 ... 706 705 704 703 702 701 700 699 698

FIG. 7

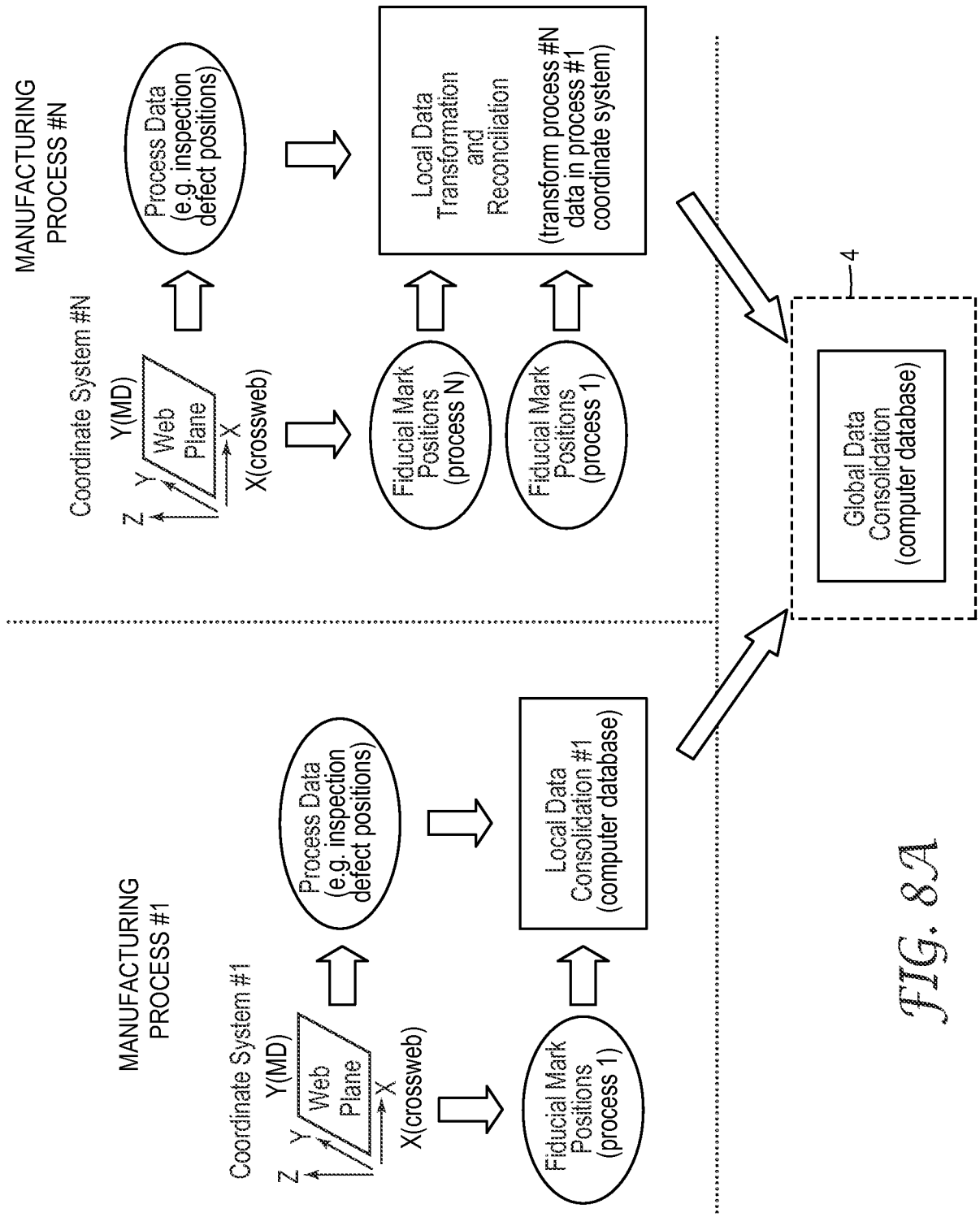

MANUFACTURING PROCESS #1
Coordinate System #1
Y(MD)
Z
Y
Web Plane
X
X(crossweb)
Process Data (e.g. inspection defect positions)
Fiducial Mark Positions (process 1)
Local Data Consolidation #1 (computer database)
MANUFACTURING PROCESS #N
Coordinate System #N
Y(MD)
Z
Y
Web Plane
X
X(crossweb)
Process Data (e.g. inspection defect positions)
Fiducial Mark Positions (process N)
Fiducial Mark Positions (process 1)
Local Data Transformation and Reconciliation
(transform process #N data in process #1 coordinate system)
4
Global Data Consolidation (computer database)

FIG. 8A

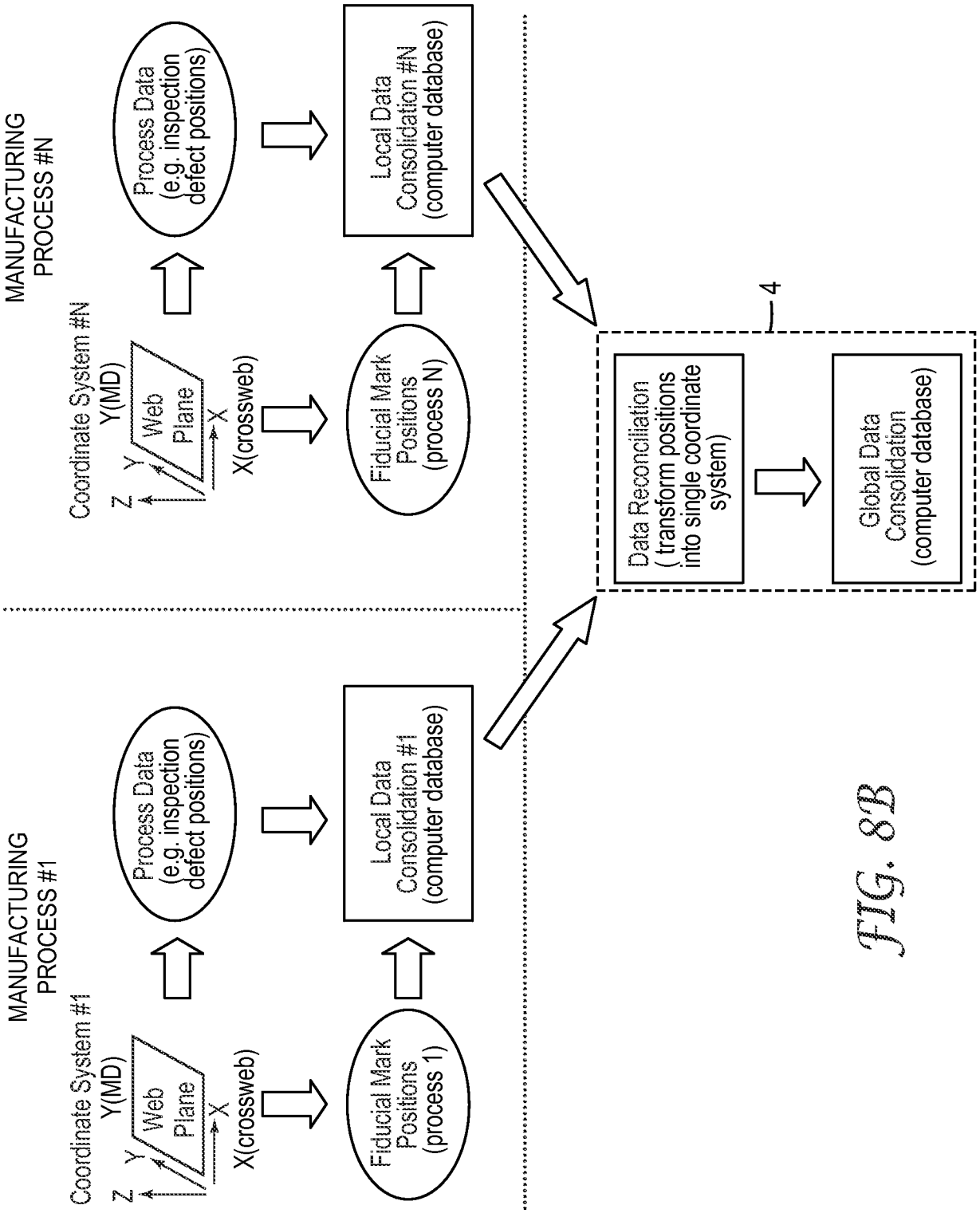

MANUFACTURING PROCESS #1
Coordinate System #1
Y(MD)
Z
Y
Web Plane
X
X(crossweb)
Fiducial Mark Positions (process 1)
Process Data (e.g. inspection defect positions)
Local Data Consolidation #1 (computer database)
MANUFACTURING PROCESS #N
Coordinate System #N
Y(MD)
Z
Y
Web Plane
X
X(crossweb)
Fiducial Mark Positions (process N)
Process Data (e.g. inspection defect positions)
Local Data Consolidation #N (computer database)
4
Data Reconciliation (transform positions into single coordinate system)
Global Data Consolidation (computer database)

FIG. 8B

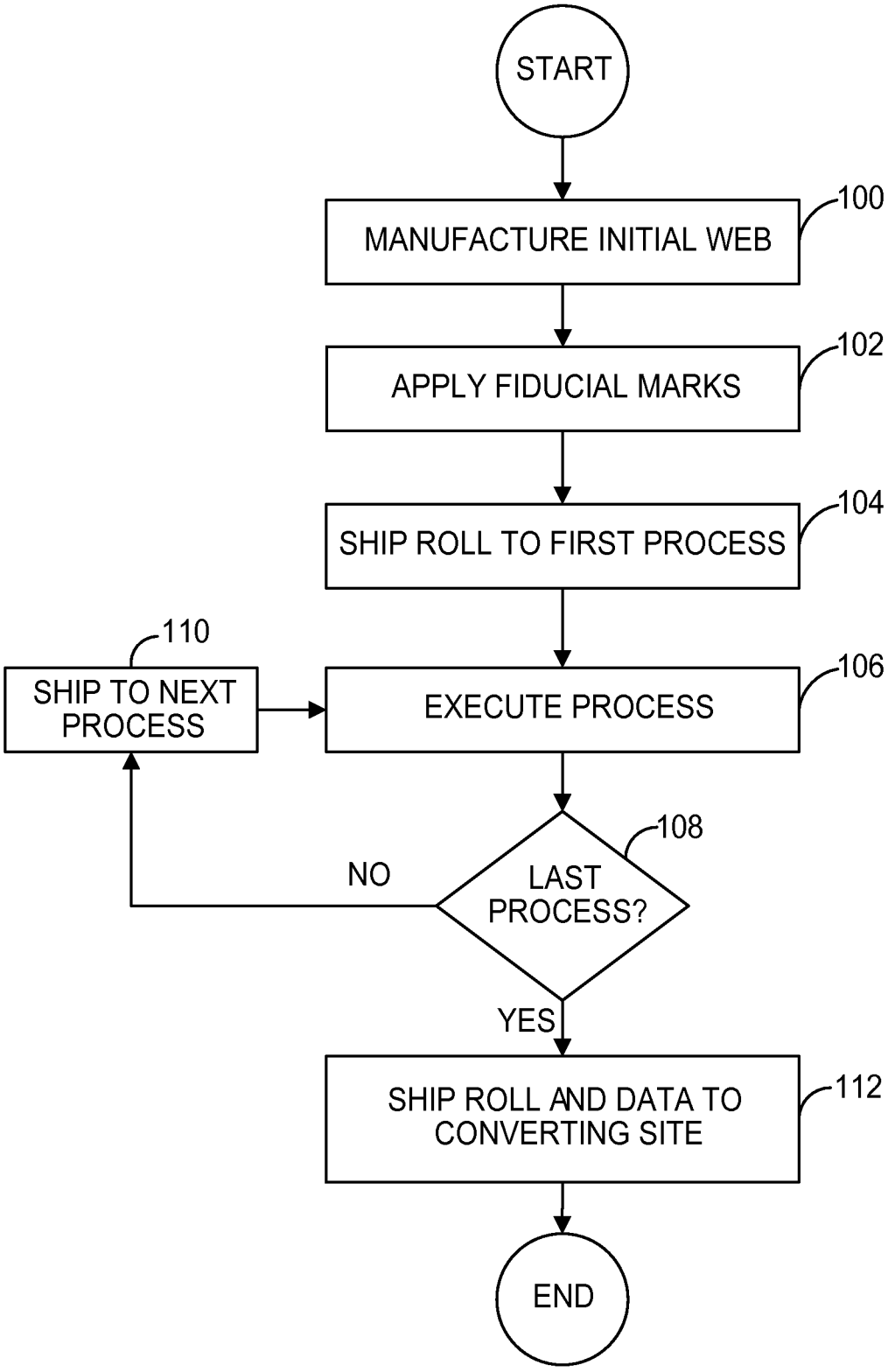

START
MANUFACTURE INITIAL WEB
100
APPLY FIDUCIAL MARKS
102
SHIP ROLL TO FIRST PROCESS
104
110
SHIP TO NEXT PROCESS
EXECUTE PROCESS
106
108
NO
LAST PROCESS?
YES
SHIP ROLL AND DATA TO CONVERTING SITE
112
END

FIG. 9

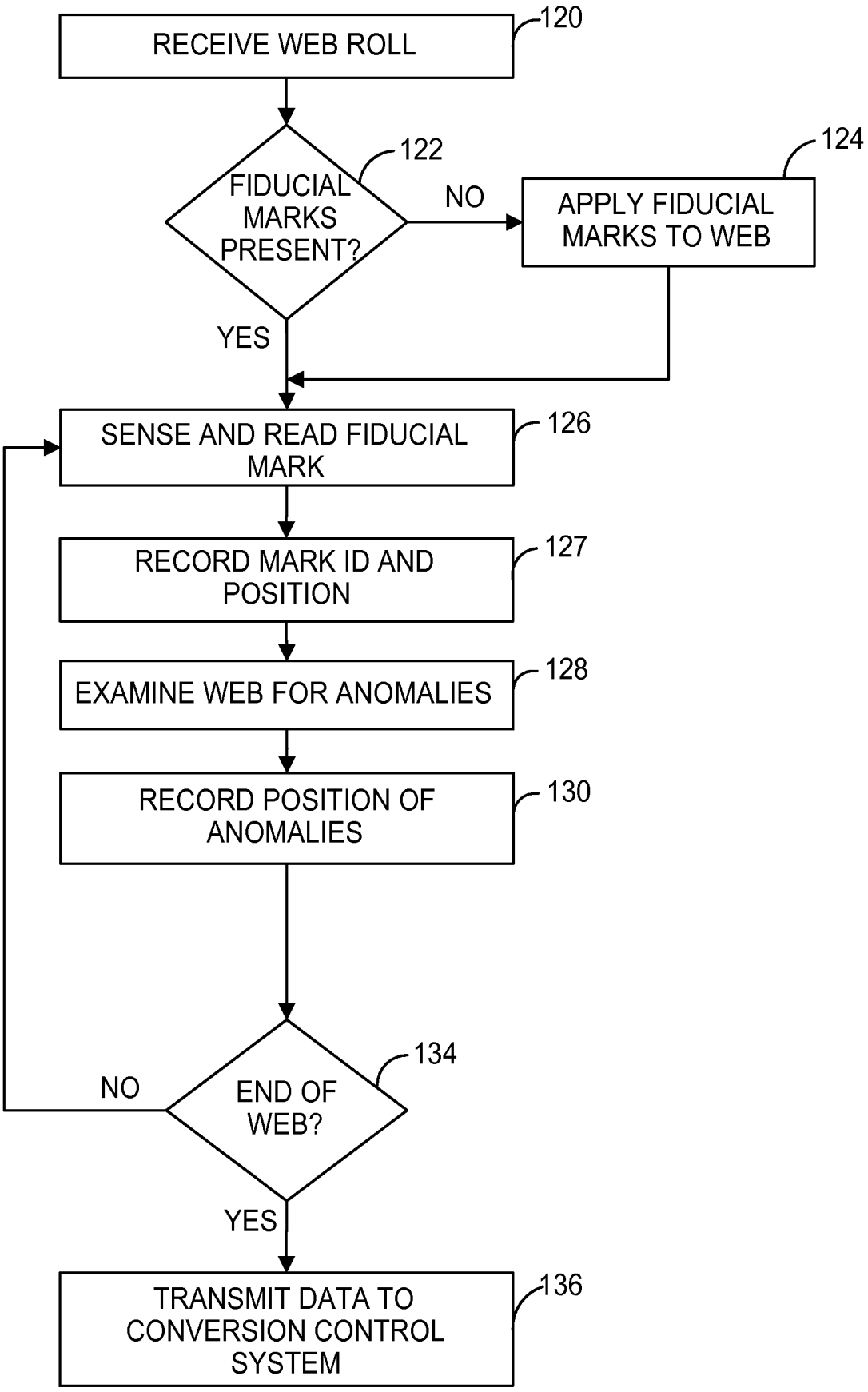

RECEIVE WEB ROLL
120
FIDUCIAL MARKS PRESENT?
122
NO
APPLY FIDUCIAL MARKS TO WEB
124
YES
SENSE AND READ FIDUCIAL MARK
126
RECORD MARK ID AND POSITION
127
EXAMINE WEB FOR ANOMALIES
128
RECORD POSITION OF ANOMALIES
130
END OF WEB?
134
NO
YES
TRANSMIT DATA TO CONVERSION CONTROL SYSTEM
136

FIG. 10

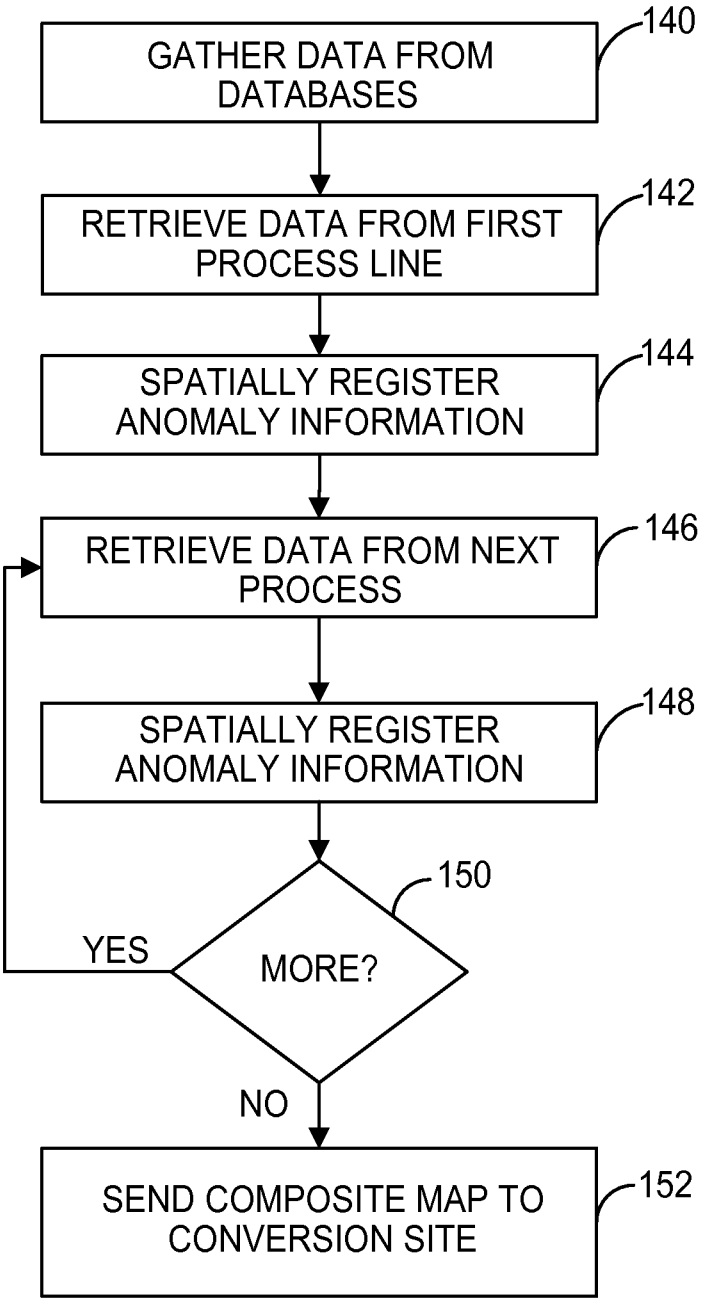

GATHER DATA FROM DATABASES
140
RETRIEVE DATA FROM FIRST PROCESS LINE
142
SPATIALLY REGISTER ANOMALY INFORMATION
144
RETRIEVE DATA FROM NEXT PROCESS
146
SPATIALLY REGISTER ANOMALY INFORMATION
148
MORE?
150
YES
NO
SEND COMPOSITE MAP TO CONVERSION SITE
152

FIG. 11

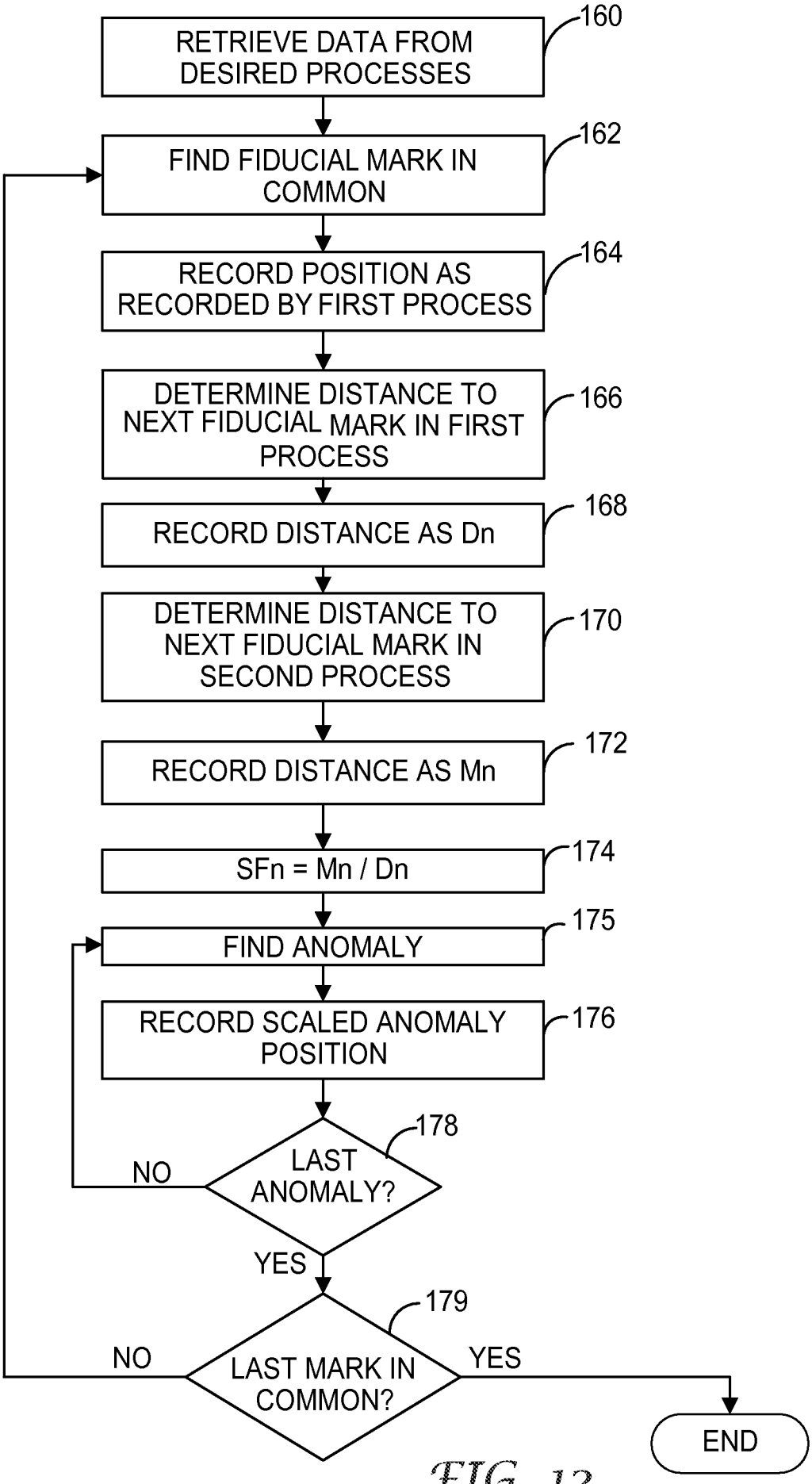

RETRIEVE DATA FROM DESIRED PROCESSES
160
FIND FIDUCIAL MARK IN COMMON
162
RECORD POSITION AS RECORDED BY FIRST PROCESS
164
DETERMINE DISTANCE TO NEXT FIDUCIAL MARK IN FIRST PROCESS
166
RECORD DISTANCE AS Dn
168
DETERMINE DISTANCE TO NEXT FIDUCIAL MARK IN SECOND PROCESS
170
RECORD DISTANCE AS Mn
172
SFn = Mn / Dn
174
FIND ANOMALY
175
RECORD SCALED ANOMALY POSITION
176
LAST ANOMALY?
178
NO
YES
LAST MARK IN COMMON?
179
NO
YES
END

FIG. 12

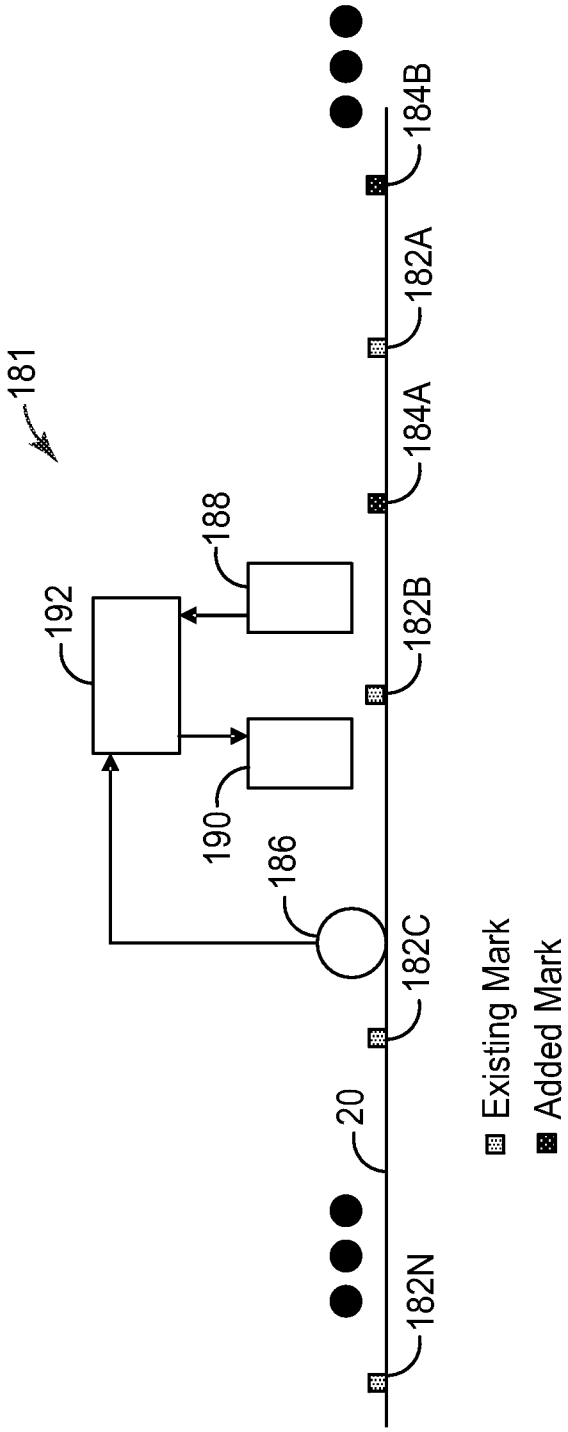

181
192
188
190
186
182N
20
182C
182B
184A
182A
184B
Existing Mark
Added Mark

FIG. 13

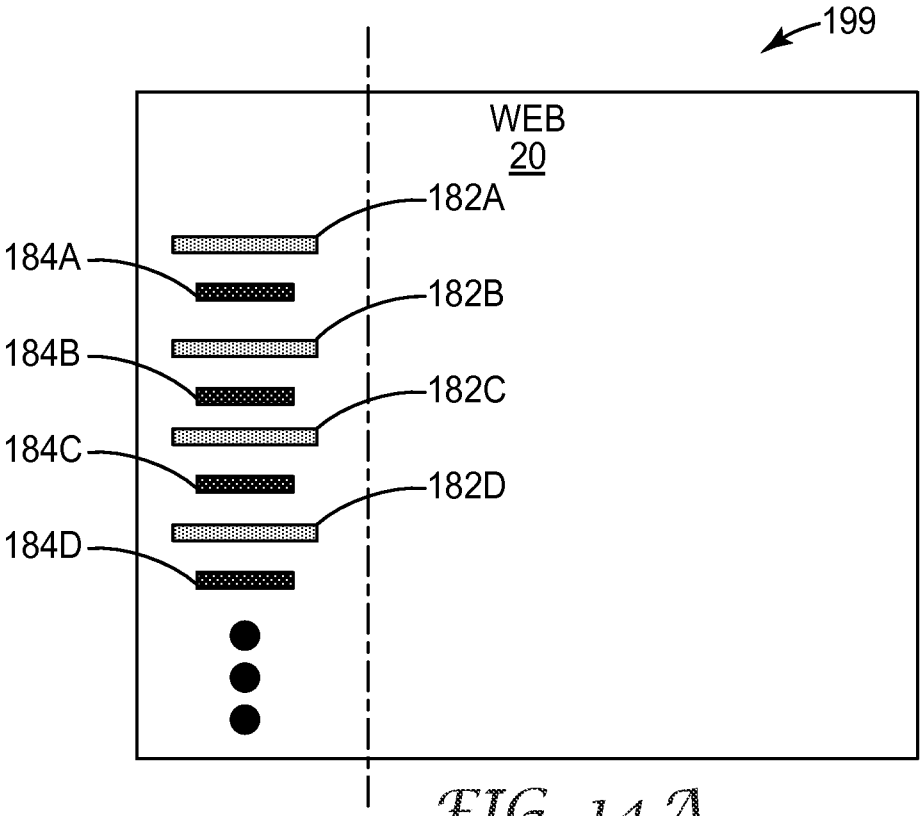


FIG. 14A

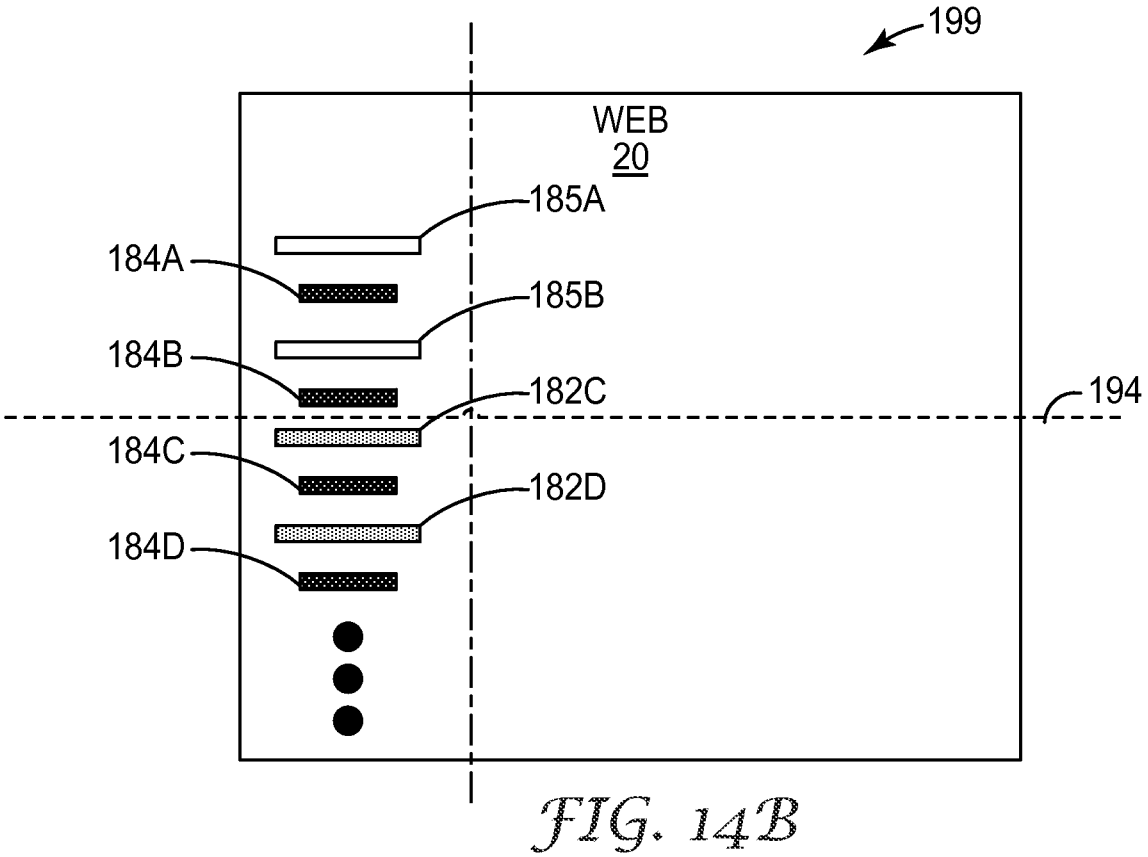


FIG. 14B

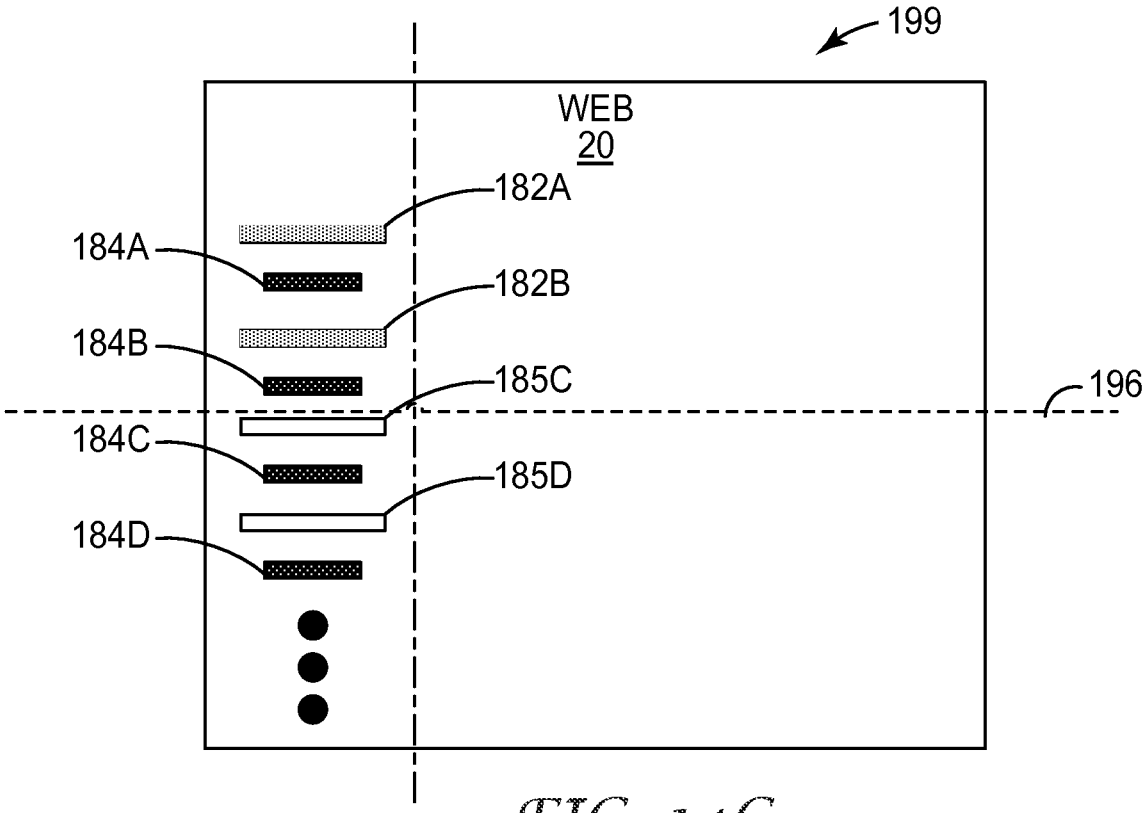


FIG. 14C

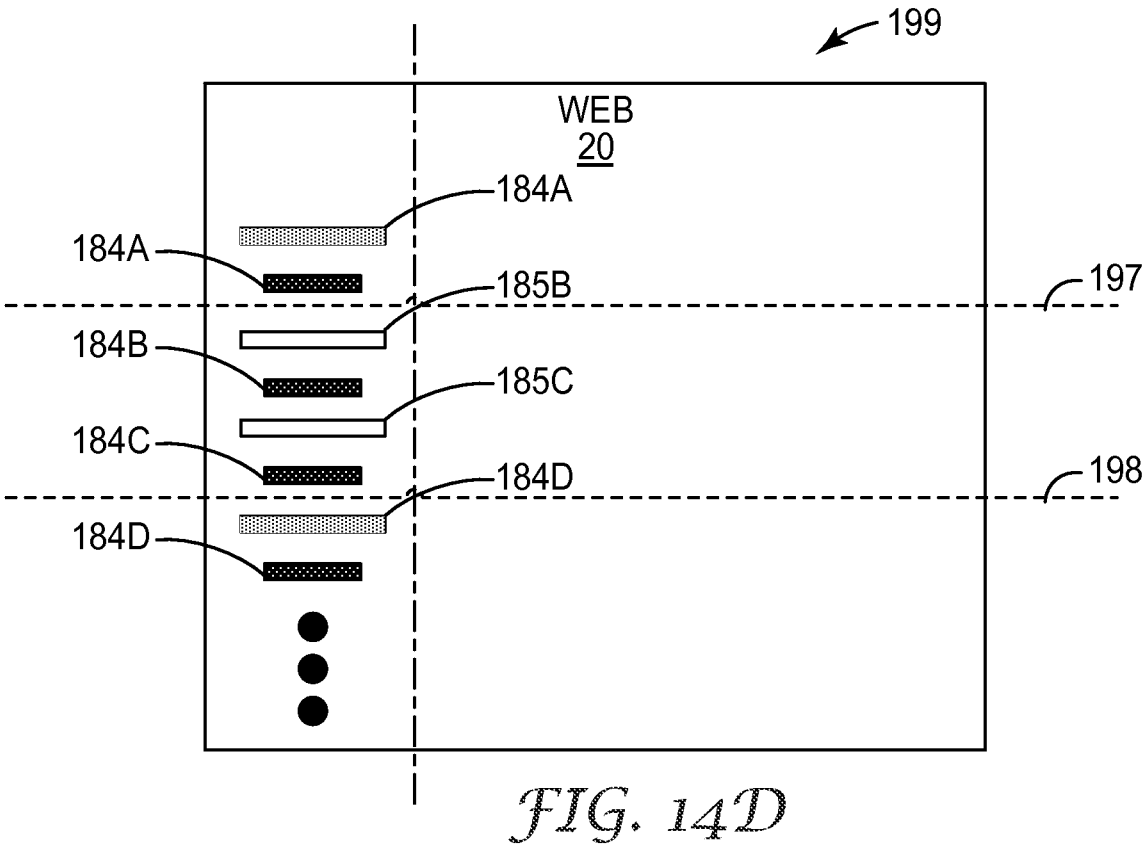


FIG. 14D

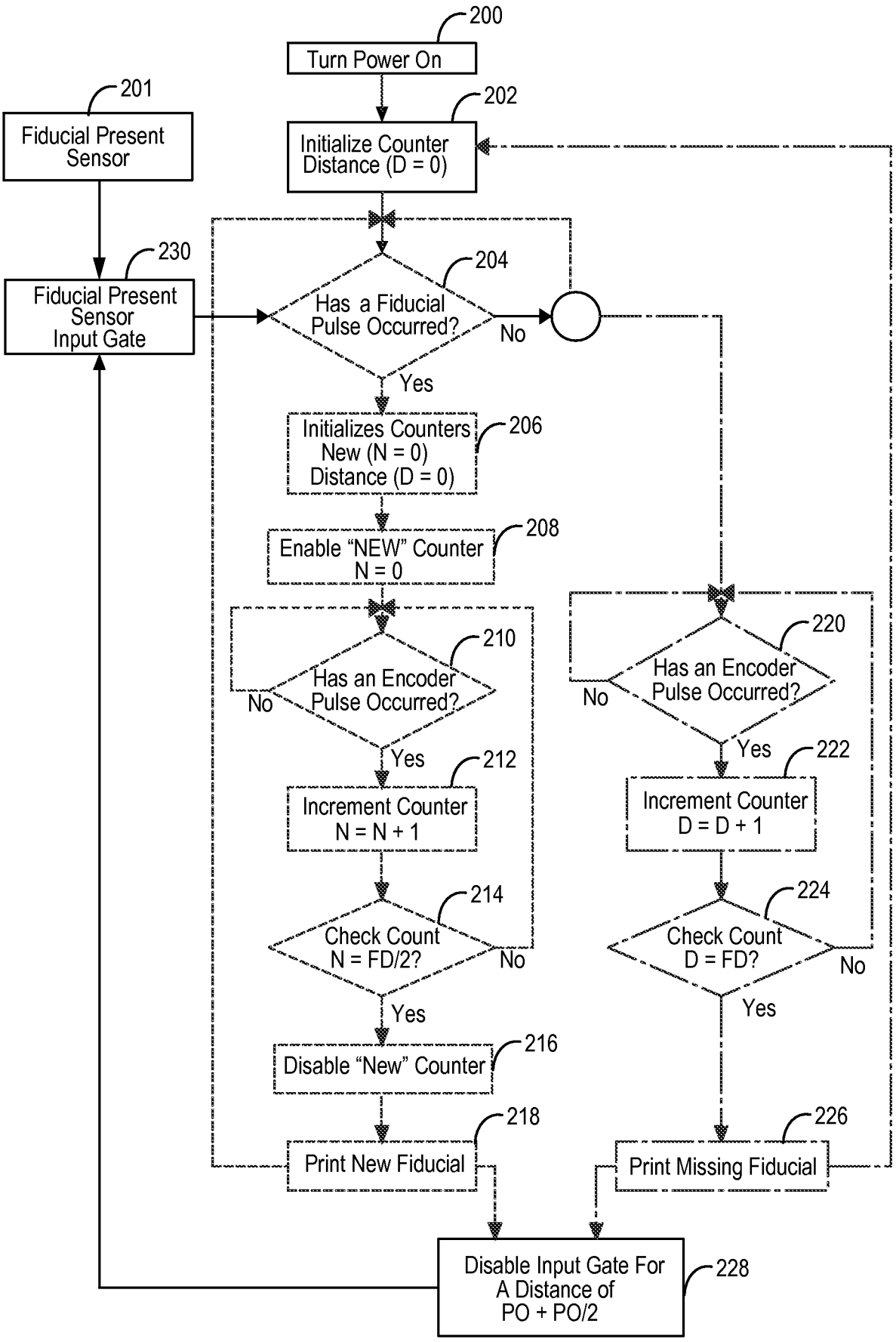

200
Turn Power On
201
Fiducial Present Sensor
202
Initialize Counter Distance (D = 0)
230
Fiducial Present Sensor Input Gate
204
Has a Fiducial Pulse Occurred?
No
Yes
Initializes Counters New (N = 0) Distance (D = 0)
206
Enable "NEW" Counter N = 0
208
210
Has an Encoder Pulse Occurred?
No
Yes
212
Increment Counter N = N + 1
214
Check Count N = FD/2?
No
Yes
216
Disable "New" Counter
218
Print New Fiducial
220
Has an Encoder Pulse Occurred?
No
Yes
222
Increment Counter D = D + 1
224
Check Count D = FD?
No
Yes
226
Print Missing Fiducial
Disable Input Gate For A Distance of PO + PO/2
228

FIG. 15

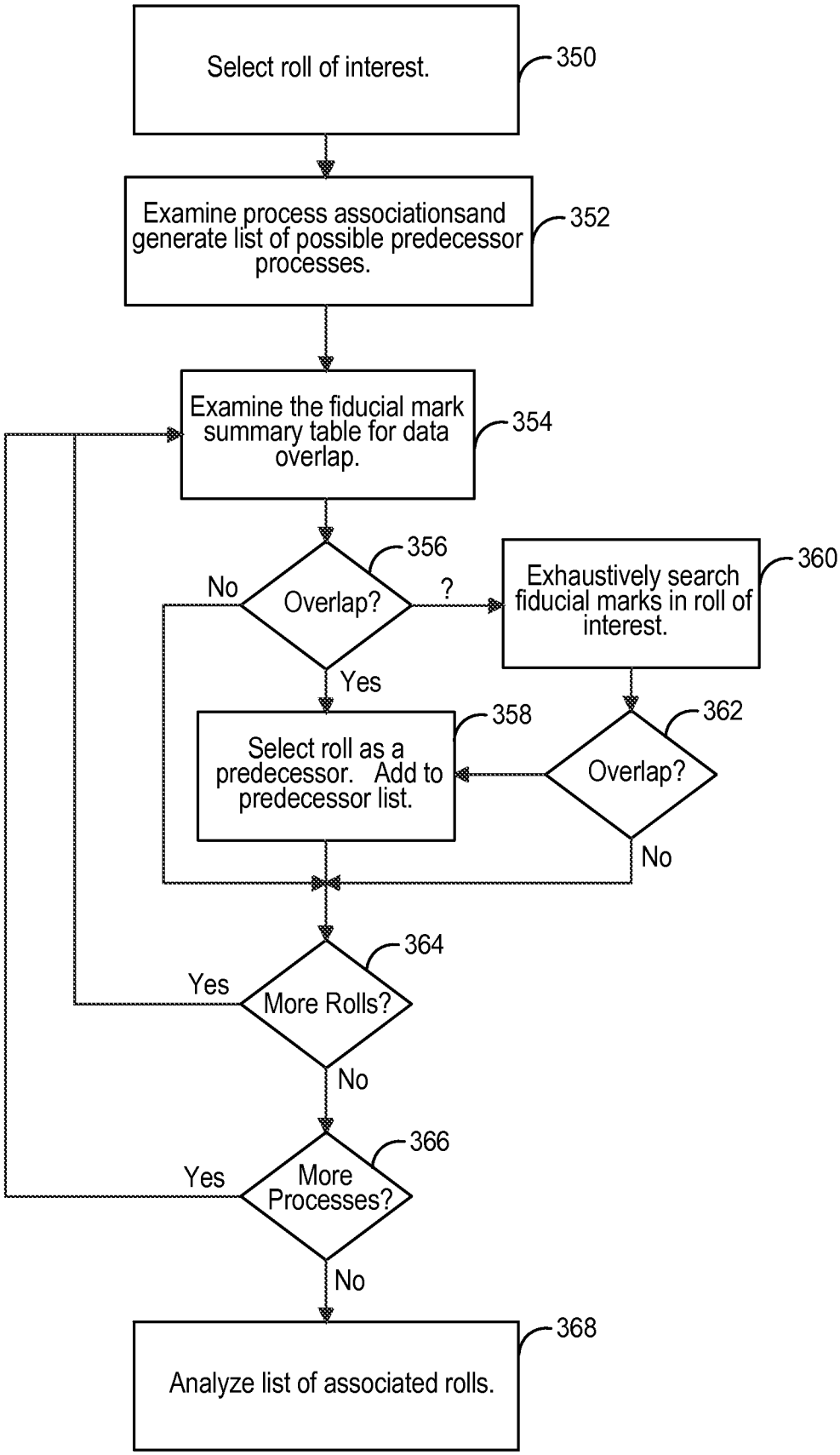

Select roll of interest.
350
Examine process associationsand generate list of possible predecessor processes.
352
Examine the fiducial mark summary table for data overlap.
354
356
Overlap?
No
?
Yes
Exhaustively search fiducial marks in roll of interest.
360
Select roll as a predecessor. Add to predecessor list.
358
Overlap?
362
No
364
More Rolls?
Yes
No
366
More Processes?
Yes
No
Analyze list of associated rolls.
368

FIG. 16

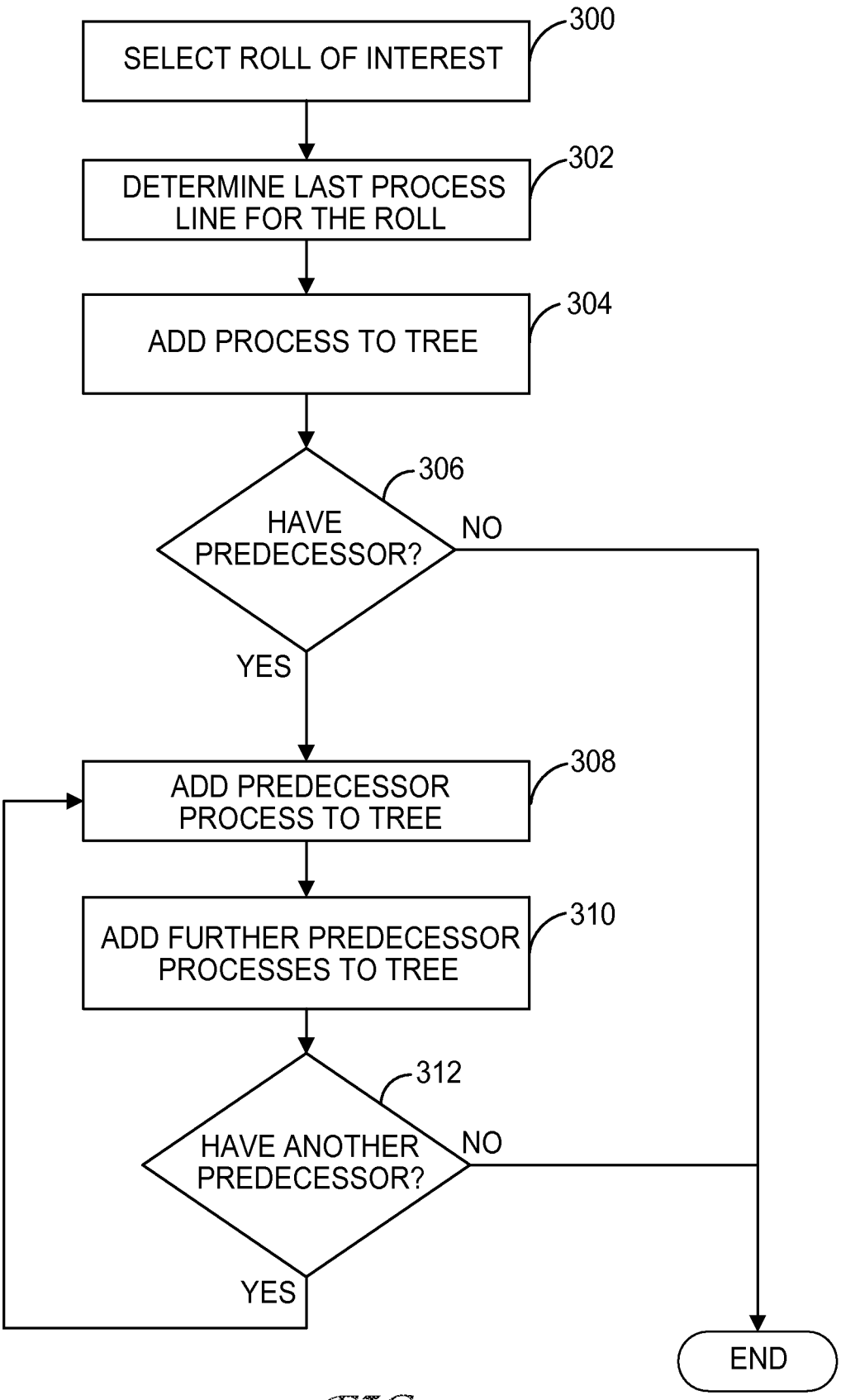

SELECT ROLL OF INTEREST
300
DETERMINE LAST PROCESS LINE FOR THE ROLL
302
ADD PROCESS TO TREE
304
HAVE PREDECESSOR?
306
NO
YES
ADD PREDECESSOR PROCESS TO TREE
308
ADD FURTHER PREDECESSOR PROCESSES TO TREE
310
HAVE ANOTHER PREDECESSOR?
312
NO
YES
END

FIG. 17

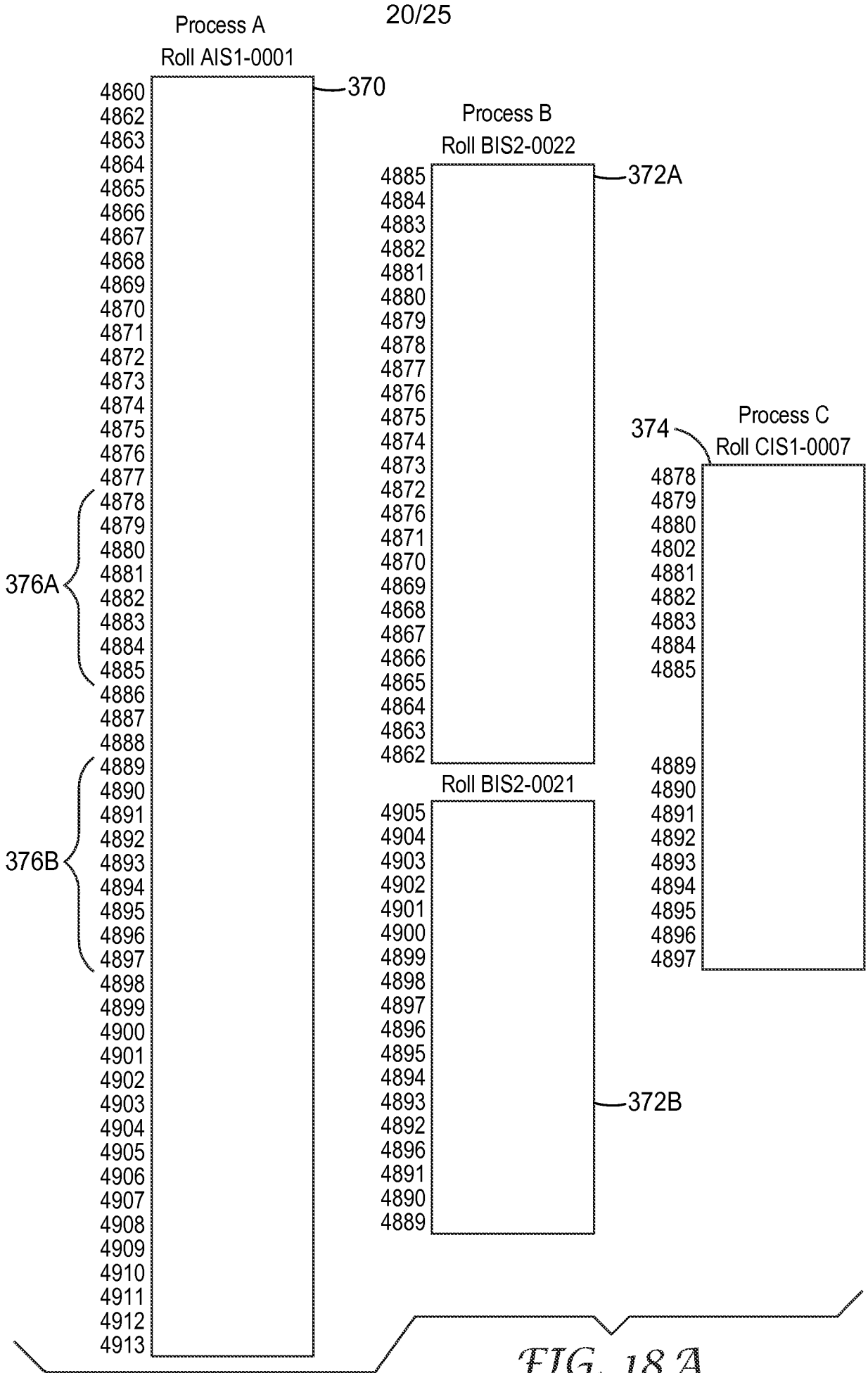

Process A
Roll AIS1-0001
370
4860
4862
4863
4864
4865
4866
4867
4868
4869
4870
4871
4872
4873
4874
4875
4876
4877
4878
4879
4880
4881
4882
4883
4884
4885
4886
4887
4888
4889
4890
4891
4892
4893
4894
4895
4896
4897
4898
4899
4900
4901
4902
4903
4904
4905
4906
4907
4908
4909
4910
4911
4912
4913
376A
376B
Process B
Roll BIS2-0022
372A
4885
4884
4883
4882
4881
4880
4879
4878
4877
4876
4875
4874
4873
4872
4876
4871
4870
4869
4868
4867
4866
4865
4864
4863
4862
Roll BIS2-0021
4905
4904
4903
4902
4901
4900
4899
4898
4897
4896
4895
4894
4893
4892
4896
4891
4890
4889
372B
374
Process C
Roll CIS1-0007
4878
4879
4880
4802
4881
4882
4883
4884
4885
4889
4890
4891
4892
4893
4894
4895
4896
4897

FIG. 18A

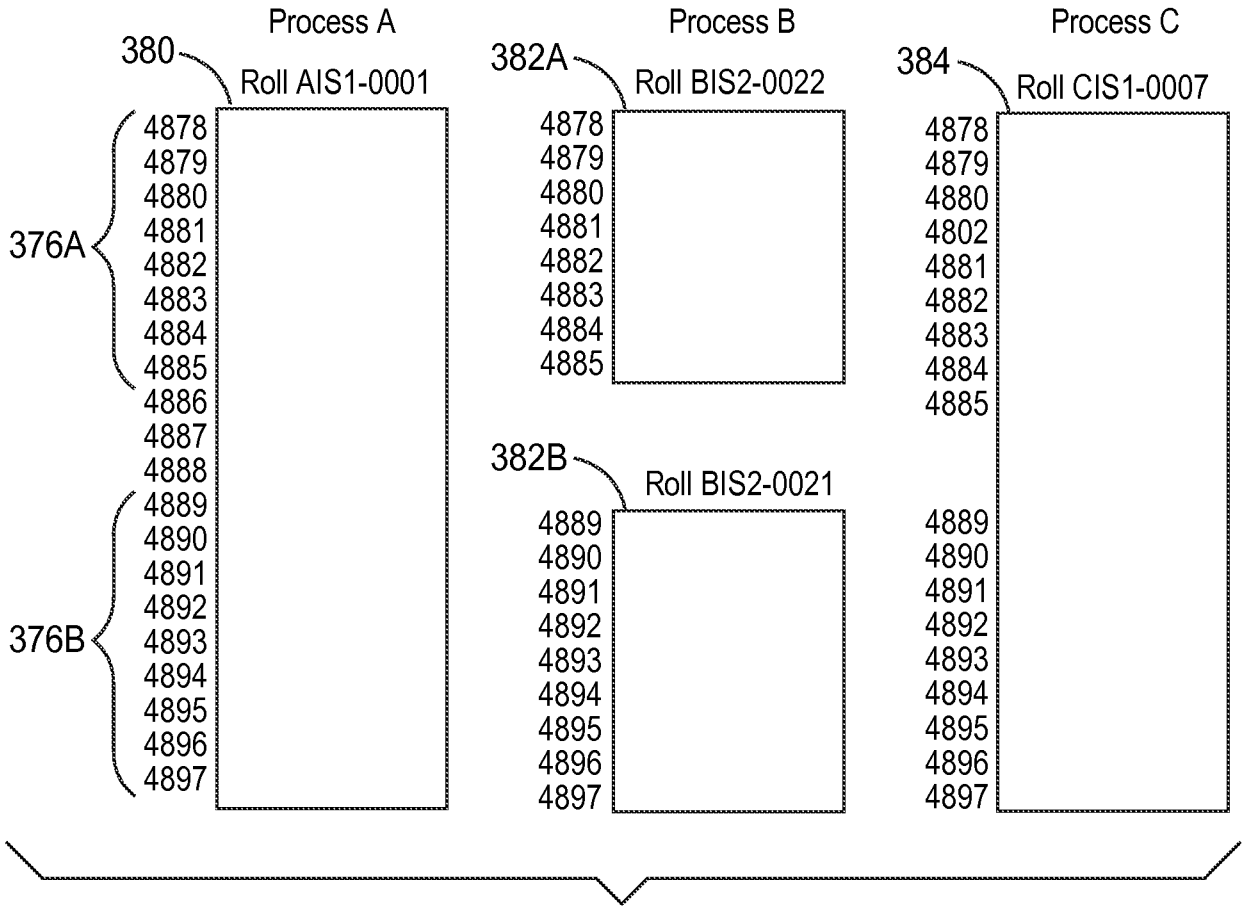

Process A
380
Roll AIS1-0001
4878
4879
4880
4881
4882
4883
4884
4885
4886
4887
4888
4889
4890
4891
4892
4893
4894
4895
4896
4897
376A
376B
Process B
382A
Roll BIS2-0022
4878
4879
4880
4881
4882
4883
4884
4885
382B
Roll BIS2-0021
4889
4890
4891
4892
4893
4894
4895
4896
4897
Process C
384
Roll CIS1-0007
4878
4879
4880
4802
4881
4882
4883
4884
4885
4889
4890
4891
4892
4893
4894
4895
4896
4897

FIG. 18B

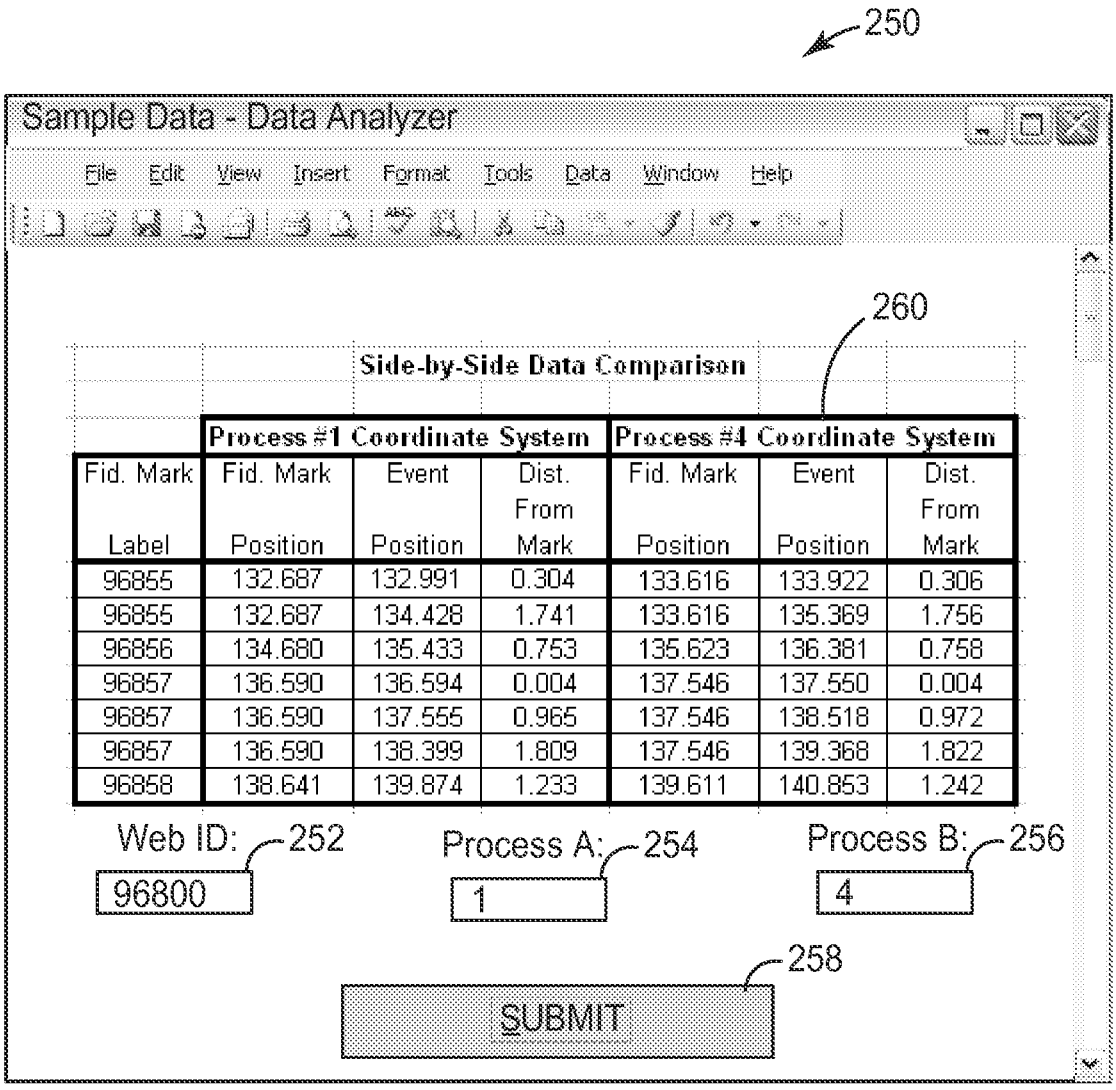

250
Sample Data - Data Analyzer
File Edit View Insert Format Tools Data Window Help
260
Side-by-Side Data Comparison
Process #1 Coordinate System
Process #4 Coordinate System
Fid. Mark Label
Fid. Mark Position
Event Position
Dist. From Mark
Fid. Mark Position
Event Position
Dist. From Mark
96855 132.687 132.991 0.304 133.616 133.922 0.306
96855 132.687 134.428 1.741 133.616 135.369 1.756
96856 134.680 135.433 0.753 135.623 136.381 0.758
96857 136.590 136.594 0.004 137.546 137.550 0.004
96857 136.590 137.555 0.965 137.546 138.518 0.972
96857 136.590 138.399 1.809 137.546 139.368 1.822
96858 138.641 139.874 1.233 139.611 140.853 1.242
Web ID: 252
96800
Process A: 254
1
Process B: 256
4
258
SUBMIT

FIG. 19

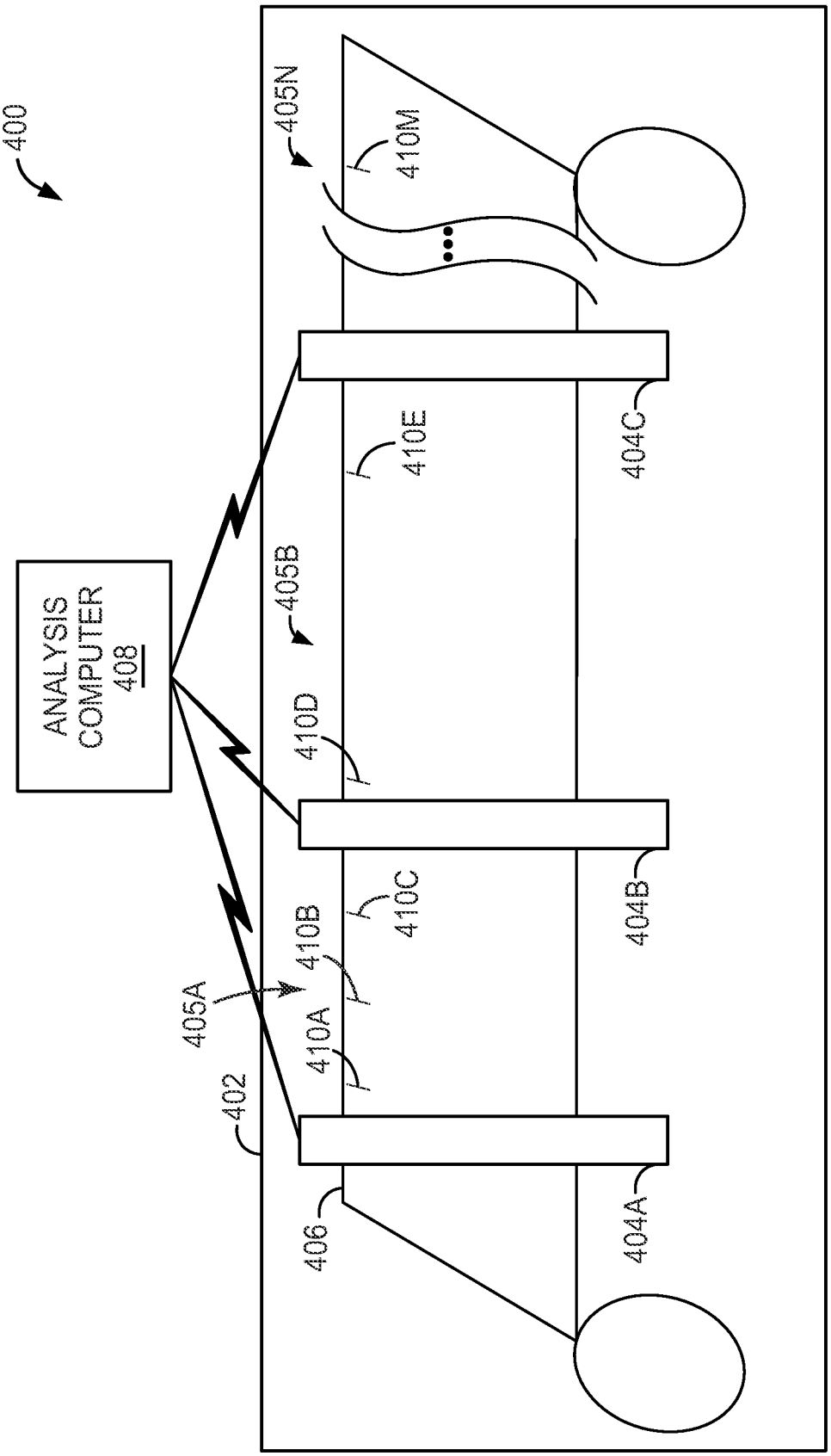

400
405N
410M
410E
404C
405B
410D
410C
404B
410B
405A
410A
402
406
404A
ANALYSIS COMPUTER 408

FIG. 20

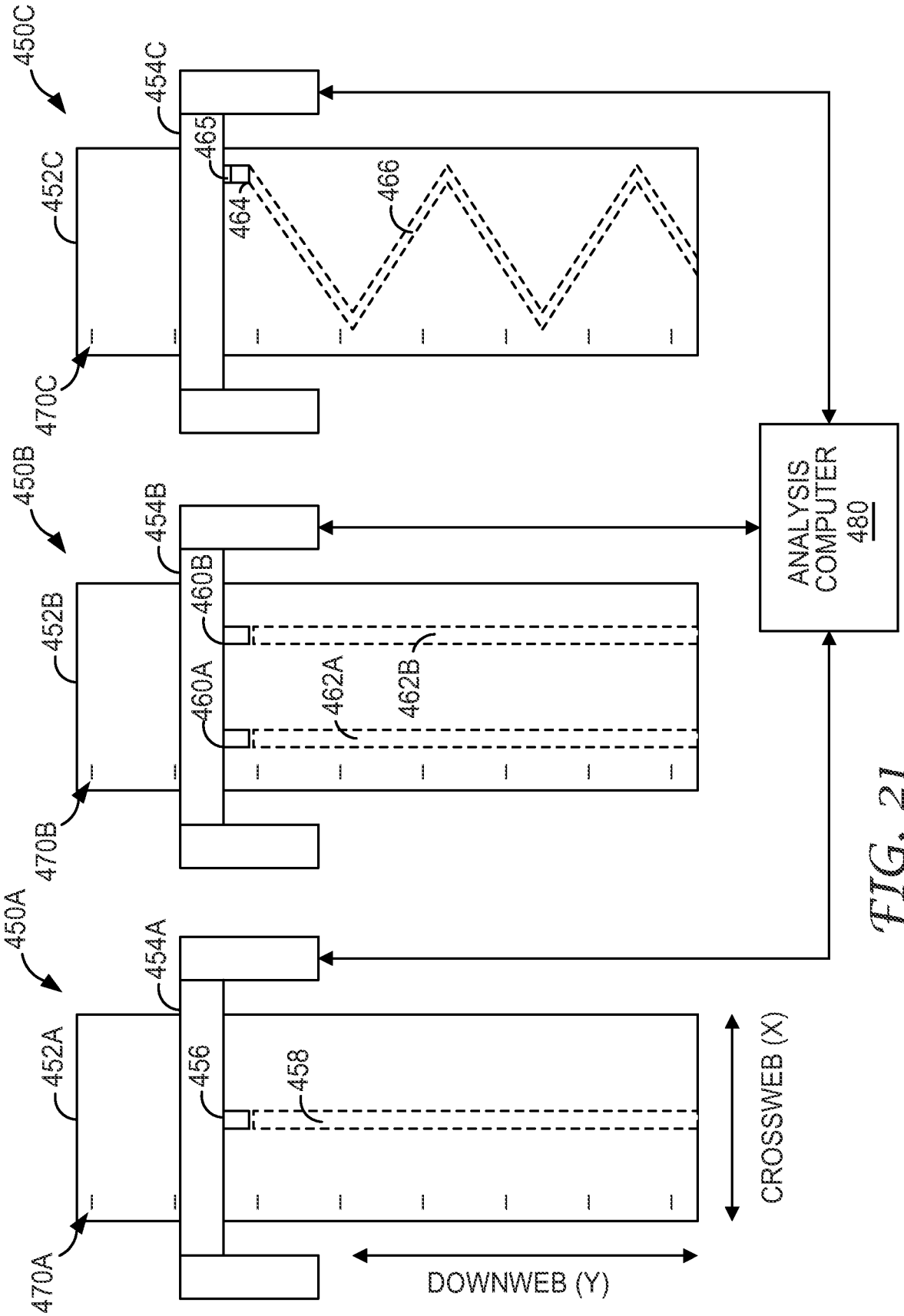

450C
454C
465
452C
464
466
470C
450B
454B
460B
452B
460A
462A
462B
470B
450A
454A
452A
456
458
470A
ANALYSIS COMPUTER 480
CROSSWEB (X)
DOWNWEB (Y)

FIG. 21

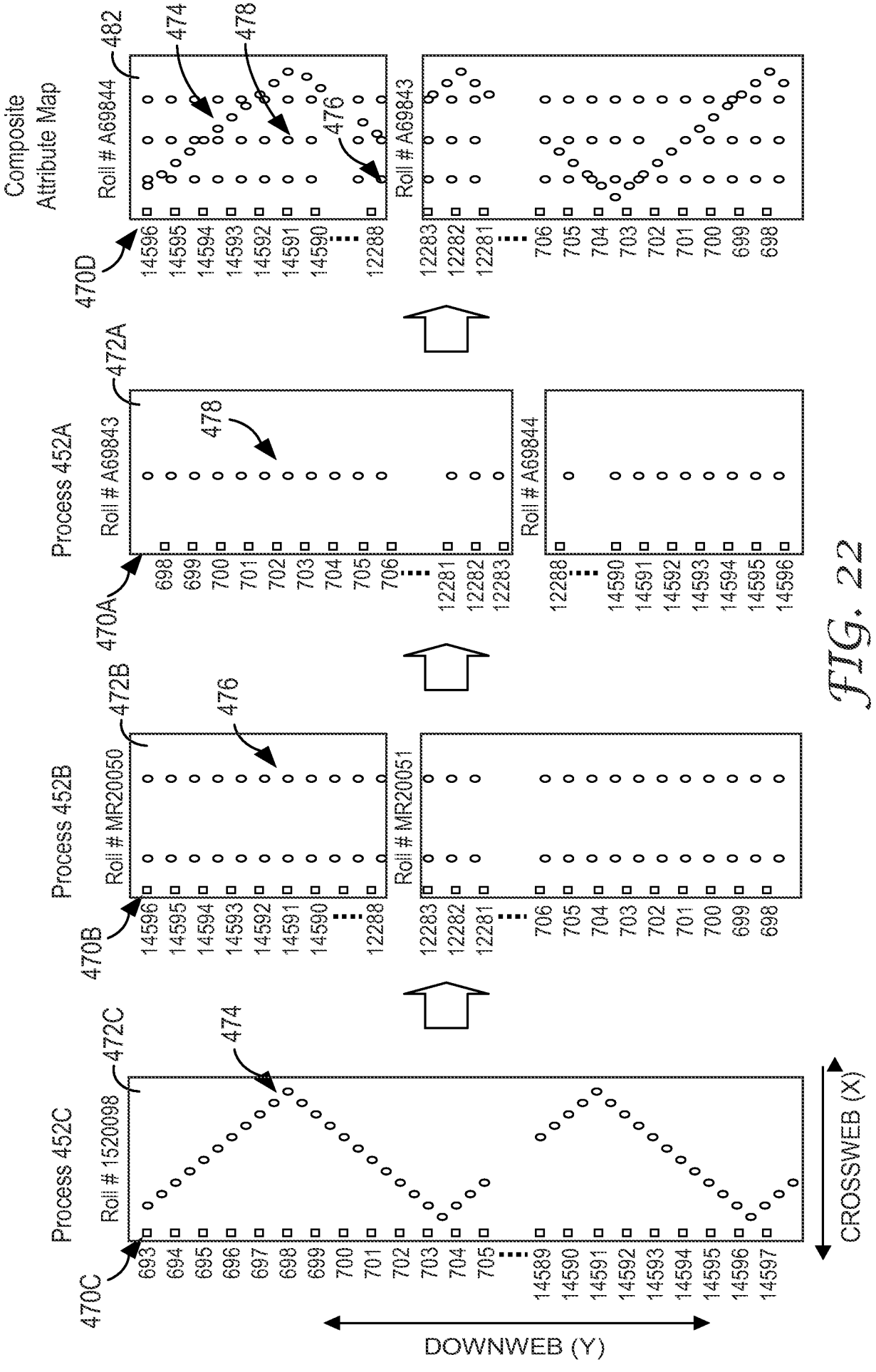

Composite Attribute Map
Process 452C
Process 452B
Process 452A
Roll # 1520098
Roll # MR20050
Roll # MR20051
Roll # A69843
Roll # A69844
470A
470B
470C
470D
472A
472B
472C
474
476
478
482
DOWNWEB (Y)
CROSSWEB (X)

FIG. 22