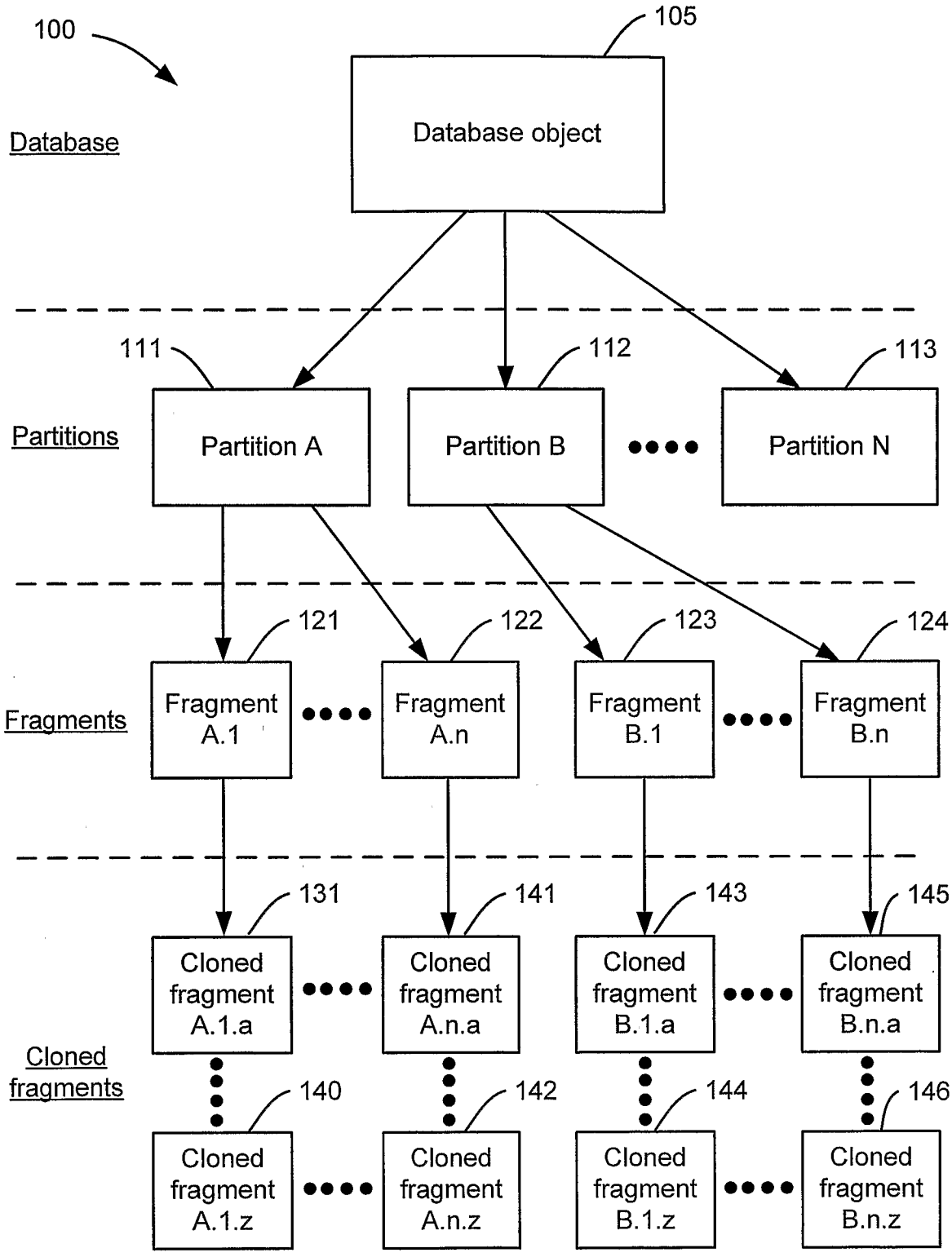

100
105
Database
Database object
111
112
113
Partitions
Partition A
Partition B
Partition N
121
122
123
124
Fragments
Fragment A.1
Fragment A.n
Fragment B.1
Fragment B.n
131
141
143
145
Cloned fragment A.1.a
Cloned fragment A.n.a
Cloned fragment B.1.a
Cloned fragment B.n.a
Cloned fragments
140
142
144
146
Cloned fragment A.1.z
Cloned fragment A.n.z
Cloned fragment B.1.z
Cloned fragment B.n.z

FIG. 1

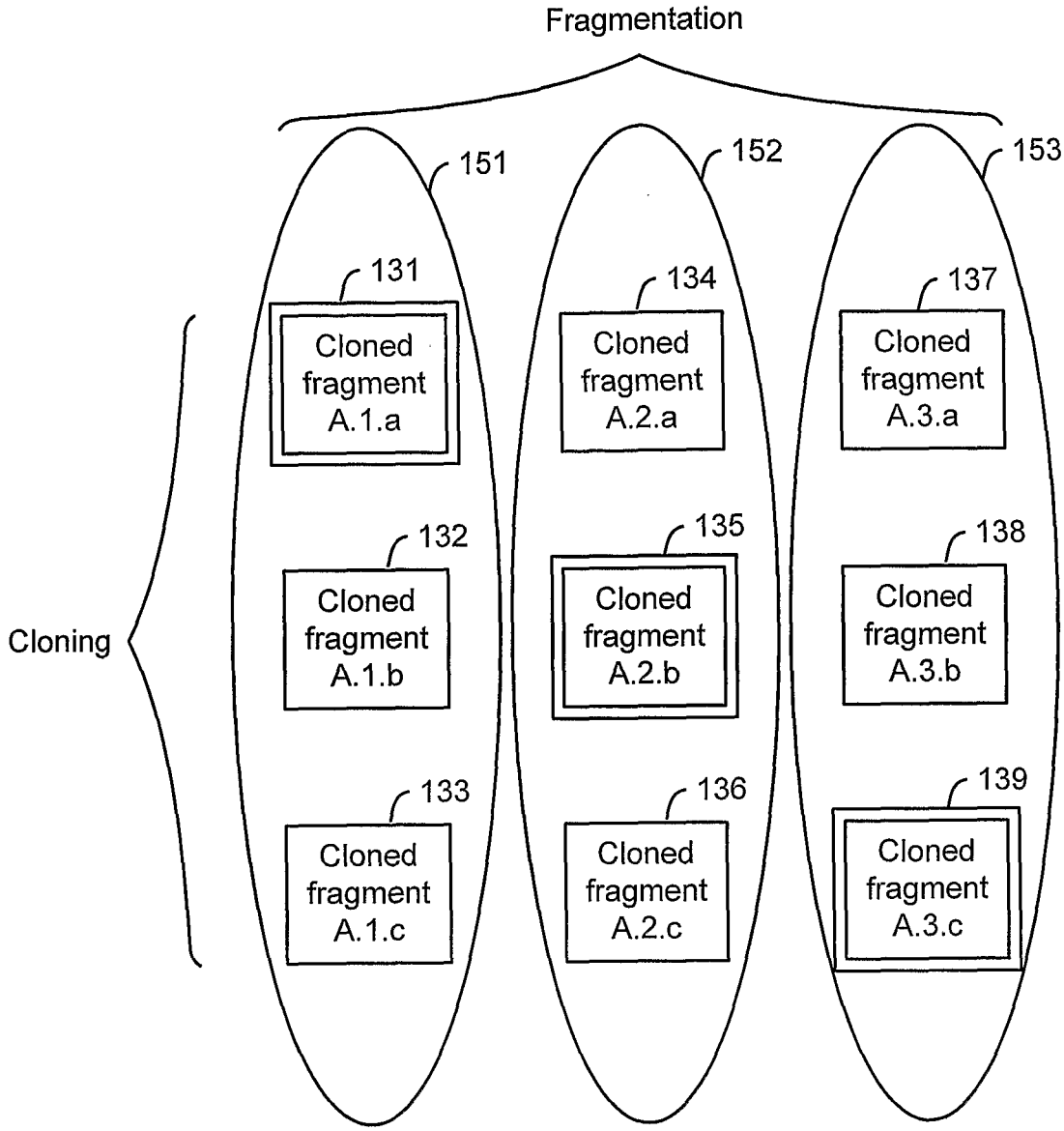

Fragmentation
151
152
153
131
134
137
Cloned fragment A.1.a
Cloned fragment A.2.a
Cloned fragment A.3.a
132
135
138
Cloned fragment A.1.b
Cloned fragment A.2.b
Cloned fragment A.3.b
133
136
139
Cloned fragment A.1.c
Cloned fragment A.2.c
Cloned fragment A.3.c
Cloning

FIG. 2

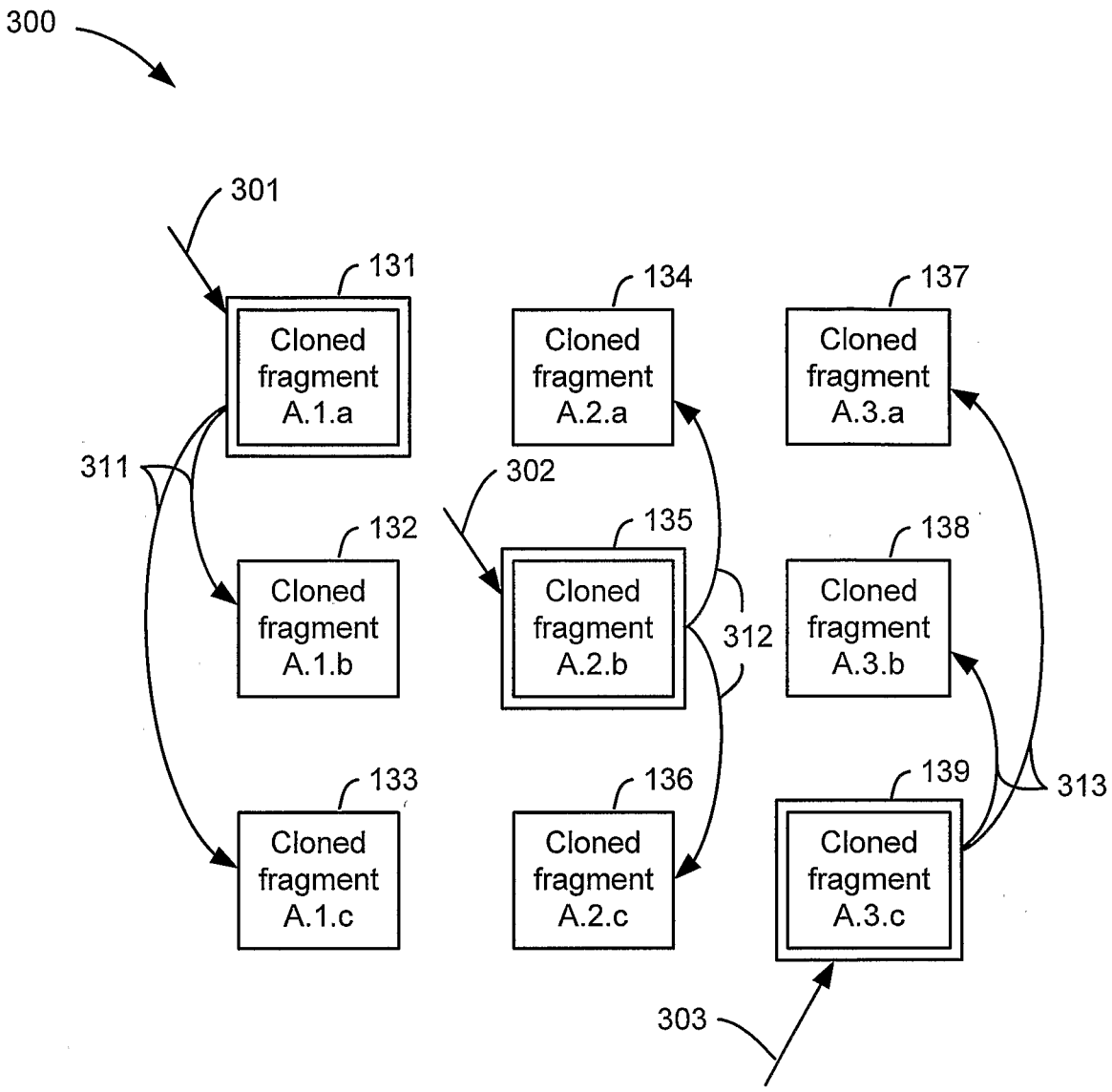

300
301
131
Cloned fragment A.1.a
134
Cloned fragment A.2.a
137
Cloned fragment A.3.a
311
302
132
Cloned fragment A.1.b
135
Cloned fragment A.2.b
312
138
Cloned fragment A.3.b
313
133
Cloned fragment A.1.c
136
Cloned fragment A.2.c
139
Cloned fragment A.3.c
303

FIG. 3

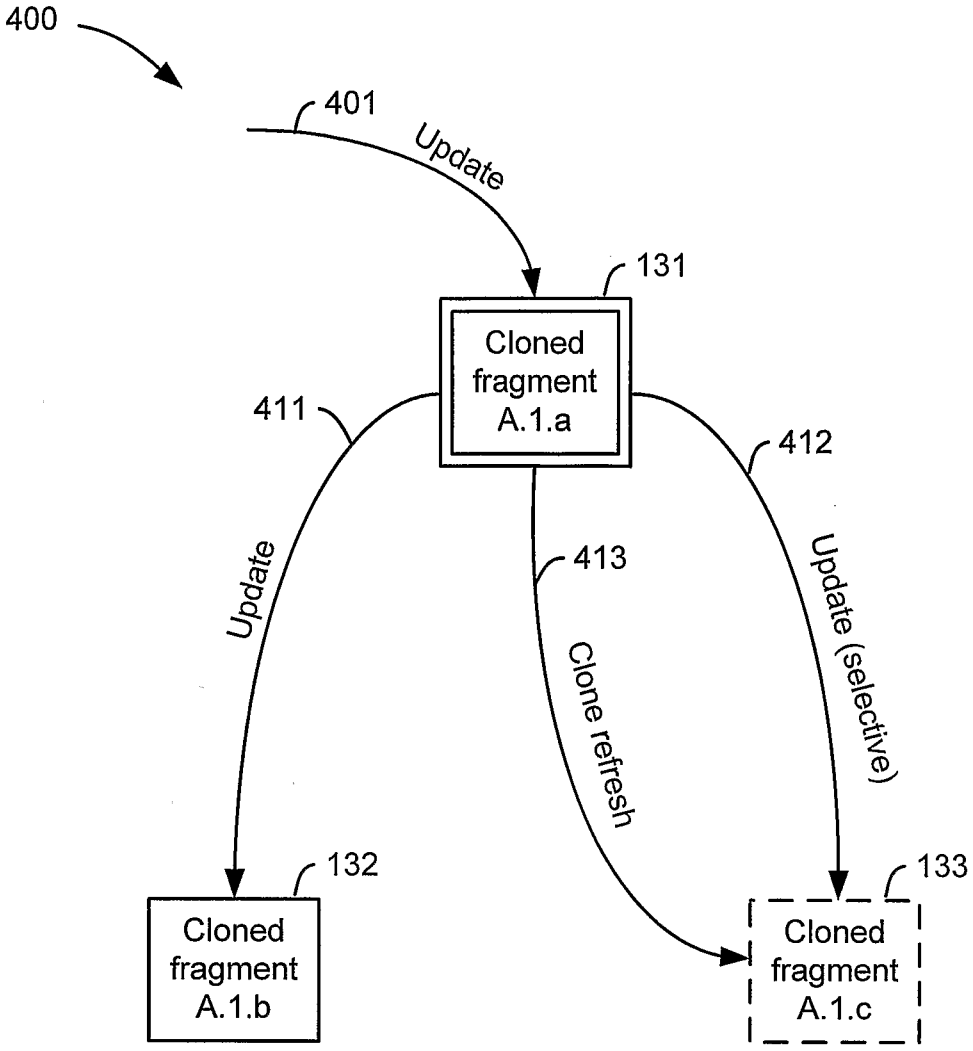

400
401
Update
131
Cloned fragment A.1.a
411
412
413
Update
Clone refresh
Update (selective)
132
133
Cloned fragment A.1.b
Cloned fragment A.1.c

FIG. 4

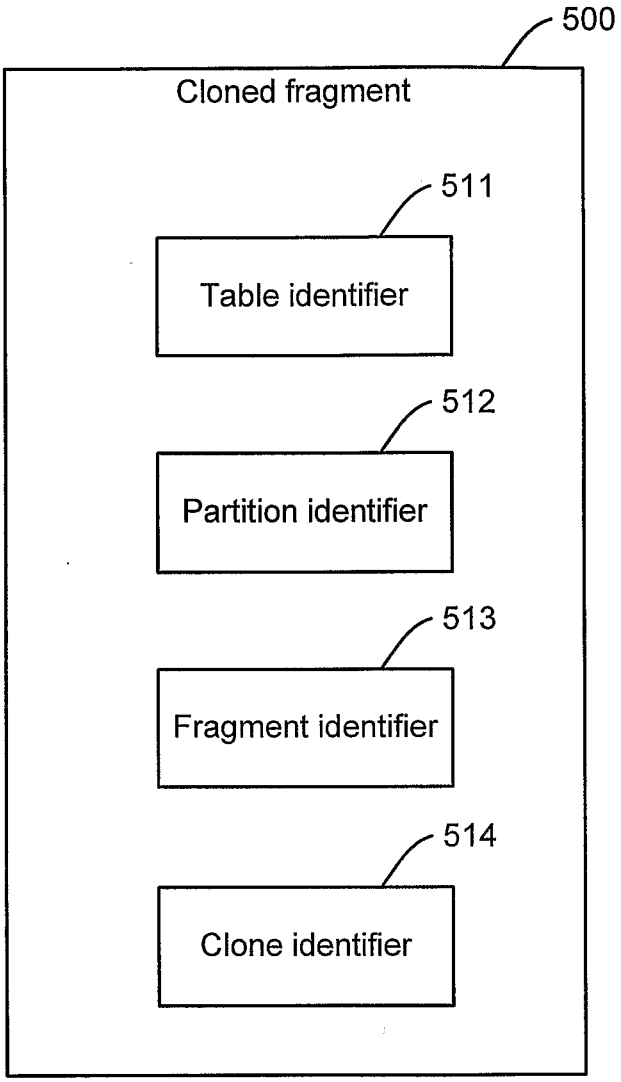

500
Cloned fragment
511
Table identifier
512
Partition identifier
513
Fragment identifier
514
Clone identifier

FIG. 5

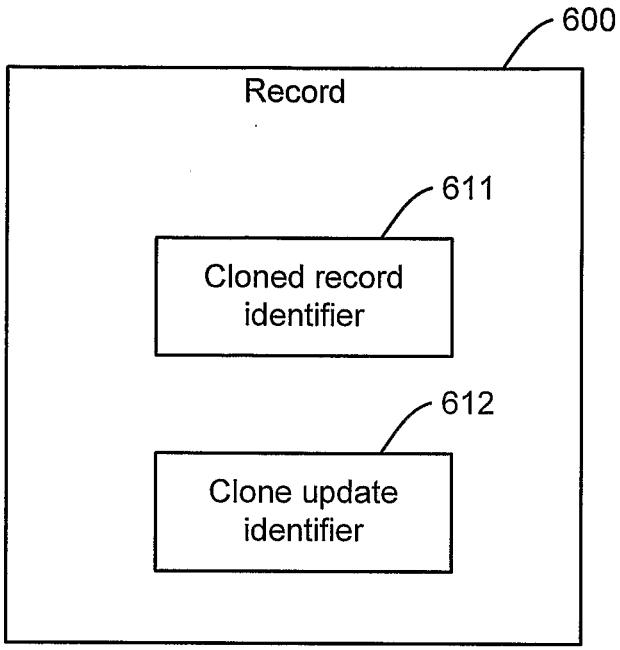

600
Record
611
Cloned record identifier
612
Clone update identifier

FIG. 6

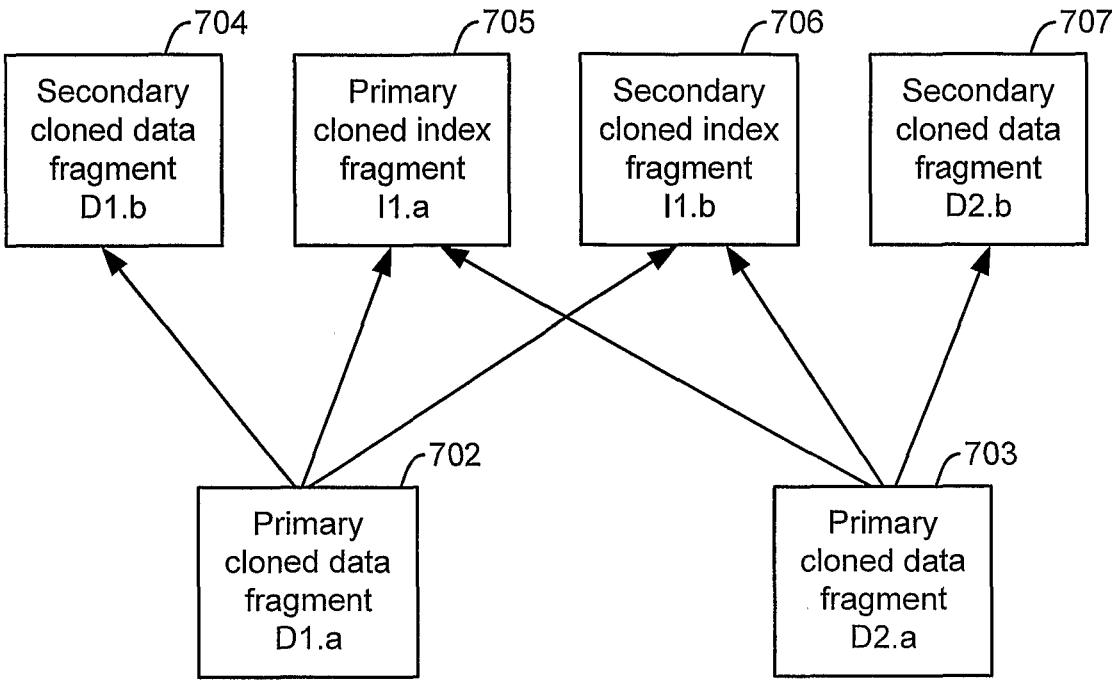

704
Secondary cloned data fragment D1.b
705
Primary cloned index fragment I1.a
706
Secondary cloned index fragment I1.b
707
Secondary cloned data fragment D2.b
702
Primary cloned data fragment D1.a
703
Primary cloned data fragment D2.a

FIG. 7

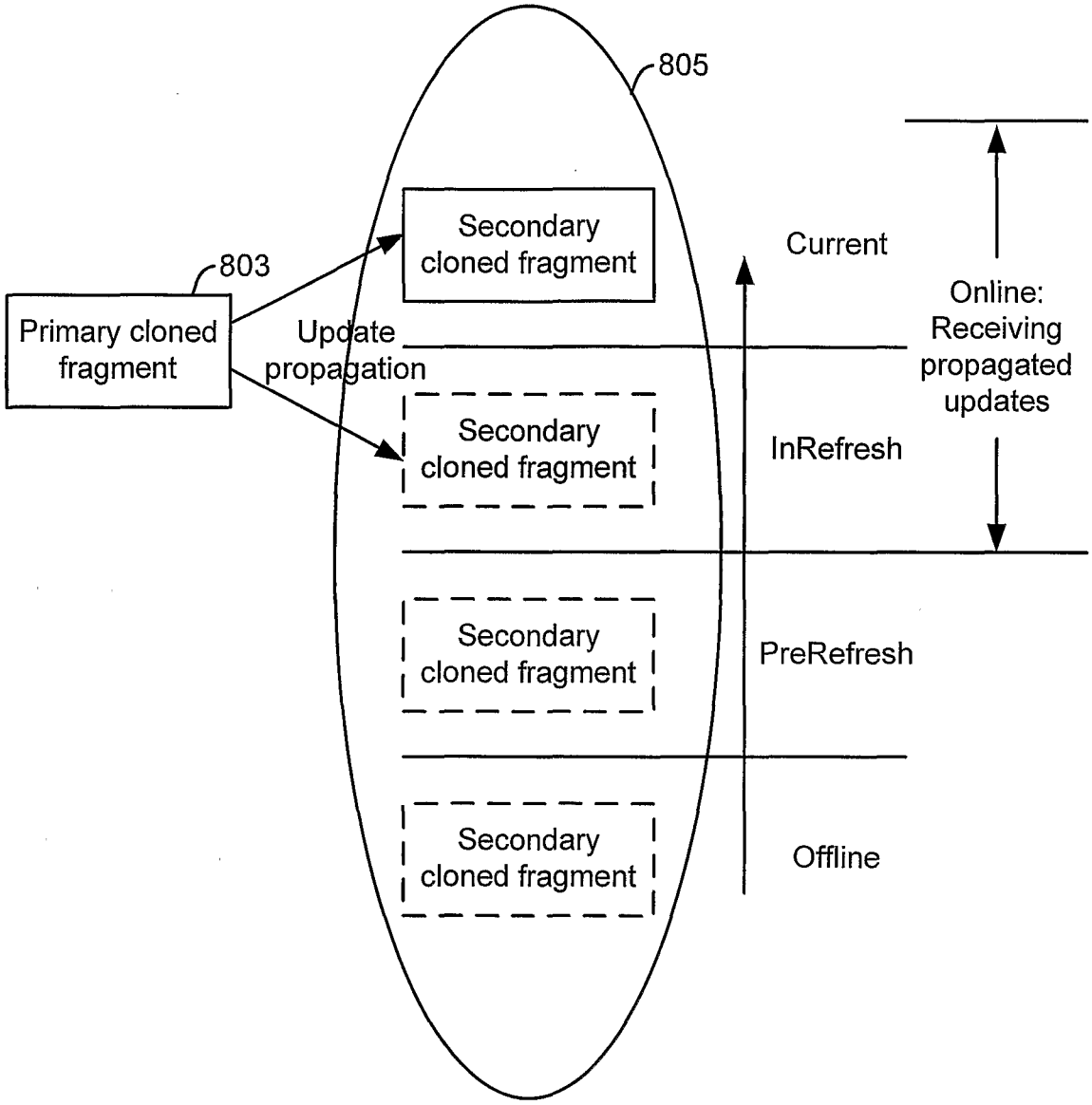

805
803
Primary cloned fragment
Update propagation
Secondary cloned fragment
Secondary cloned fragment
Secondary cloned fragment
Secondary cloned fragment
Current
InRefresh
PreRefresh
Offline
Online: Receiving propagated updates

FIG. 8

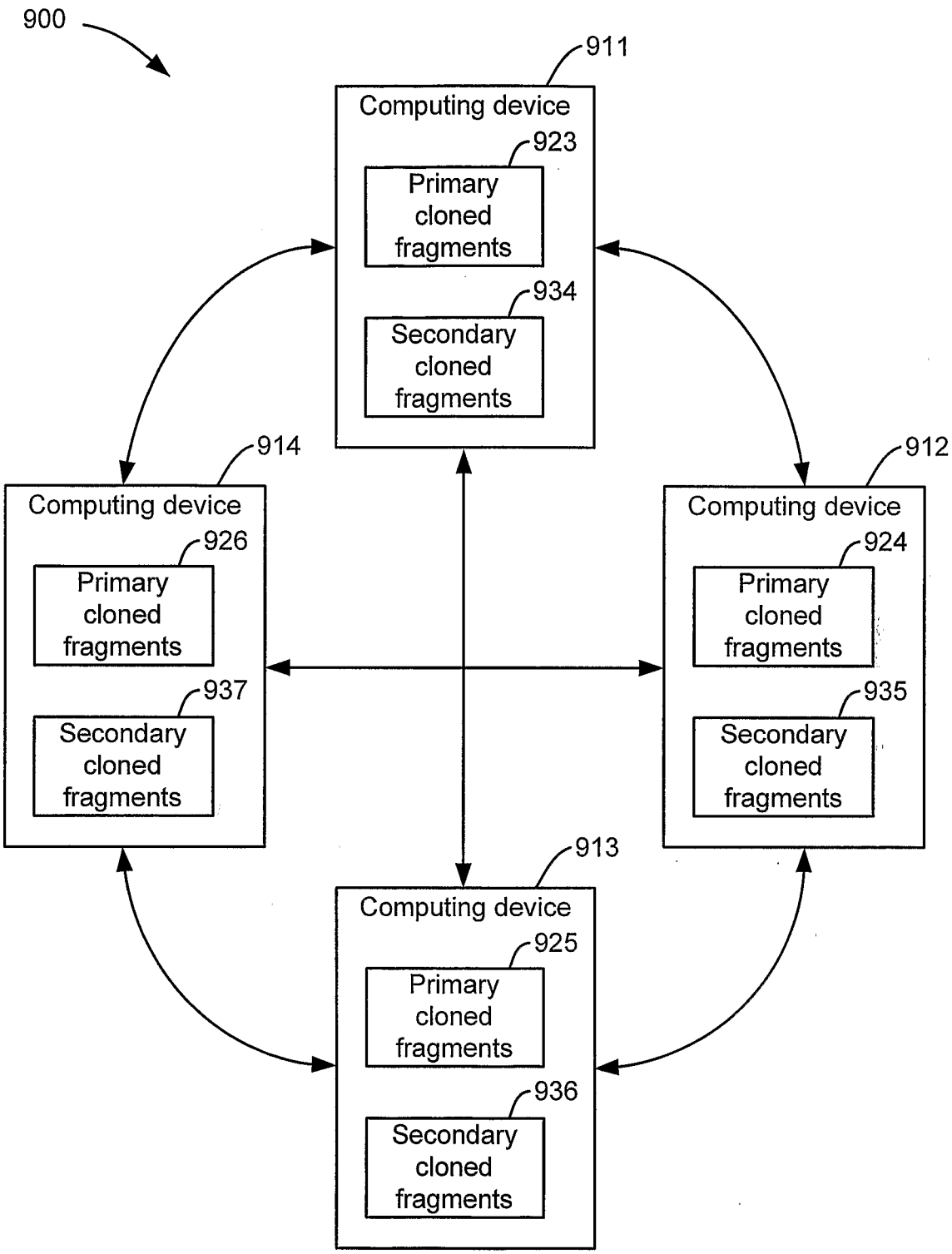

900
911
Computing device
923
Primary cloned fragments
934
Secondary cloned fragments
914
Computing device
926
Primary cloned fragments
937
Secondary cloned fragments
912
Computing device
924
Primary cloned fragments
935
Secondary cloned fragments
913
Computing device
925
Primary cloned fragments
936
Secondary cloned fragments

FIG. 9

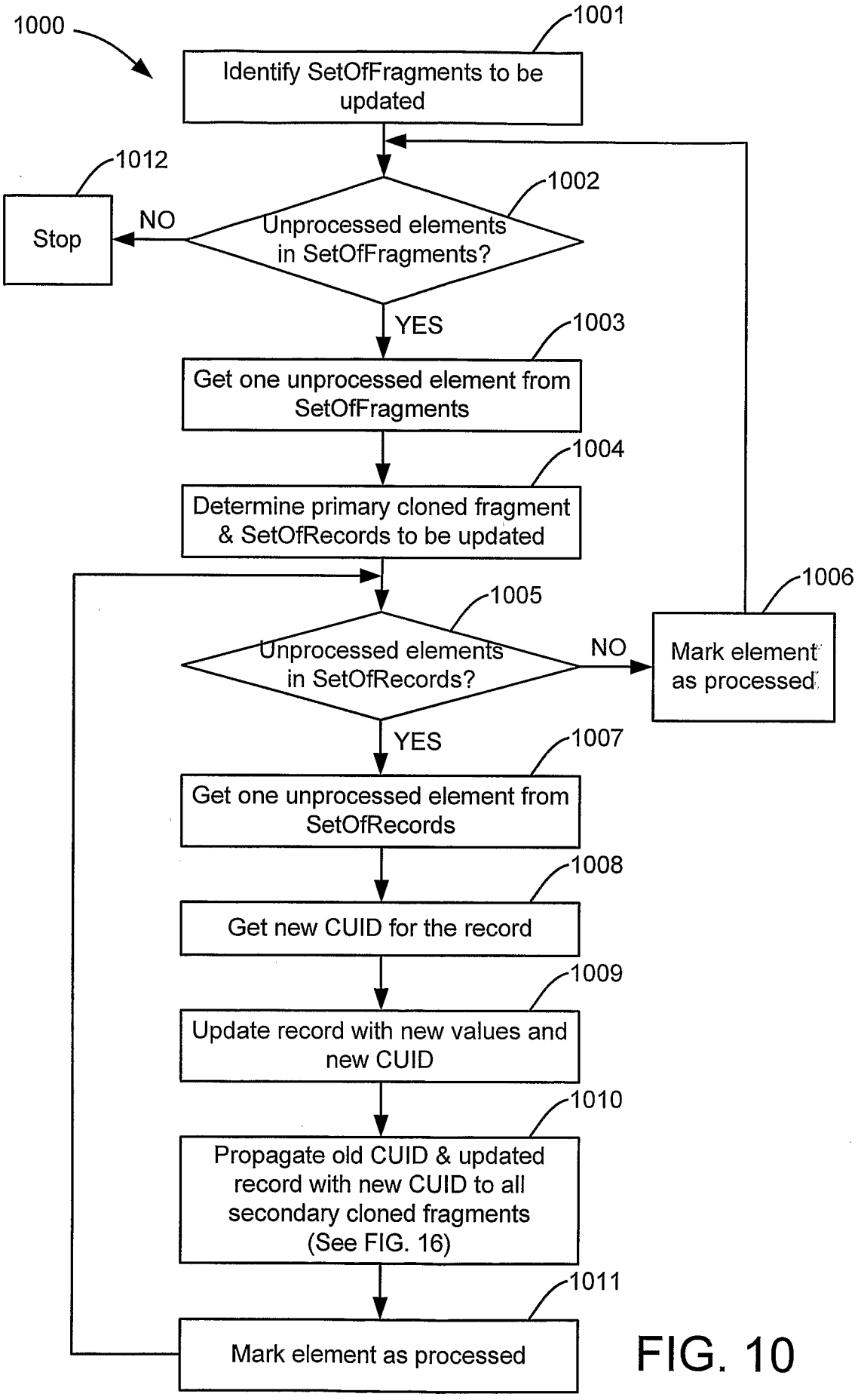

1000
1001
Identify SetOfFragments to be updated
1012
Stop
NO
1002
Unprocessed elements in SetOfFragments?
YES
1003
Get one unprocessed element from SetOfFragments
1004
Determine primary cloned fragment & SetOfRecords to be updated
1005
Unprocessed elements in SetOfRecords?
NO
1006
Mark element as processed
YES
1007
Get one unprocessed element from SetOfRecords
1008
Get new CUID for the record
1009
Update record with new values and new CUID
1010
Propagate old CUID & updated record with new CUID to all secondary cloned fragments (See FIG. 16)
1011
Mark element as processed

FIG. 10

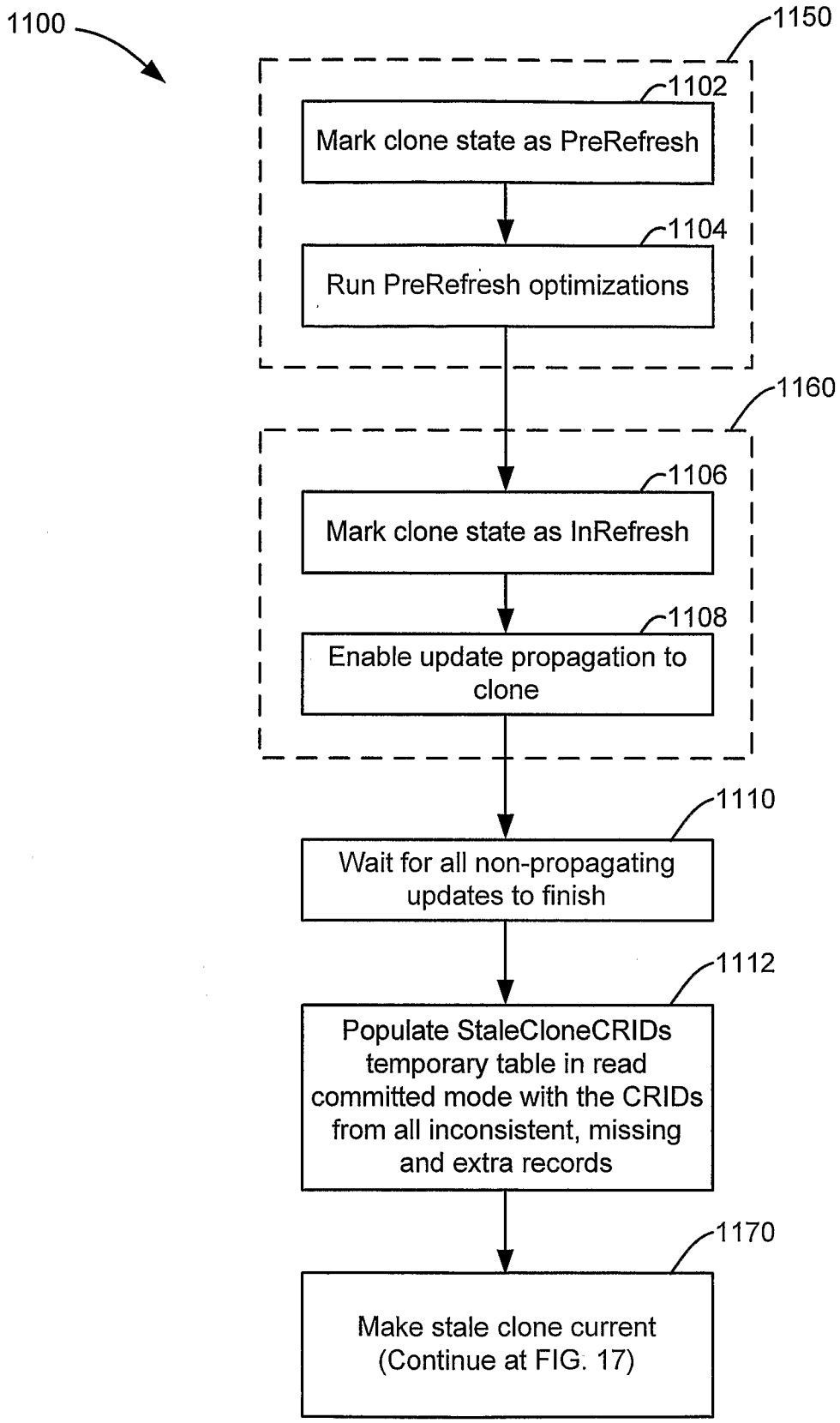

1100
1150
1102
Mark clone state as PreRefresh
1104
Run PreRefresh optimizations
1160
1106
Mark clone state as InRefresh
1108
Enable update propagation to clone
1110
Wait for all non-propagating updates to finish
1112
Populate StaleCloneCRIDs temporary table in read committed mode with the CRIDs from all inconsistent, missing and extra records
1170
Make stale clone current
(Continue at FIG. 17)

FIG. 11

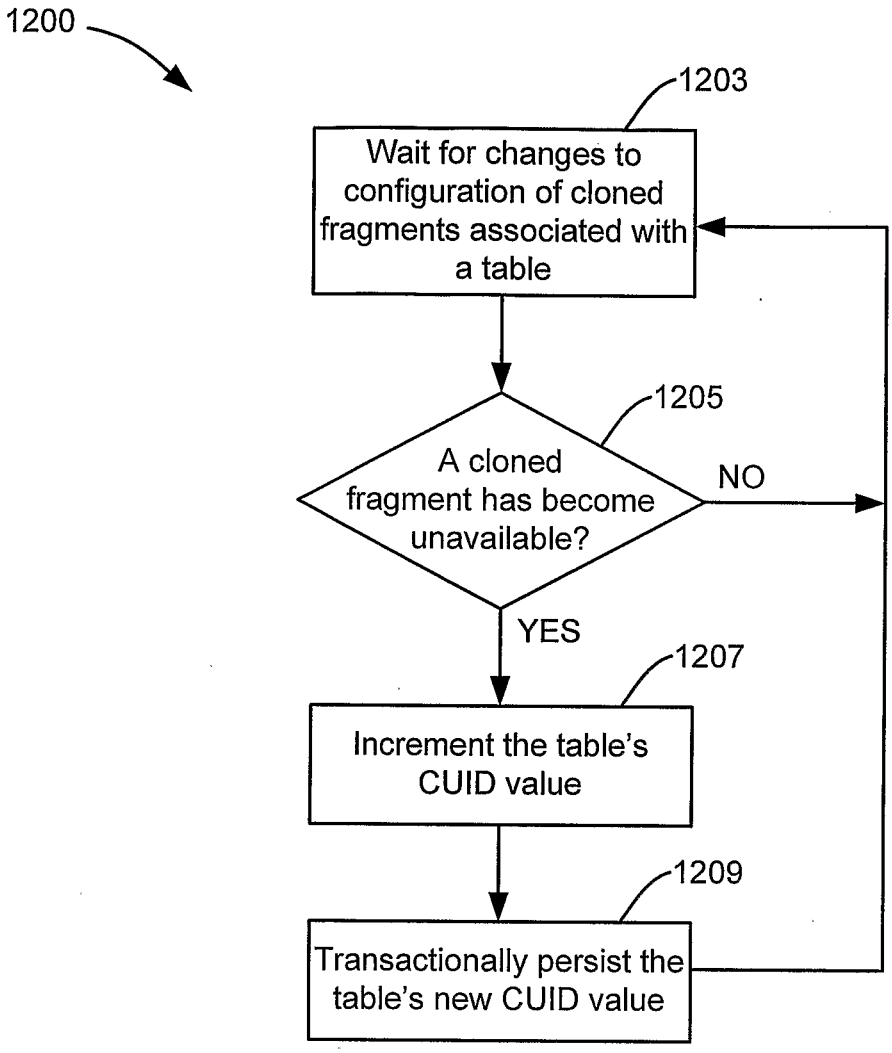

1200
1203
Wait for changes to configuration of cloned fragments associated with a table
1205
A cloned fragment has become unavailable?
NO
YES
1207
Increment the table's CUID value
1209
Transactionally persist the table's new CUID value

FIG. 12

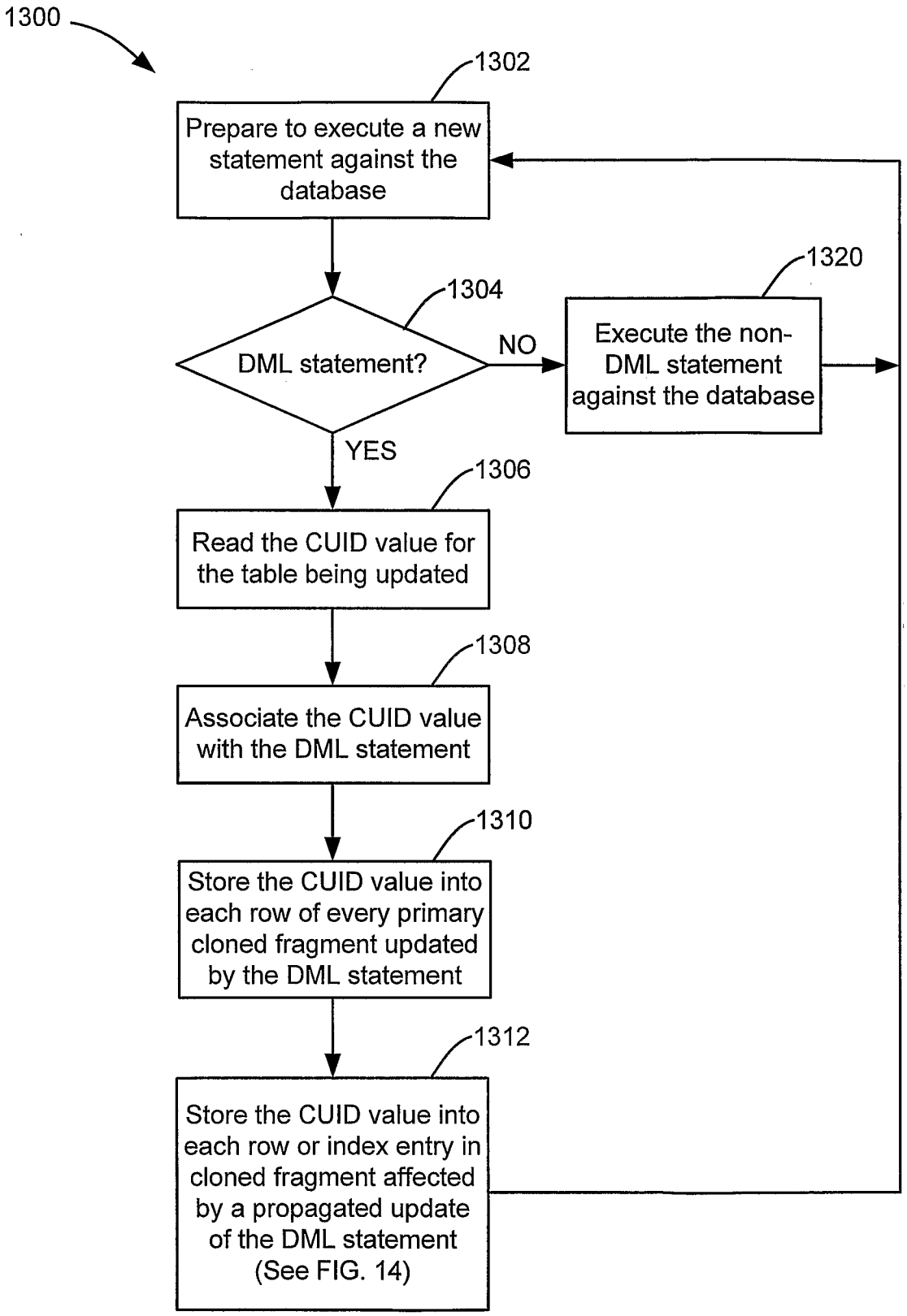

1300
1302
Prepare to execute a new statement against the database
1304
DML statement?
NO
1320
Execute the non-DML statement against the database
YES
1306
Read the CUID value for the table being updated
1308
Associate the CUID value with the DML statement
1310
Store the CUID value into each row of every primary cloned fragment updated by the DML statement
1312
Store the CUID value into each row or index entry in cloned fragment affected by a propagated update of the DML statement (See FIG. 14)

FIG. 13

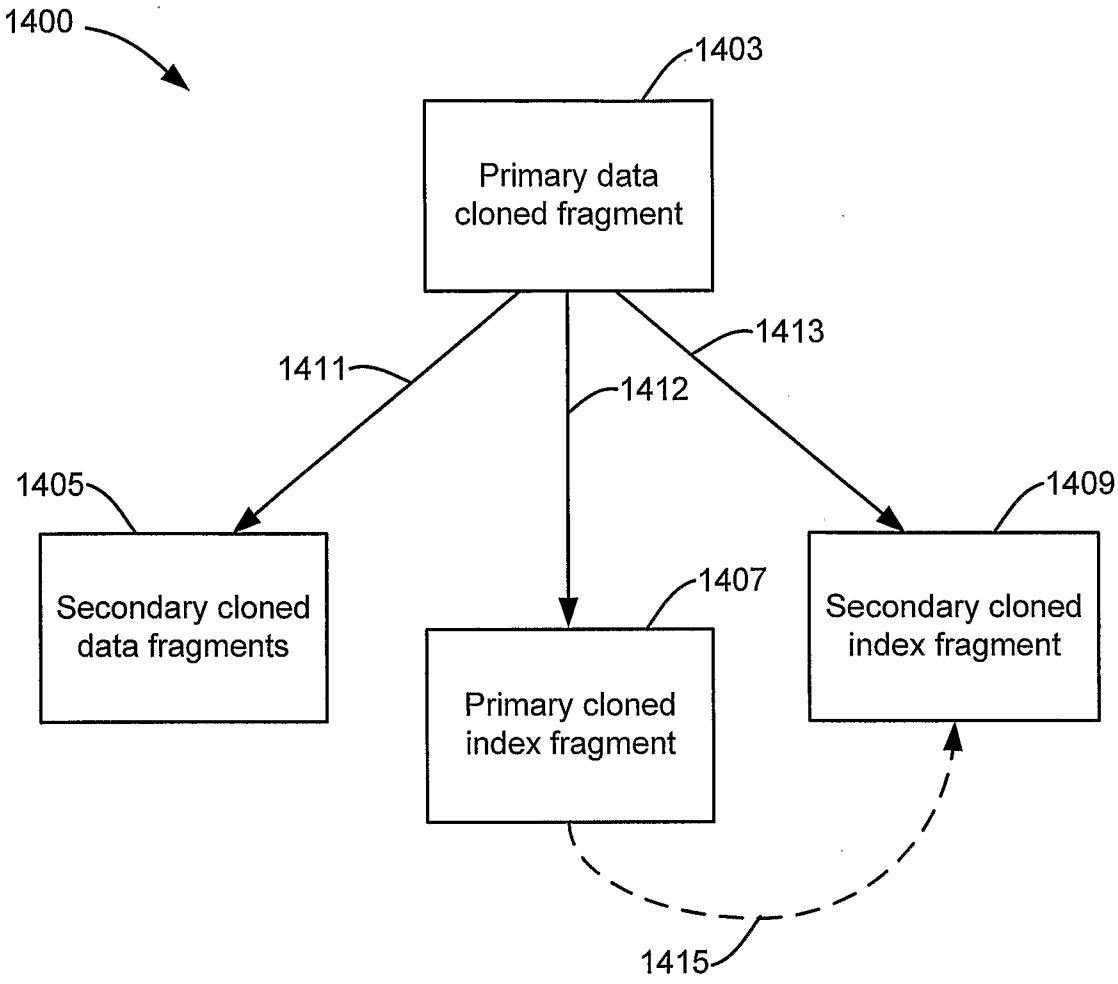

1400
1403
Primary data cloned fragment
1411
1412
1413
1405
Secondary cloned data fragments
1407
Primary cloned index fragment
1409
Secondary cloned index fragment
1415

FIG. 14

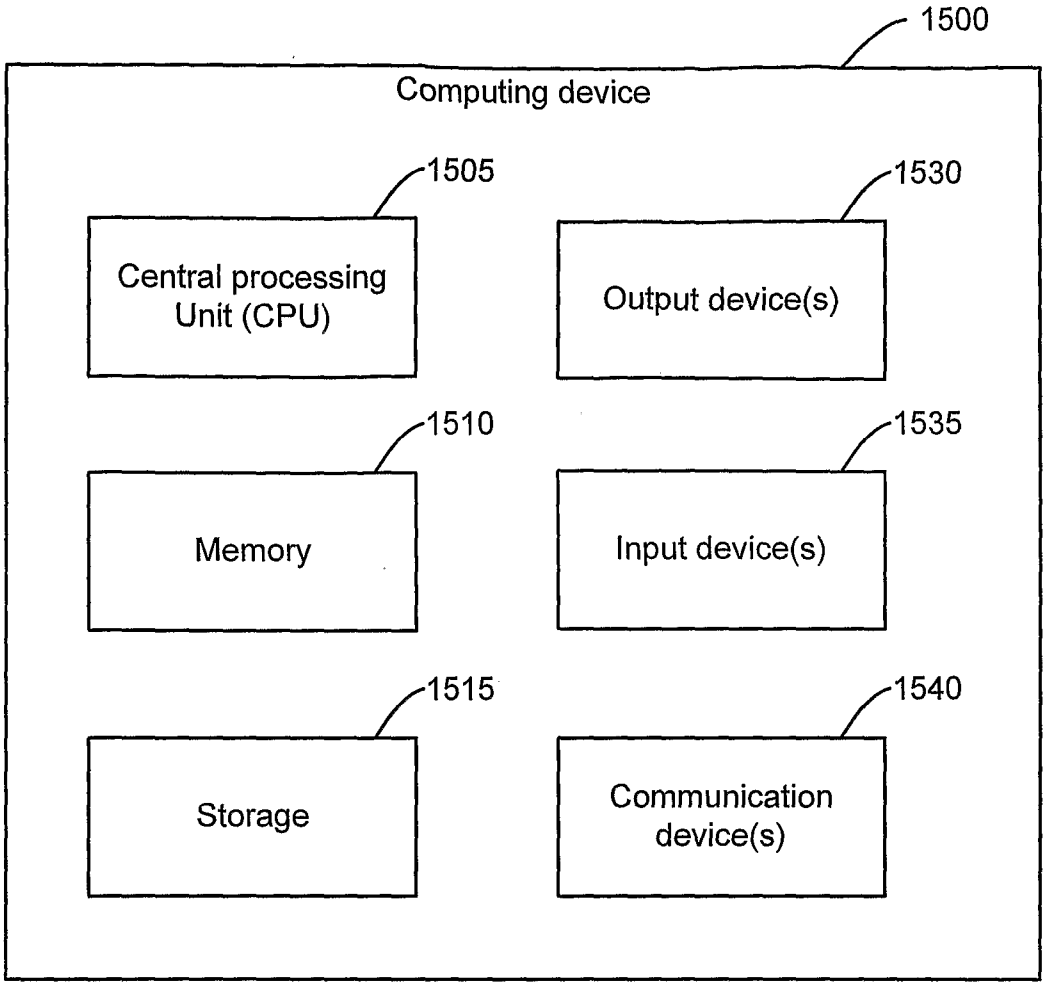

1500
Computing device
1505
Central processing Unit (CPU)
1530
Output device(s)
1510
Memory
1535
Input device(s)
1515
Storage
1540
Communication device(s)

FIG. 15

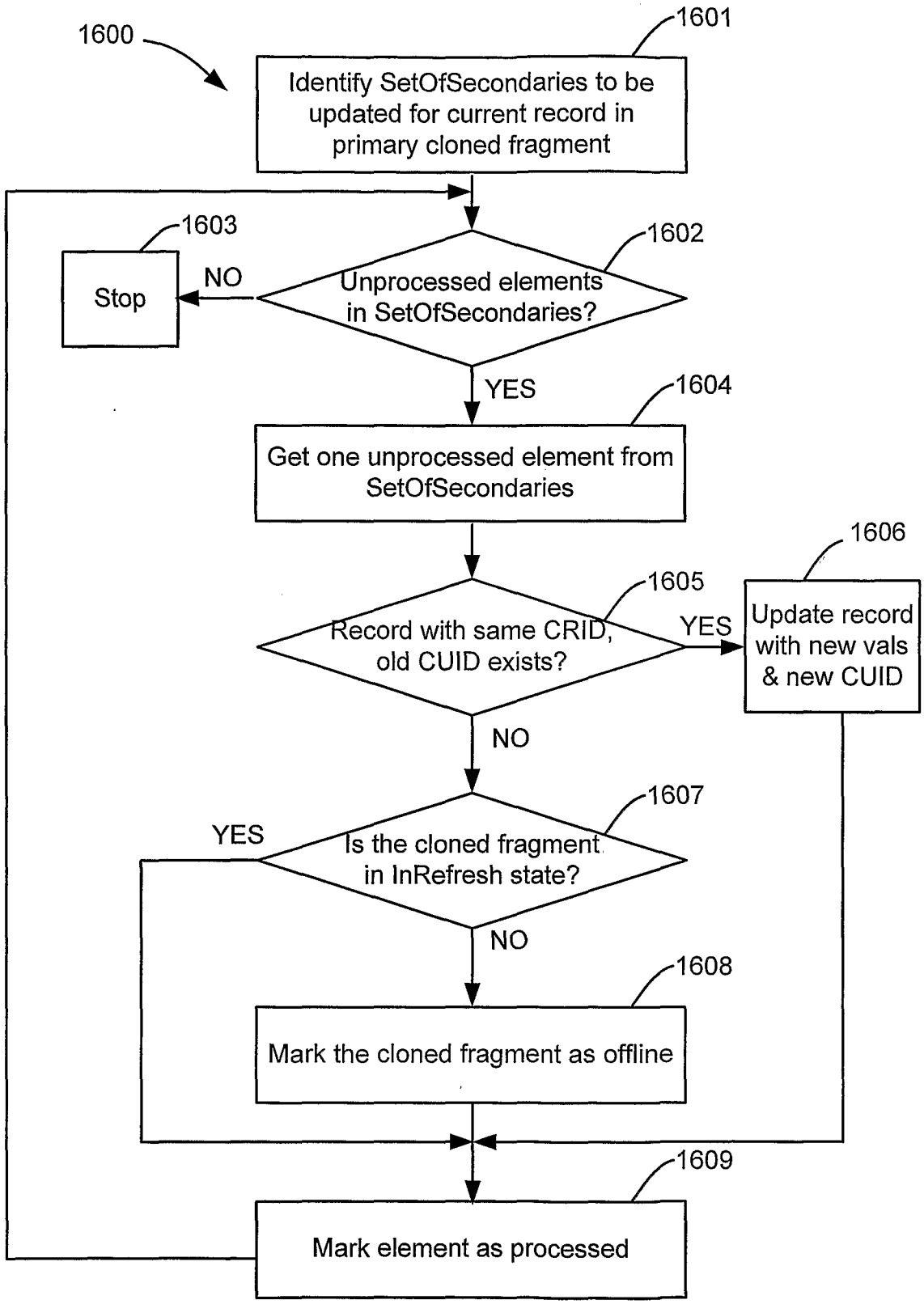

1600
1601
Identify SetOfSecondaries to be updated for current record in primary cloned fragment
1602
Unprocessed elements in SetOfSecondaries?
NO
1603
Stop
YES
1604
Get one unprocessed element from SetOfSecondaries
1605
Record with same CRID, old CUID exists?
YES
1606
Update record with new vals & new CUID
NO
1607
Is the cloned fragment in InRefresh state?
YES
NO
1608
Mark the cloned fragment as offline
1609
Mark element as processed

FIG. 16

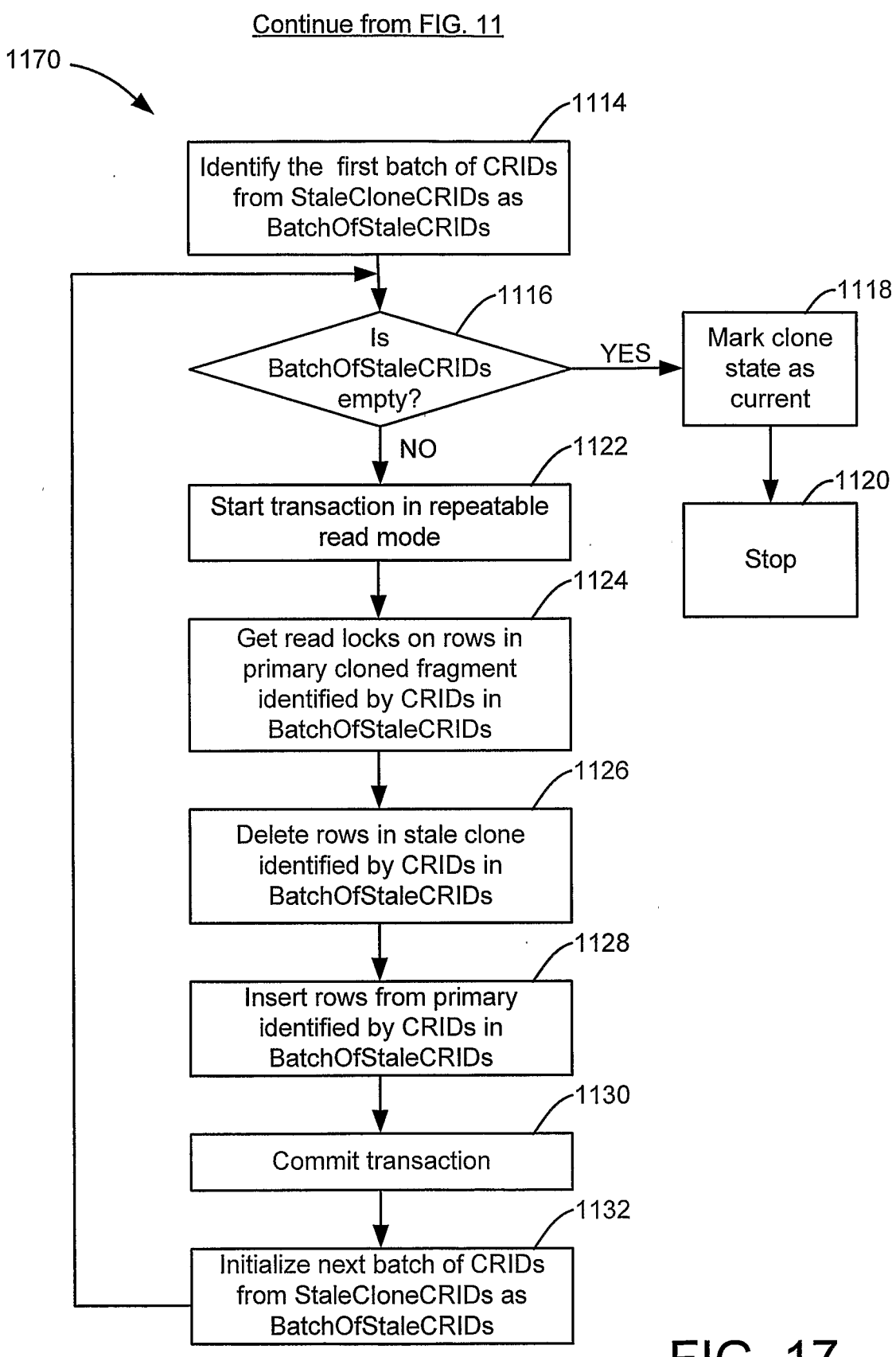

Continue from FIG. 11
1170
1114
Identify the first batch of CRIDs from StaleCloneCRIDs as BatchOfStaleCRIDs
1116
Is BatchOfStaleCRIDs empty?
YES
1118
Mark clone state as current
NO
1122
Start transaction in repeatable read mode
1120
Stop
1124
Get read locks on rows in primary cloned fragment identified by CRIDs in BatchOfStaleCRIDs
1126
Delete rows in stale clone identified by CRIDs in BatchOfStaleCRIDs
1128
Insert rows from primary identified by CRIDs in BatchOfStaleCRIDs
1130
Commit transaction
1132
Initialize next batch of CRIDs from StaleCloneCRIDs as BatchOfStaleCRIDs

FIG. 17