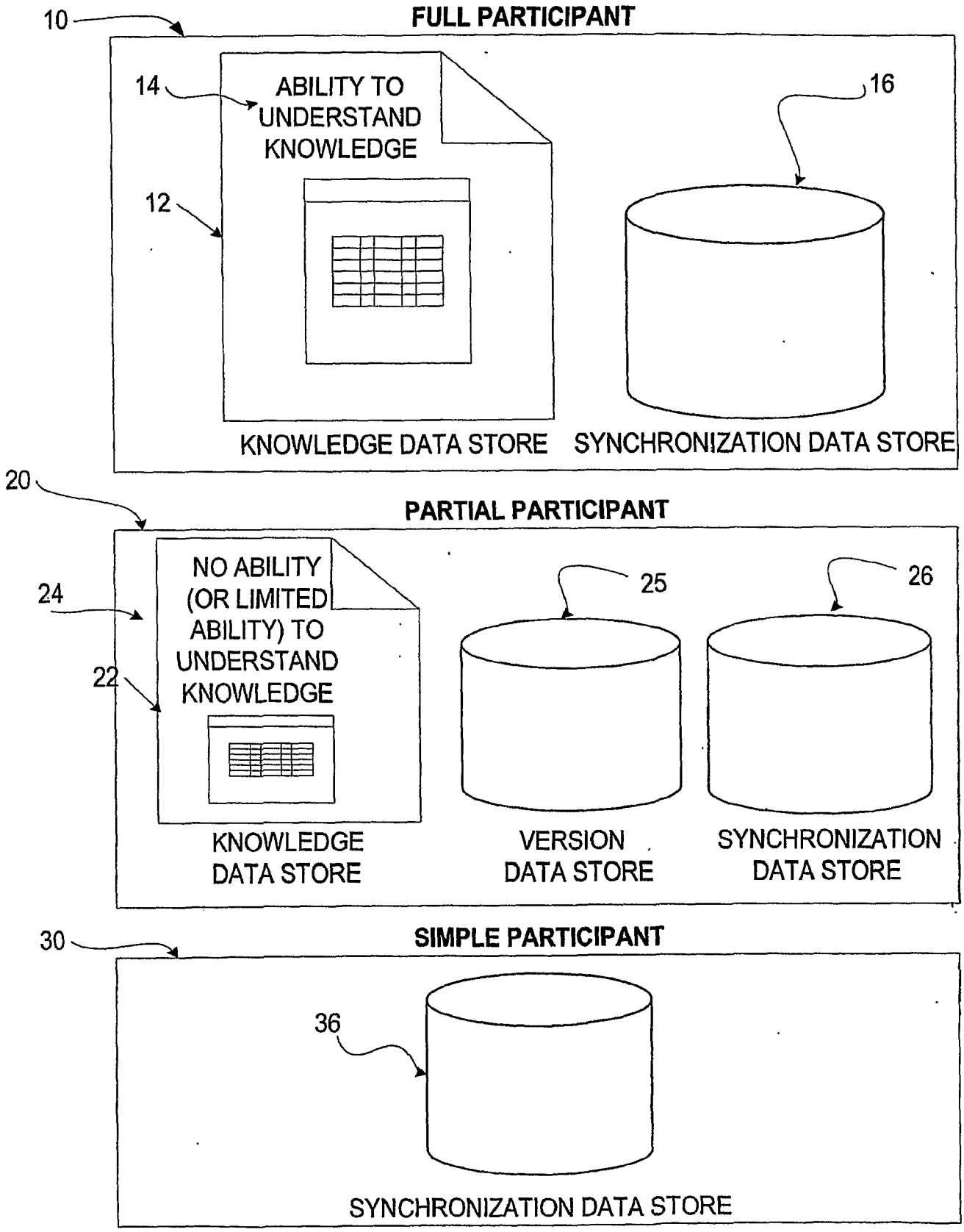

10
FULL PARTICIPANT
14
ABILITY TO UNDERSTAND KNOWLEDGE
12
16
KNOWLEDGE DATA STORE
SYNCHRONIZATION DATA STORE
20
PARTIAL PARTICIPANT
24
NO ABILITY (OR LIMITED ABILITY) TO UNDERSTAND KNOWLEDGE
22
25
26
KNOWLEDGE DATA STORE
VERSION DATA STORE
SYNCHRONIZATION DATA STORE
30
SIMPLE PARTICIPANT
36
SYNCHRONIZATION DATA STORE

FIG. 1

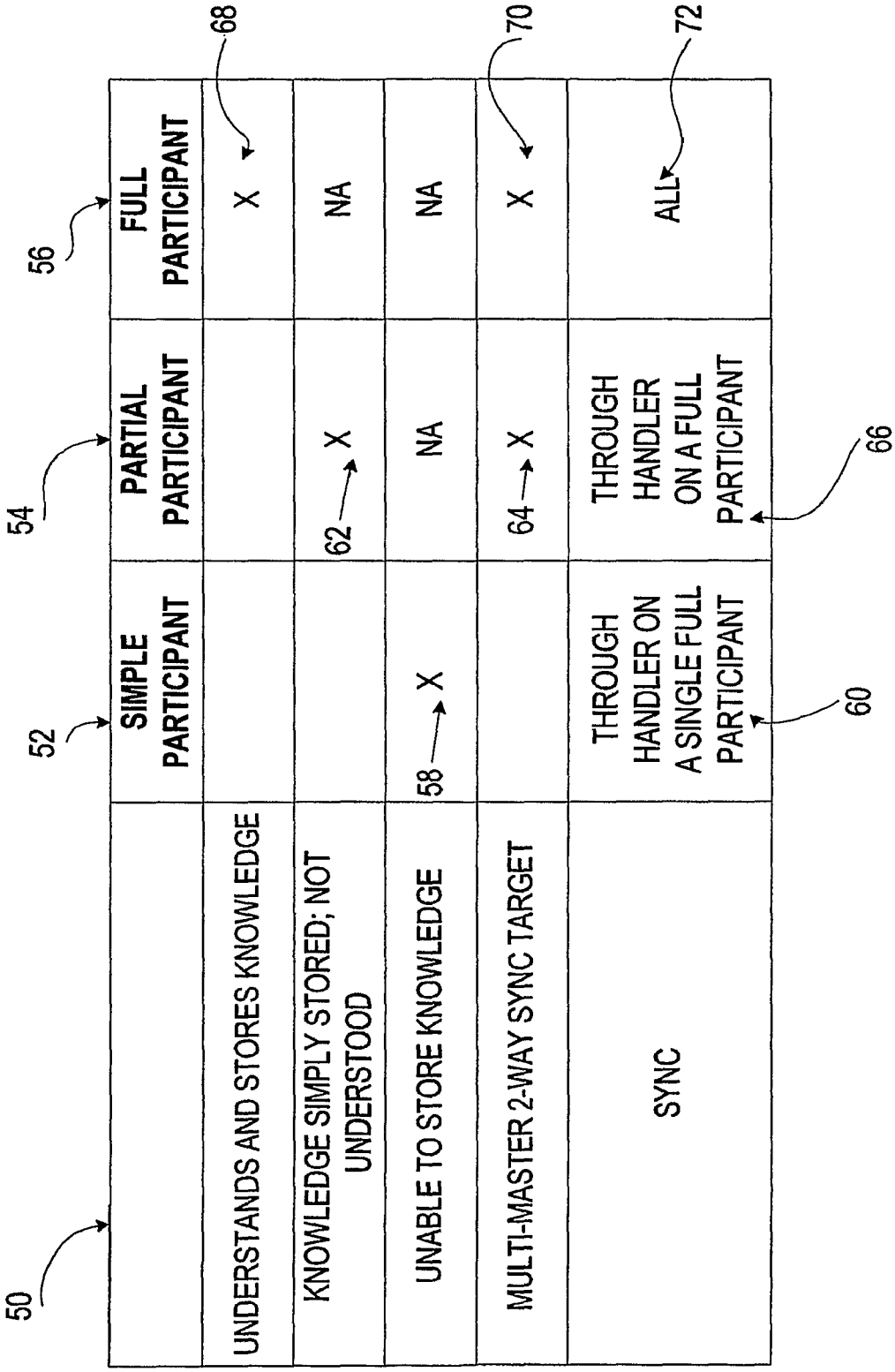

50
52
54
56
SIMPLE PARTICIPANT
PARTIAL PARTICIPANT
FULL PARTICIPANT
UNDERSTANDS AND STORES KNOWLEDGE
X
68
KNOWLEDGE SIMPLY STORED; NOT UNDERSTOOD
62
X
NA
UNABLE TO STORE KNOWLEDGE
58
X
NA
NA
MULTI-MASTER 2-WAY SYNC TARGET
64
X
X
70
SYNC
THROUGH HANDLER ON A SINGLE FULL PARTICIPANT
60
THROUGH HANDLER ON A FULL PARTICIPANT
66
ALL
72

FIG. 2

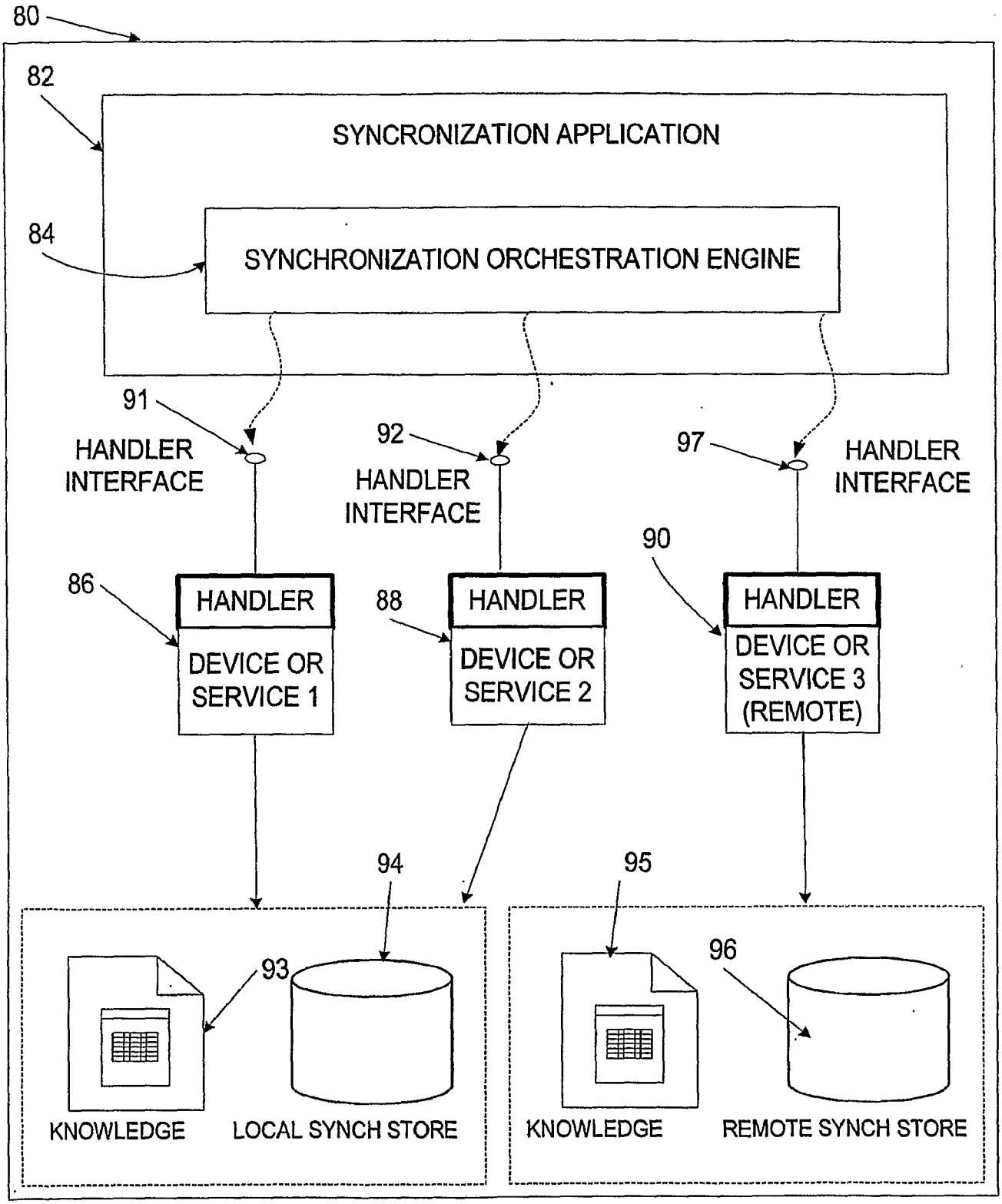

80
82
SYNCRONIZATION APPLICATION
84
SYNCHRONIZATION ORCHESTRATION ENGINE
91
HANDLER INTERFACE
92
HANDLER INTERFACE
97
HANDLER INTERFACE
90
86
HANDLER
DEVICE OR SERVICE 1
88
HANDLER
DEVICE OR SERVICE 2
HANDLER
DEVICE OR SERVICE 3 (REMOTE)
94
95
93
96
KNOWLEDGE
LOCAL SYNCH STORE
KNOWLEDGE
REMOTE SYNCH STORE

FIG. 3

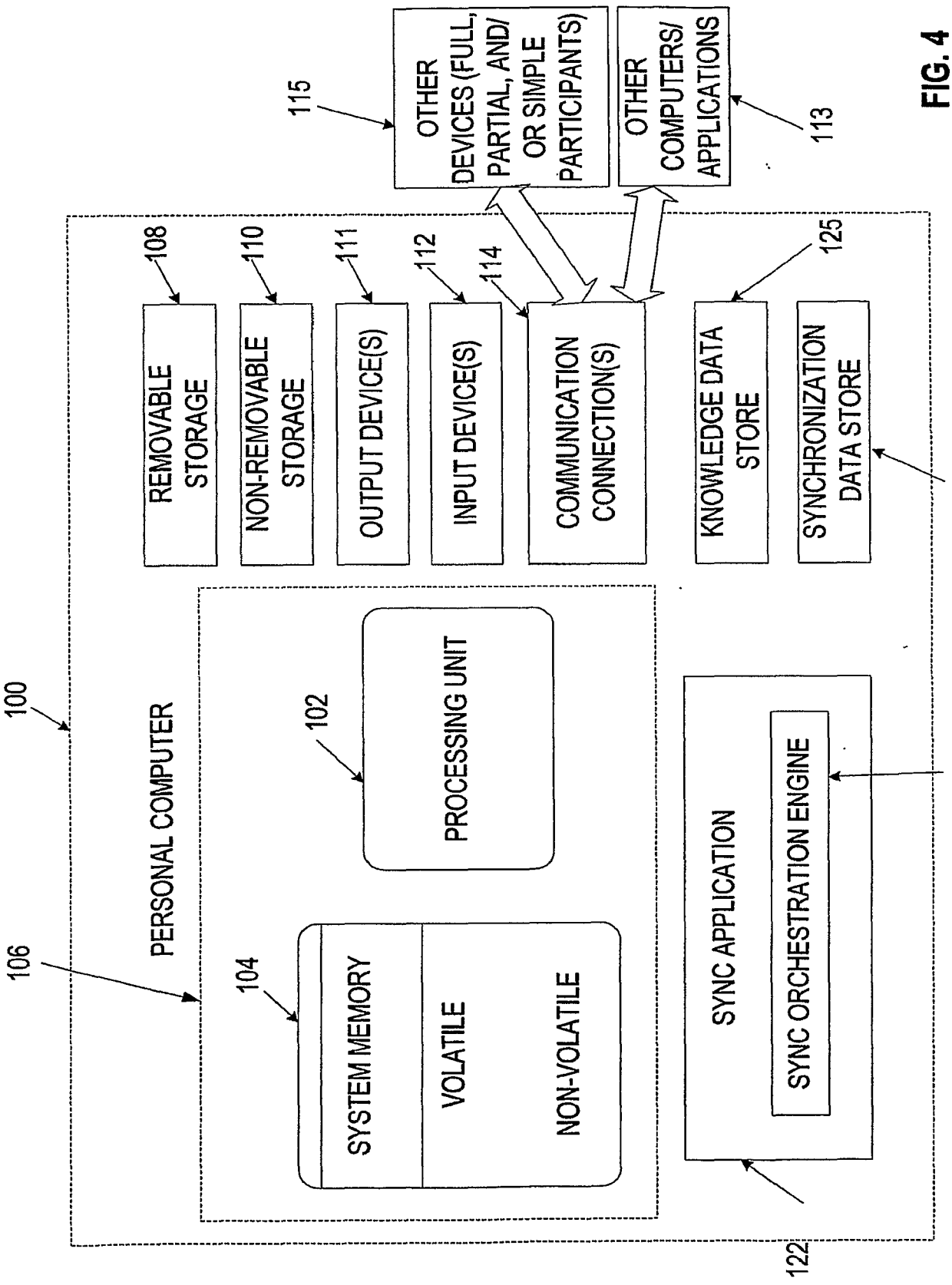

100
PERSONAL COMPUTER
106
104
SYSTEM MEMORY
VOLATILE
NON-VOLATILE
102
PROCESSING UNIT
108
REMOVABLE STORAGE
110
NON-REMOVABLE STORAGE
111
OUTPUT DEVICE(S)
112
INPUT DEVICE(S)
114
COMMUNICATION CONNECTION(S)
125
KNOWLEDGE DATA STORE
SYNCHRONIZATION DATA STORE
126
SYNC APPLICATION
SYNC ORCHESTRATION ENGINE
124
122
115
OTHER DEVICES (FULL, PARTIAL, AND/ OR SIMPLE PARTICIPANTS)
OTHER COMPUTERS/ APPLICATIONS
113

FIG. 4

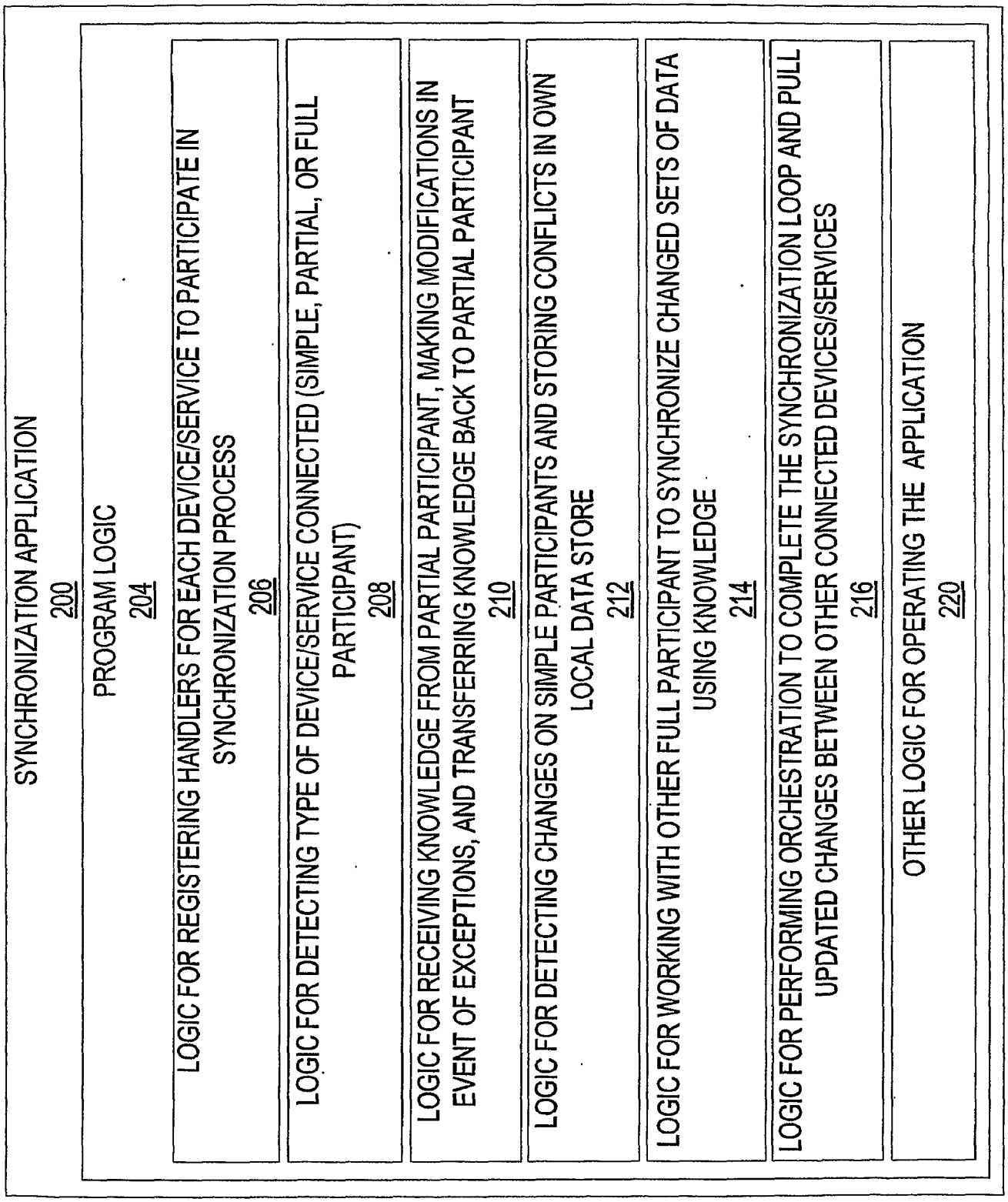

SYNCHRONIZATION APPLICATION
200
PROGRAM LOGIC
204
LOGIC FOR REGISTERING HANDLERS FOR EACH DEVICE/SERVICE TO PARTICIPATE IN SYNCHRONIZATION PROCESS
206
LOGIC FOR DETECTING TYPE OF DEVICE/SERVICE CONNECTED (SIMPLE, PARTIAL, OR FULL PARTICIPANT)
208
LOGIC FOR RECEIVING KNOWLEDGE FROM PARTIAL PARTICIPANT, MAKING MODIFICATIONS IN EVENT OF EXCEPTIONS, AND TRANSFERRING KNOWLEDGE BACK TO PARTIAL PARTICIPANT
210
LOGIC FOR DETECTING CHANGES ON SIMPLE PARTICIPANTS AND STORING CONFLICTS IN OWN LOCAL DATA STORE
212
LOGIC FOR WORKING WITH OTHER FULL PARTICIPANT TO SYNCHRONIZE CHANGED SETS OF DATA USING KNOWLEDGE
214
LOGIC FOR PERFORMING ORCHESTRATION TO COMPLETE THE SYNCHRONIZATION LOOP AND PULL UPDATED CHANGES BETWEEN OTHER CONNECTED DEVICES/SERVICES
216
OTHER LOGIC FOR OPERATING THE APPLICATION
220

FIG. 5

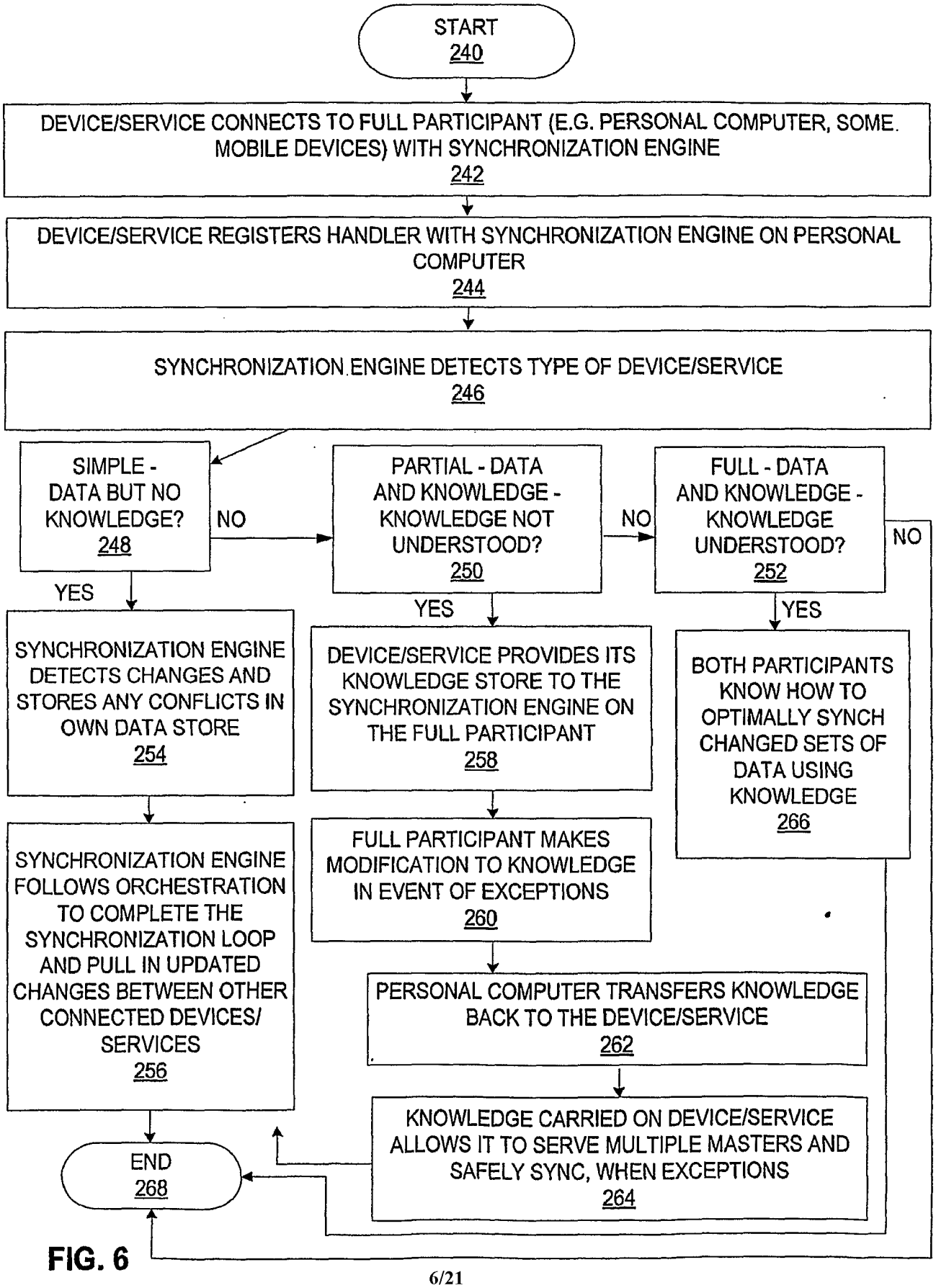

START
240
DEVICE/SERVICE CONNECTS TO FULL PARTICIPANT (E.G. PERSONAL COMPUTER, SOME MOBILE DEVICES) WITH SYNCHRONIZATION ENGINE
242
DEVICE/SERVICE REGISTERS HANDLER WITH SYNCHRONIZATION ENGINE ON PERSONAL COMPUTER
244
SYNCHRONIZATION ENGINE DETECTS TYPE OF DEVICE/SERVICE
246
SIMPLE - DATA BUT NO KNOWLEDGE?
248
NO
PARTIAL - DATA AND KNOWLEDGE - KNOWLEDGE NOT UNDERSTOOD?
250
NO
FULL - DATA AND KNOWLEDGE - KNOWLEDGE UNDERSTOOD?
252
NO
YES
YES
YES
SYNCHRONIZATION ENGINE DETECTS CHANGES AND STORES ANY CONFLICTS IN OWN DATA STORE
254
DEVICE/SERVICE PROVIDES ITS KNOWLEDGE STORE TO THE SYNCHRONIZATION ENGINE ON THE FULL PARTICIPANT
258
BOTH PARTICIPANTS KNOW HOW TO OPTIMALLY SYNCH CHANGED SETS OF DATA USING KNOWLEDGE
266
SYNCHRONIZATION ENGINE FOLLOWS ORCHESTRATION TO COMPLETE THE SYNCHRONIZATION LOOP AND PULL IN UPDATED CHANGES BETWEEN OTHER CONNECTED DEVICES/ SERVICES
256
FULL PARTICIPANT MAKES MODIFICATION TO KNOWLEDGE IN EVENT OF EXCEPTIONS
260
PERSONAL COMPUTER TRANSFERS KNOWLEDGE BACK TO THE DEVICE/SERVICE
262
KNOWLEDGE CARRIED ON DEVICE/SERVICE ALLOWS IT TO SERVE MULTIPLE MASTERS AND SAFELY SYNC, WHEN EXCEPTIONS
264
END
268

FIG. 6

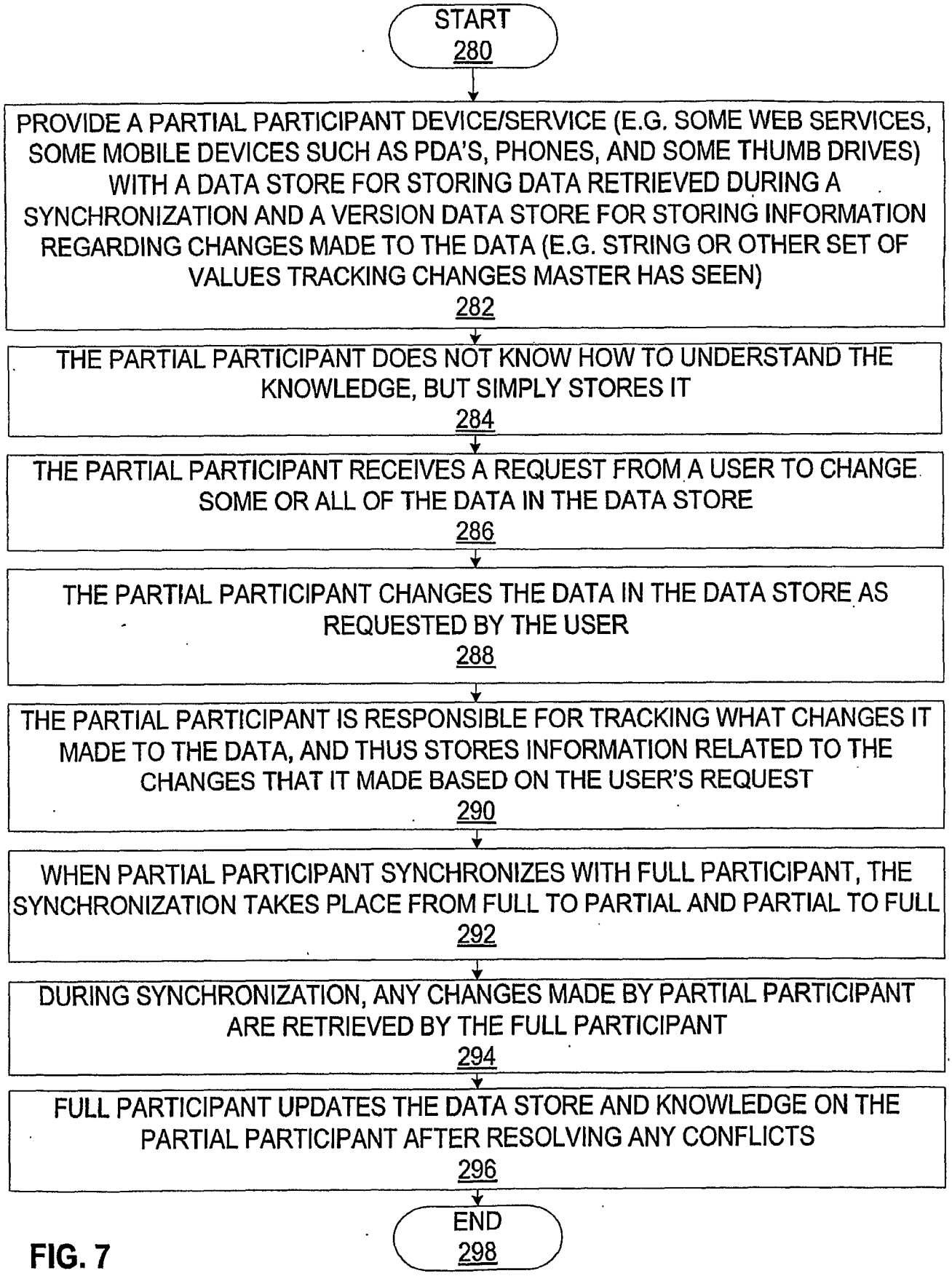

START
280
PROVIDE A PARTIAL PARTICIPANT DEVICE/SERVICE (E.G. SOME WEB SERVICES, SOME MOBILE DEVICES SUCH AS PDA'S, PHONES, AND SOME THUMB DRIVES) WITH A DATA STORE FOR STORING DATA RETRIEVED DURING A SYNCHRONIZATION AND A VERSION DATA STORE FOR STORING INFORMATION REGARDING CHANGES MADE TO THE DATA (E.G. STRING OR OTHER SET OF VALUES TRACKING CHANGES MASTER HAS SEEN)
282
THE PARTIAL PARTICIPANT DOES NOT KNOW HOW TO UNDERSTAND THE KNOWLEDGE, BUT SIMPLY STORES IT
284
THE PARTIAL PARTICIPANT RECEIVES A REQUEST FROM A USER TO CHANGE SOME OR ALL OF THE DATA IN THE DATA STORE
286
THE PARTIAL PARTICIPANT CHANGES THE DATA IN THE DATA STORE AS REQUESTED BY THE USER
288
THE PARTIAL PARTICIPANT IS RESPONSIBLE FOR TRACKING WHAT CHANGES IT MADE TO THE DATA, AND THUS STORES INFORMATION RELATED TO THE CHANGES THAT IT MADE BASED ON THE USER'S REQUEST
290
WHEN PARTIAL PARTICIPANT SYNCHRONIZES WITH FULL PARTICIPANT, THE SYNCHRONIZATION TAKES PLACE FROM FULL TO PARTIAL AND PARTIAL TO FULL
292
DURING SYNCHRONIZATION, ANY CHANGES MADE BY PARTIAL PARTICIPANT ARE RETRIEVED BY THE FULL PARTICIPANT
294
FULL PARTICIPANT UPDATES THE DATA STORE AND KNOWLEDGE ON THE PARTIAL PARTICIPANT AFTER RESOLVING ANY CONFLICTS
296
END
298

FIG. 7

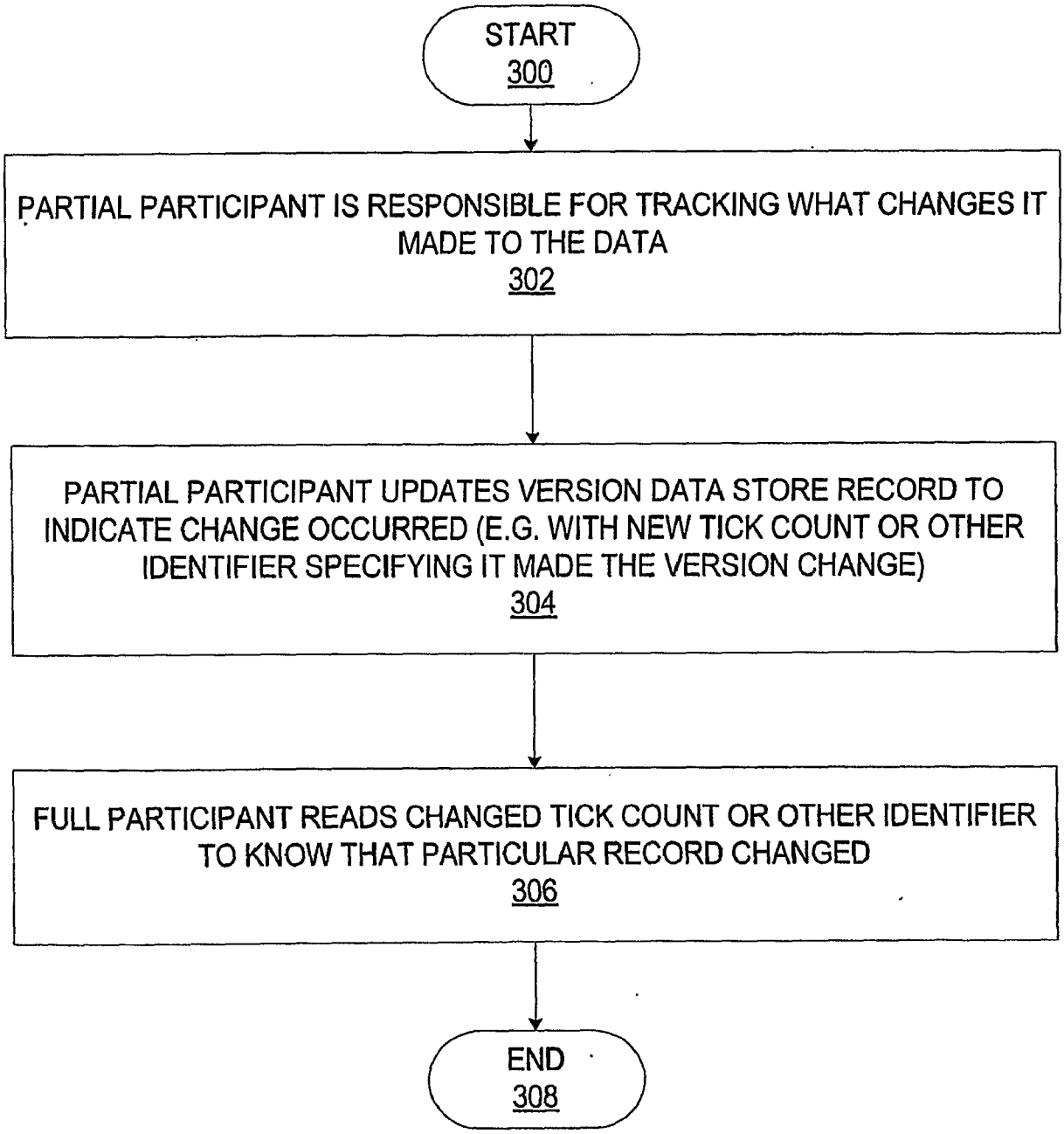

START
300
PARTIAL PARTICIPANT IS RESPONSIBLE FOR TRACKING WHAT CHANGES IT MADE TO THE DATA
302
PARTIAL PARTICIPANT UPDATES VERSION DATA STORE RECORD TO INDICATE CHANGE OCCURRED (E.G. WITH NEW TICK COUNT OR OTHER IDENTIFIER SPECIFYING IT MADE THE VERSION CHANGE)
304
FULL PARTICIPANT READS CHANGED TICK COUNT OR OTHER IDENTIFIER TO KNOW THAT PARTICULAR RECORD CHANGED
306
END
308

FIG. 8

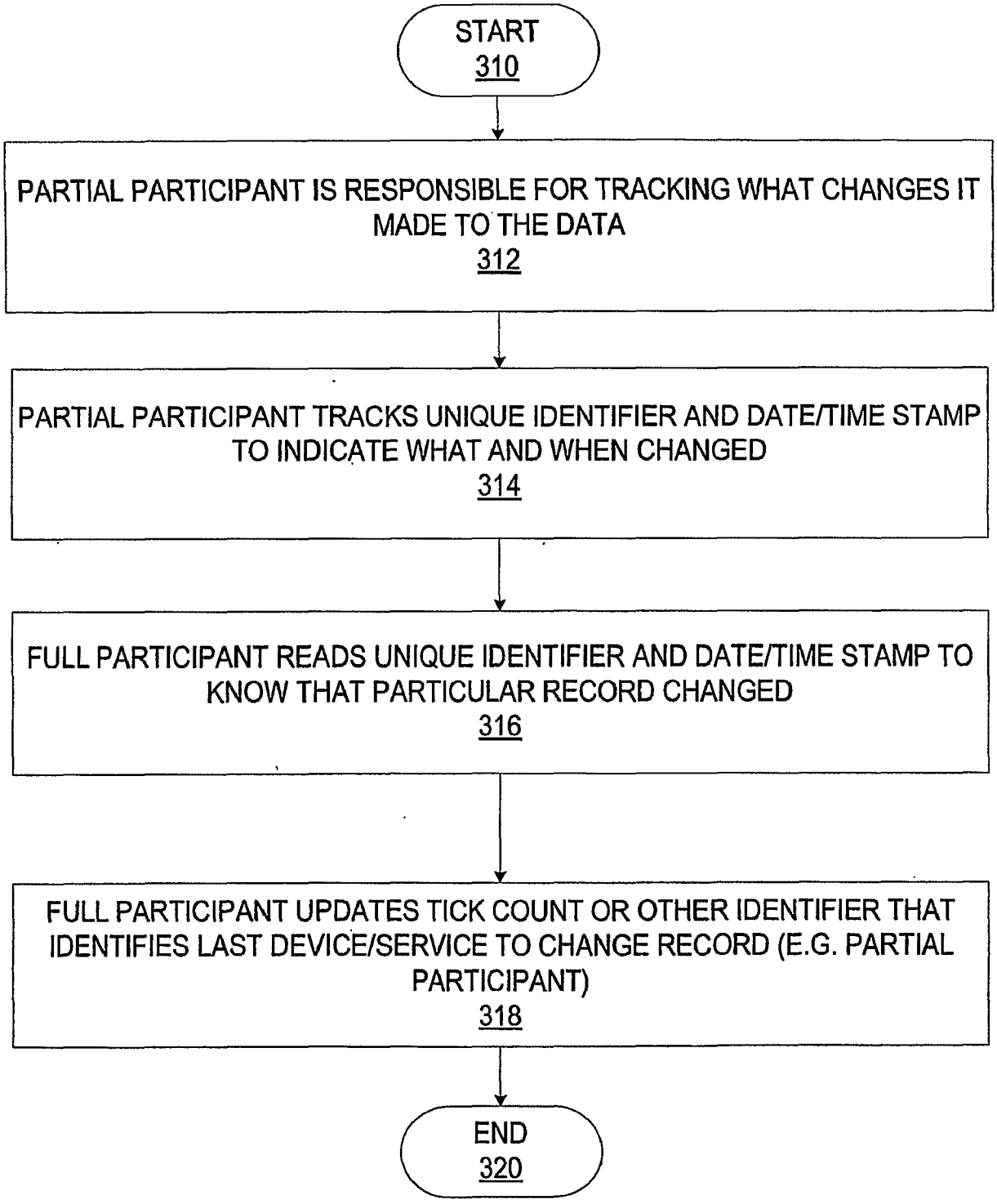

START
310
PARTIAL PARTICIPANT IS RESPONSIBLE FOR TRACKING WHAT CHANGES IT MADE TO THE DATA
312
PARTIAL PARTICIPANT TRACKS UNIQUE IDENTIFIER AND DATE/TIME STAMP TO INDICATE WHAT AND WHEN CHANGED
314
FULL PARTICIPANT READS UNIQUE IDENTIFIER AND DATE/TIME STAMP TO KNOW THAT PARTICULAR RECORD CHANGED
316
FULL PARTICIPANT UPDATES TICK COUNT OR OTHER IDENTIFIER THAT IDENTIFIES LAST DEVICE/SERVICE TO CHANGE RECORD (E.G. PARTIAL PARTICIPANT)
318
END
320

FIG. 9

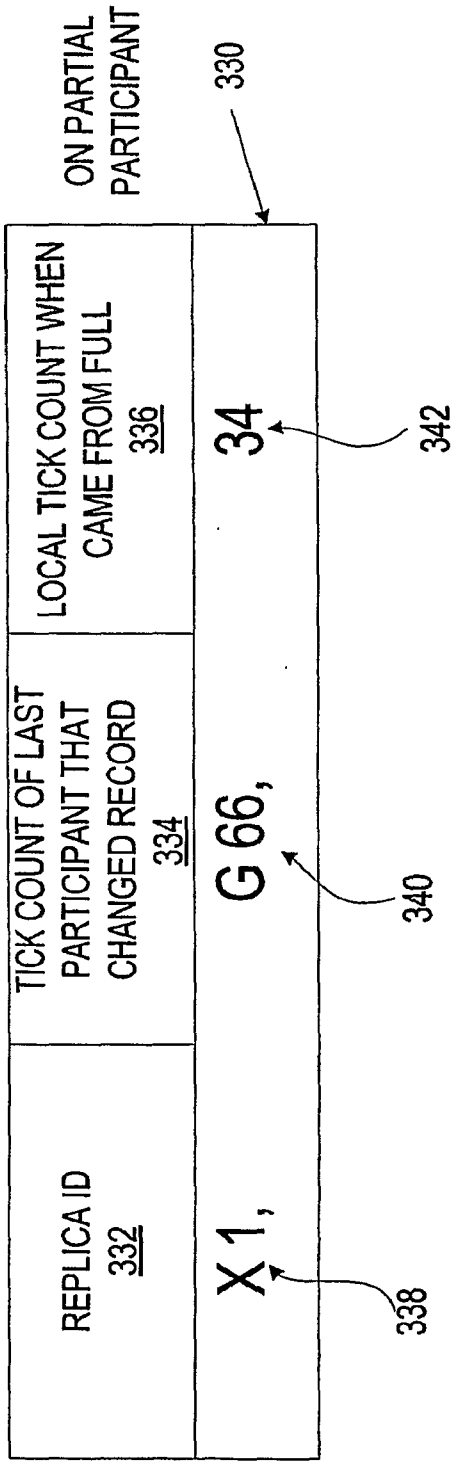

ON PARTIAL PARTICIPANT
330
REPLICA ID 332
TICK COUNT OF LAST PARTICIPANT THAT CHANGED RECORD 334
LOCAL TICK COUNT WHEN CAME FROM FULL 336
X 1,
G 66,
34
338
340
342

FIG. 10

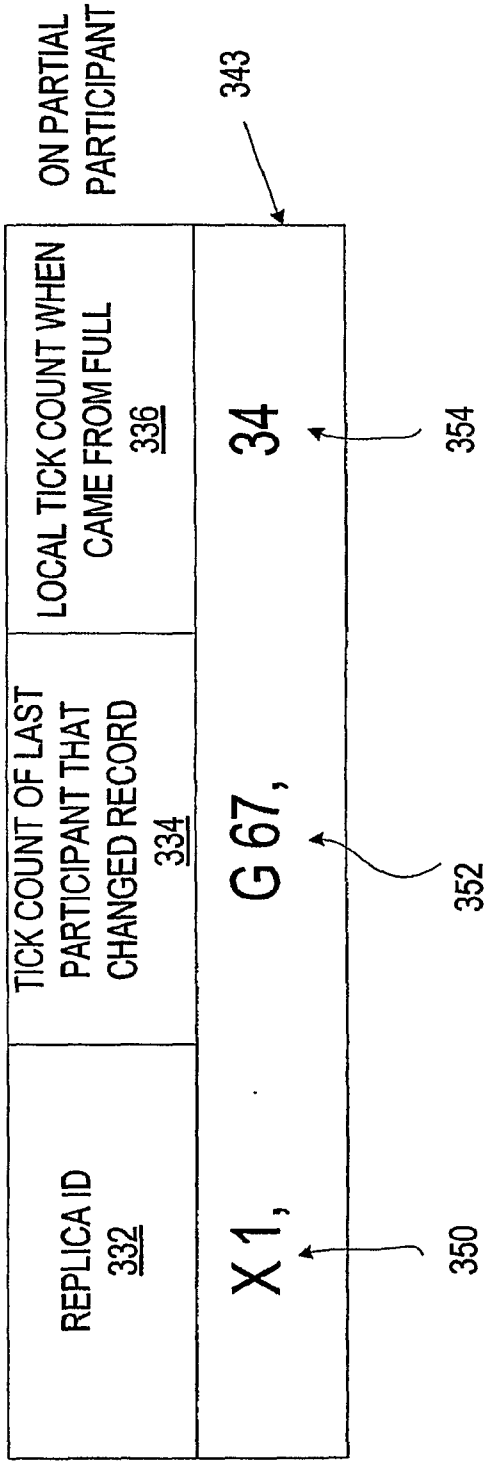

ON PARTIAL PARTICIPANT
343
REPLICA ID 332
TICK COUNT OF LAST PARTICIPANT THAT CHANGED RECORD 334
LOCAL TICK COUNT WHEN CAME FROM FULL 336
X 1,
G 67,
34
350
352
354

FIG. 11

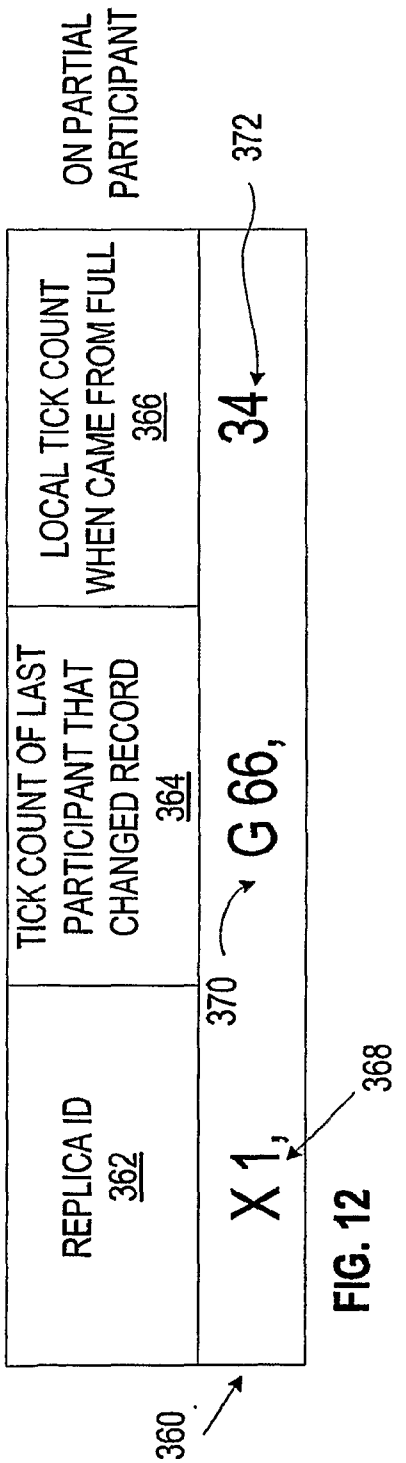


FIG. 12

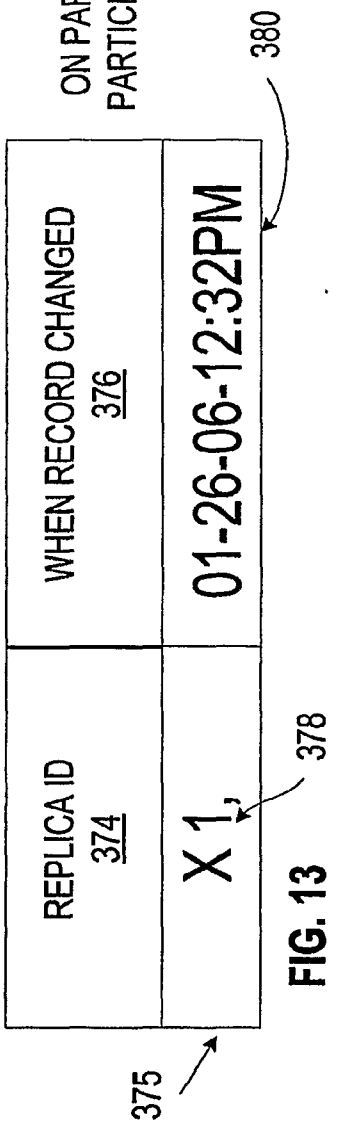


FIG. 13

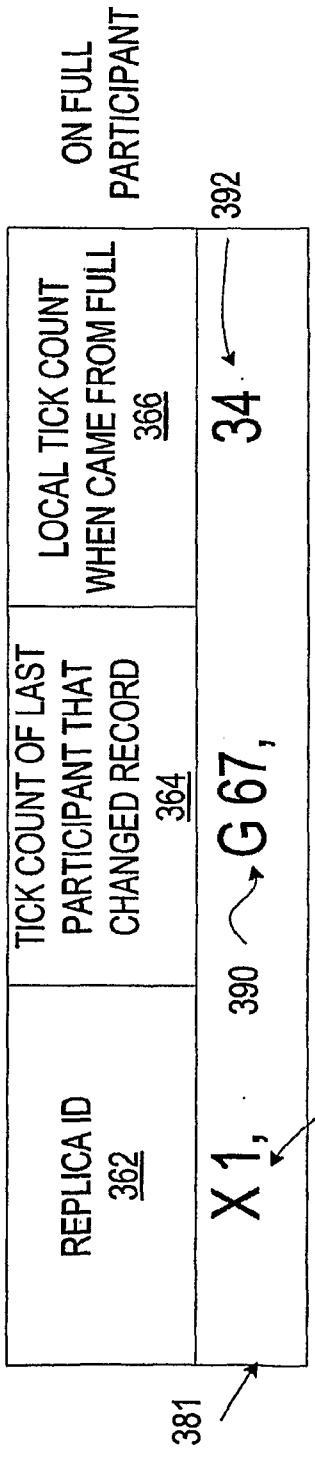


FIG. 14

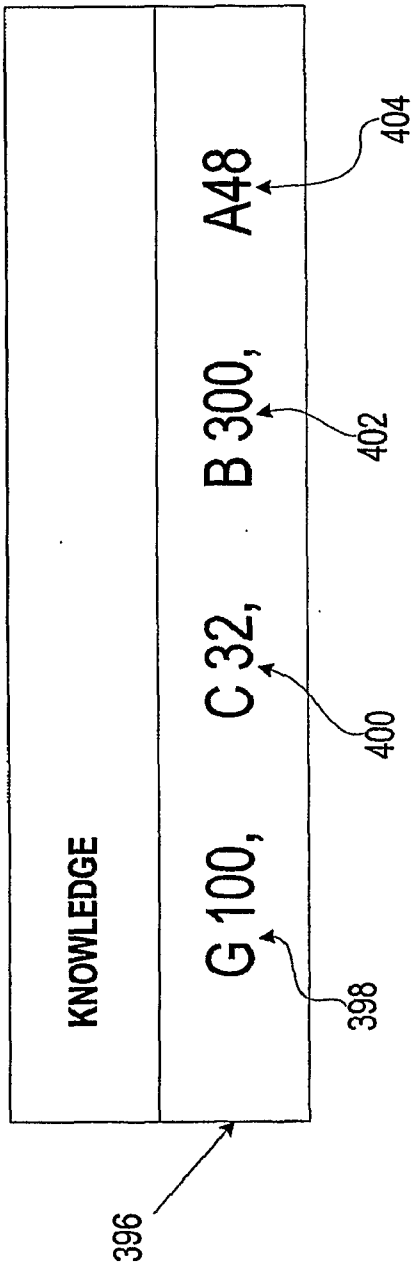


FIG. 15

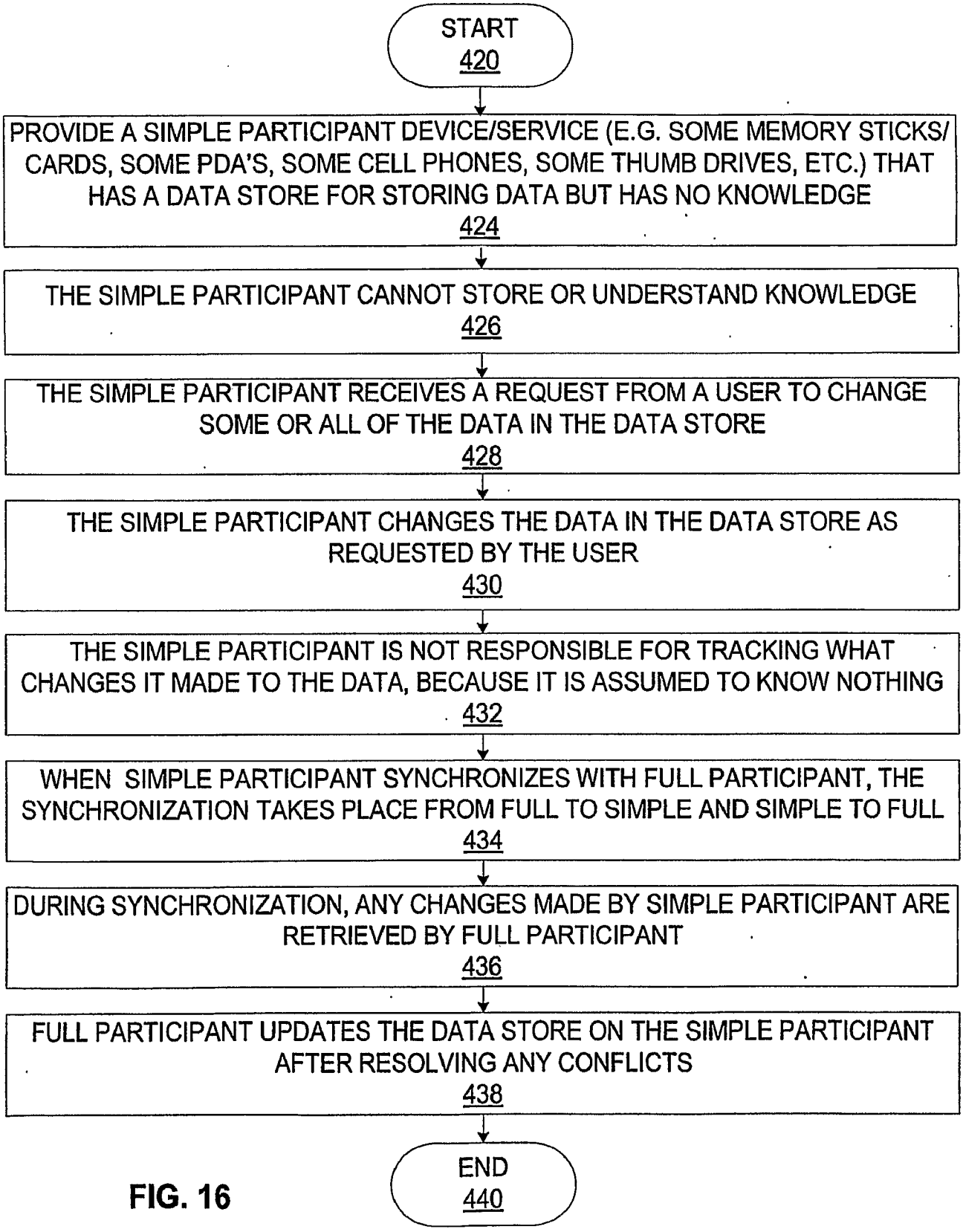

START
420
PROVIDE A SIMPLE PARTICIPANT DEVICE/SERVICE (E.G. SOME MEMORY STICKS/ CARDS, SOME PDA'S, SOME CELL PHONES, SOME THUMB DRIVES, ETC.) THAT HAS A DATA STORE FOR STORING DATA BUT HAS NO KNOWLEDGE
424
THE SIMPLE PARTICIPANT CANNOT STORE OR UNDERSTAND KNOWLEDGE
426
THE SIMPLE PARTICIPANT RECEIVES A REQUEST FROM A USER TO CHANGE SOME OR ALL OF THE DATA IN THE DATA STORE
428
THE SIMPLE PARTICIPANT CHANGES THE DATA IN THE DATA STORE AS REQUESTED BY THE USER
430
THE SIMPLE PARTICIPANT IS NOT RESPONSIBLE FOR TRACKING WHAT CHANGES IT MADE TO THE DATA, BECAUSE IT IS ASSUMED TO KNOW NOTHING
432
WHEN SIMPLE PARTICIPANT SYNCHRONIZES WITH FULL PARTICIPANT, THE SYNCHRONIZATION TAKES PLACE FROM FULL TO SIMPLE AND SIMPLE TO FULL
434
DURING SYNCHRONIZATION, ANY CHANGES MADE BY SIMPLE PARTICIPANT ARE RETRIEVED BY FULL PARTICIPANT
436
FULL PARTICIPANT UPDATES THE DATA STORE ON THE SIMPLE PARTICIPANT AFTER RESOLVING ANY CONFLICTS
438
END
440

FIG. 16

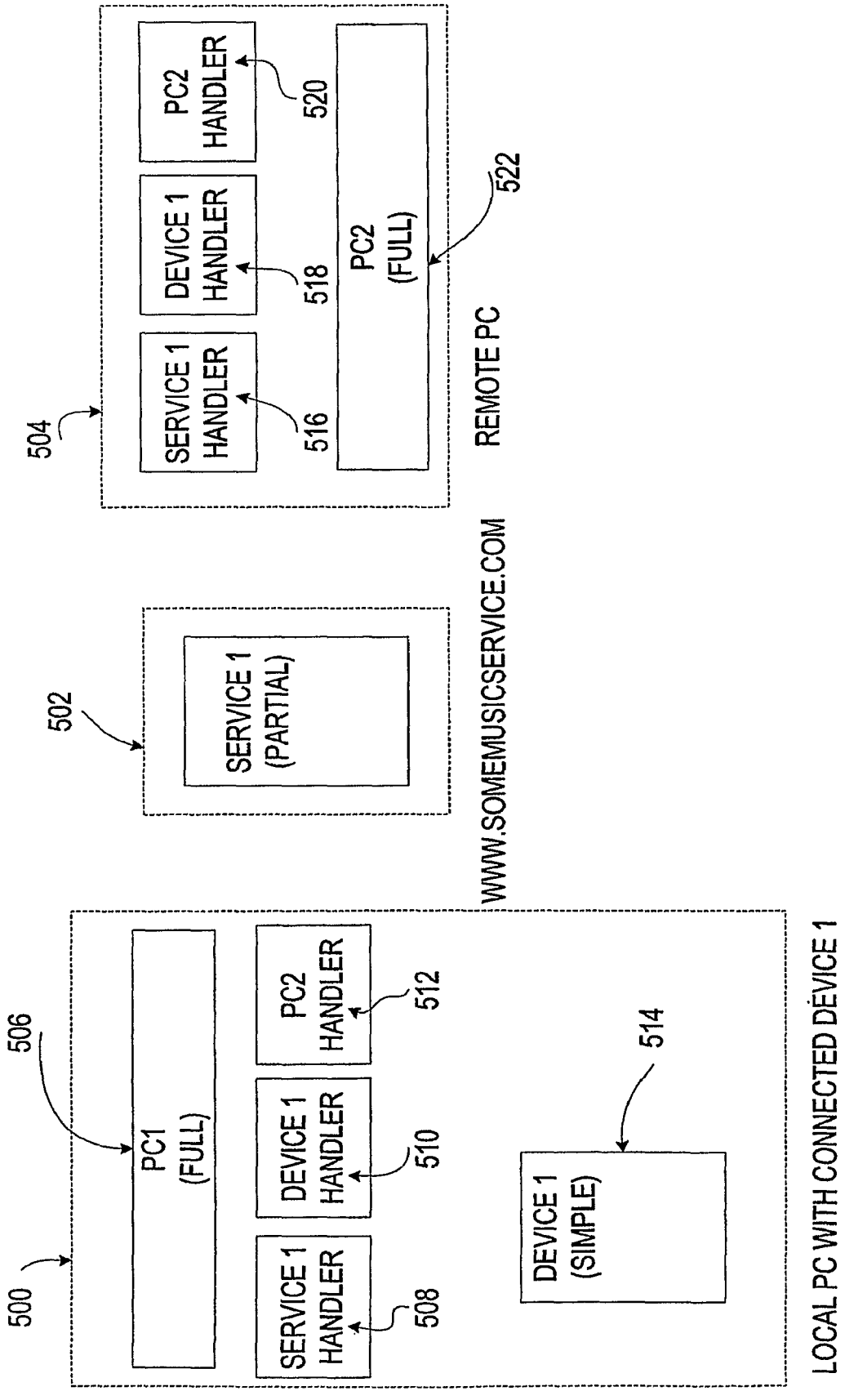

500
506
PC1
(FULL)
SERVICE 1
HANDLER
508
DEVICE 1
HANDLER
510
PC2
HANDLER
512
DEVICE 1
(SIMPLE)
514
LOCAL PC WITH CONNECTED DEVICE 1
WWW.SOMEMUSICSERVICE.COM
502
SERVICE 1
(PARTIAL)
504
SERVICE 1
HANDLER
516
DEVICE 1
HANDLER
518
PC2
HANDLER
520
PC2
(FULL)
522
REMOTE PC

FIG. 17

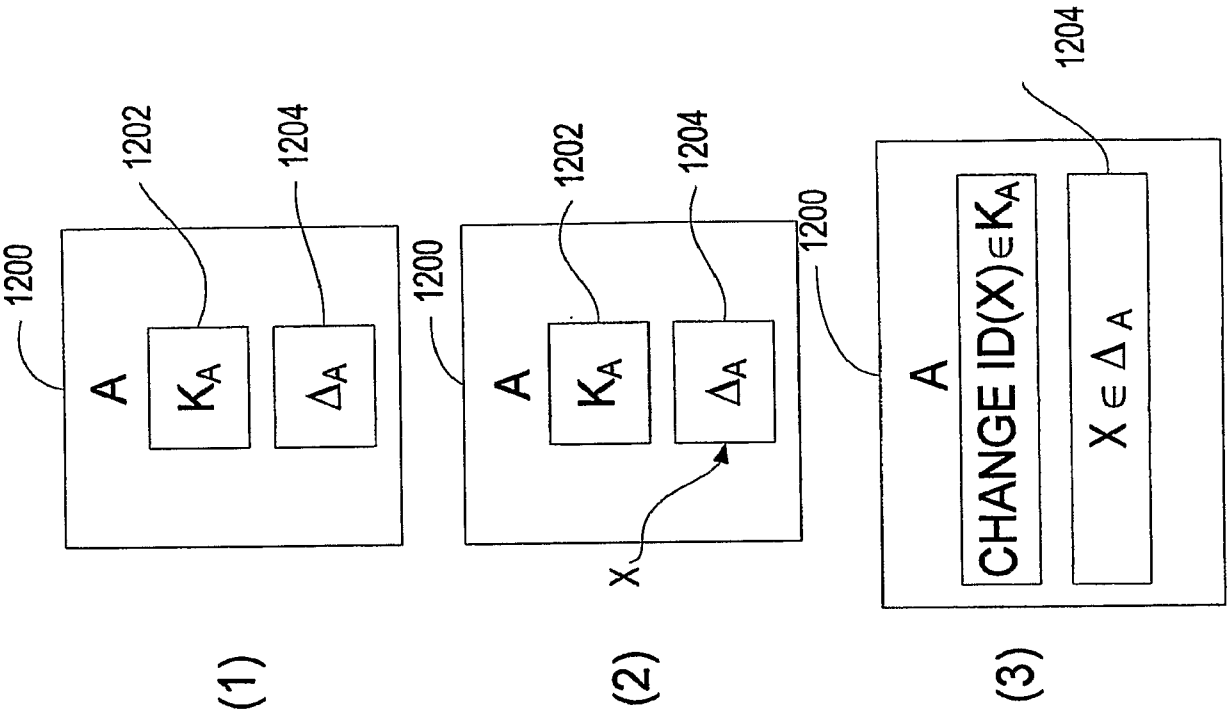

1200
A
1202
K_A
1204
Δ_A
(1)
X
(2)
CHANGE ID(X)$\in K_A$
$X \in \Delta_A$
(3)

FIG. 19

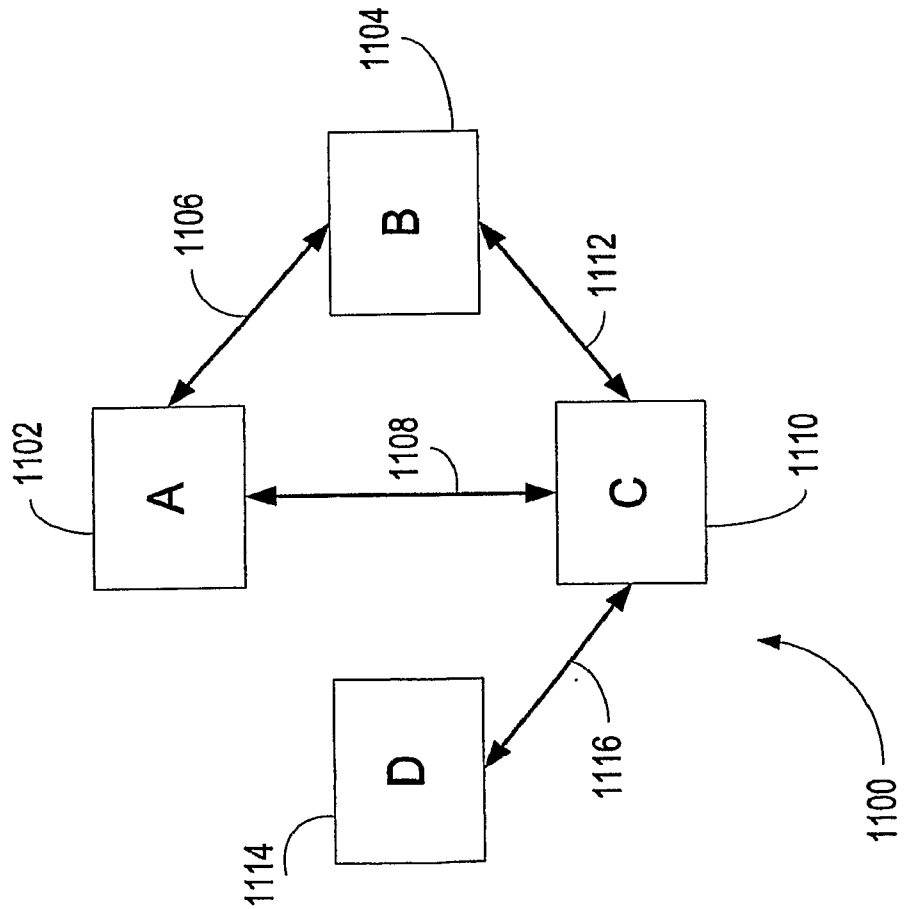

A
B
C
D
1102
1104
1106
1108
1110
1112
1114
1116
1100

FIG. 18

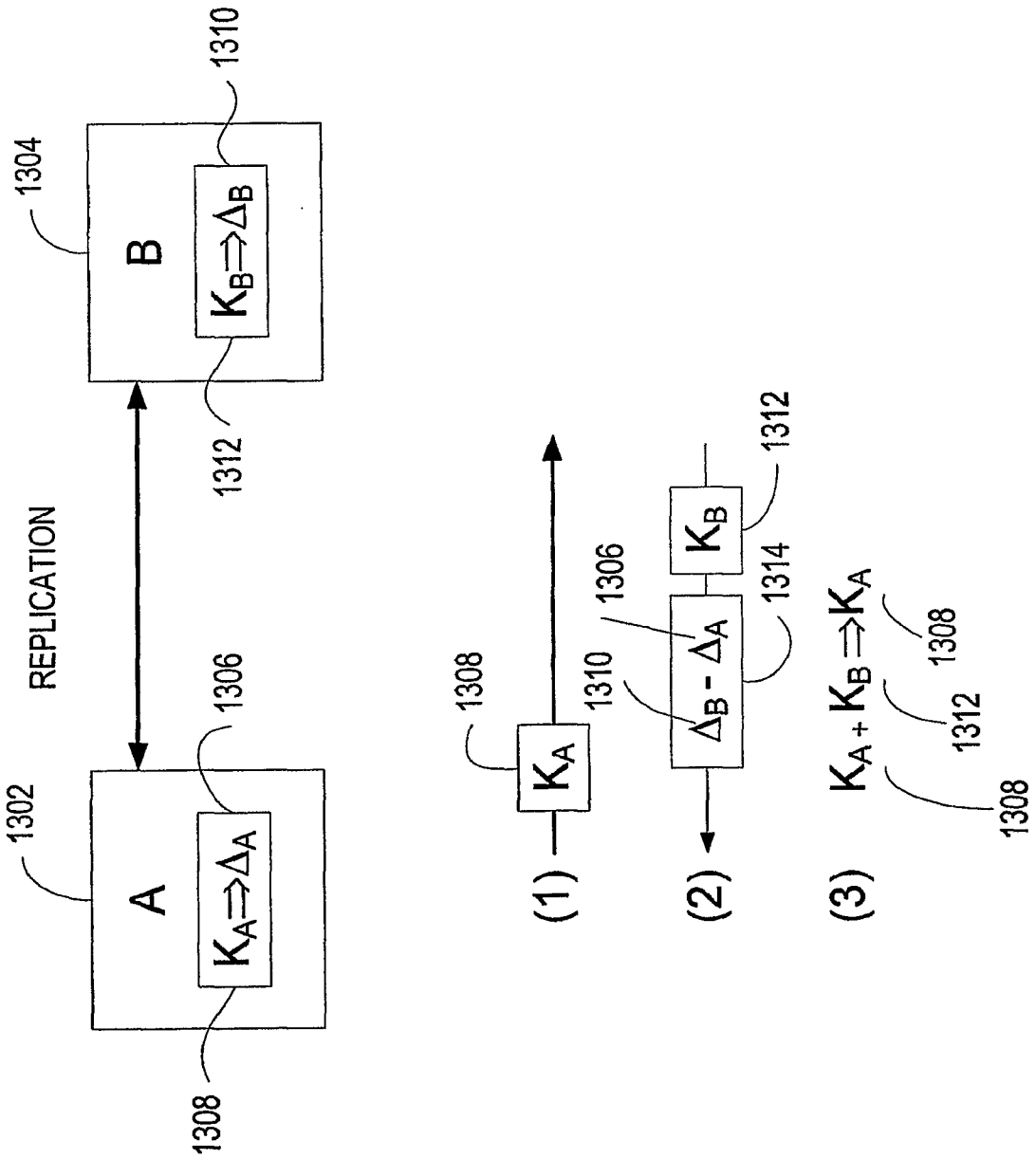

1302
A
$K_A \Rightarrow \Delta_A$
1306
1308
REPLICATION
1304
B
$K_B \Rightarrow \Delta_B$
1310
1312
(1)
K_A
1308
1310
(2)
$\Delta_B - \Delta_A$
1306
1314
K_B
1312
(3)
$K_A + K_B \Rightarrow K_A$
1308
1312
1308

FIG. 20

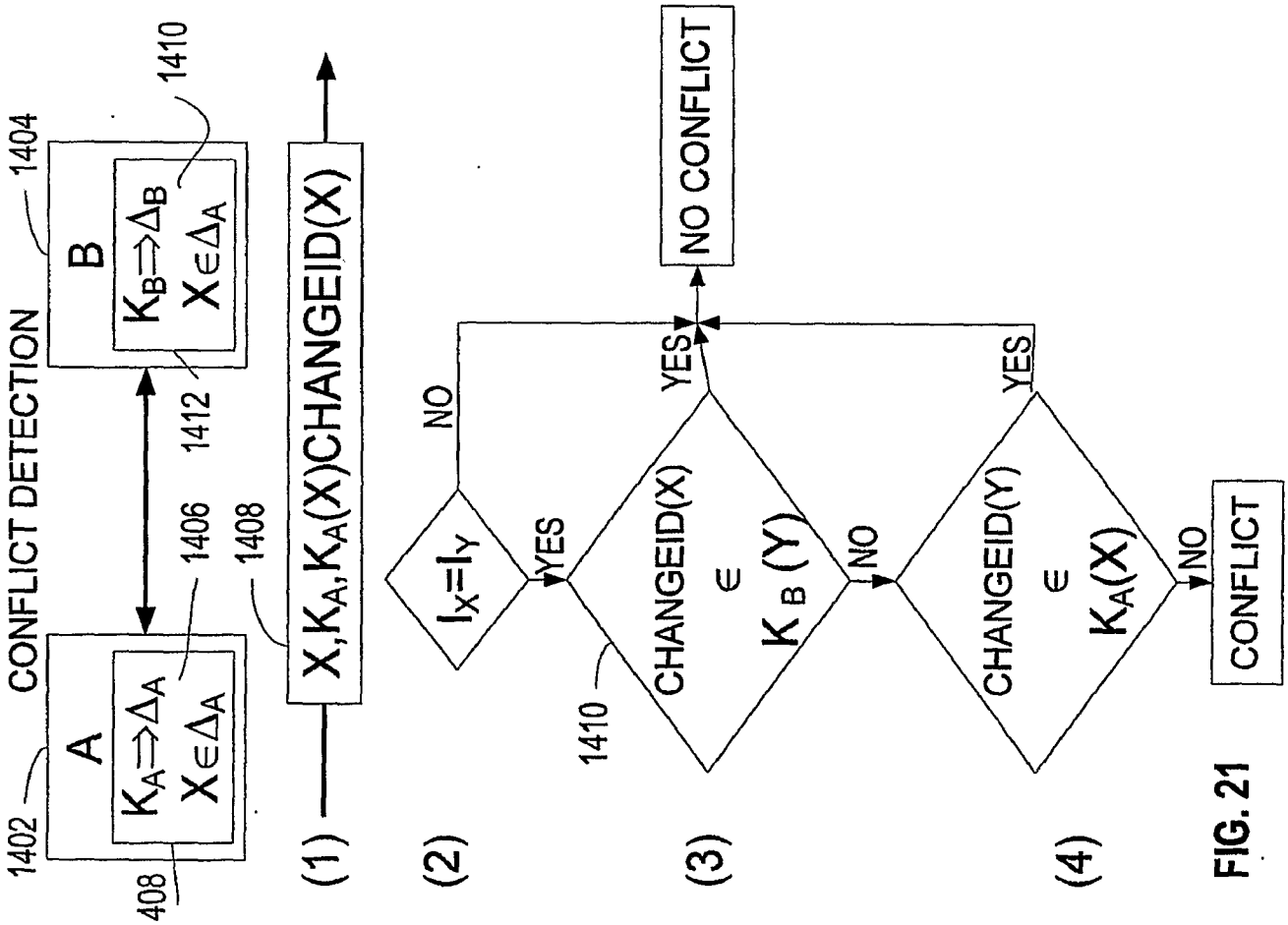

CONFLICT DETECTION
A
$K_A \Rightarrow \Delta_A$
$X \in \Delta_A$
B
$K_B \Rightarrow \Delta_B$
$X \in \Delta_A$
1402
1404
1406
1408
1410
1412
$X, K_A, K_A(X)$CHANGEID(X)
(1)
(2)
$I_X = I_Y$
NO
YES
(3)
CHANGEID(X) $\in K_B(Y)$
YES
NO
NO CONFLICT
(4)
CHANGEID(Y) $\in K_A(X)$
YES
NO
CONFLICT

FIG. 21

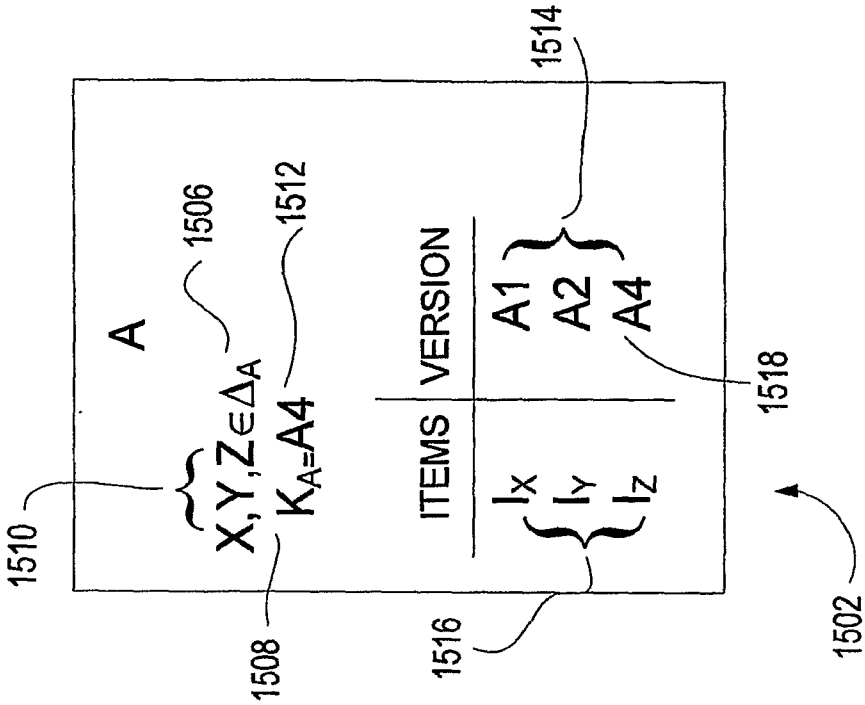

A
$X, Y, Z \in \Delta_A$
$K_A = A4$
ITEMS
VERSION
I_X
I_Y
I_Z
A1
A2
A4
1502
1506
1508
1510
1512
1514
1516
1518

FIG. 22

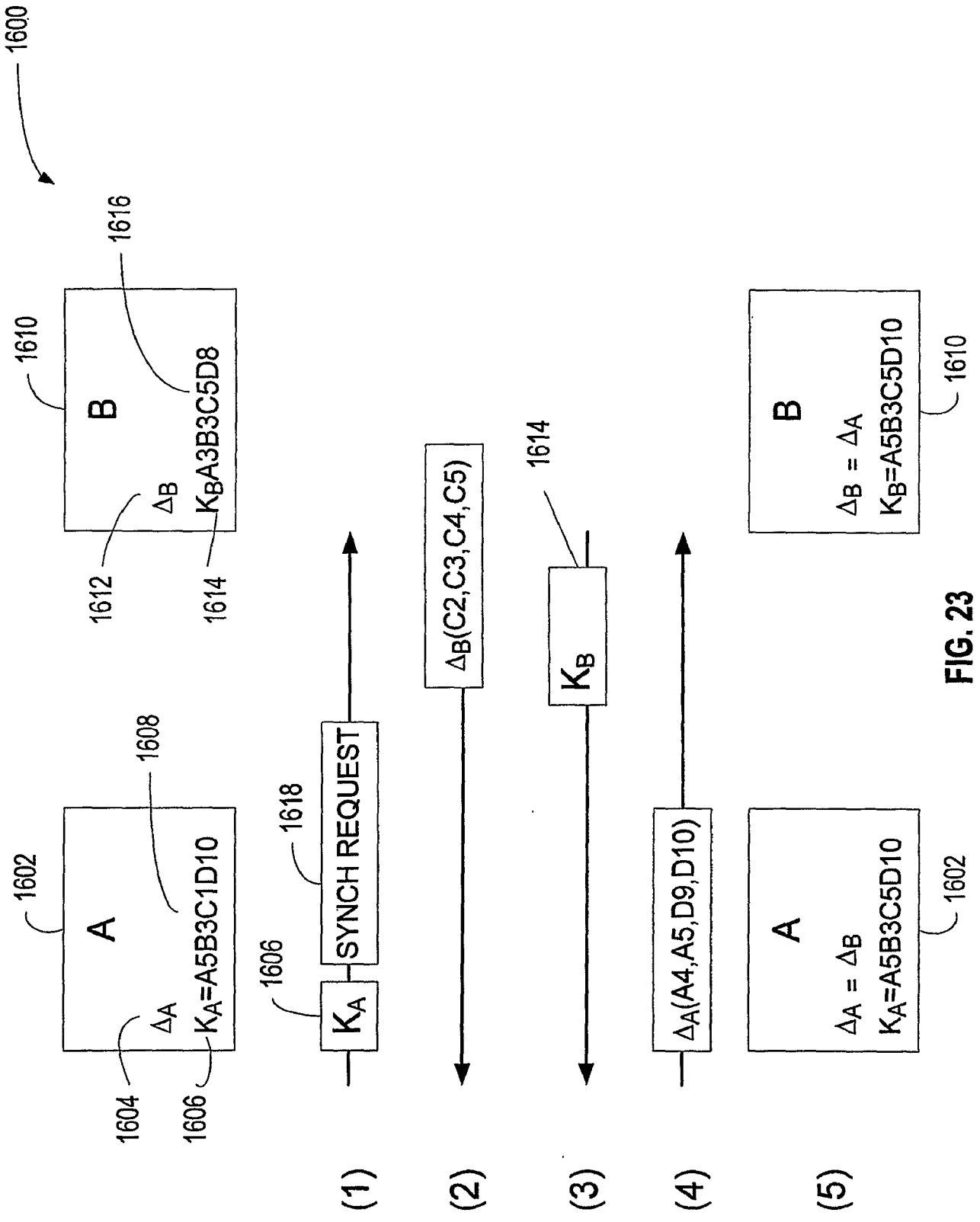

1600
1610
B
1616
Δ_B
K_BA3B3C5D8
1612
1614
1602
A
1608
Δ_A
K_A=A5B3C1D10
1604
1606
1606
K_A
1618
SYNCH REQUEST
Δ_B(C2,C3,C4,C5)
1614
K_B
Δ_A(A4,A5,D9,D10)
B
$\Delta_B = \Delta_A$
K_B=A5B3C5D10
1610
A
$\Delta_A = \Delta_B$
K_A=A5B3C5D10
1602
(1)
(2)
(3)
(4)
(5)

FIG. 23

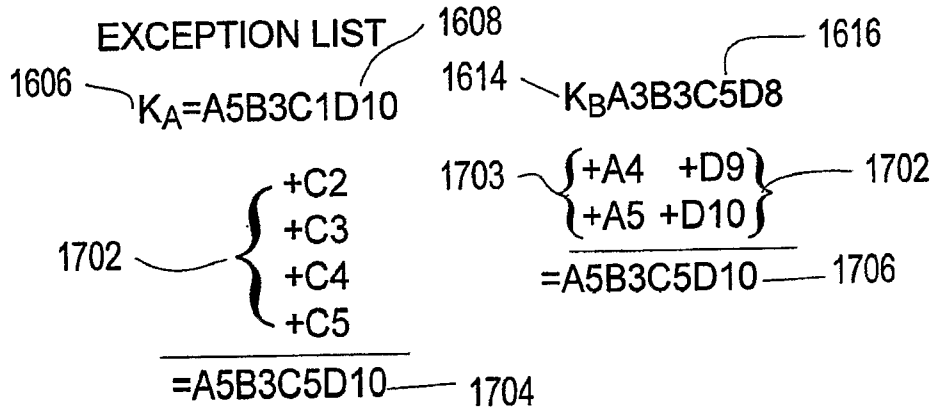


FIG. 24A

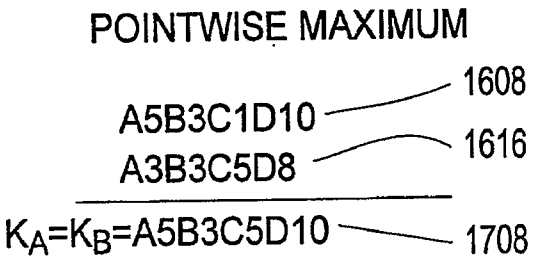


FIG. 24B

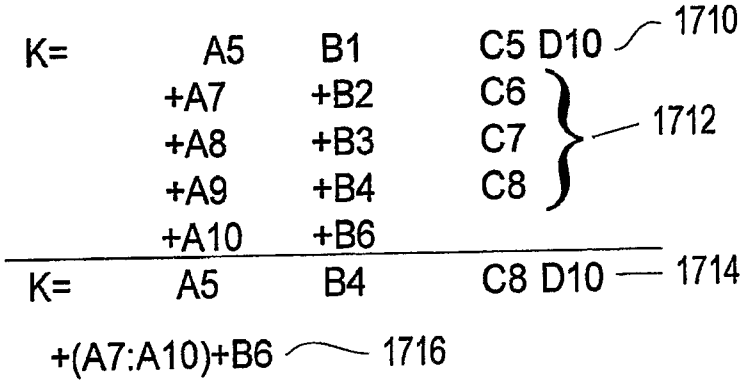


FIG. 24C

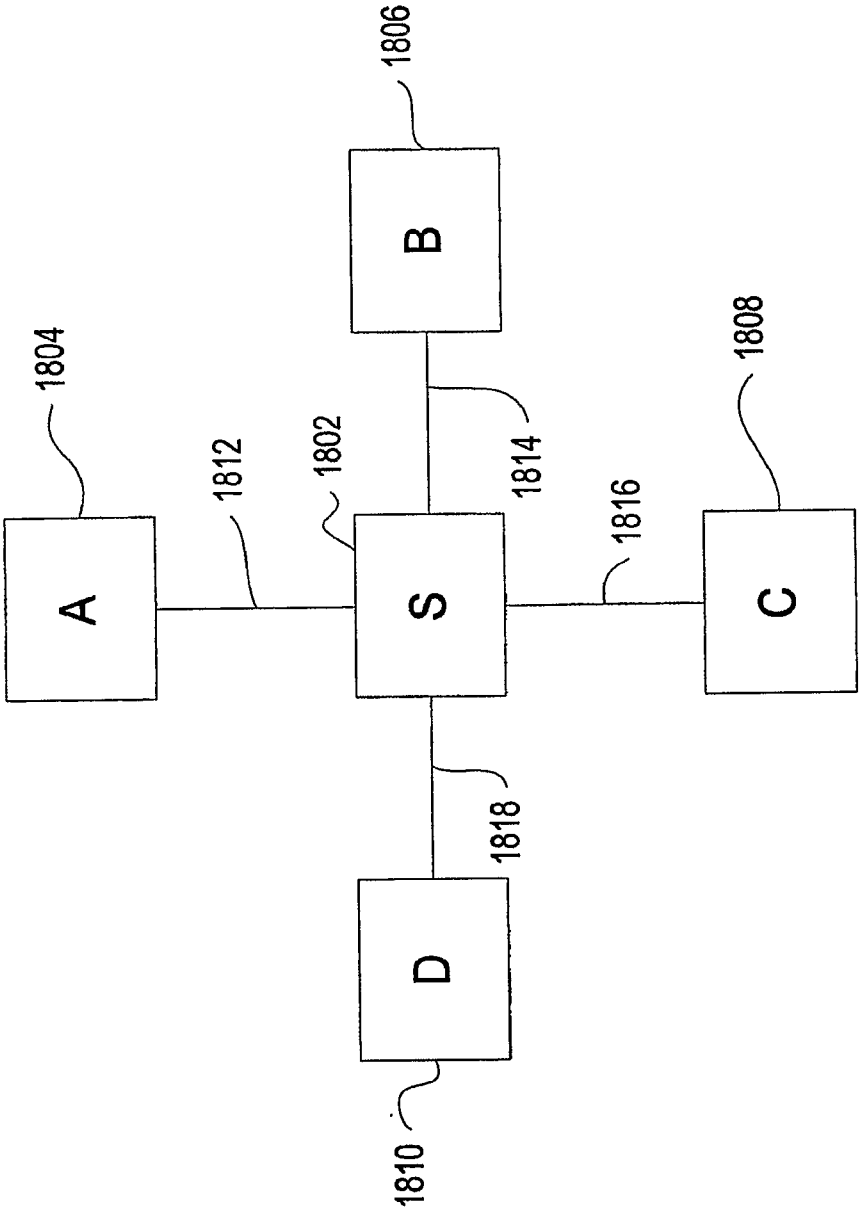


FIG. 25

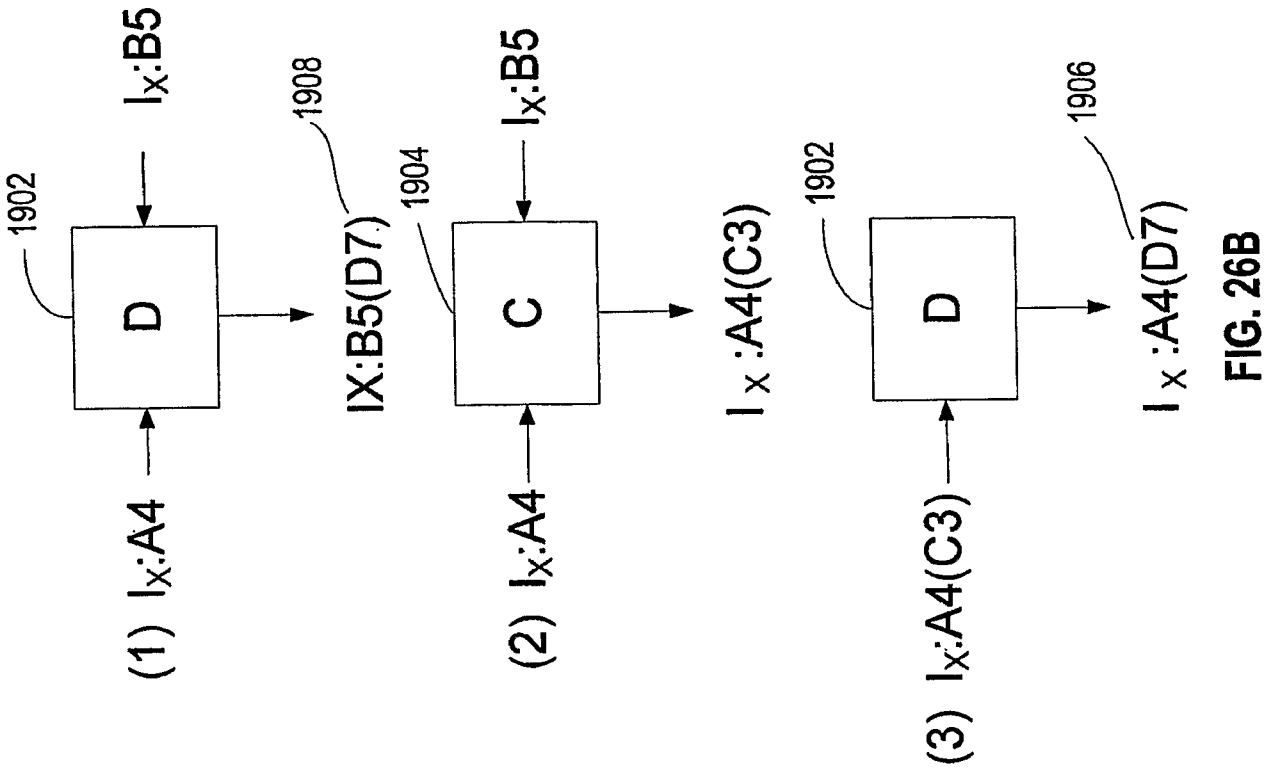


FIG. 26B

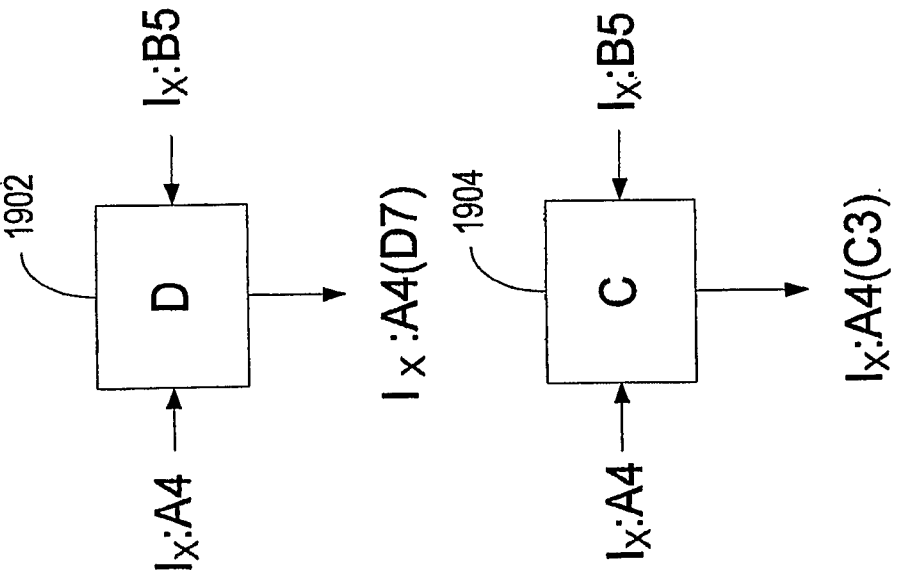


FIG. 26A