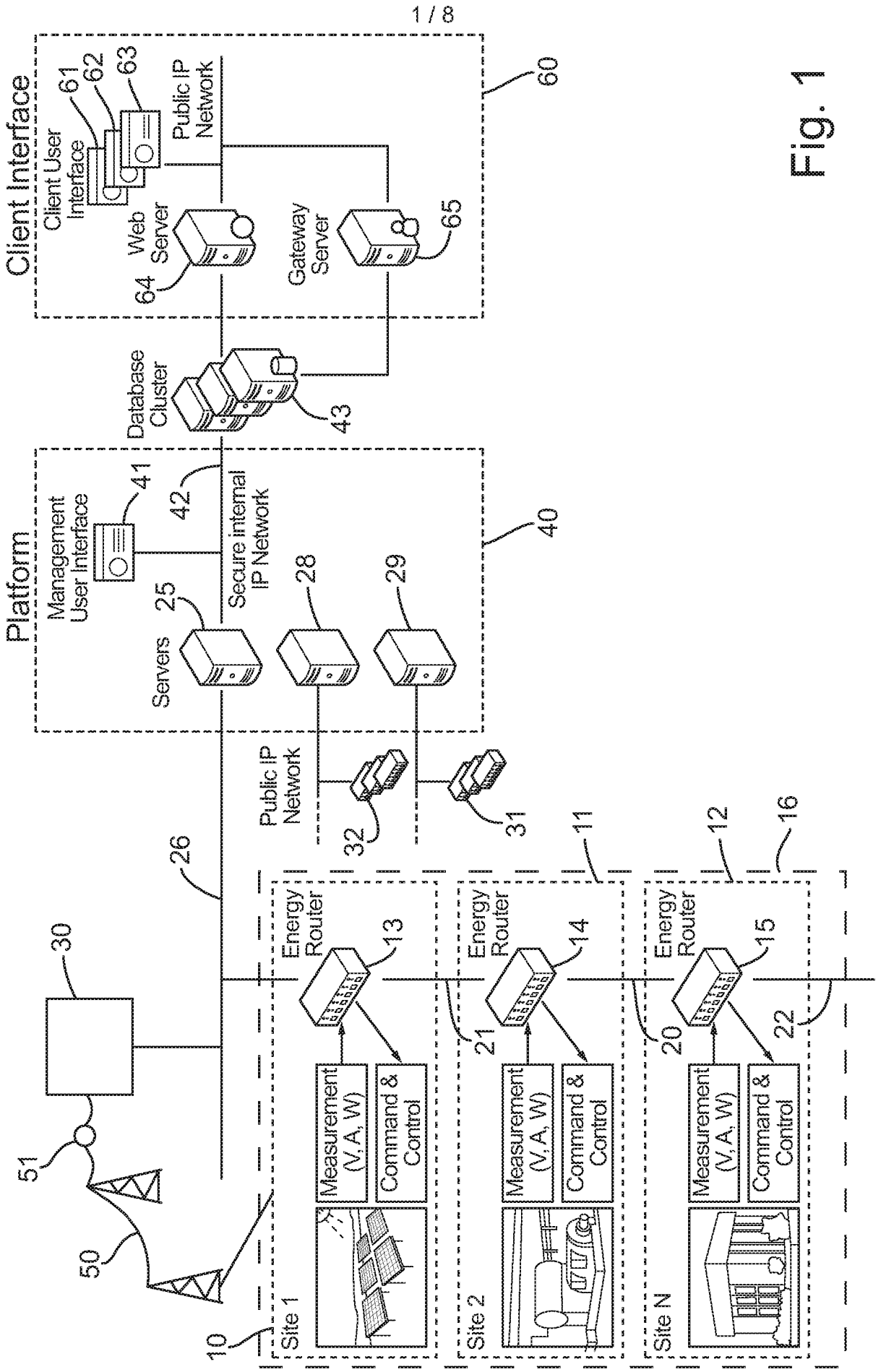

Client Interface
60
Client User Interface
61
62
63
Public IP Network
Web Server
64
Gateway Server
65
Database Cluster
43
Platform
40
Management User Interface
41
42
Secure internal IP Network
Servers
25
28
29
Public IP Network
32
31
26
11
12
16
Energy Router
13
14
15
30
51
50
10
20
21
22
Measurement (V,A,W)
Command & Control
Site 1
Site 2
Site N

Fig. 1

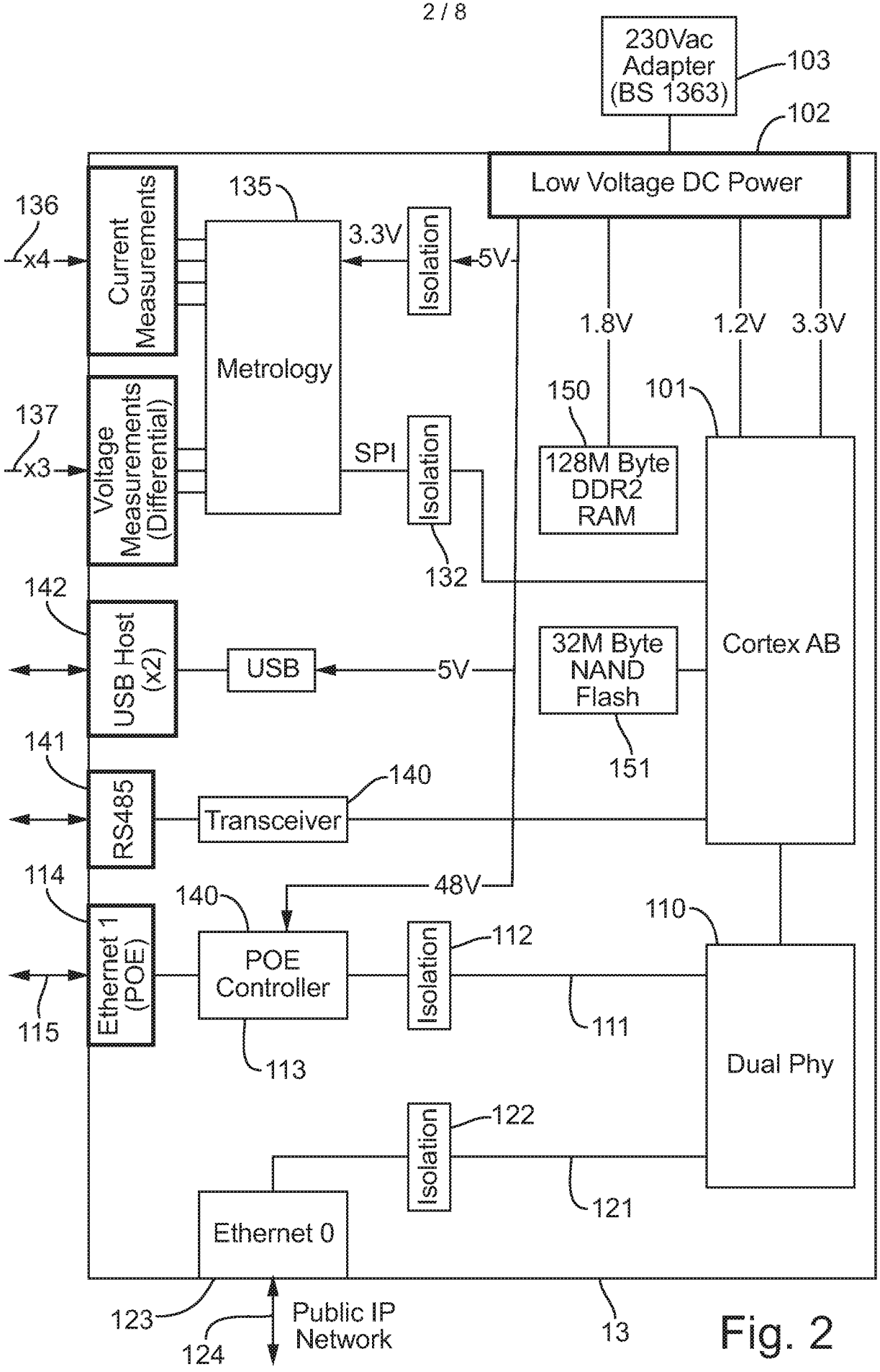

230Vac Adapter (BS 1363)
103
102
Low Voltage DC Power
136
x4
Current Measurements
135
3.3V
Isolation
5V
Metrology
1.8V
1.2V
3.3V
137
x3
Voltage Measurements (Differential)
SPI
Isolation
150
128M Byte DDR2 RAM
101
132
142
USB Host (x2)
USB
5V
32M Byte NAND Flash
Cortex AB
151
141
RS485
Transceiver
140
114
48V
140
110
Ethernet 1 (POE)
POE Controller
Isolation
112
115
111
Dual Phy
113
Isolation
122
121
Ethernet 0
123
124
Public IP Network
13

Fig. 2

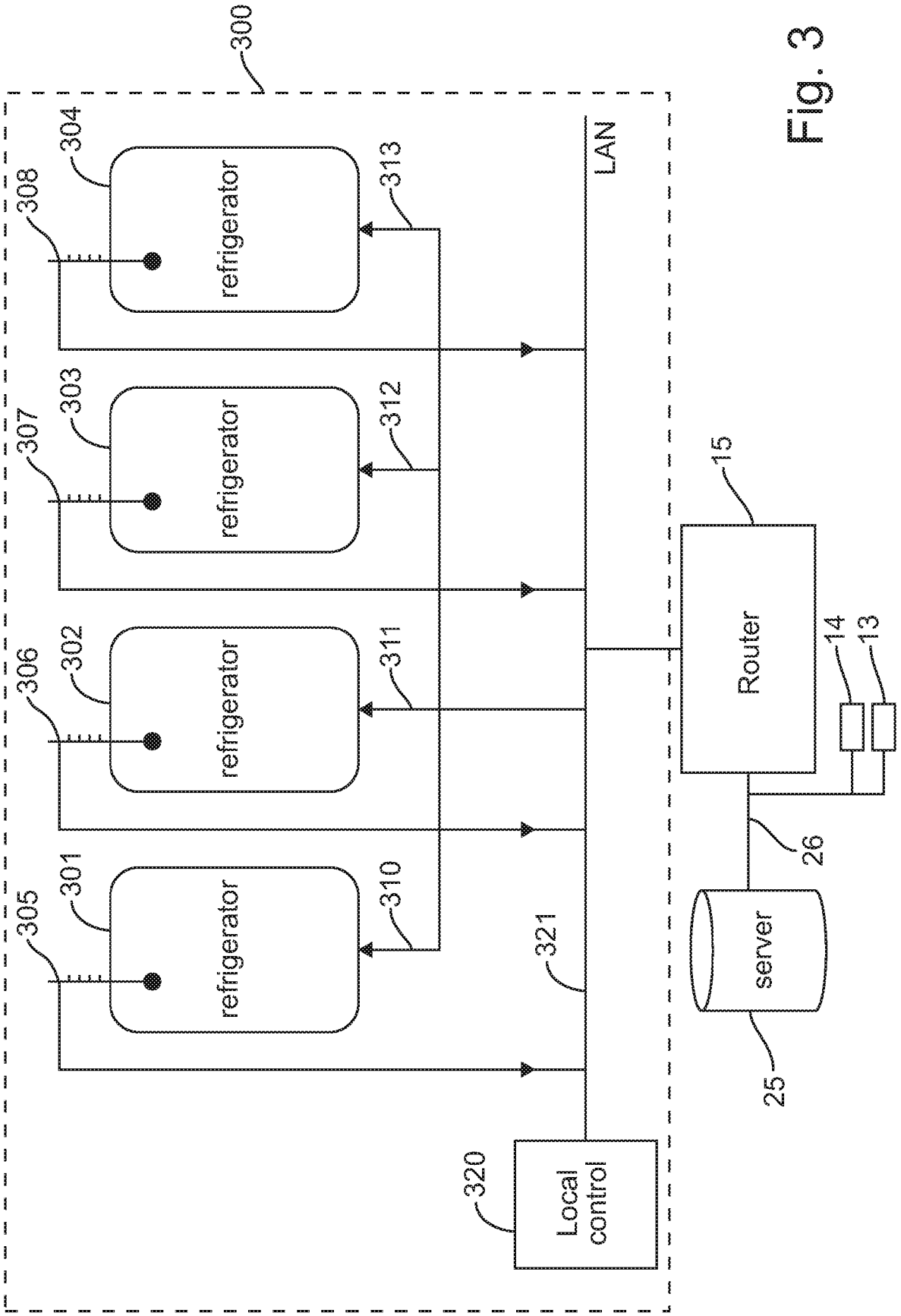

300
LAN
refrigerator
refrigerator
refrigerator
refrigerator
301
302
303
304
305
306
307
308
310
311
312
313
321
Local control
320
Router
15
14
13
26
server
25

Fig. 3

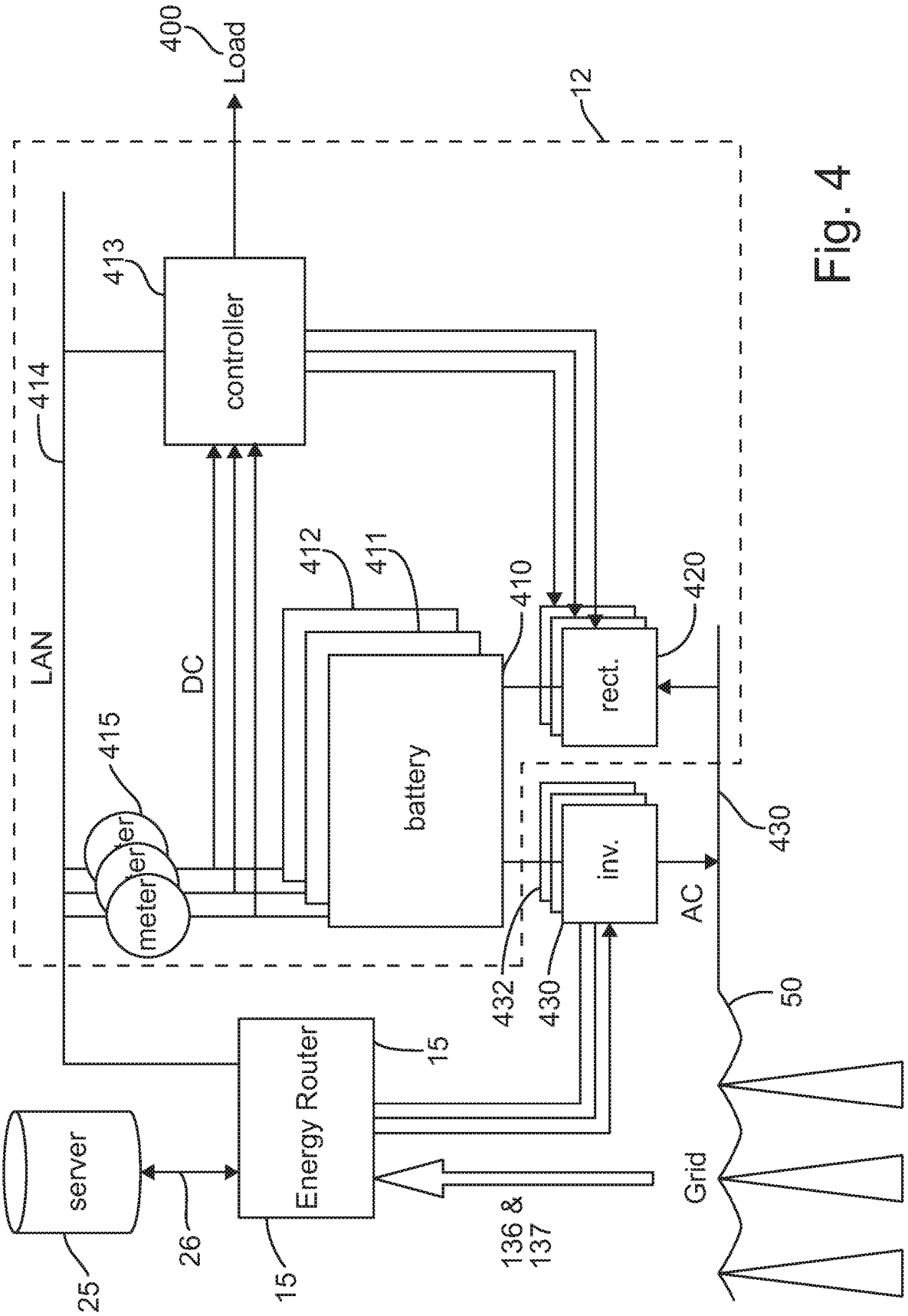

400
Load
12
413
controller
414
LAN
DC
412
411
410
420
rect.
battery
415
meter
meter
meter
inv.
AC
430
432
430
50
Grid
15
Energy Router
server
26
25
15
136 &
137

Fig. 4

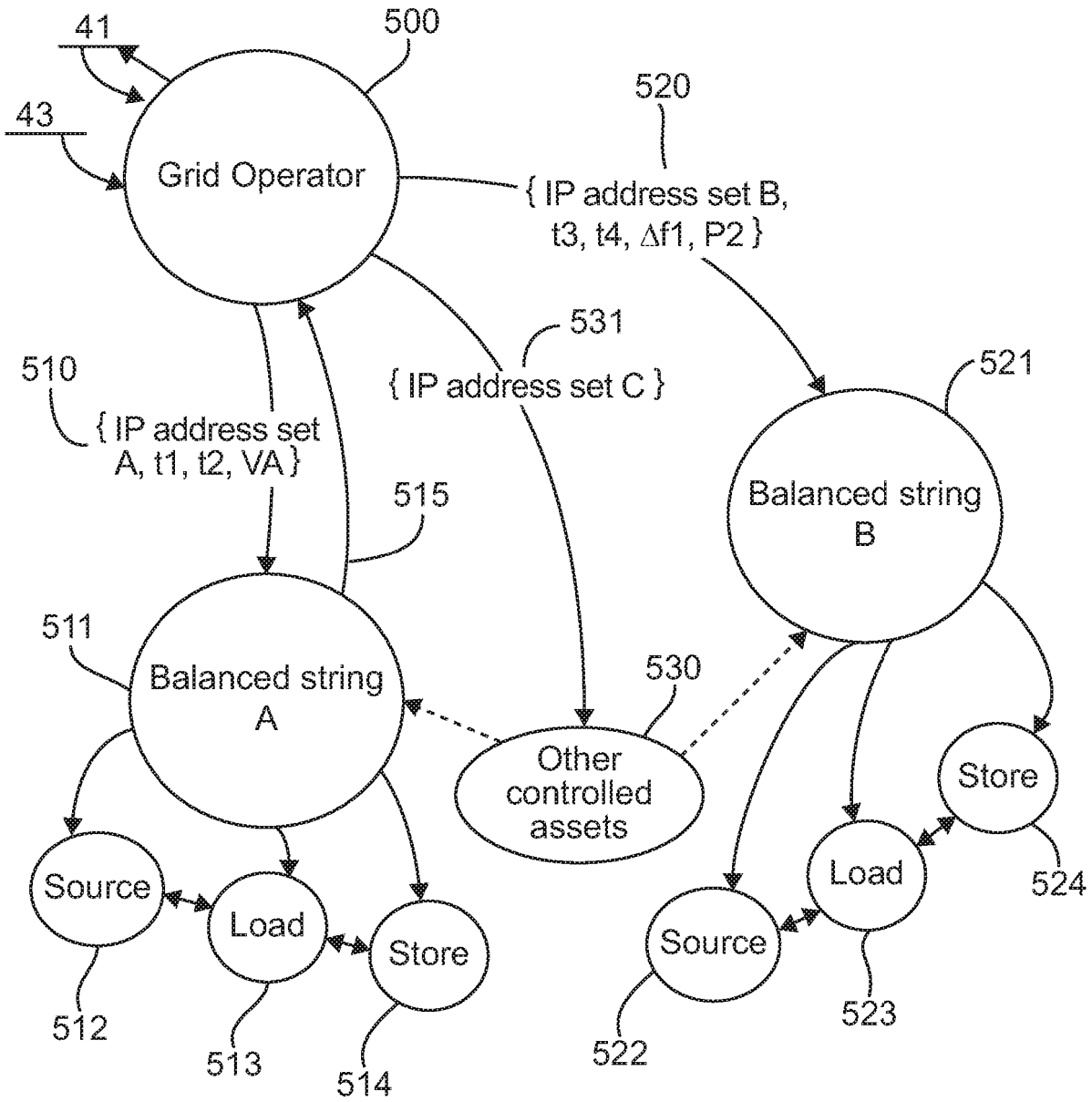

41
500
43
Grid Operator
520
{ IP address set B,
t3, t4, Δf1, P2 }
531
{ IP address set C }
510
{ IP address set
A, t1, t2, VA }
515
521
Balanced string
B
511
Balanced string
A
530
Other
controlled
assets
Source
Load
Store
512
513
514
Source
Load
Store
522
523
524

Fig. 5

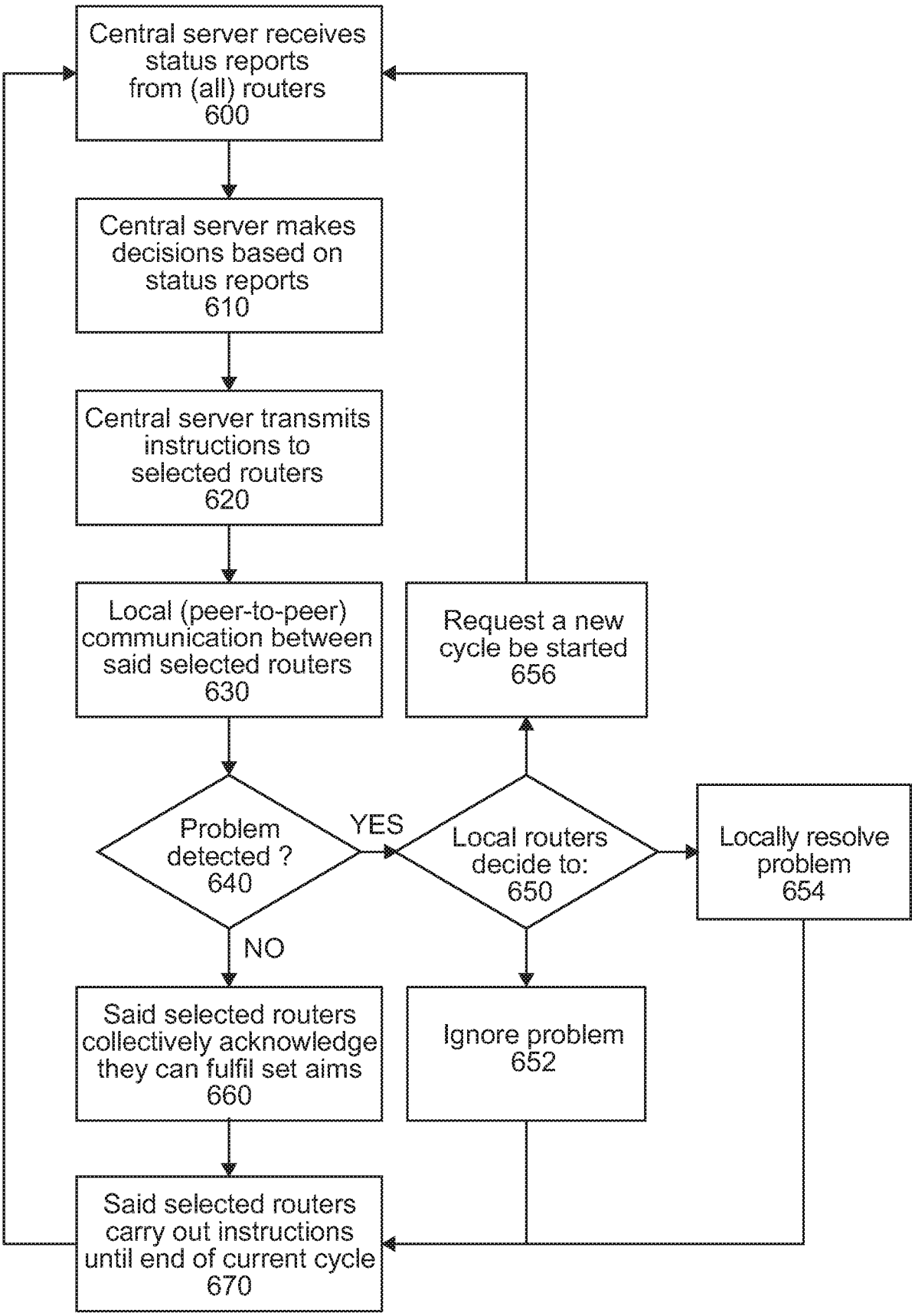

Central server receives status reports from (all) routers 600
Central server makes decisions based on status reports 610
Central server transmits instructions to selected routers 620
Local (peer-to-peer) communication between said selected routers 630
Problem detected ? 640
YES
NO
Local routers decide to: 650
Request a new cycle be started 656
Locally resolve problem 654
Said selected routers collectively acknowledge they can fulfil set aims 660
Ignore problem 652
Said selected routers carry out instructions until end of current cycle 670

Fig. 6

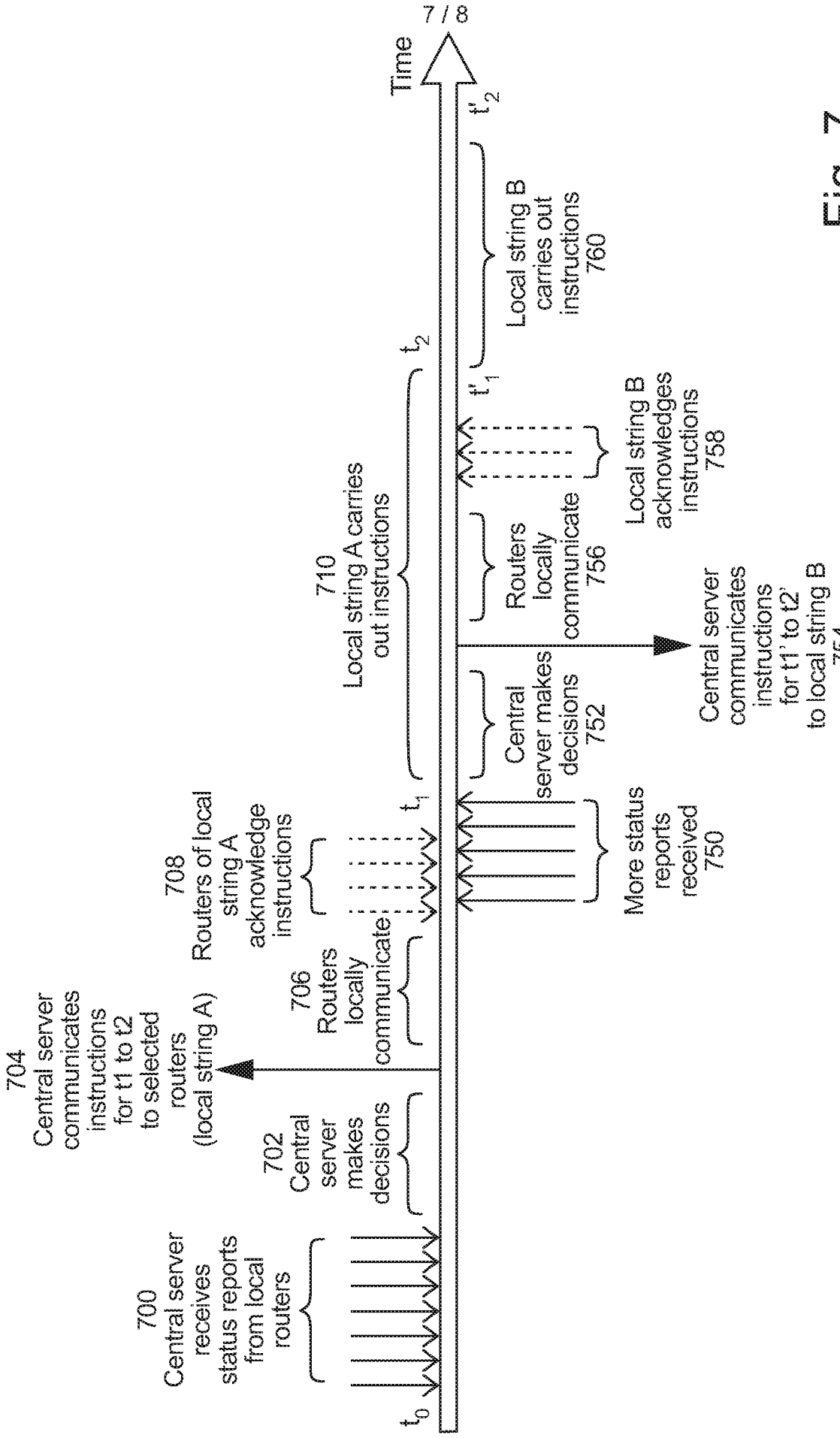

Time
t_0
t_1
t_2
t'_1
t'_2
700 Central server receives status reports from local routers
702 Central server makes decisions
704 Central server communicates instructions for t1 to t2 to selected routers (local string A)
706 Routers locally communicate
708 Routers of local string A acknowledge instructions
710 Local string A carries out instructions
More status reports received 750
Central server makes decisions 752
Central server communicates instructions for t1' to t2' to local string B 754
Routers locally communicate 756
Local string B acknowledges instructions 758
Local string B carries out instructions 760

Fig. 7

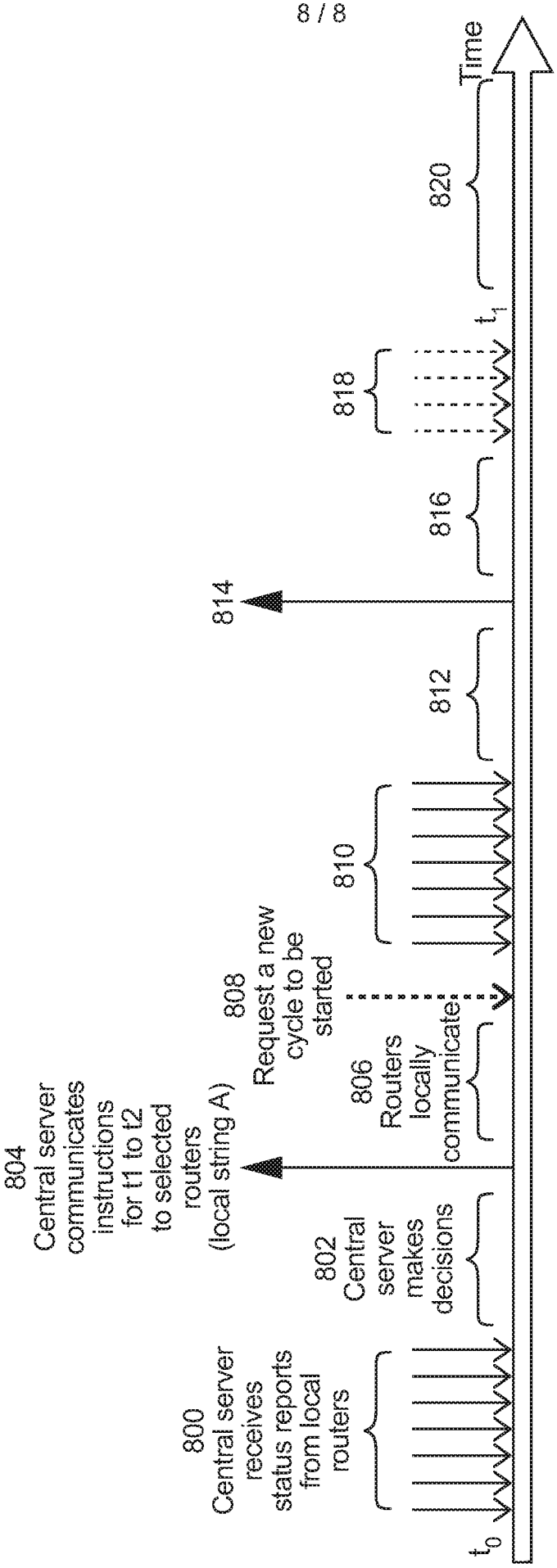

Time
t_0
t_1
800
Central server receives status reports from local routers
802
Central server makes decisions
804
Central server communicates instructions for t1 to t2 to selected routers (local string A)
806
Routers locally communicate
808
Request a new cycle to be started
810
812
814
816
818
820

Fig. 8