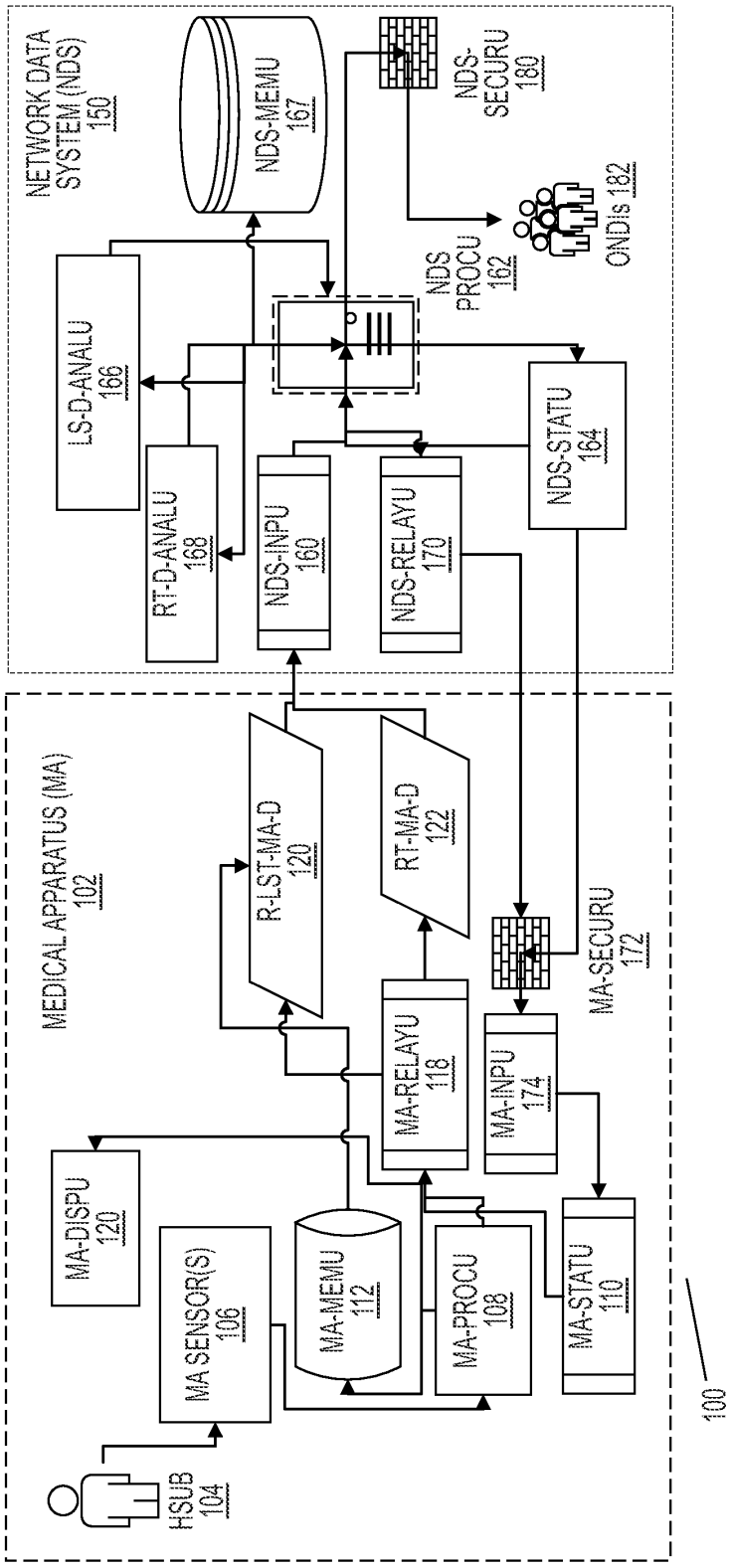
NETWORK DATA SYSTEM (NDS) 150
NDS-MEMU 167
NDS-SECURU 180
ONDIs 182
NDS PROCU 162
LS-D-ANALU 166
RT-D-ANALU 168
NDS-INPU 160
NDS-RELAYU 170
NDS-STATU 164
MEDICAL APPARATUS (MA) 102
R-LST-MA-D 120
RT-MA-D 122
MA-SECURU 172
MA-RELAYU 118
MA-INPU 174
MA-DISPU 120
MA SENSOR(S) 106
MA-MEMU 112
MA-PROCU 108
MA-STATU 110
HSUB 104
100

FIG. 1

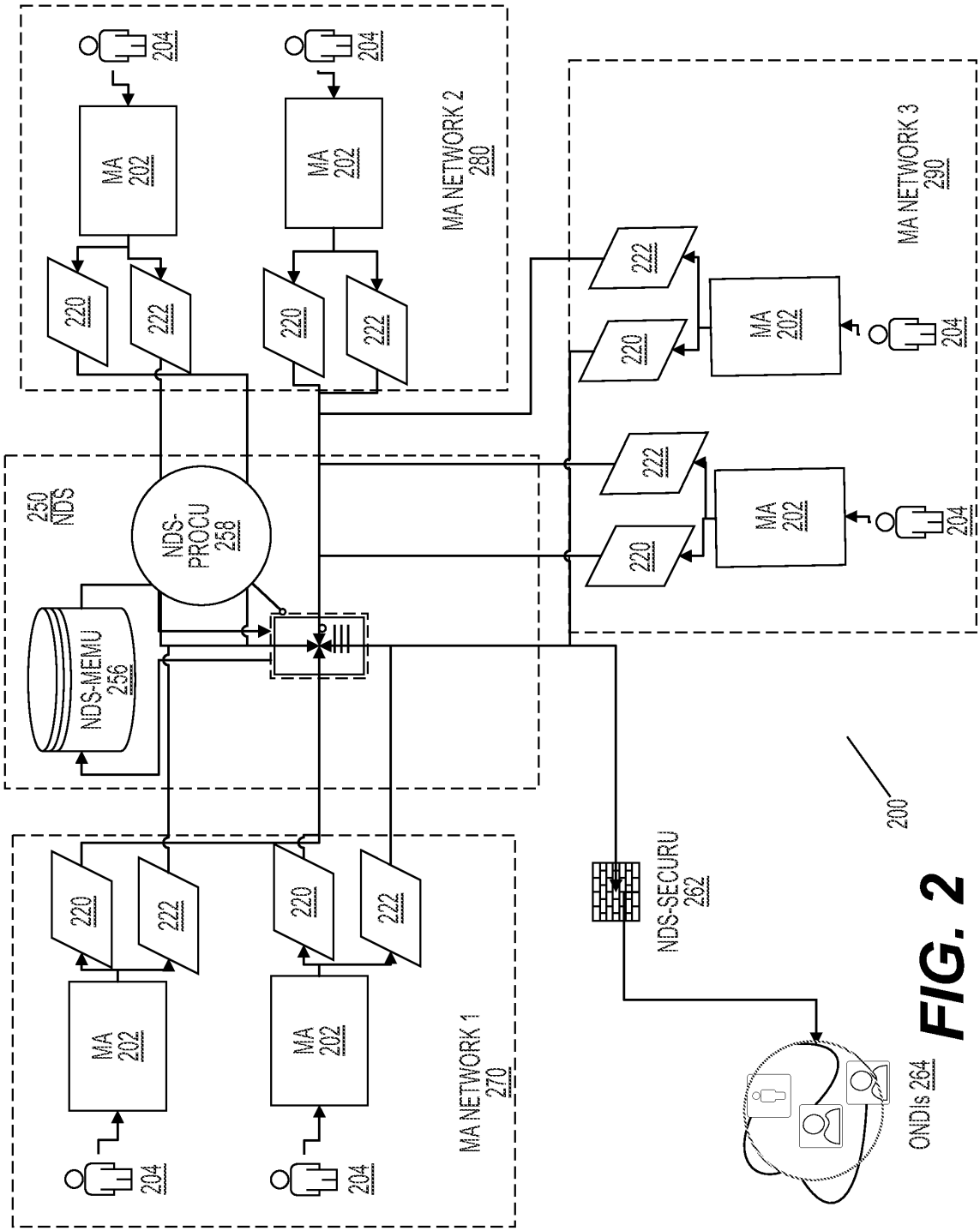
MA NETWORK 2
280
MA NETWORK 3
290
MA NETWORK 1
270
250
NDS
NDS-PROCU
258
NDS-MEMU
256
NDS-SECURU
262
MA
202
204
220
222
200
ONDIs 264

FIG. 2

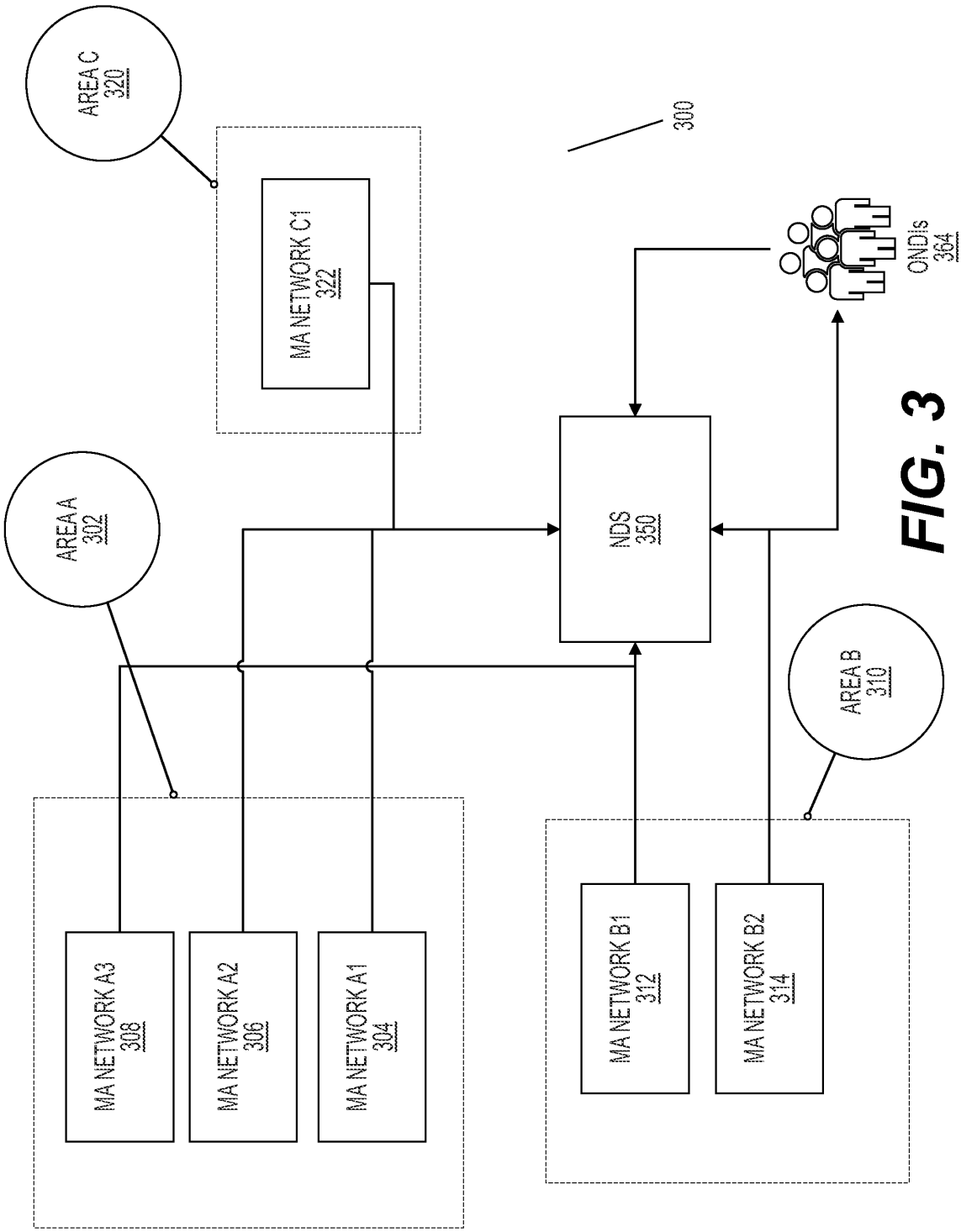
AREA C
320
MA NETWORK C1
322
300
ONDIs
364
AREA A
302
NDS
350
AREA B
310
MA NETWORK A3
308
MA NETWORK A2
306
MA NETWORK A1
304
MA NETWORK B1
312
MA NETWORK B2
314

FIG. 3

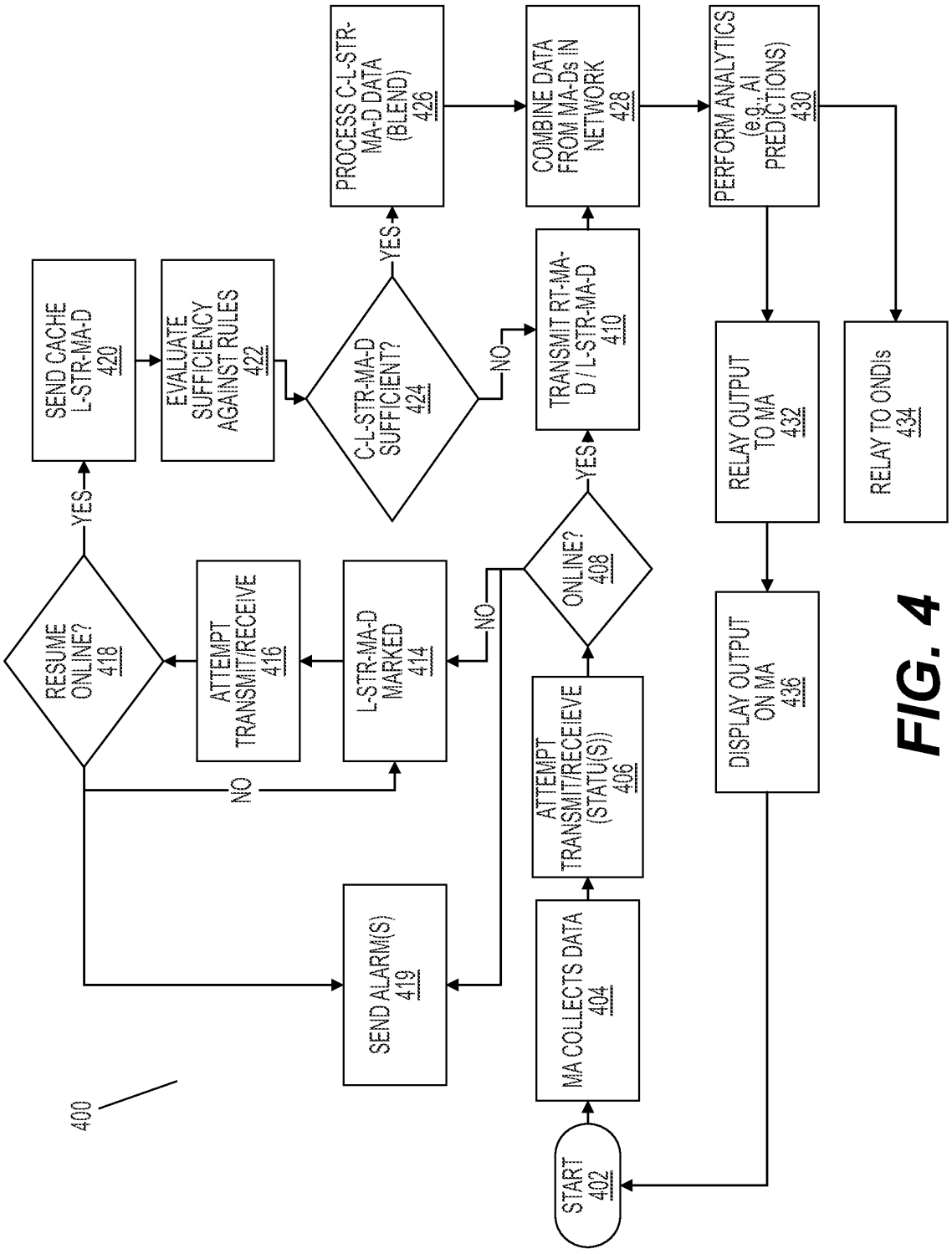
400
START 402
MA COLLECTS DATA 404
ATTEMPT TRANSMIT/RECEIEVE (STATU(S)) 406
ONLINE? 408
YES
NO
TRANSMIT RT-MA-D / L-STR-MA-D 410
C-L-STR-MA-D SUFFICIENT? 424
YES
NO
PROCESS C-L-STR-MA-D DATA (BLEND) 426
COMBINE DATA FROM MA-Ds IN NETWORK 428
PERFORM ANALYTICS (e.g., AI PREDICTIONS) 430
RELAY OUTPUT TO MA 432
RELAY TO ONDIs 434
DISPLAY OUTPUT ON MA 436
SEND ALARM(S) 419
L-STR-MA-D MARKED 414
ATTEMPT TRANSMIT/RECEIVE 416
RESUME ONLINE? 418
YES
NO
SEND CACHE L-STR-MA-D 420
EVALUATE SUFFICIENCY AGAINST RULES 422

FIG. 4

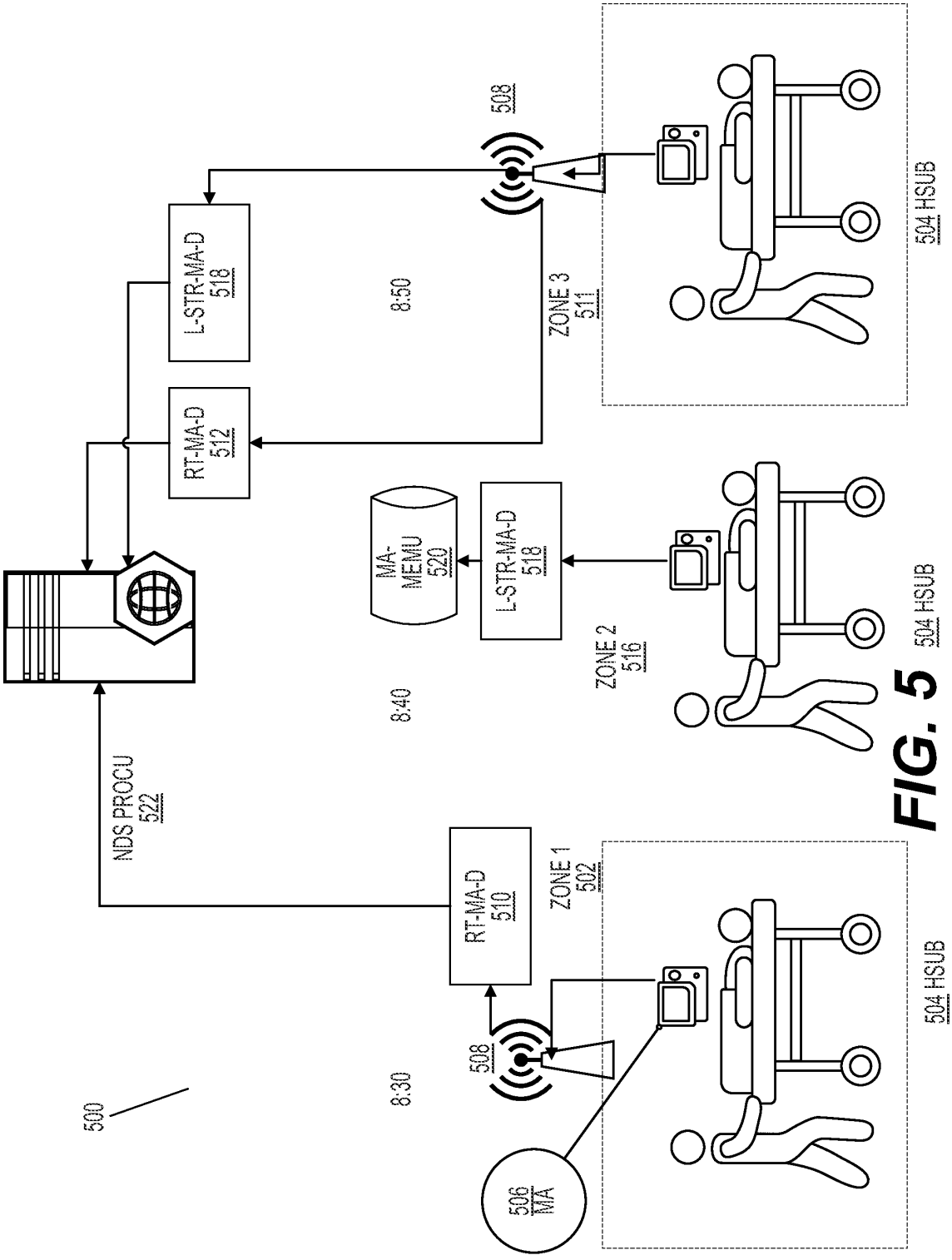
500
NDS PROCU 522
RT-MA-D 510
ZONE 1 502
504 HSUB
506 MA
508
8:30
MA-MEMU 520
L-STR-MA-D 518
ZONE 2 516
504 HSUB
8:40
RT-MA-D 512
L-STR-MA-D 518
ZONE 3 511
504 HSUB
8:50
508

FIG. 5

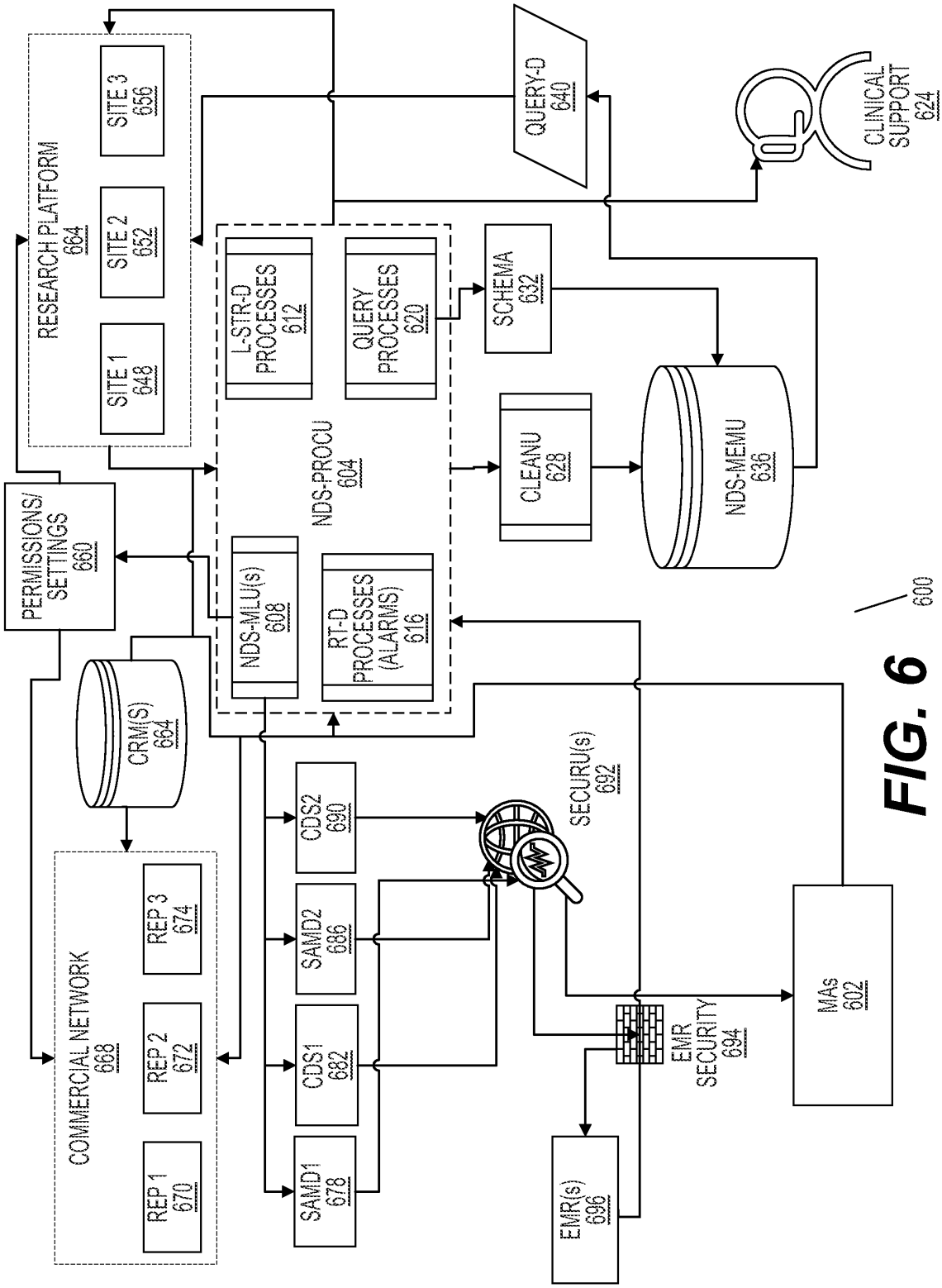
RESEARCH PLATFORM 664
SITE 1 648
SITE 2 652
SITE 3 656
PERMISSIONS/ SETTINGS 660
NDS-PROCU 604
L-STR-D PROCESSES 612
QUERY PROCESSES 620
NDS-MLU(s) 608
RT-D PROCESSES (ALARMS) 616
QUERY-D 640
SCHEMA 632
CLEANU 628
NDS-MEMU 636
CLINICAL SUPPORT 624
CRM(S) 664
COMMERCIAL NETWORK 668
REP 1 670
REP 2 672
REP 3 674
CDS2 690
SAMD2 686
CDS1 682
SAMD1 678
SECURU(s) 692
EMR SECURITY 694
EMR(s) 696
MAs 602
600

FIG. 6

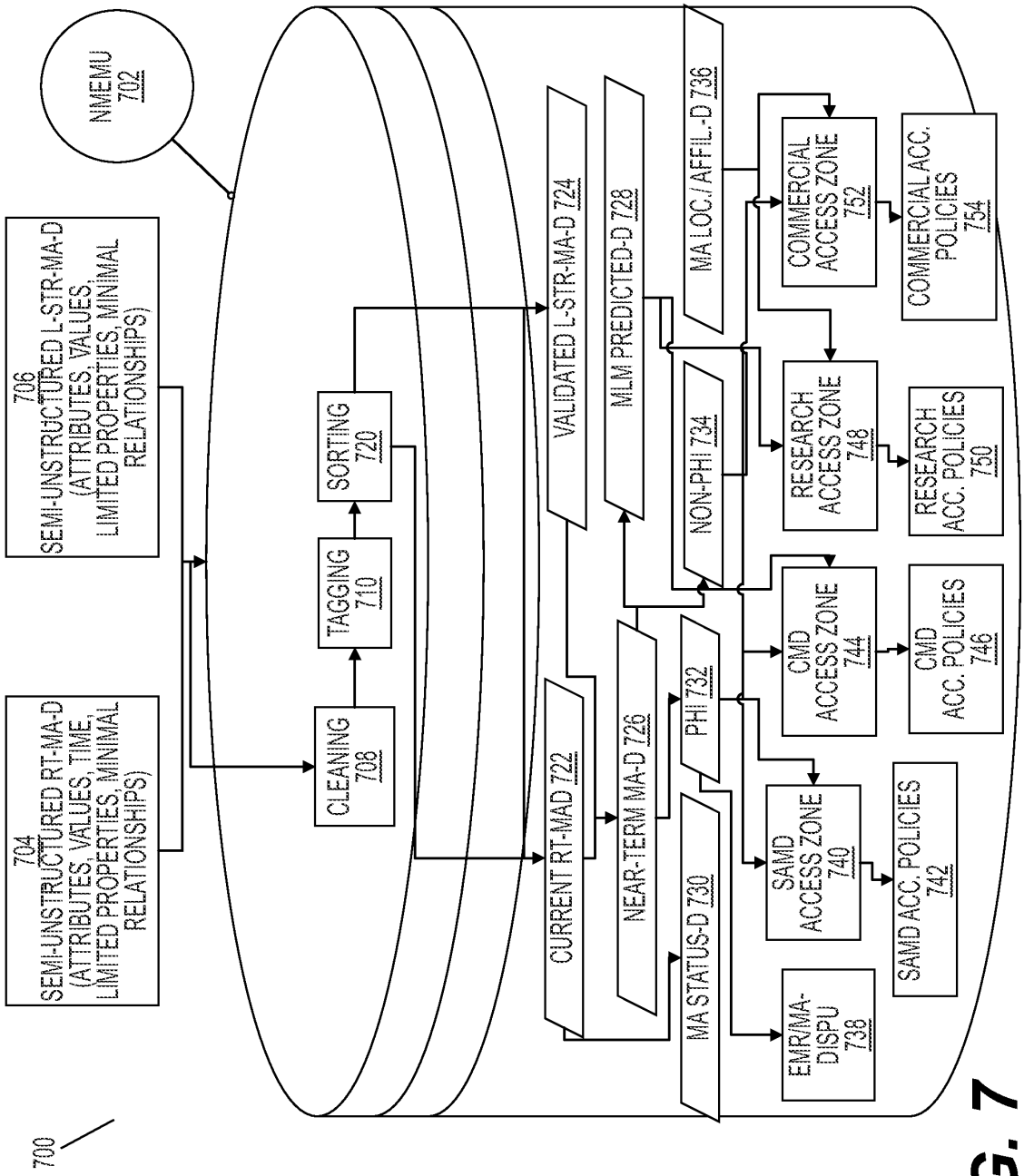
700
NMEMU 702
704 SEMI-UNSTRUCTURED RT-MA-D (ATTRIBUTES, VALUES, TIME, LIMITED PROPERTIES, MINIMAL RELATIONSHIPS)
706 SEMI-UNSTRUCTURED L-STR-MA-D (ATTRIBUTES, VALUES, LIMITED PROPERTIES, MINIMAL RELATIONSHIPS)
CLEANING 708
TAGGING 710
SORTING 720
CURRENT RT-MAD 722
VALIDATED L-STR-MA-D 724
NEAR-TERM MA-D 726
MLM PREDICTED-D 728
MA STATUS-D 730
PHI 732
NON-PHI 734
MA LOC./AFFIL.-D 736
EMR/MA-DISPU 738
SAMD ACCESS ZONE 740
SAMD ACC. POLICIES 742
CMD ACCESS ZONE 744
CMD ACC. POLICIES 746
RESEARCH ACCESS ZONE 748
RESEARCH ACC. POLICIES 750
COMMERCIAL ACCESS ZONE 752
COMMERCIAL ACC. POLICIES 754

FIG. 7

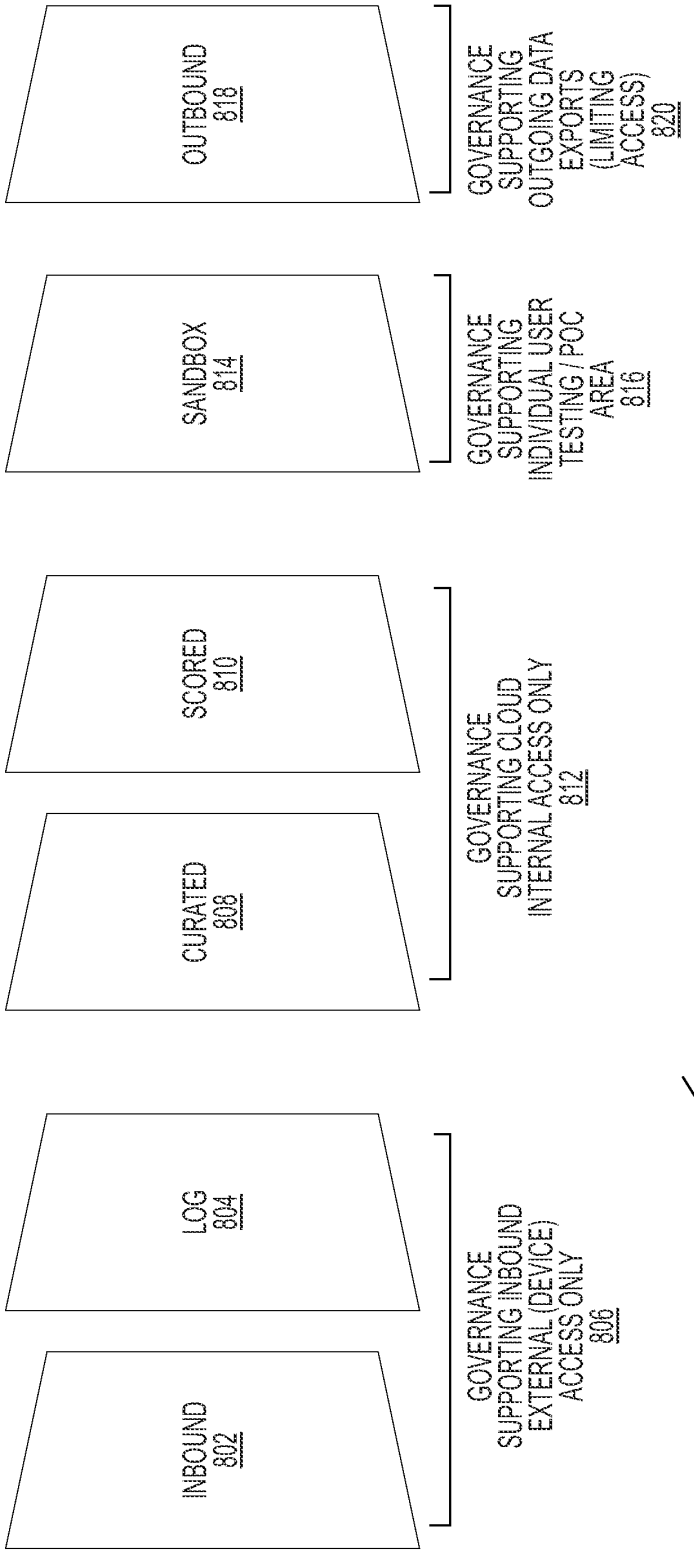
INBOUND
802
LOG
804
GOVERNANCE
SUPPORTING INBOUND
EXTERNAL (DEVICE)
ACCESS ONLY
806
CURATED
808
SCORED
810
GOVERNANCE
SUPPORTING CLOUD
INTERNAL ACCESS ONLY
812
SANDBOX
814
GOVERNANCE
SUPPORTING
INDIVIDUAL USER
TESTING / POC
AREA
816
OUTBOUND
818
GOVERNANCE
SUPPORTING
OUTGOING DATA
EXPORTS
(LIMITING
ACCESS)
820
800

FIG. 8

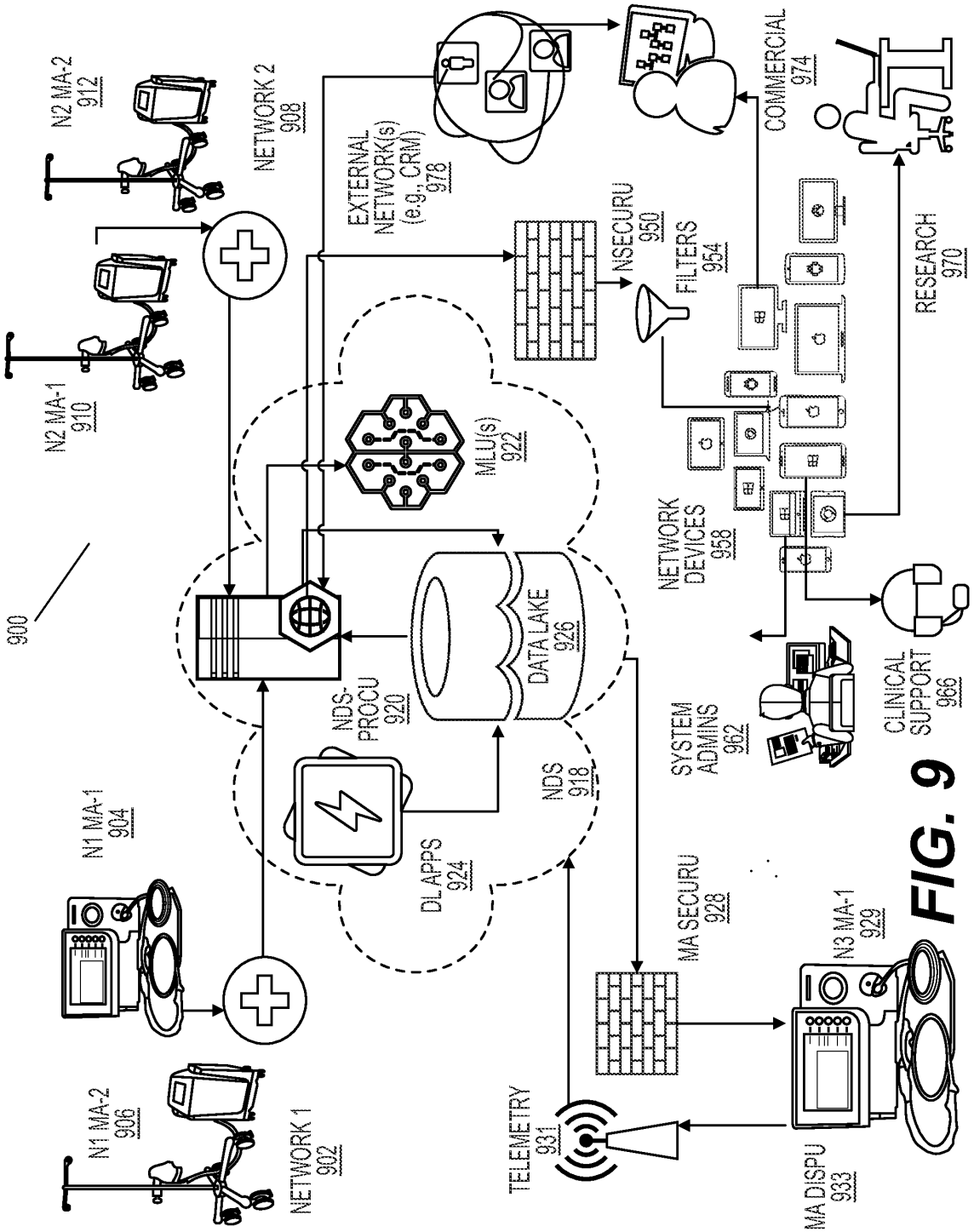
900
N2 MA-2
912
N2 MA-1
910
NETWORK 2
908
EXTERNAL
NETWORK(s)
(e.g., CRM)
978
COMMERCIAL
974
NSECURU
950
FILTERS
954
RESEARCH
970
MLU(s)
922
NETWORK
DEVICES
958
DATA LAKE
926
NDS-
PROCU
920
SYSTEM
ADMINS
962
CLINICAL
SUPPORT
966
N1 MA-1
904
DLAPPS
924
NDS
918
MA SECURU
928
N3 MA-1
929
N1 MA-2
906
NETWORK 1
902
TELEMETRY
931
MA DISPU
933

FIG. 9

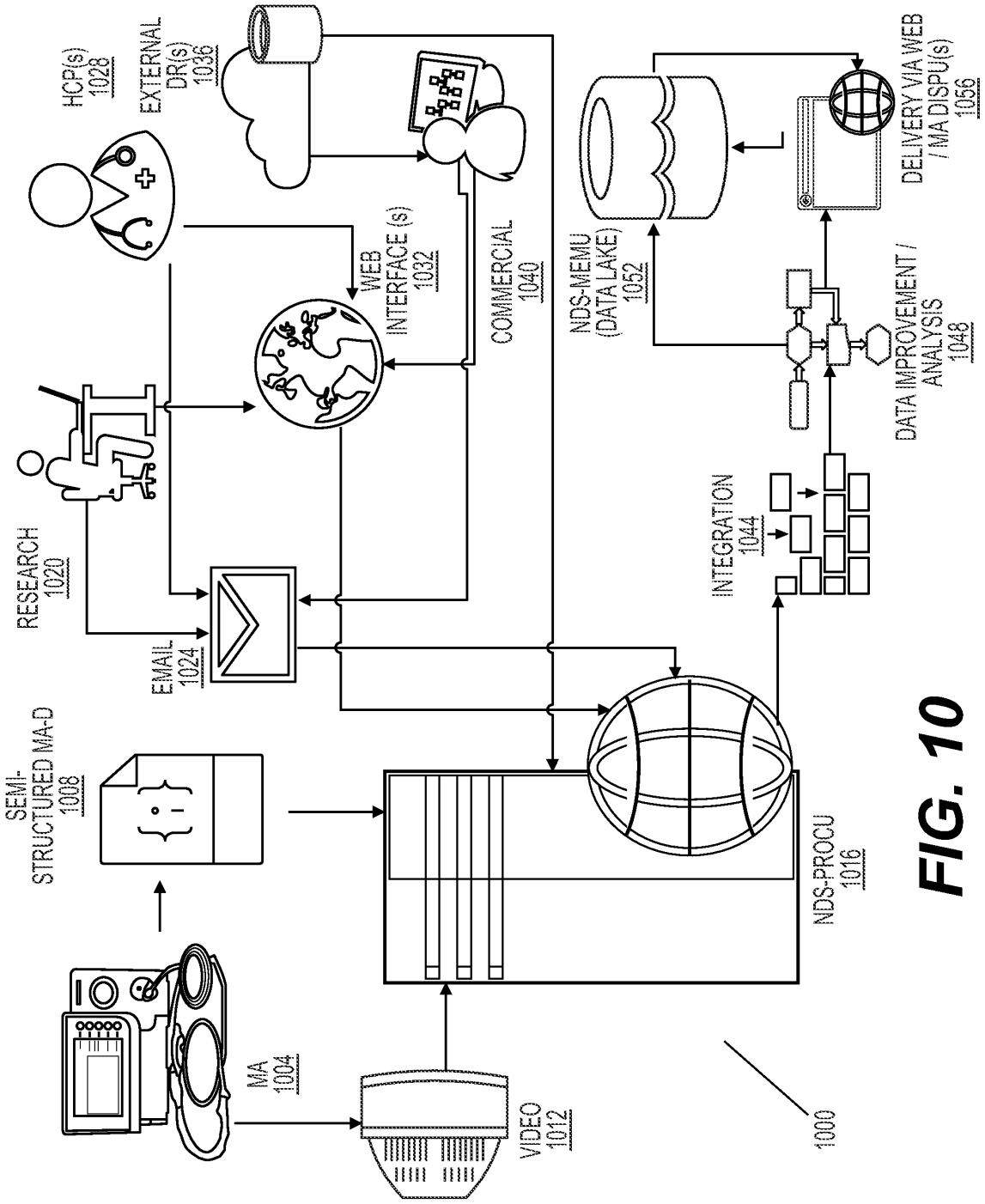
HCP(s)
1028
EXTERNAL
DR(s)
1036
WEB
INTERFACE (s)
1032
COMMERCIAL
1040
NDS-MEMU
(DATA LAKE)
1052
DELIVERY VIA WEB
/ MA DISPU(s)
1056
DATA IMPROVEMENT /
ANALYSIS
1048
INTEGRATION
1044
RESEARCH
1020
EMAIL
1024
SEMI-
STRUCTURED MA-D
1008
NDS-PROCU
1016
MA
1004
VIDEO
1012
1000

FIG. 10

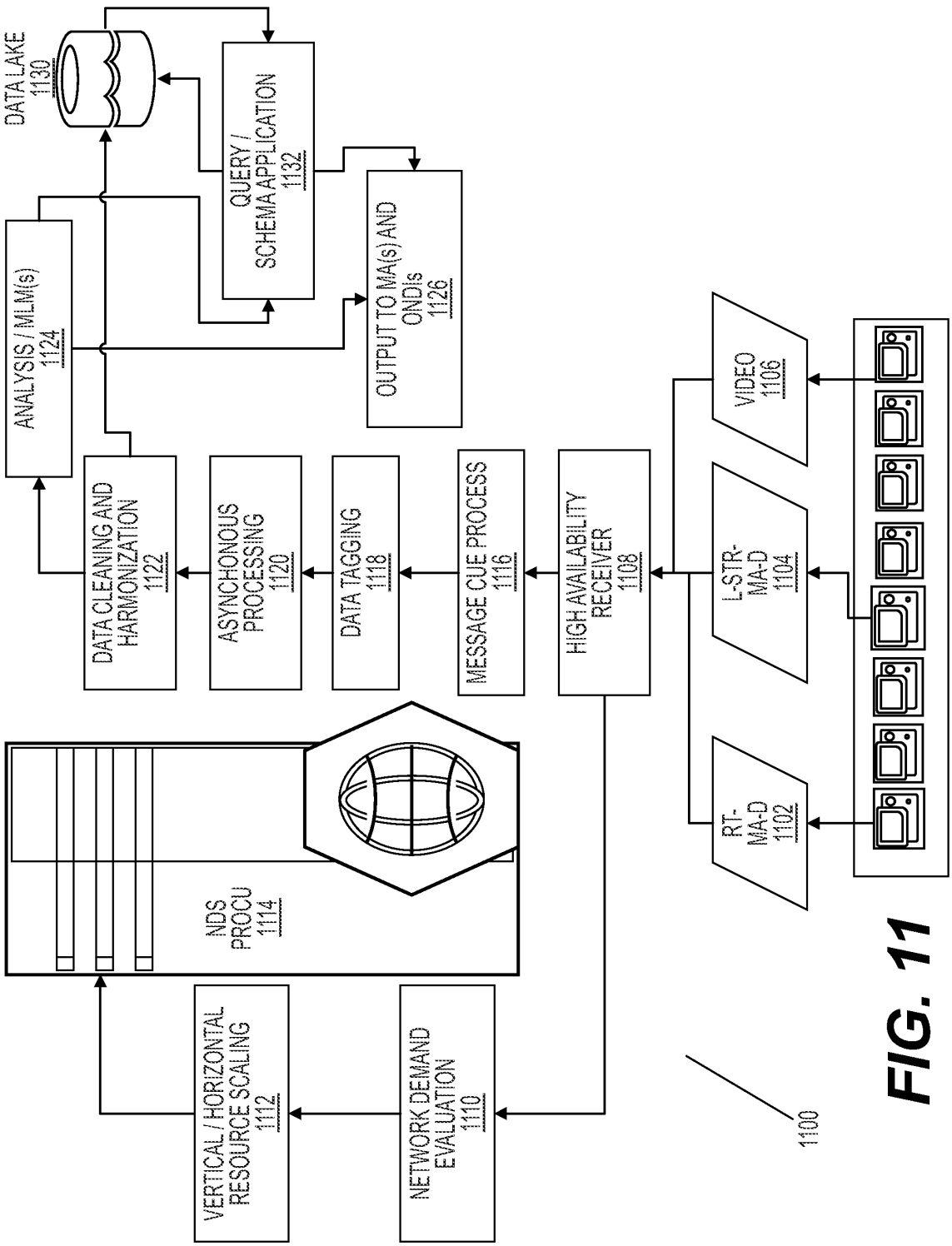
DATA LAKE
1130
QUERY / SCHEMA APPLICATION
1132
ANALYSIS / MLM(s)
1124
OUTPUT TO MA(s) AND ONDIs
1126
DATA CLEANING AND HARMONIZATION
1122
ASYNCHONOUS PROCESSING
1120
DATA TAGGING
1118
MESSAGE CUE PROCESS
1116
HIGH AVAILABILITY RECEIVER
1108
VIDEO
1106
L-STR-MA-D
1104
RT-MA-D
1102
NDS PROCU
1114
VERTICAL / HORIZONTAL RESOURCE SCALING
1112
NETWORK DEMAND EVALUATION
1110
1100

FIG. 11

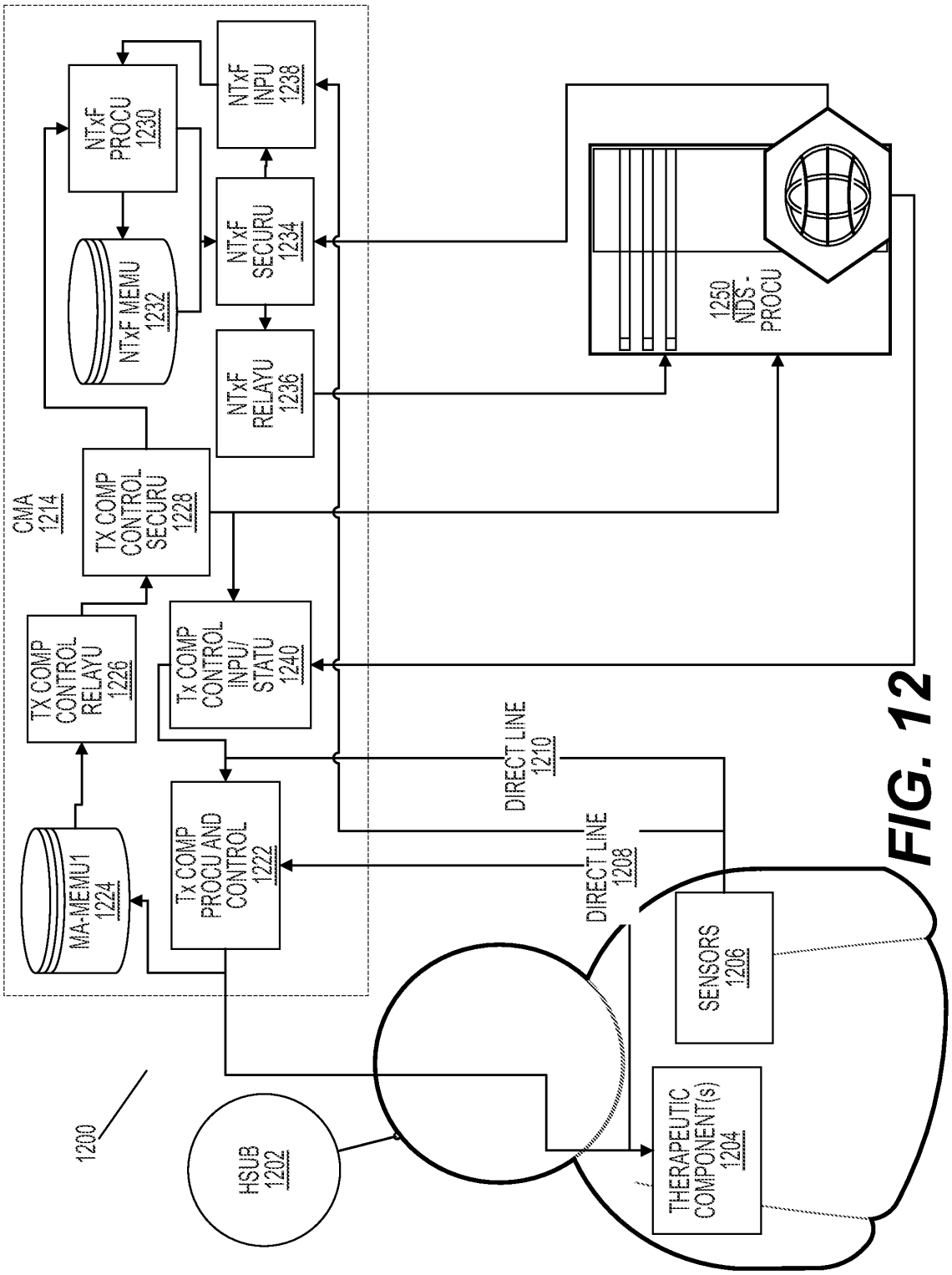
1200
HSUB
1202
CMA
1214
MA-MEMU1
1224
TX COMP
CONTROL
RELAYU
1226
TX COMP
CONTROL
SECURU
1228
NTxF
PROCU
1230
NTxF MEMU
1232
NTxF
SECURU
1234
NTxF
RELAYU
1236
NTxF
INPU
1238
Tx COMP
CONTROL
INPU/
STATU
1240
Tx COMP
PROCU AND
CONTROL
1222
DIRECT LINE
1210
DIRECT LINE
1208
1250
NDS -
PROCU
SENSORS
1206
THERAPEUTIC
COMPONENT(s)
1204

FIG. 12

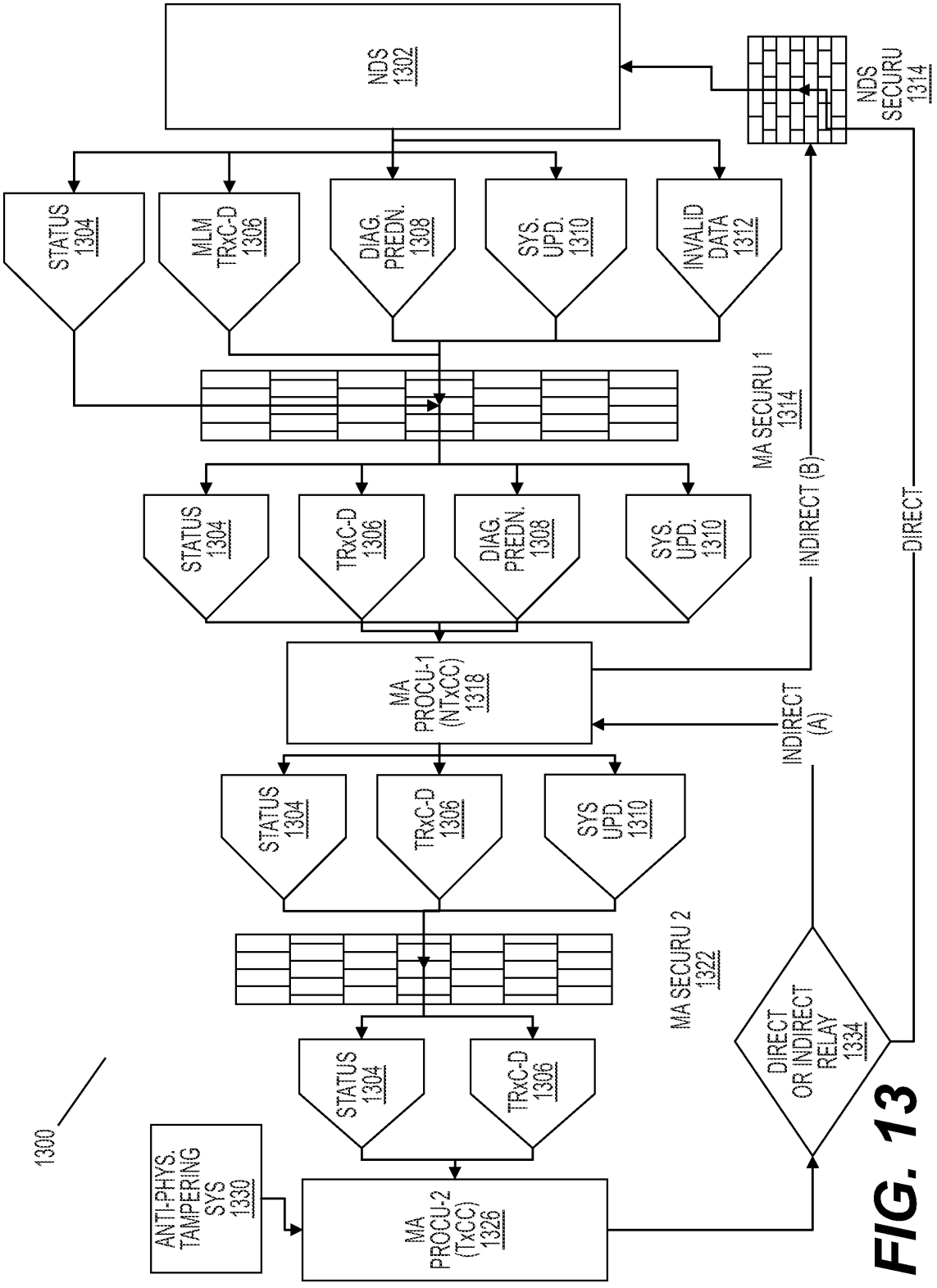
NDS 1302
NDS SECURU 1314
STATUS 1304
MLM TRxC-D 1306
DIAG. PREDN. 1308
SYS. UPD. 1310
INVALID DATA 1312
MA SECURU 1 1314
STATUS 1304
TRxC-D 1306
DIAG. PREDN. 1308
SYS. UPD. 1310
INDIRECT (B)
DIRECT
MA PROCU-1 (NTxCC) 1318
INDIRECT (A)
STATUS 1304
TRxC-D 1306
SYS UPD. 1310
MA SECURU 2 1322
DIRECT OR INDIRECT RELAY 1334
STATUS 1304
TRxC-D 1306
1300
ANTI-PHYS. TAMPERING SYS 1330
MA PROCU-2 (TxCC) 1326

FIG. 13

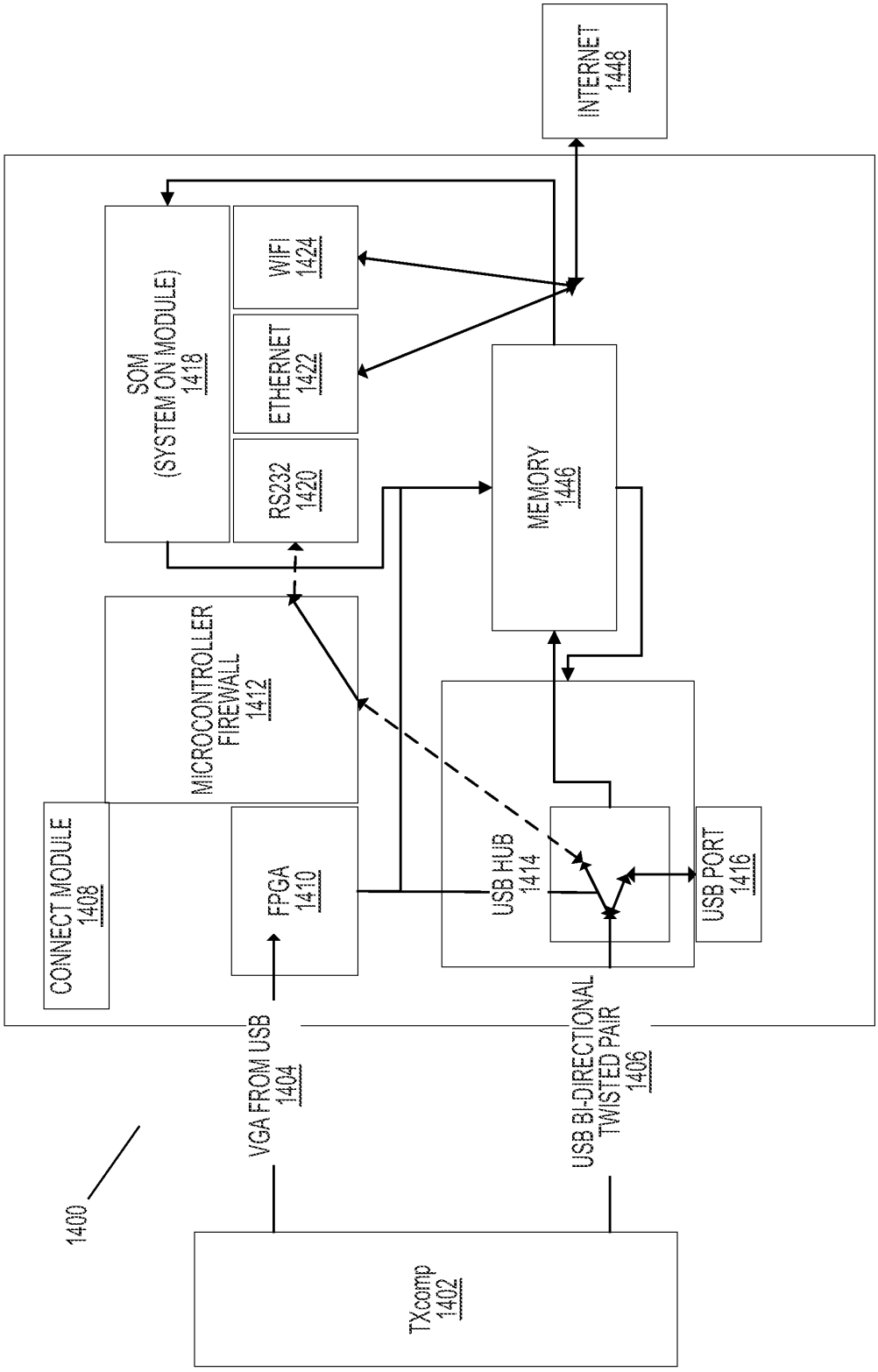
INTERNET
1448
SOM
(SYSTEM ON MODULE)
1418
WIFI
1424
ETHERNET
1422
RS232
1420
MEMORY
1446
MICROCONTROLLER
FIREWALL
1412
CONNECT MODULE
1408
FPGA
1410
USB HUB
1414
USB PORT
1416
VGA FROM USB
1404
USB BI-DIRECTIONAL
TWISTED PAIR
1406
1400
TXcomp
1402

FIG. 14

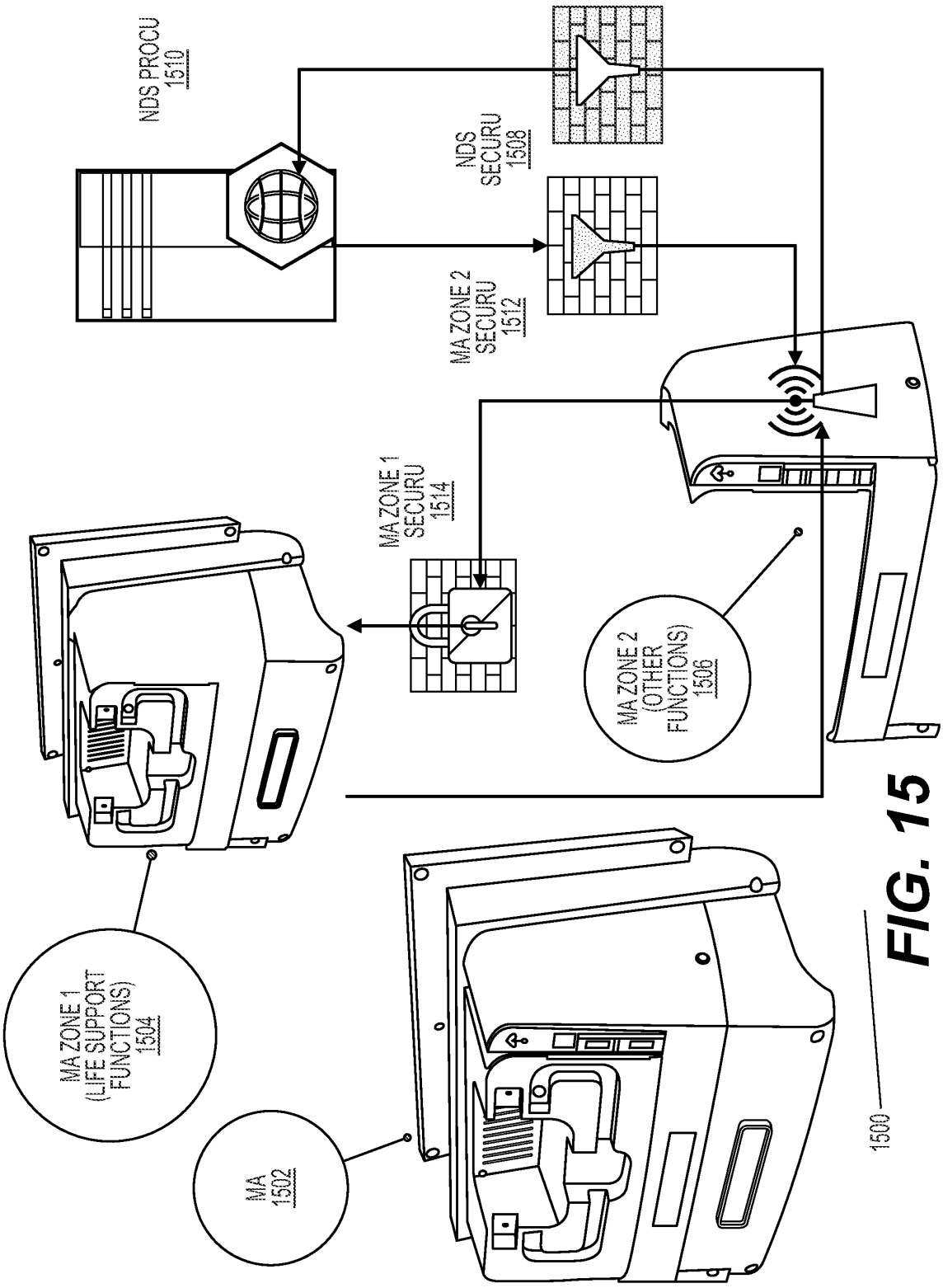
NDS PROCU
1510
NDS
SECURU
1508
MA ZONE 2
SECURU
1512
MA ZONE 1
SECURU
1514
MA ZONE 2
(OTHER
FUNCTIONS)
1506
MA ZONE 1
(LIFE SUPPORT
FUNCTIONS)
1504
MA
1502
1500

FIG. 15

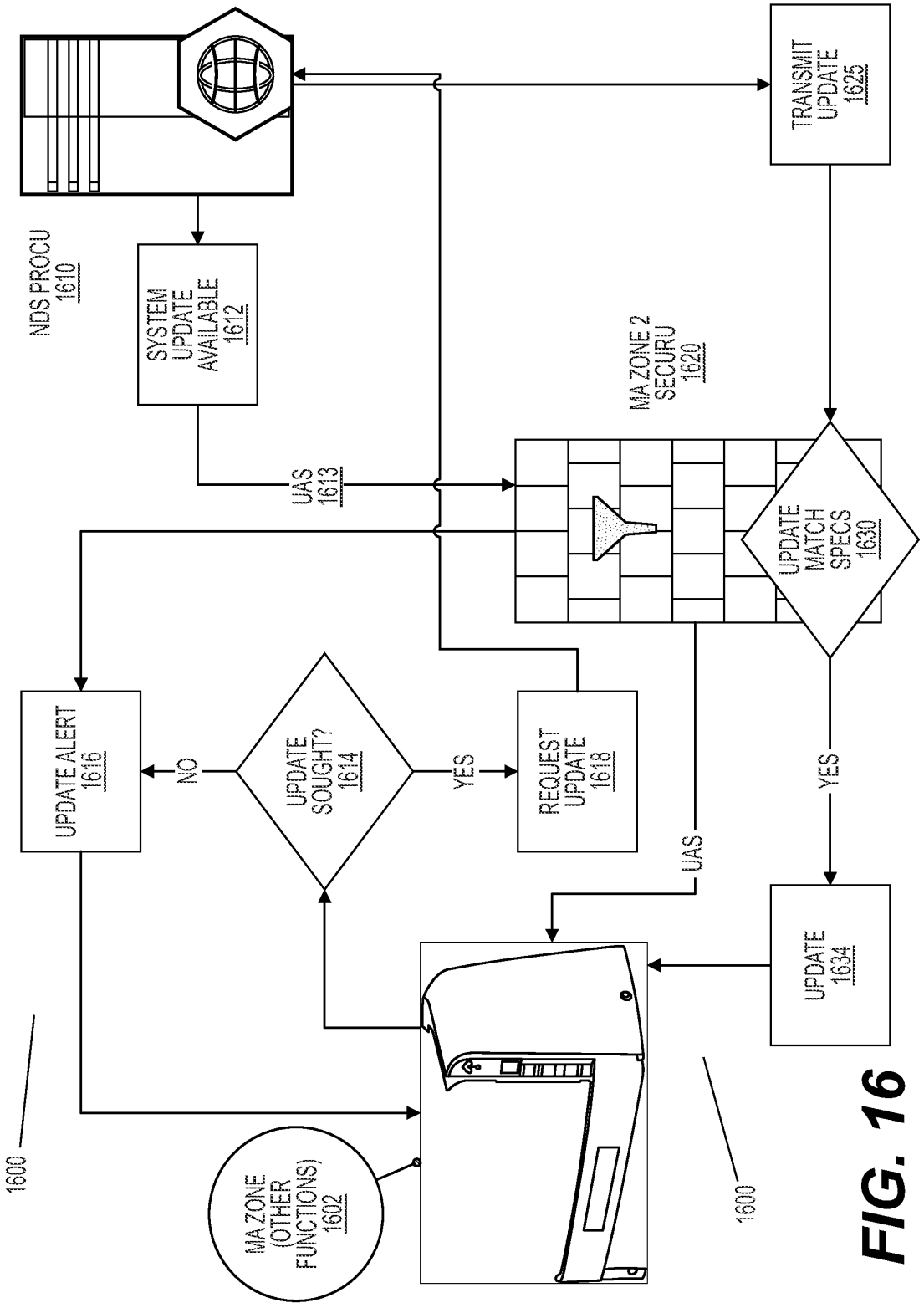
NDS PROCU
1610
SYSTEM
UPDATE
AVAILABLE
1612
UAS
1613
MA ZONE 2
SECURU
1620
TRANSMIT
UPDATE
1625
UPDATE
MATCH
SPECS
1630
UPDATE ALERT
1616
NO
UPDATE
SOUGHT?
1614
YES
REQUEST
UPDATE
1618
UAS
YES
UPDATE
1634
MA ZONE
(OTHER
FUNCTIONS)
1602
1600
1600

FIG. 16

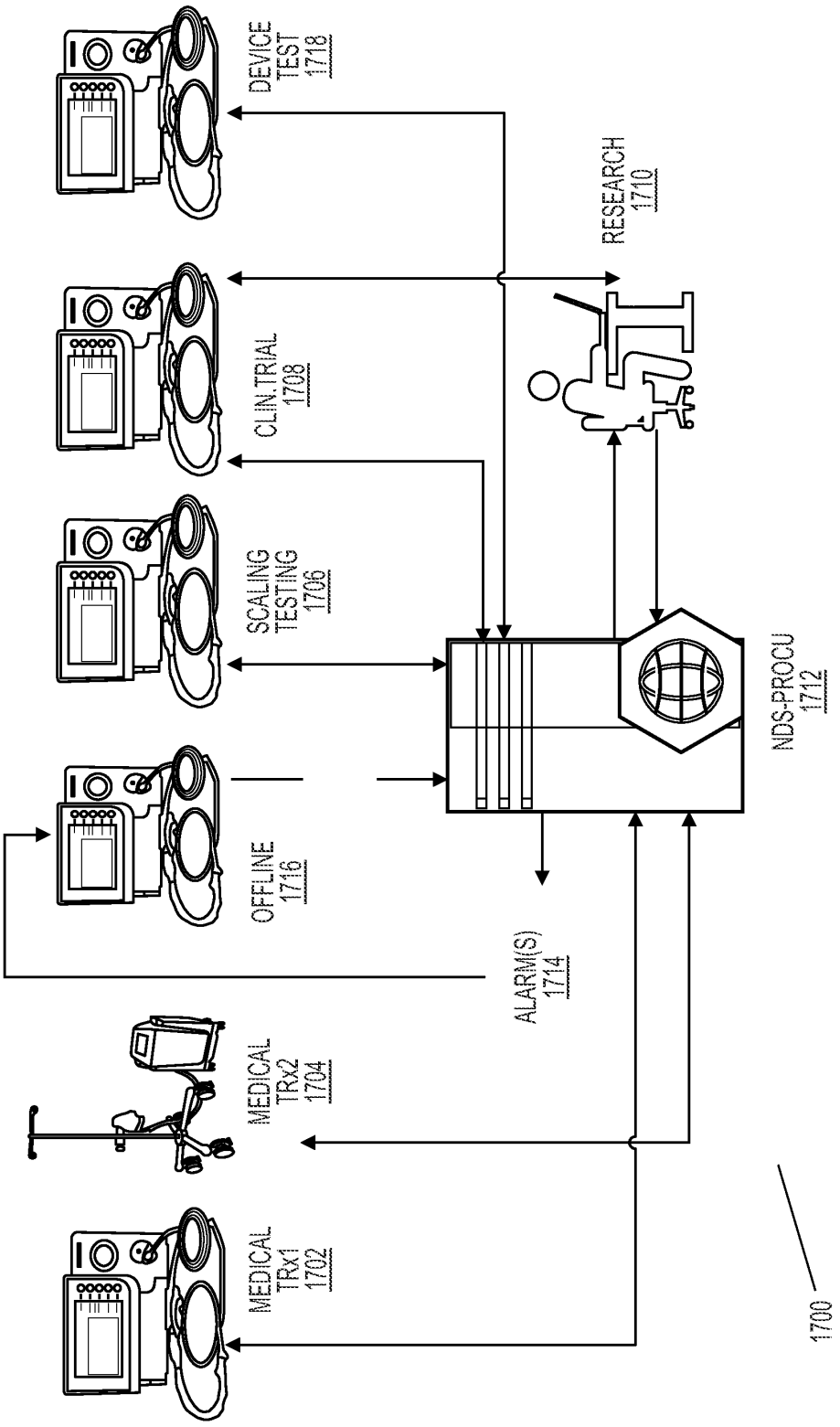
DEVICE TEST 1718
RESEARCH 1710
CLIN.TRIAL 1708
SCALING TESTING 1706
NDS-PROCU 1712
OFFLINE 1716
ALARM(S) 1714
MEDICAL TRx2 1704
MEDICAL TRx1 1702
1700

FIG. 17

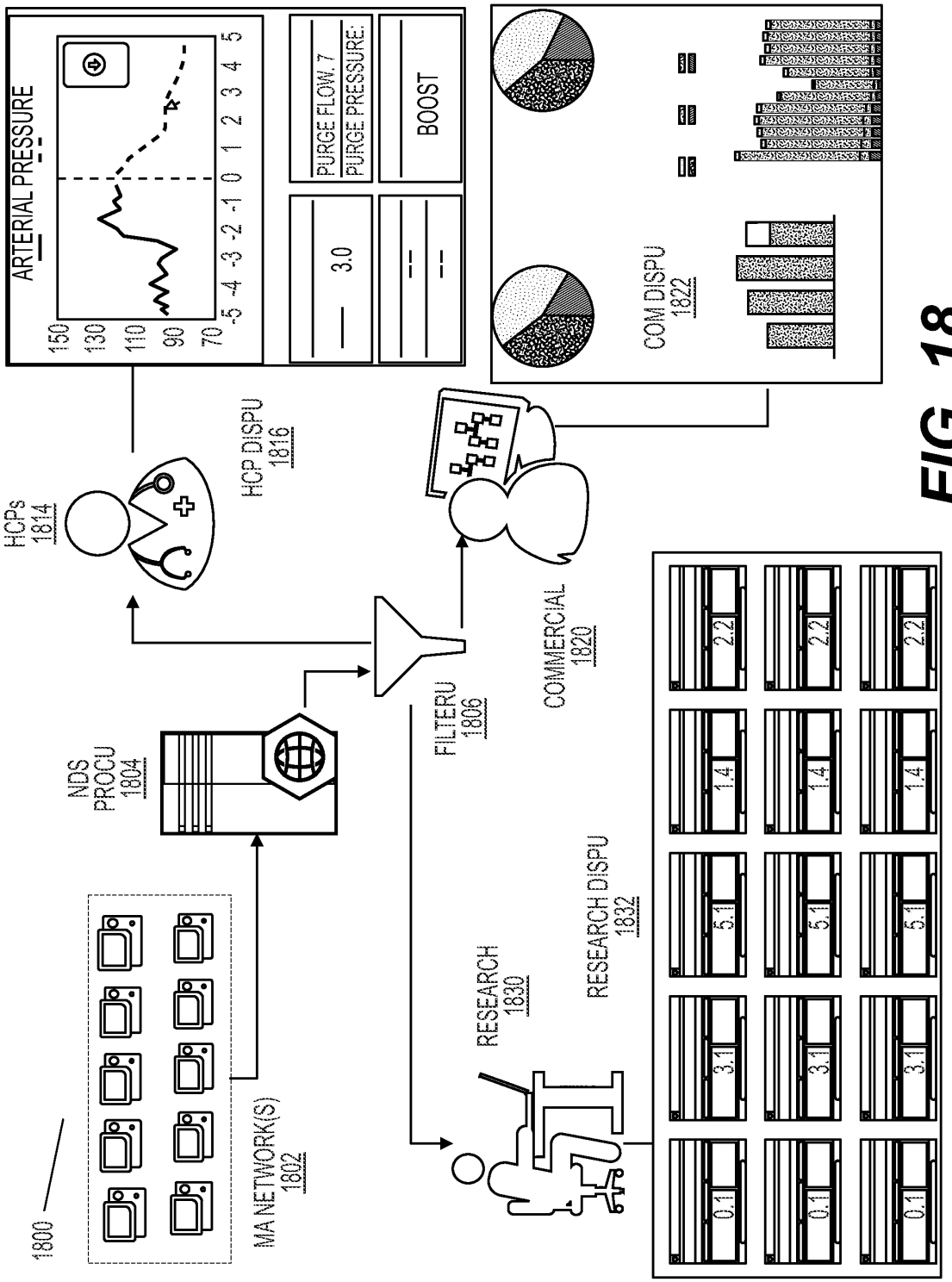
1800
MA NETWORK(S)
1802
NDS
PROCU
1804
FILTERU
1806
HCPs
1814
HCP DISPU
1816
COMMERCIAL
1820
COM DISPU
1822
RESEARCH
1830
RESEARCH DISPU
1832
ARTERIAL PRESSURE
150
130
110
90
70
-5 -4 -3 -2 -1 0 1 2 3 4 5
PURGE FLOW: 7
PURGE PRESSURE:
3.0
BOOST
0.1
3.1
5.1
1.4
2.2

FIG. 18

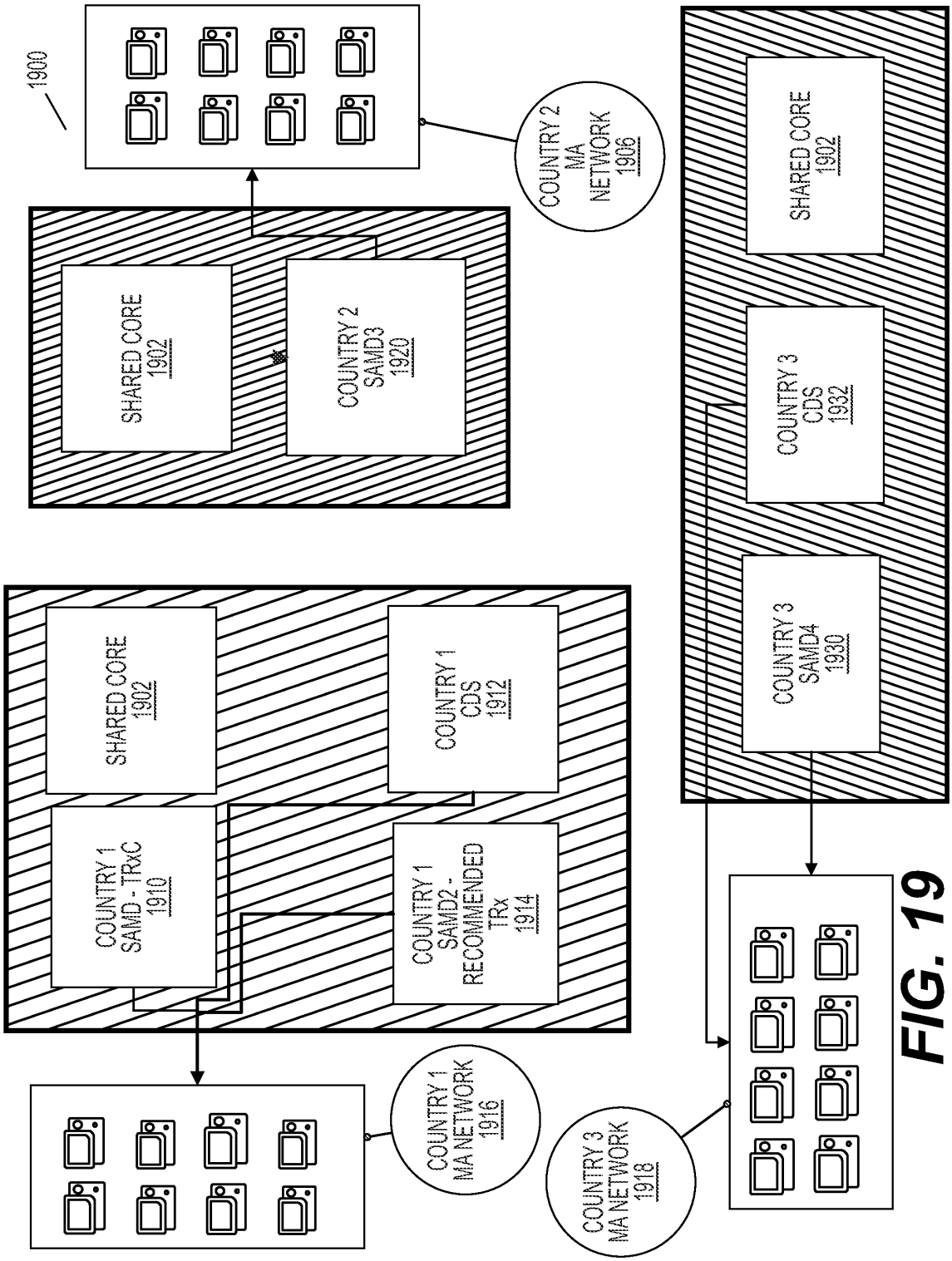
1900
SHARED CORE 1902
COUNTRY 2 SAMD3 1920
COUNTRY 2 MA NETWORK 1906
SHARED CORE 1902
COUNTRY 3 CDS 1932
COUNTRY 3 SAMD4 1930
SHARED CORE 1902
COUNTRY 1 CDS 1912
COUNTRY 1 SAMD - TRxC 1910
COUNTRY 1 SAMD2 - RECOMMENDED TRx 1914
COUNTRY 1 MA NETWORK 1916
COUNTRY 3 MA NETWORK 1918

FIG. 19

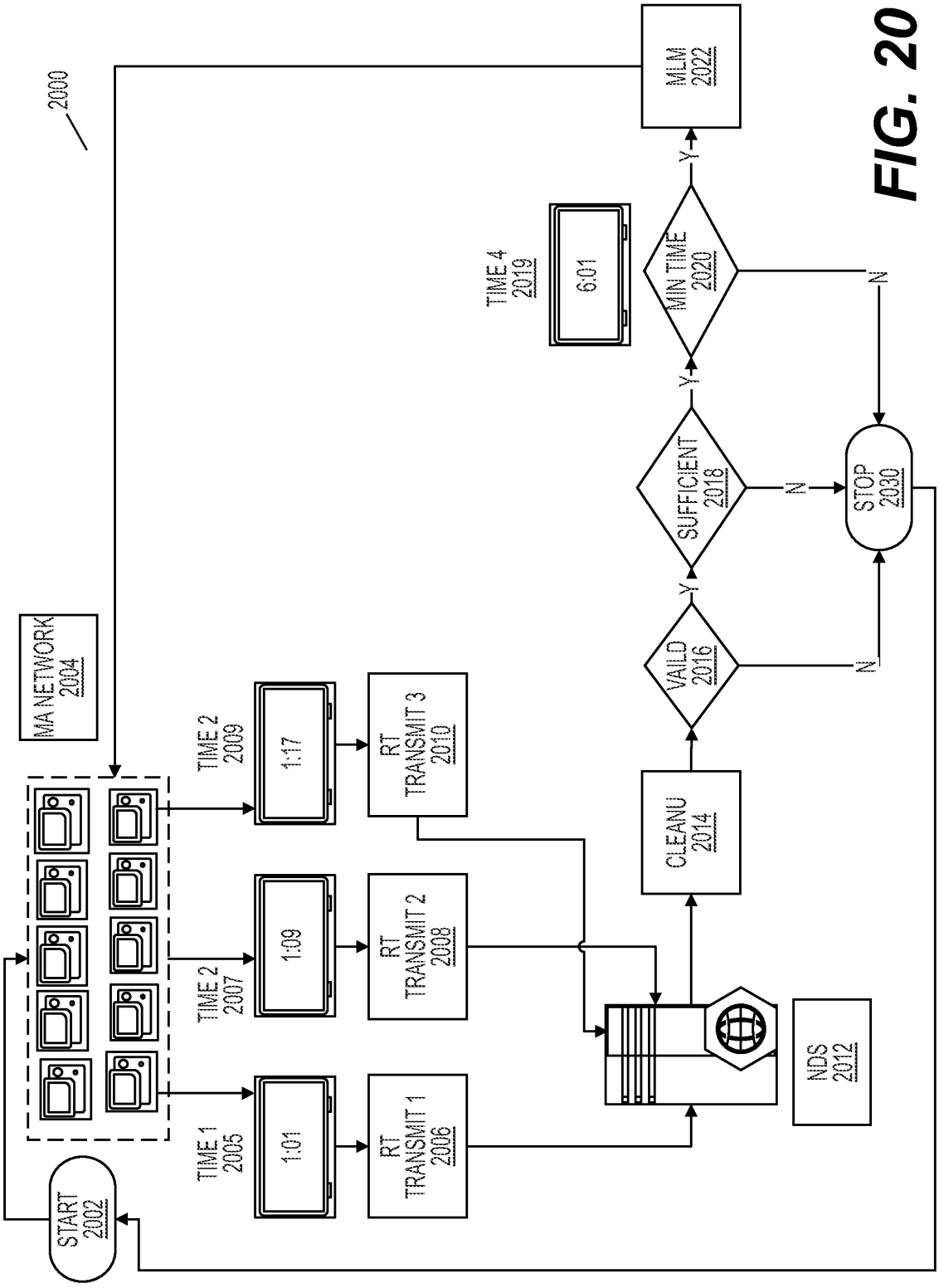
2000
START 2002
MA NETWORK 2004
TIME 1 2005
1:01
RT TRANSMIT 1 2006
TIME 2 2007
1:09
RT TRANSMIT 2 2008
TIME 2 2009
1:17
RT TRANSMIT 3 2010
NDS 2012
CLEANU 2014
VAILD 2016
SUFFICIENT 2018
TIME 4 2019
6:01
MIN TIME 2020
MLM 2022
STOP 2030
Y
N

FIG. 20

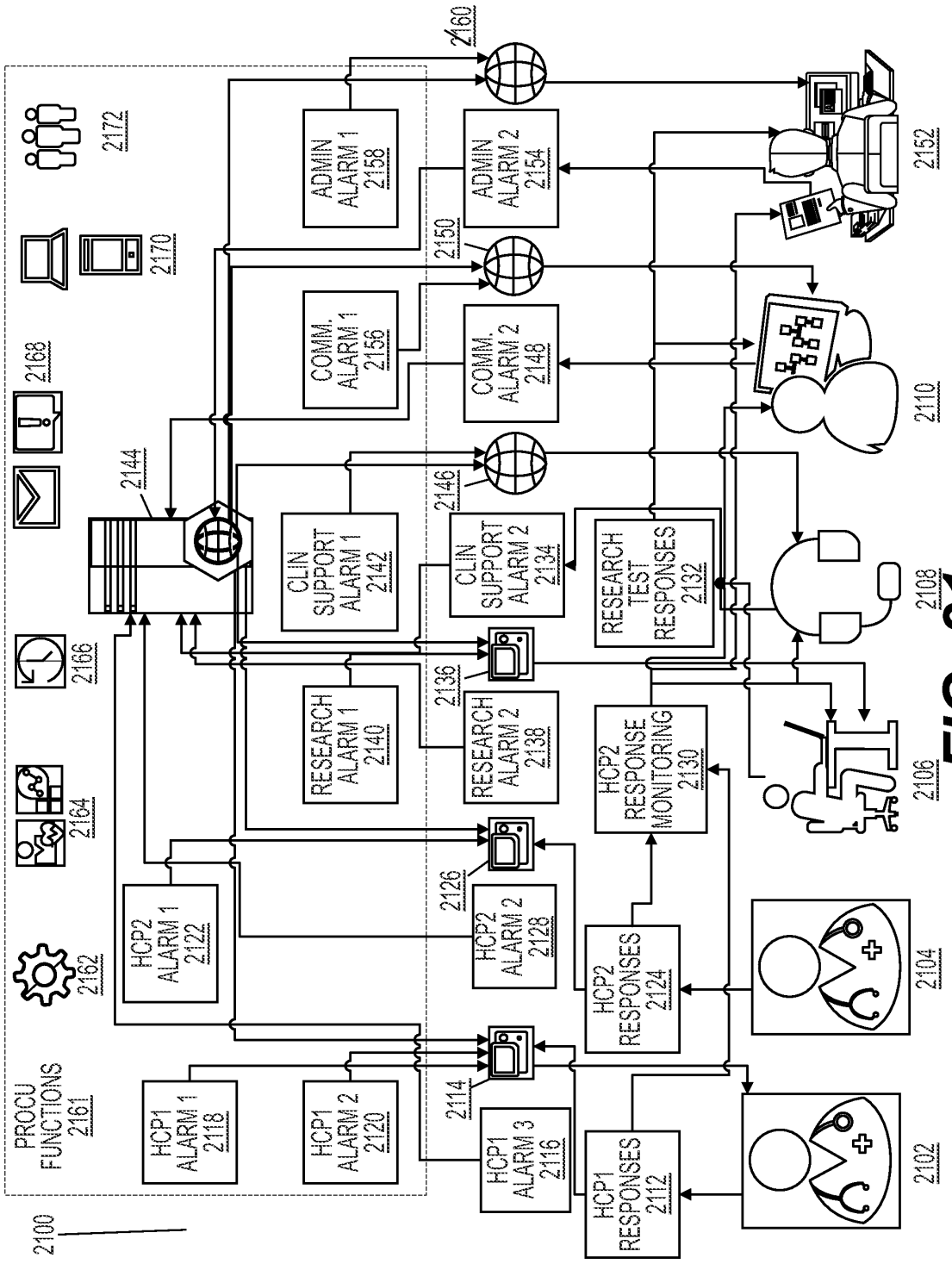
2100
PROCU FUNCTIONS 2161
HCP1 ALARM 1 2118
HCP1 ALARM 2 2120
HCP1 ALARM 3 2116
HCP1 RESPONSES 2112
HCP2 ALARM 1 2122
HCP2 ALARM 2 2128
HCP2 RESPONSES 2124
HCP2 RESPONSE MONITORING 2130
RESEARCH ALARM 1 2140
RESEARCH ALARM 2 2138
RESEARCH TEST RESPONSES 2132
CLIN SUPPORT ALARM 1 2142
CLIN SUPPORT ALARM 2 2134
COMM. ALARM 1 2156
COMM. ALARM 2 2148
ADMIN ALARM 1 2158
ADMIN ALARM 2 2154
2102
2104
2106
2108
2110
2112
2114
2116
2118
2120
2122
2124
2126
2128
2130
2132
2134
2136
2138
2140
2142
2144
2146
2148
2150
2152
2154
2156
2158
2160
2162
2164
2166
2168
2170
2172

FIG. 21

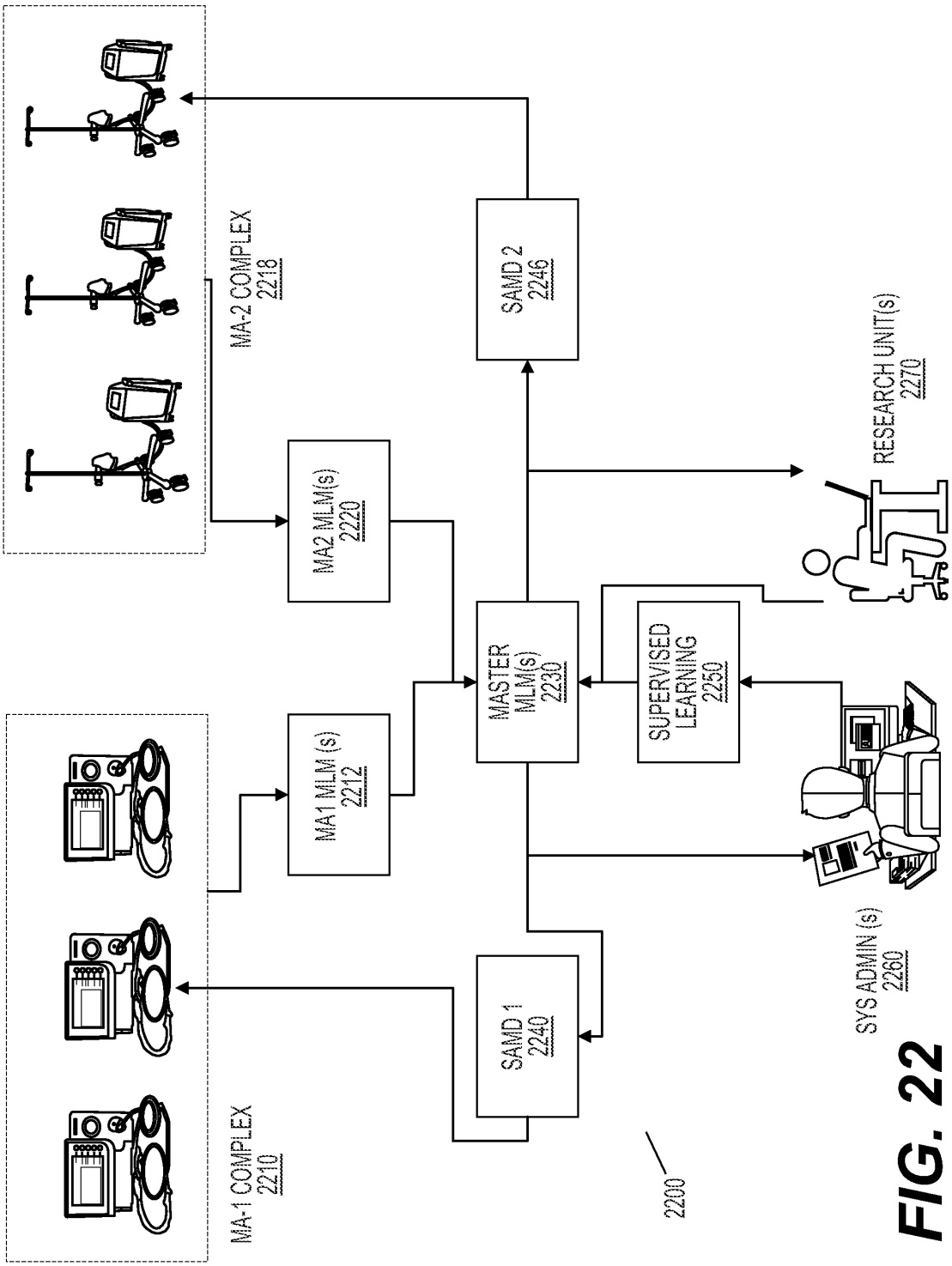
MA-1 COMPLEX
2210
MA-2 COMPLEX
2218
MA1 MLM (s)
2212
MA2 MLM(s)
2220
MASTER
MLM(s)
2230
SAMD 1
2240
SAMD 2
2246
SUPERVISED
LEARNING
2250
RESEARCH UNIT(s)
2270
SYS ADMIN (s)
2260
2200

FIG. 22

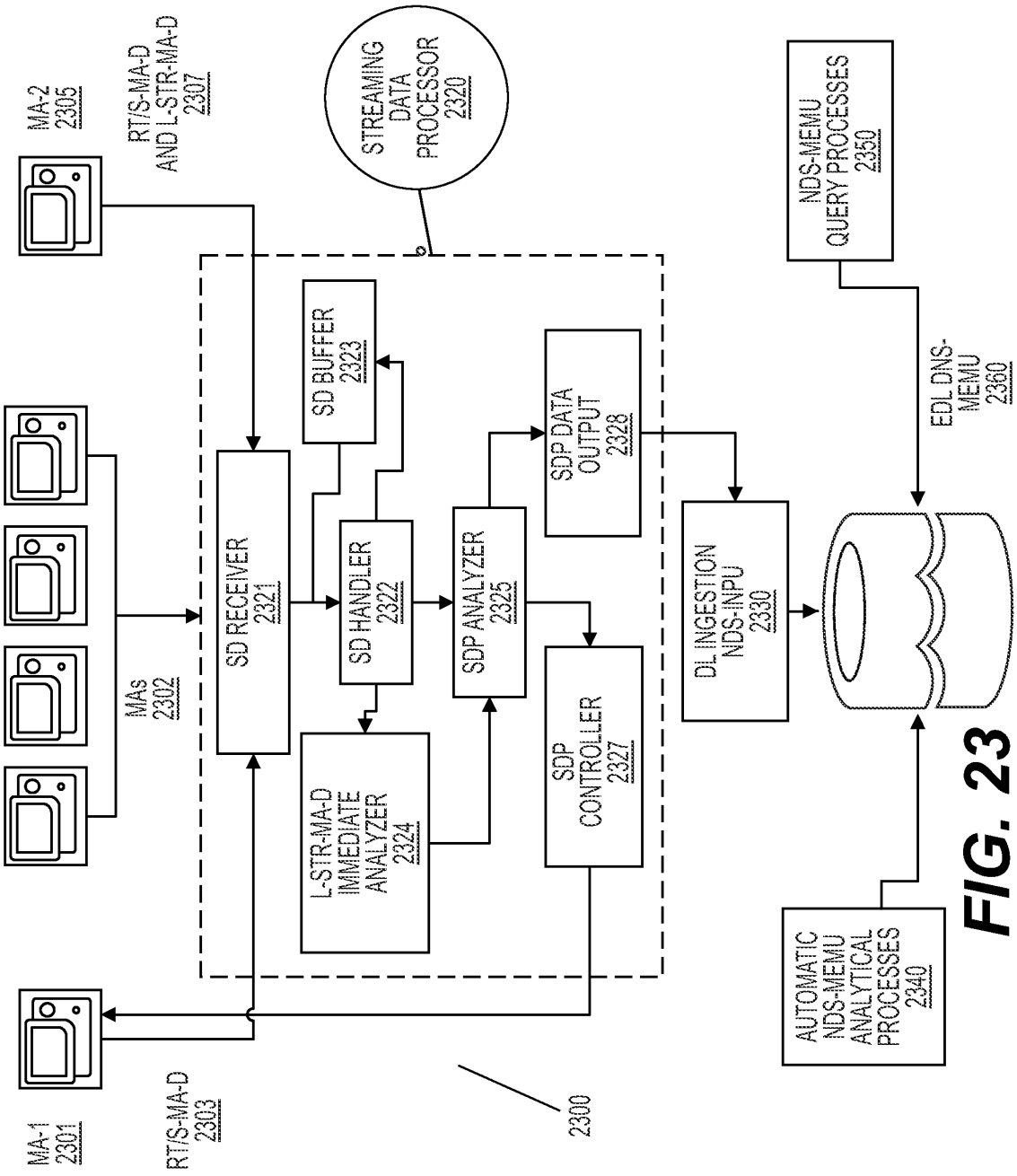
MA-2
2305
RT/S-MA-D
AND L-STR-MA-D
2307
STREAMING
DATA
PROCESSOR
2320
NDS-MEMU
QUERY PROCESSES
2350
SD BUFFER
2323
SDP DATA
OUTPUT
2328
EDL DNS-
MEMU
2360
MAs
2302
SD RECEIVER
2321
SD HANDLER
2322
SDP ANALYZER
2325
DL INGESTION
NDS-INPU
2330
L-STR-MA-D
IMMEDIATE
ANALYZER
2324
SDP
CONTROLLER
2327
AUTOMATIC
NDS-MEMU
ANALYTICAL
PROCESSES
2340
MA-1
2301
RT/S-MA-D
2303
2300

FIG. 23

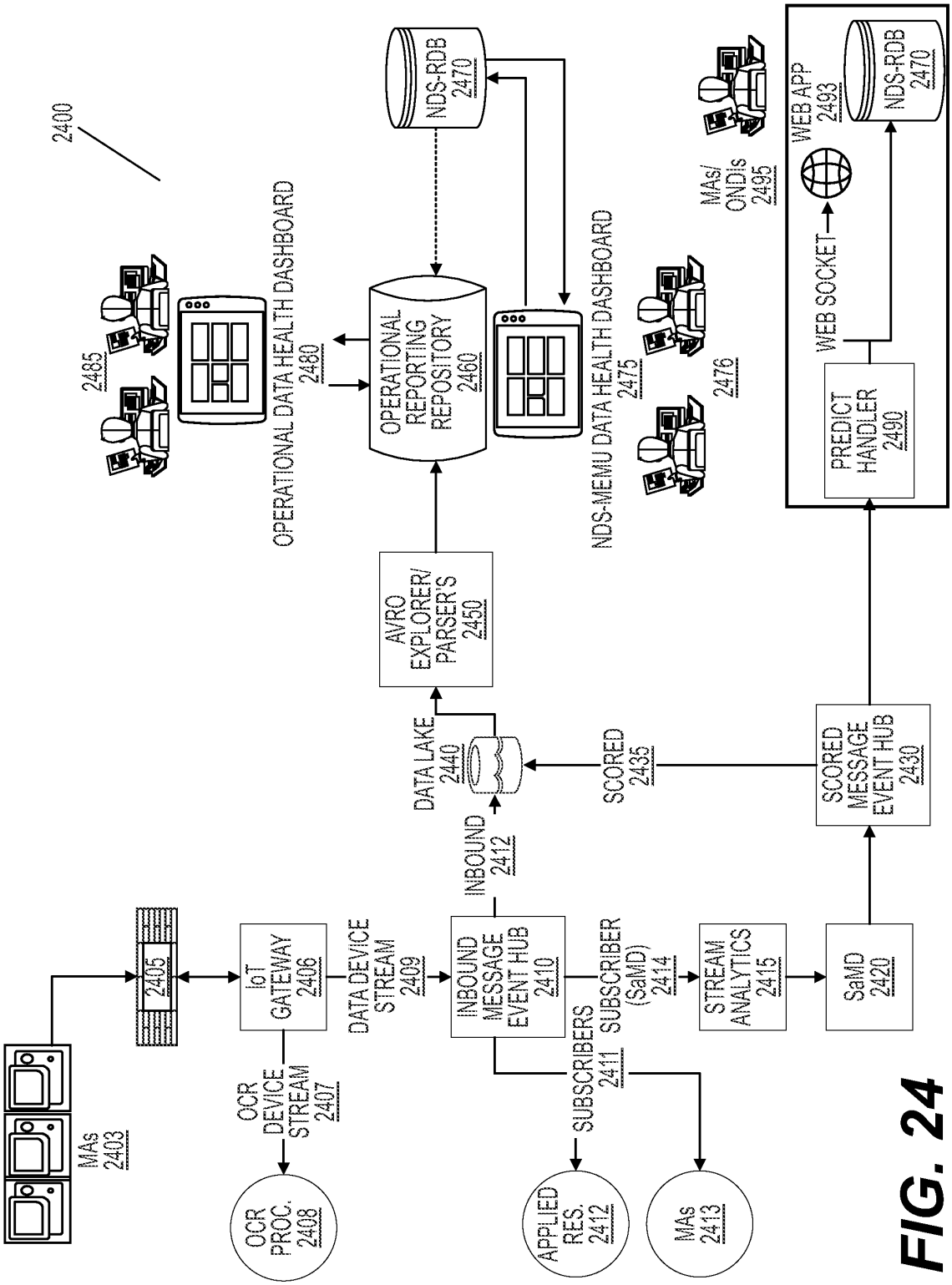
2400
MAs 2403
2405
IoT GATEWAY 2406
OCR DEVICE STREAM 2407
OCR PROC. 2408
DATA DEVICE STREAM 2409
INBOUND MESSAGE EVENT HUB 2410
SUBSCRIBERS 2411
APPLIED RES. 2412
SUBSCRIBER (SaMD) 2414
MAs 2413
STREAM ANALYTICS 2415
SaMD 2420
INBOUND 2412
DATA LAKE 2440
AVRO EXPLORER/ PARSER'S 2450
SCORED 2435
SCORED MESSAGE EVENT HUB 2430
OPERATIONAL REPORTING REPOSITORY 2460
NDS-RDB 2470
OPERATIONAL DATA HEALTH DASHBOARD 2480
2485
NDS-MEMU DATA HEALTH DASHBOARD 2475
2476
MAs/ ONDIs 2495
WEB APP 2493
WEB SOCKET
PREDICT HANDLER 2490
NDS-RDB 2470

FIG. 24

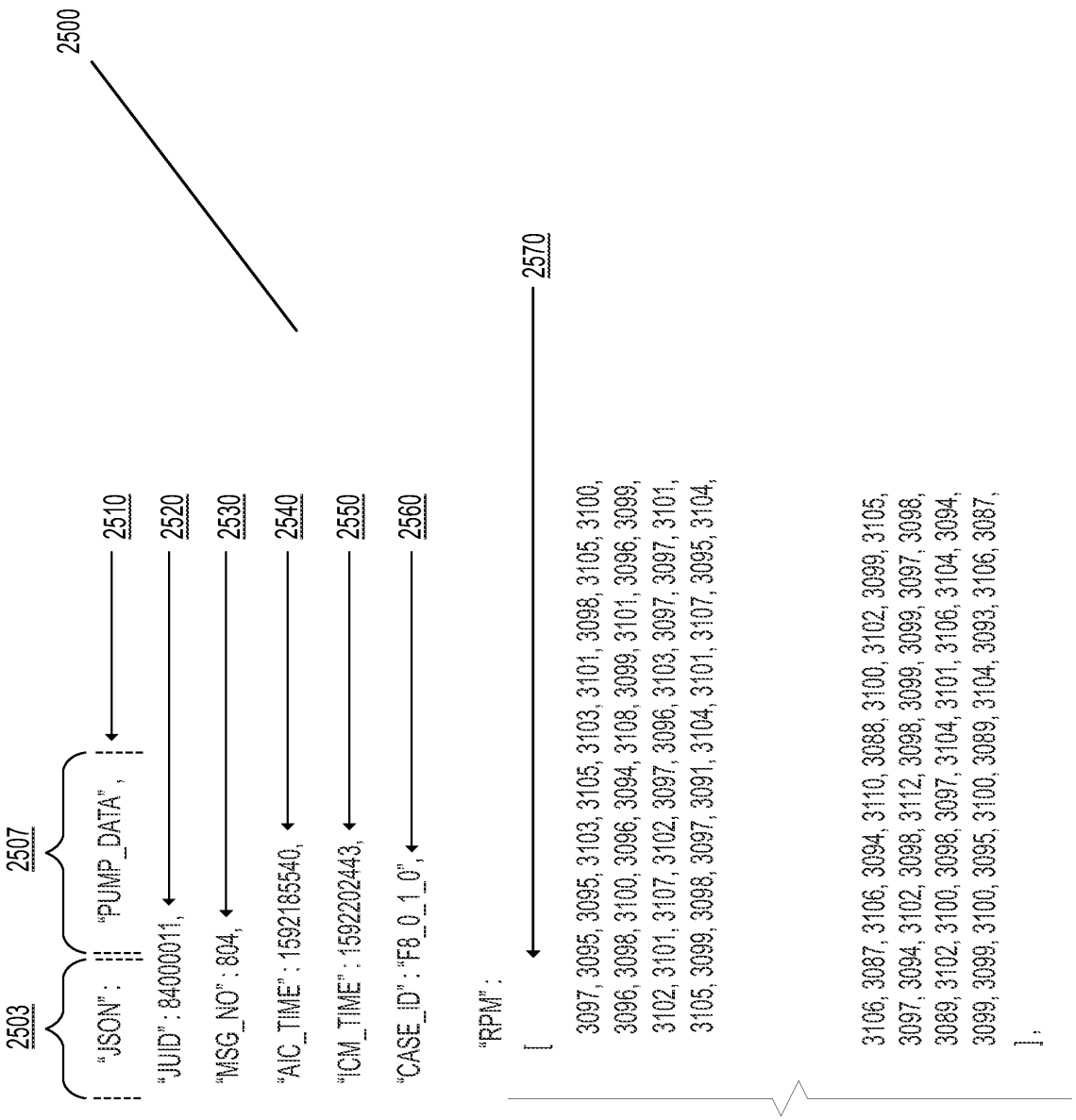
2500
2503
2507
"JSON": "PUMP_DATA",
2510
"JUID": 84000011,
2520
"MSG_NO": 804,
2530
"AIC_TIME": 1592185540,
2540
"ICM_TIME": 1592202443,
2550
"CASE_ID": "F8_0_1_0",
2560
"RPM":
2570
[
3097, 3095, 3095, 3103, 3105, 3103, 3101, 3098, 3105, 3100,
3096, 3098, 3100, 3096, 3094, 3108, 3099, 3101, 3096, 3099,
3102, 3101, 3107, 3102, 3097, 3096, 3103, 3097, 3097, 3101,
3105, 3099, 3098, 3097, 3091, 3104, 3101, 3107, 3095, 3104,
3106, 3087, 3106, 3094, 3110, 3088, 3100, 3102, 3099, 3105,
3097, 3094, 3102, 3098, 3112, 3098, 3099, 3099, 3097, 3098,
3089, 3102, 3100, 3098, 3097, 3104, 3101, 3106, 3104, 3094,
3099, 3099, 3100, 3095, 3100, 3089, 3104, 3093, 3106, 3087,
],

FIG. 25

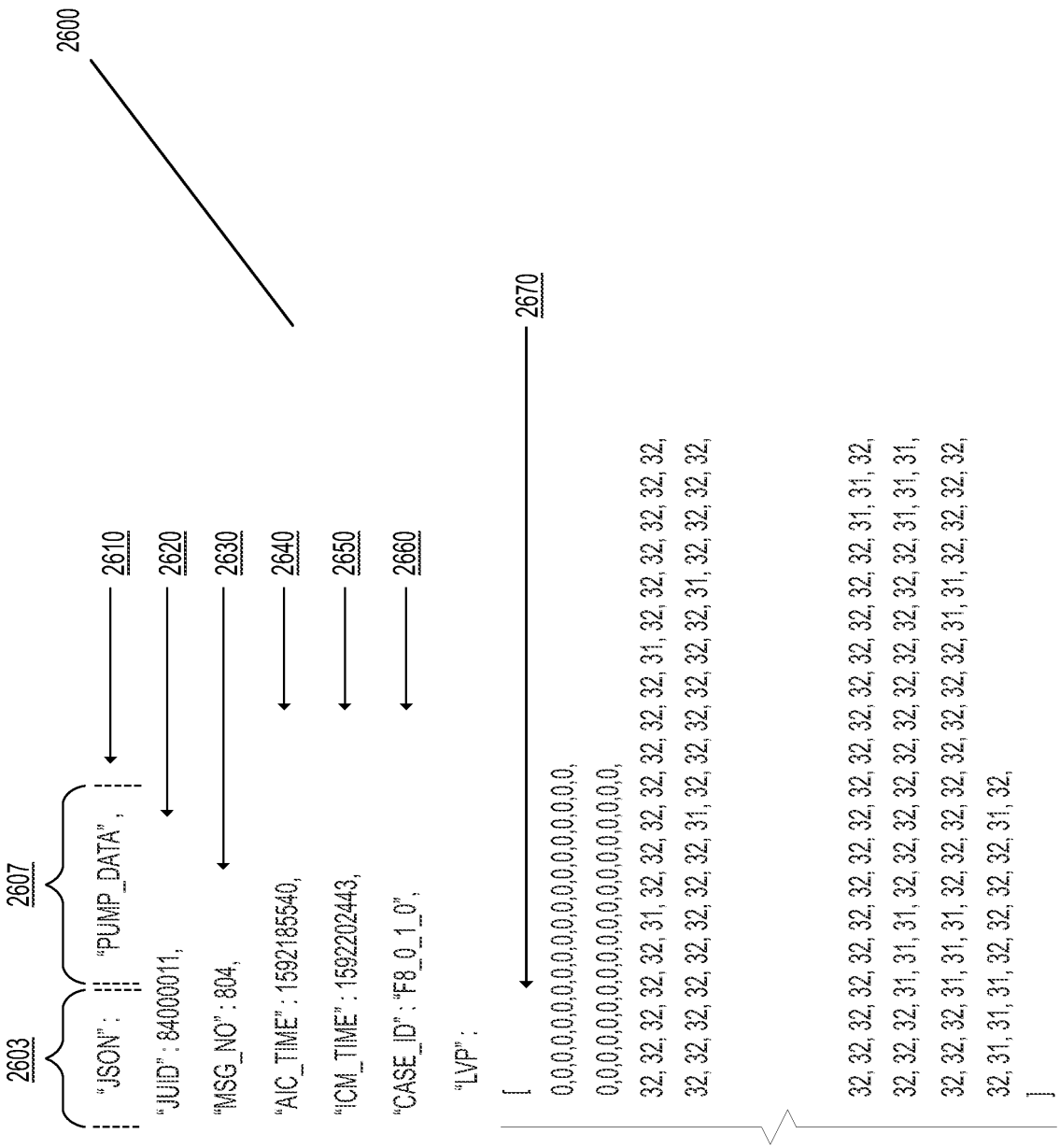
2600
2603
2607
"JSON" : "PUMP_DATA" ,
2610
"JUID" : 84000011,
2620
"MSG_NO" : 804,
2630
"AIC_TIME" : 1592185540,
2640
"ICM_TIME" : 1592202443,
2650
"CASE_ID" : "F8_0_1_0",
2660
"LVP" :
2670
[
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
32, 32, 32, 32, 32, 31, 32, 32, 32, 32, 32, 32, 31, 32, 32, 32, 32, 32, 32, 32,
32, 32, 32, 32, 32, 32, 31, 32, 32, 32, 32, 32, 32, 32, 31, 32, 32, 32, 32, 32,
32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 31, 31, 32,
32, 32, 32, 31, 31, 31, 32, 32, 32, 32, 32, 32, 32, 32, 31, 31, 32, 32, 32, 32,
32, 31, 31, 31, 32, 32, 32, 32, 31, 32,
]

FIG. 26

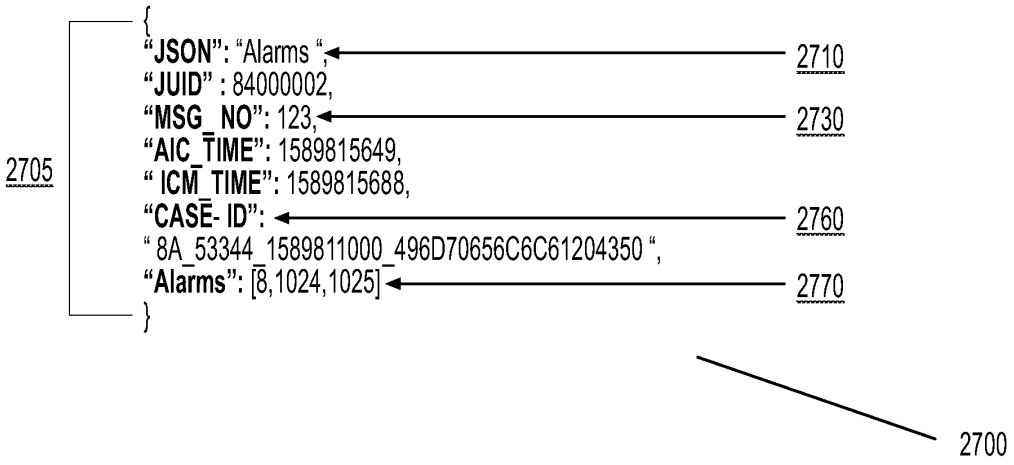
{
"JSON": "Alarms ",
"JUID" : 84000002,
"MSG_NO": 123,
"AIC_TIME": 1589815649,
" ICM_TIME": 1589815688,
"CASE- ID":
" 8A_53344_1589811000_496D70656C6C61204350 ",
"Alarms": [8,1024,1025]
}
2710
2730
2760
2770
2705
2700

FIG. 27

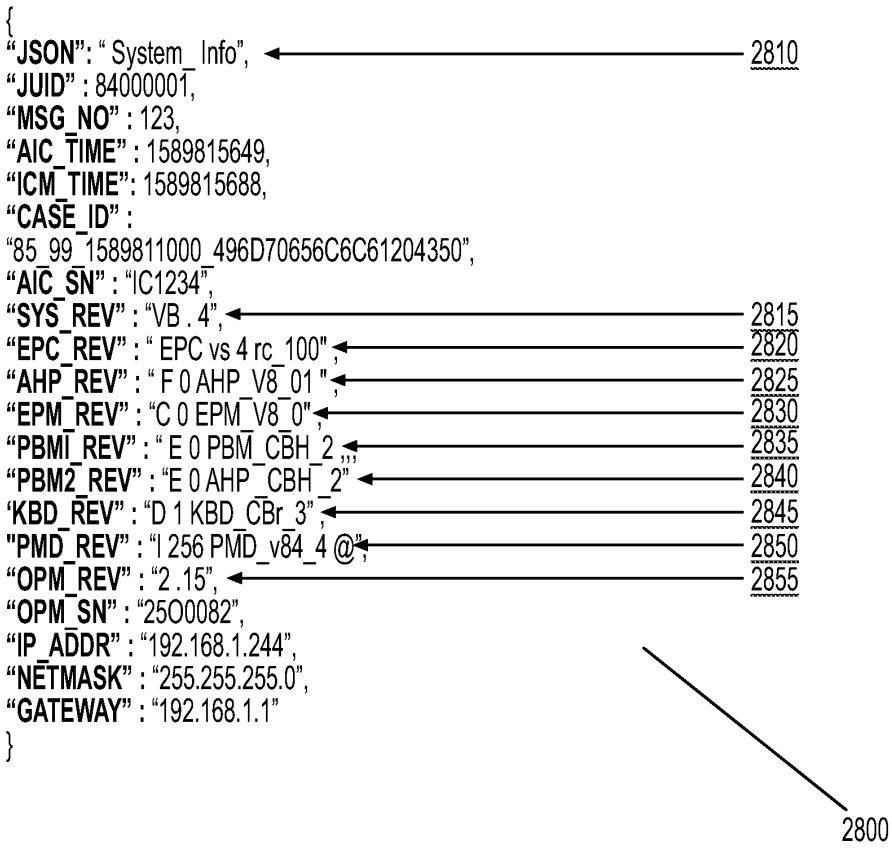
{
"JSON": " System_ Info",
"JUID" : 84000001,
"MSG_NO" : 123,
"AIC_TIME" : 1589815649,
"ICM_TIME": 1589815688,
"CASE_ID" :
"85_99_1589811000_496D70656C6C61204350",
"AIC_SN" : "IC1234",
"SYS_REV" : "VB . 4",
"EPC_REV" : " EPC vs 4 rc_100",
"AHP_REV" : " F 0 AHP_V8_01 ",
"EPM_REV" : "C 0 EPM_V8_0",
"PBMI_REV" : " E 0 PBM_CBH_2 ,,,
"PBM2_REV" : "E 0 AHP_CBH_2"
'KBD_REV" : "D 1 KBD_CBr_3",
"PMD_REV" : "I 256 PMD_v84_4 @",
"OPM_REV" : "2 .15",
"OPM_SN" : "25O0082",
"IP_ADDR" : "192.168.1.244",
"NETMASK" : "255.255.255.0",
"GATEWAY" : "192.168.1.1"
}
2810
2815
2820
2825
2830
2835
2840
2845
2850
2855
2800

FIG. 28