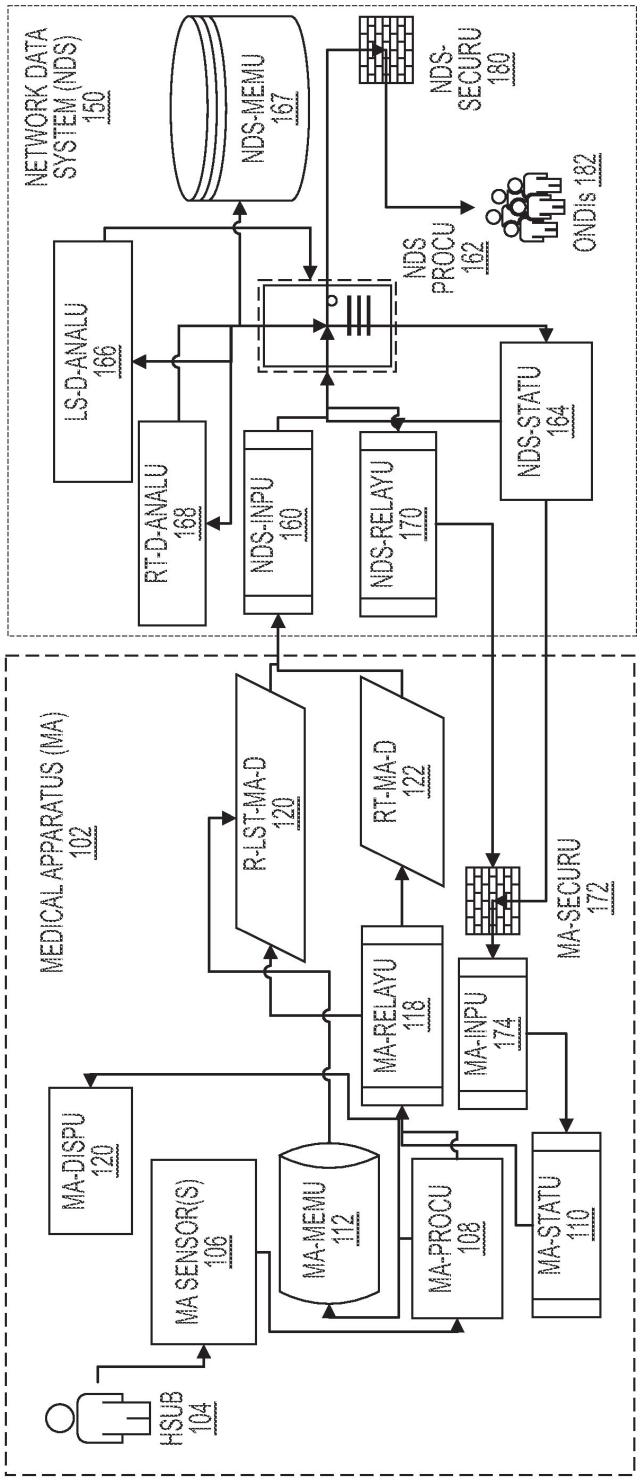

NETWORK DATA SYSTEM (NDS) 160
NDS-MEMU 167
NDS-SECURU 180
ONDIs 182
NDS PROCU 162
LS-D-ANALU 166
RT-D-ANALU 168
NDS-INPU 160
NDS-RELAYU 170
NDS-STATU 164
MEDICAL APPARATUS (MA) 102
R-LST-MA-D 120
RT-MA-D 122
MA-SECURU 172
MA-DISPU 120
MA-RELAYU 118
MA-INPU 174
MA SENSOR(S) 106
MA-MEMU 112
MA-PROCU 108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

FIG. 1

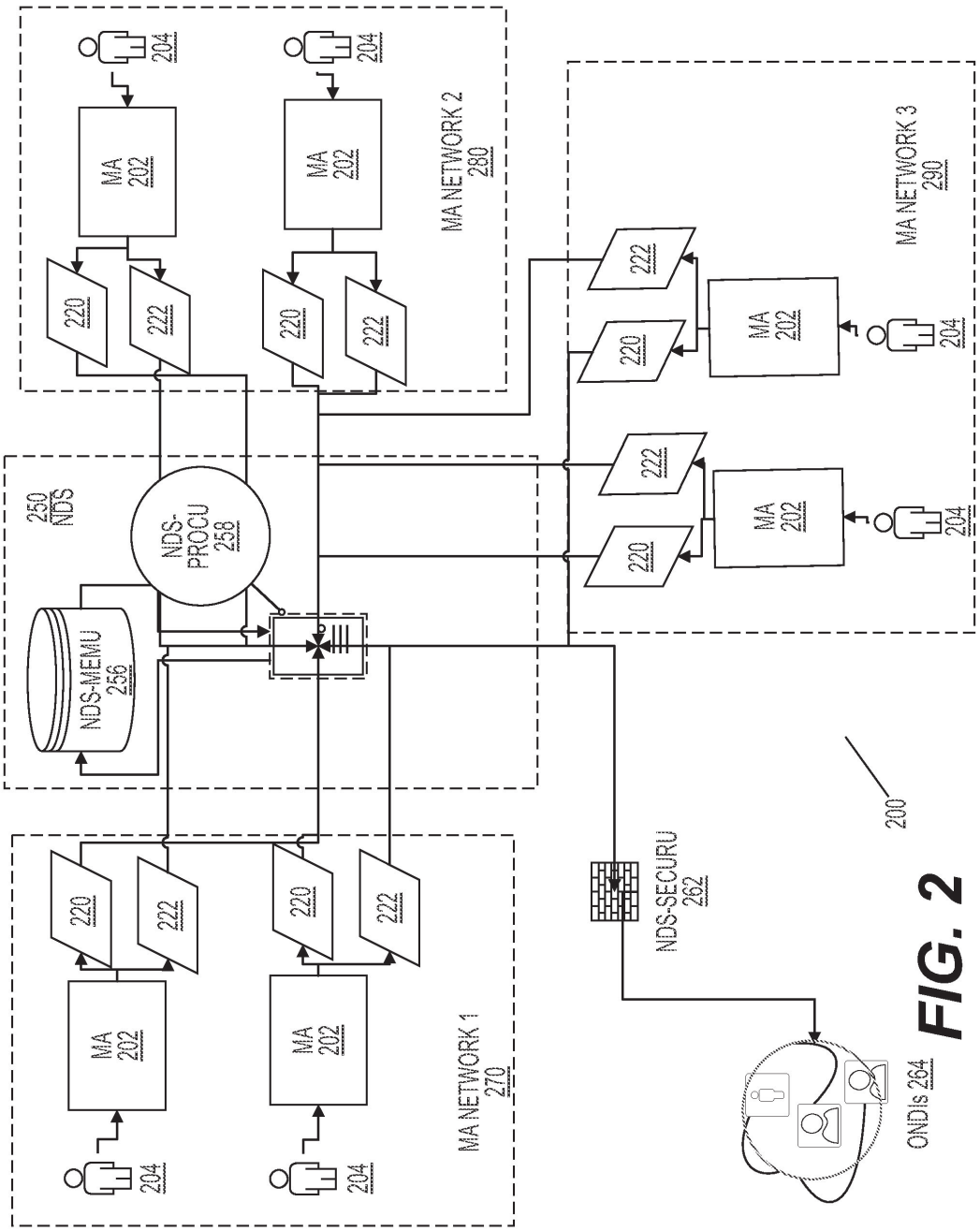

MA NETWORK 2
280
MA NETWORK 3
290
MA NETWORK 1
270
250
NDS
NDS-
PROCU
258
NDS-MEMU
256
NDS-SECURU
262
ONDIs 264
200
MA
202
204
220
222

FIG. 2

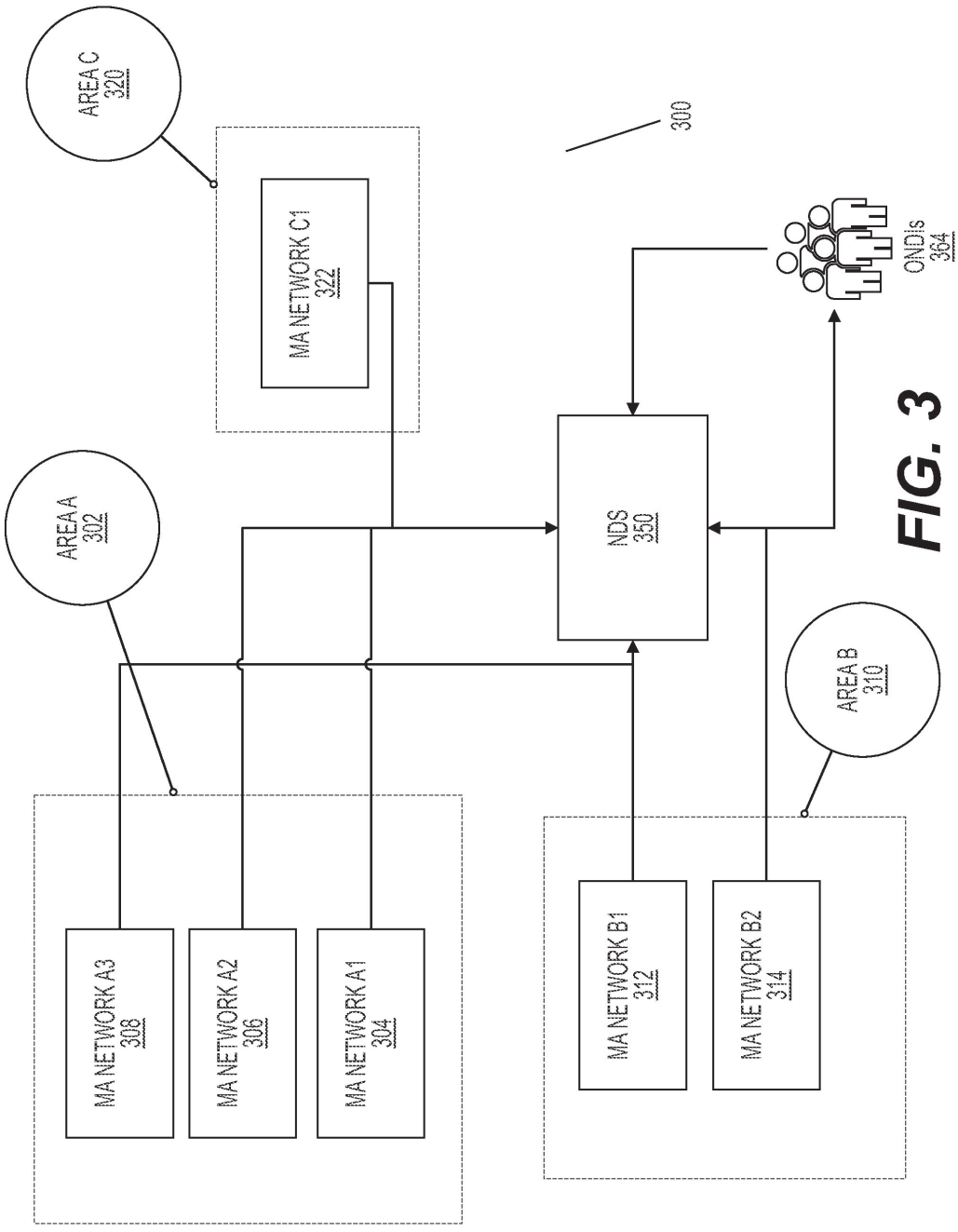

AREA C
320
MA NETWORK C1
322
300
ONDIs
364
AREA A
302
NDS
350
AREA B
310
MA NETWORK A3
308
MA NETWORK A2
306
MA NETWORK A1
304
MA NETWORK B1
312
MA NETWORK B2
314

FIG. 3

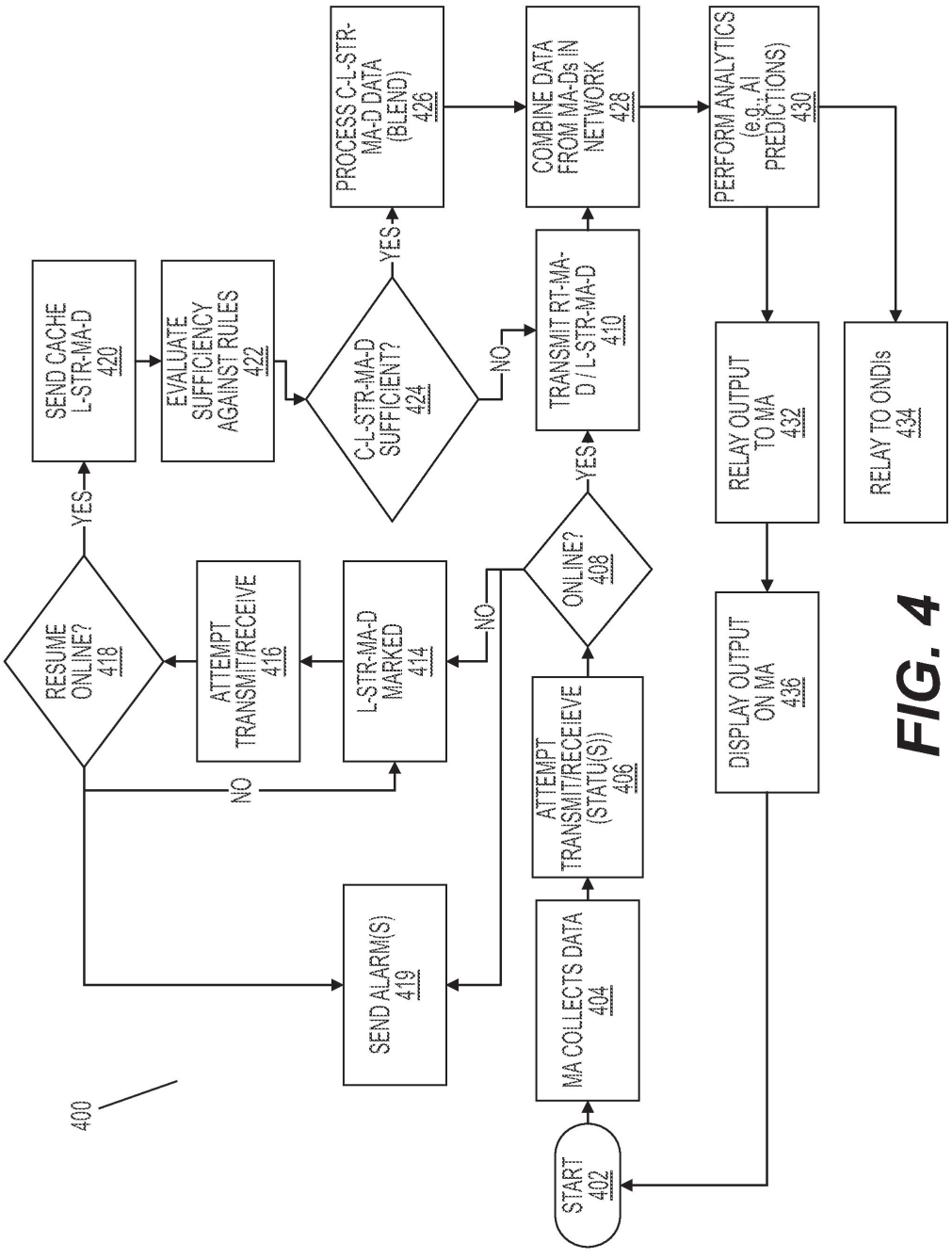

400
START 402
MA COLLECTS DATA 404
ATTEMPT TRANSMIT/RECEIEVE (STATU(S)) 406
ONLINE? 408
YES
NO
TRANSMIT RT-MA-D / L-STR-MA-D 410
C-L-STR-MA-D SUFFICIENT? 424
YES
NO
PROCESS C-L-STR-MA-D DATA (BLEND) 426
COMBINE DATA FROM MA-Ds IN NETWORK 428
PERFORM ANALYTICS (e.g., AI PREDICTIONS) 430
RELAY OUTPUT TO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

FIG. 4

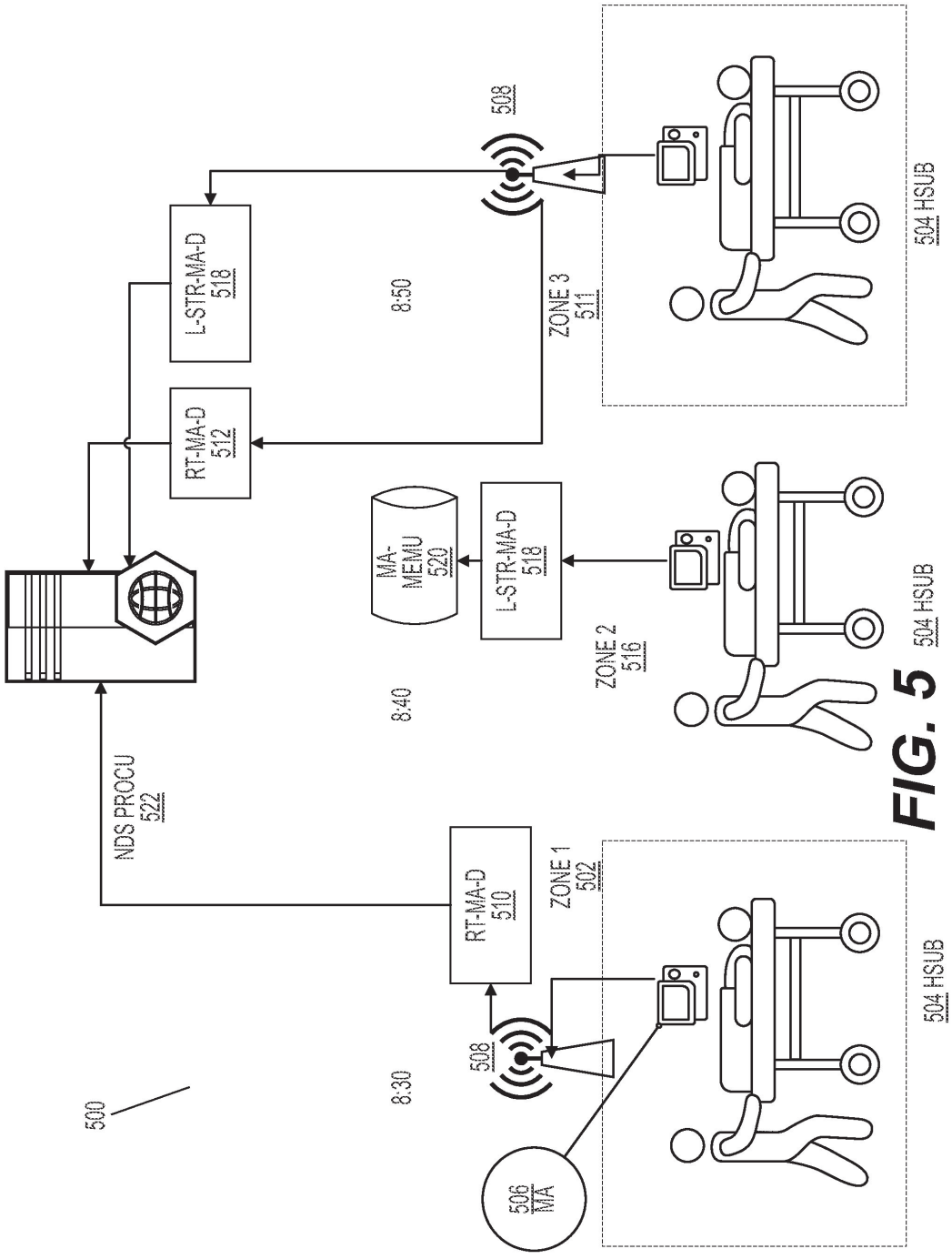

500
NDS PROCU
522
RT-MA-D
510
ZONE 1
502
504 HSUB
506
MA
508
8:30
L-STR-MA-D
518
RT-MA-D
512
MA-
MEMU
520
L-STR-MA-D
518
8:40
ZONE 2
516
504 HSUB
8:50
ZONE 3
511
508
504 HSUB

FIG. 5

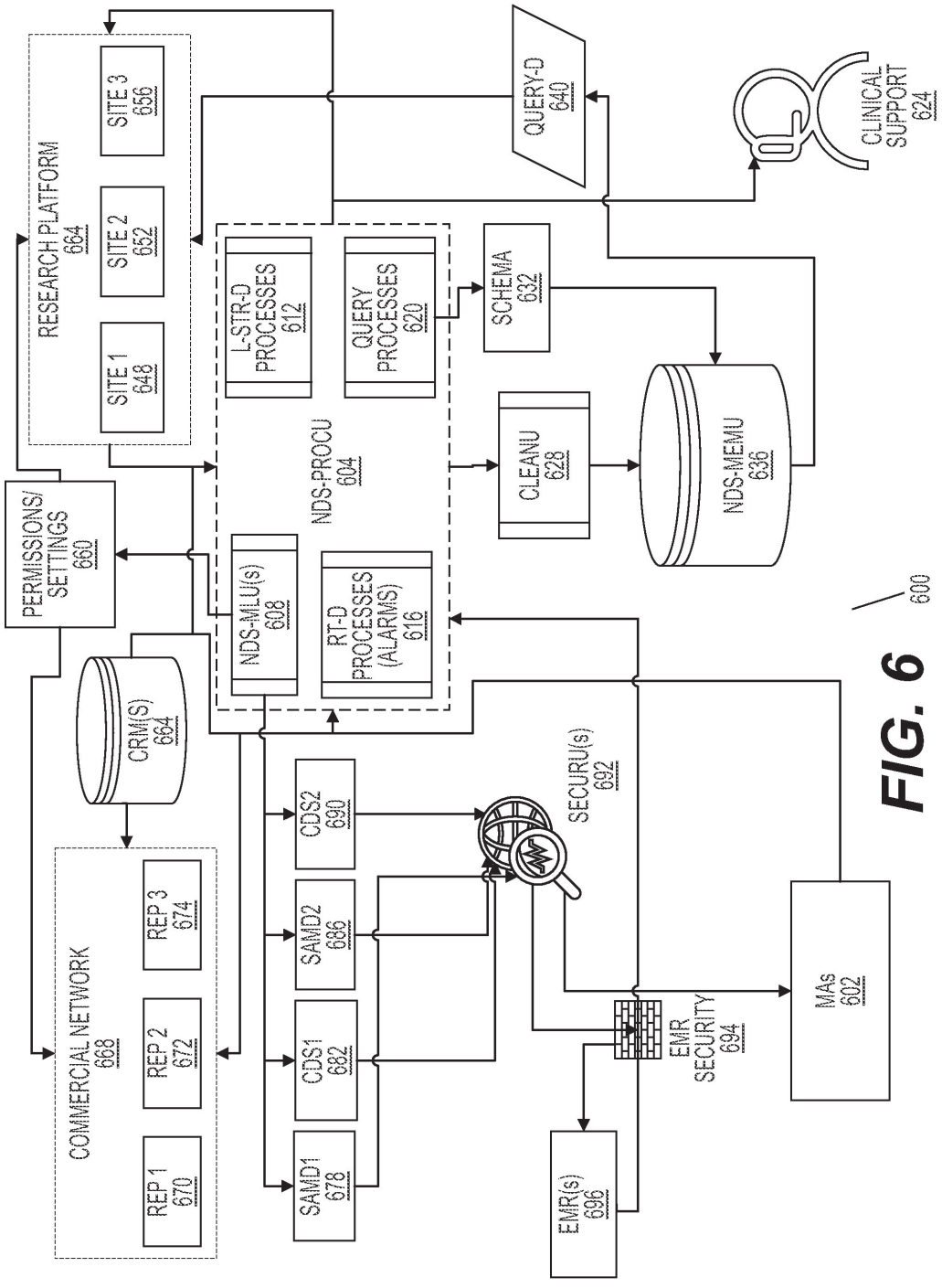

RESEARCH PLATFORM
664
SITE 1
648
SITE 2
652
SITE 3
656
PERMISSIONS/
SETTINGS
660
COMMERCIAL NETWORK
668
REP 1
670
REP 2
672
REP 3
674
CRM(S)
664
NDS-PROCU
604
NDS-MLU(s)
608
L-STR-D
PROCESSES
612
RT-D
PROCESSES
(ALARMS)
616
QUERY
PROCESSES
620
SCHEMA
632
CLEANU
628
NDS-MEMU
636
QUERY-D
640
CLINICAL
SUPPORT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

FIG. 6

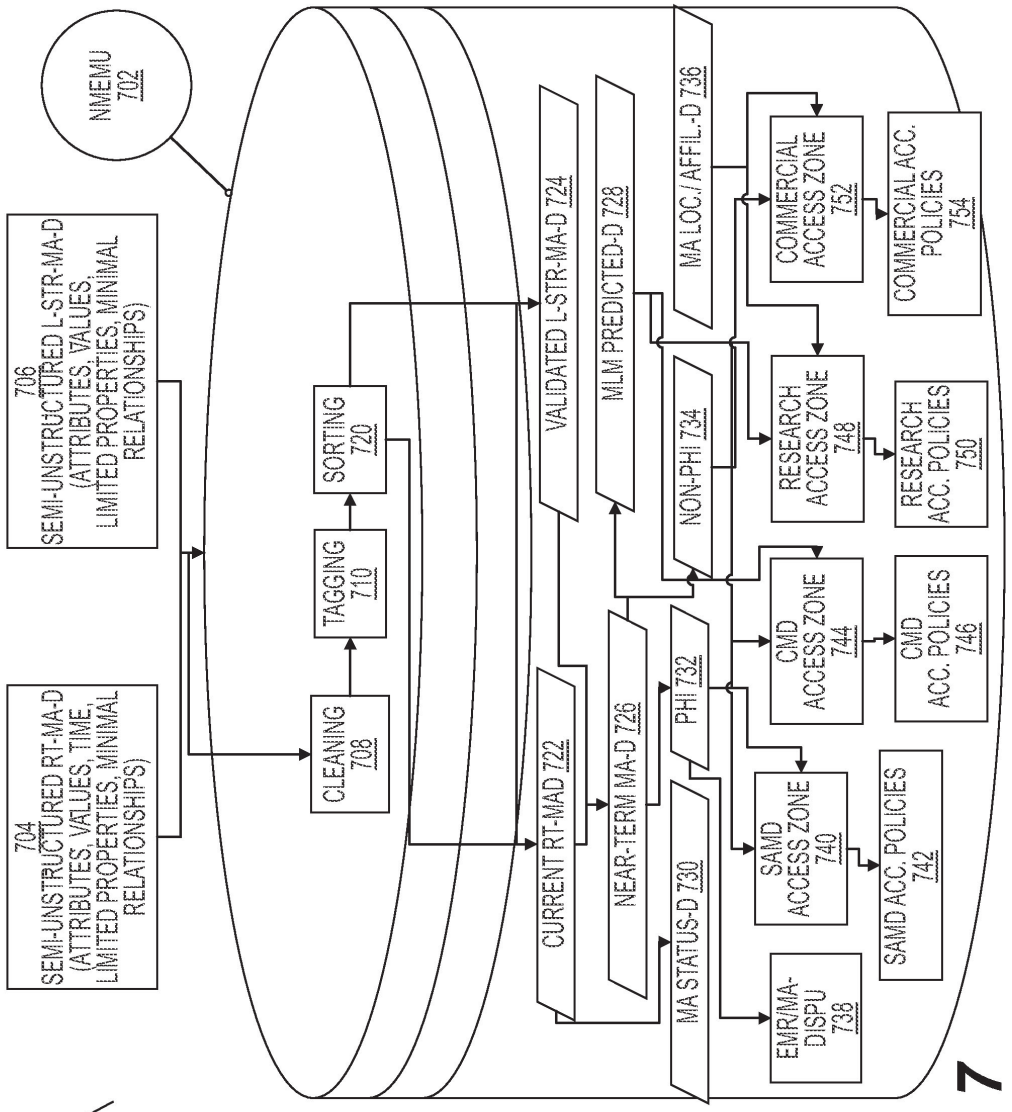

700
704
SEMI-UNSTRUCTURED RT-MA-D
(ATTRIBUTES, VALUES, TIME,
LIMITED PROPERTIES, MINIMAL
RELATIONSHIPS)
706
SEMI-UNSTRUCTURED L-STR-MA-D
(ATTRIBUTES, VALUES,
LIMITED PROPERTIES, MINIMAL
RELATIONSHIPS)
NMEMU
702
CLEANING
708
TAGGING
710
SORTING
720
CURRENT RT-MAD 722
VALIDATED L-STR-MA-D 724
NEAR-TERM 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

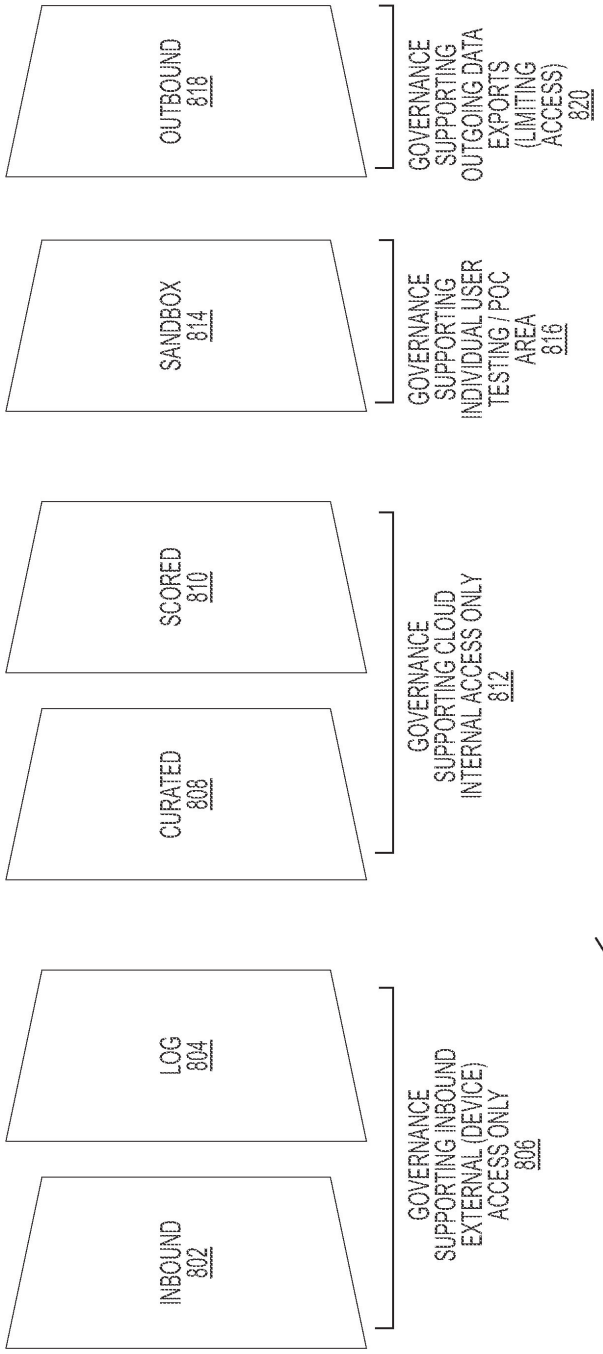

INBOUND
802
LOG
804
CURATED
808
SCORED
810
SANDBOX
814
OUTBOUND
818
GOVERNANCE
SUPPORTING INBOUND
EXTERNAL (DEVICE)
ACCESS ONLY
806
GOVERNANCE
SUPPORTING CLOUD
INTERNAL ACCESS ONLY
812
GOVERNANCE
SUPPORTING
INDIVIDUAL USER
TESTING / POC
AREA
816
GOVERNANCE
SUPPORTING
OUTGOING DATA
EXPORTS
(LIMITING
ACCESS)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

FIG. 8

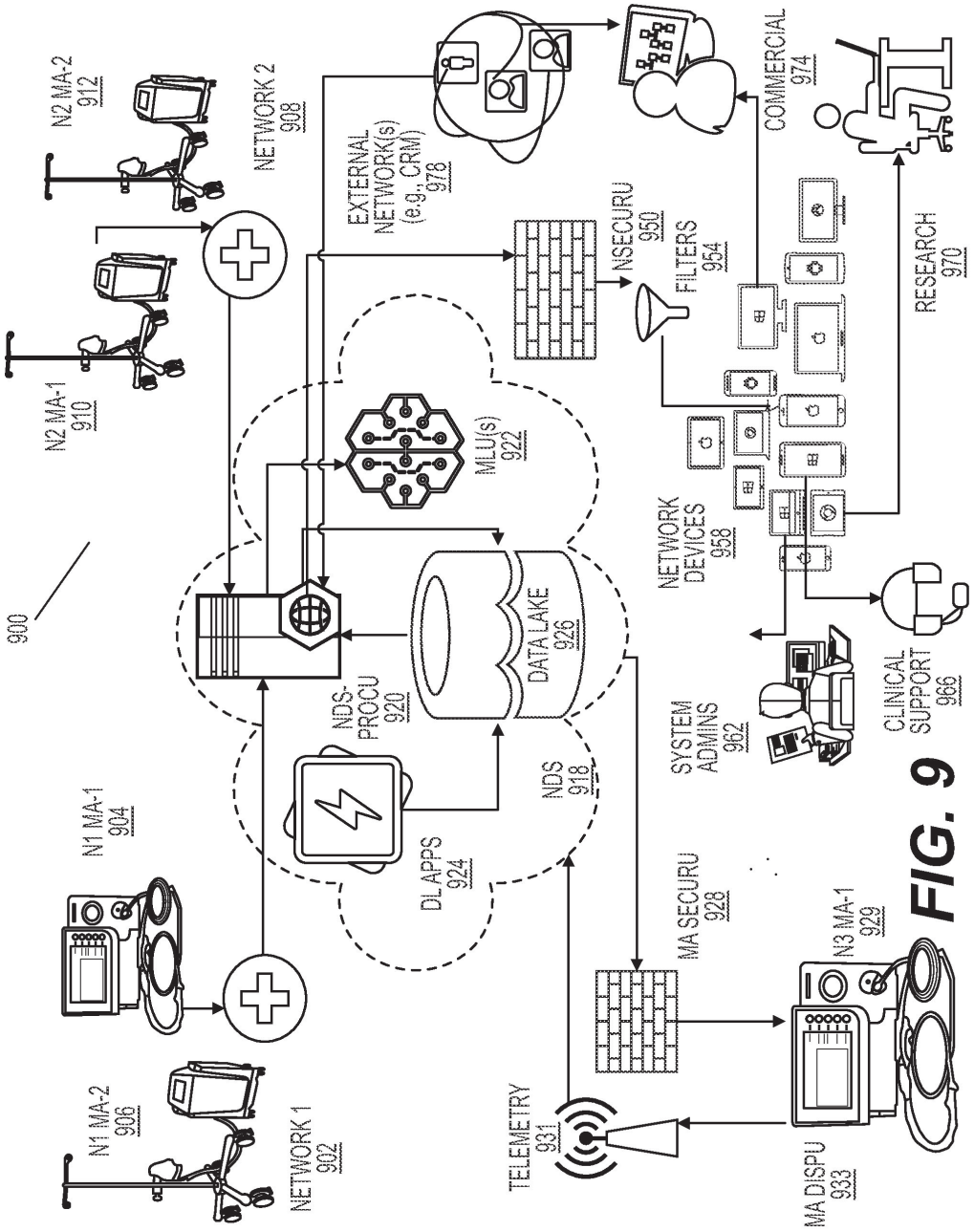

900
N1 MA-2
906
NETWORK 1
902
N1 MA-1
904
N2 MA-1
910
N2 MA-2
912
NETWORK 2
908
EXTERNAL NETWORK(s) (e.g., CRM)
978
COMMERCIAL
974
NSECURU
950
FILTERS
954
RESEARCH
970
MLU(s)
922
NETWORK DEVICES
958
DATA LAKE
926
NDS-PROCU
920
DLAPPS
924
NDS
918
SYSTEM ADMINS
962
CLINICAL SUPPORT
966
TELEMETRY
931
MA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

FIG. 9

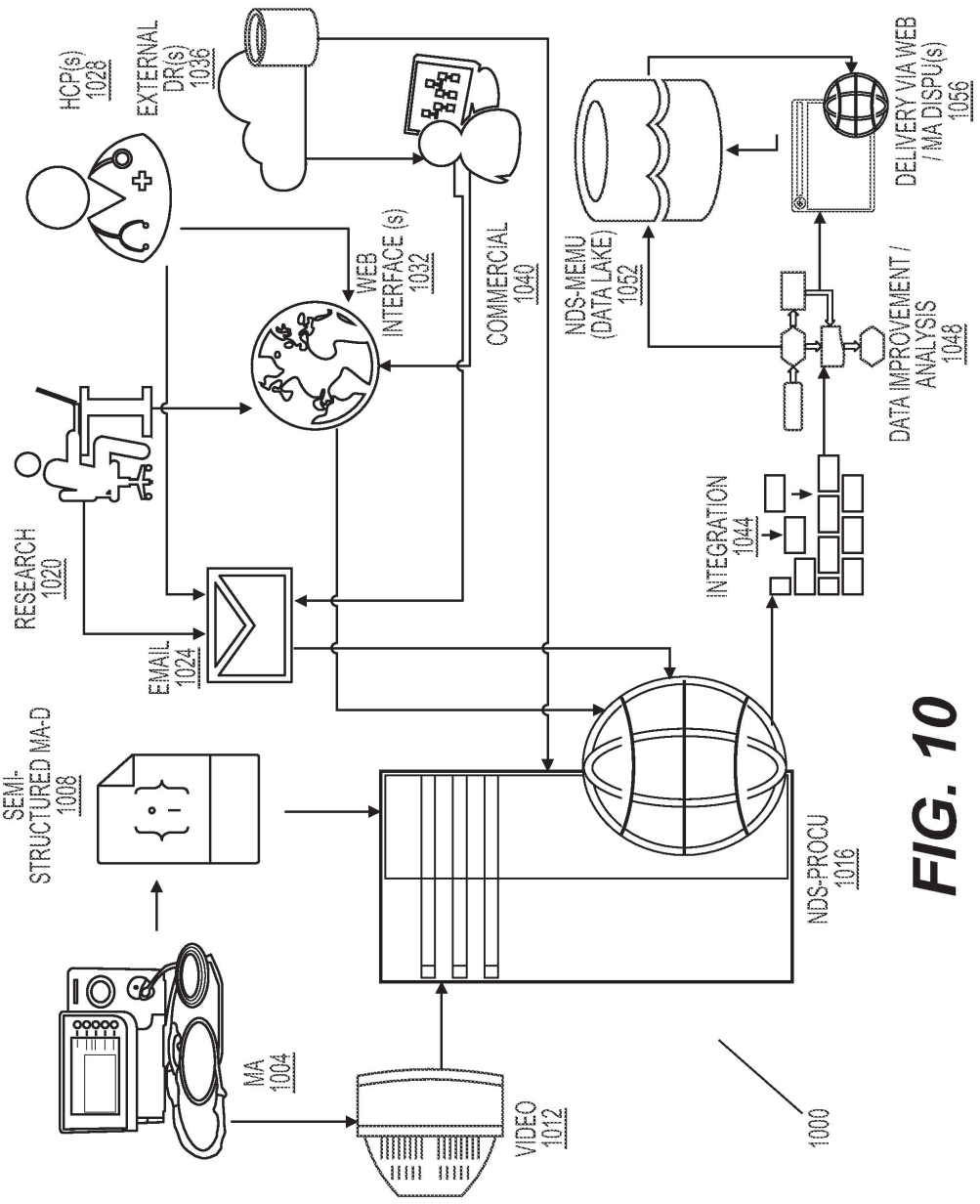

HCP(s)
1028
EXTERNAL
DR(s)
1036
WEB
INTERFACE (s)
1032
COMMERCIAL
1040
NDS-MEMU
(DATA LAKE)
1052
DELIVERY VIA WEB
/ MA DISPU(s)
1056
DATA IMPROVEMENT /
ANALYSIS
1048
RESEARCH
1020
EMAIL
1024
INTEGRATION
1044
SEMI-
STRUCTURED MA-D
1008
NDS-PROCU
1016
MA
1004
VIDEO
1012
1000

FIG. 10

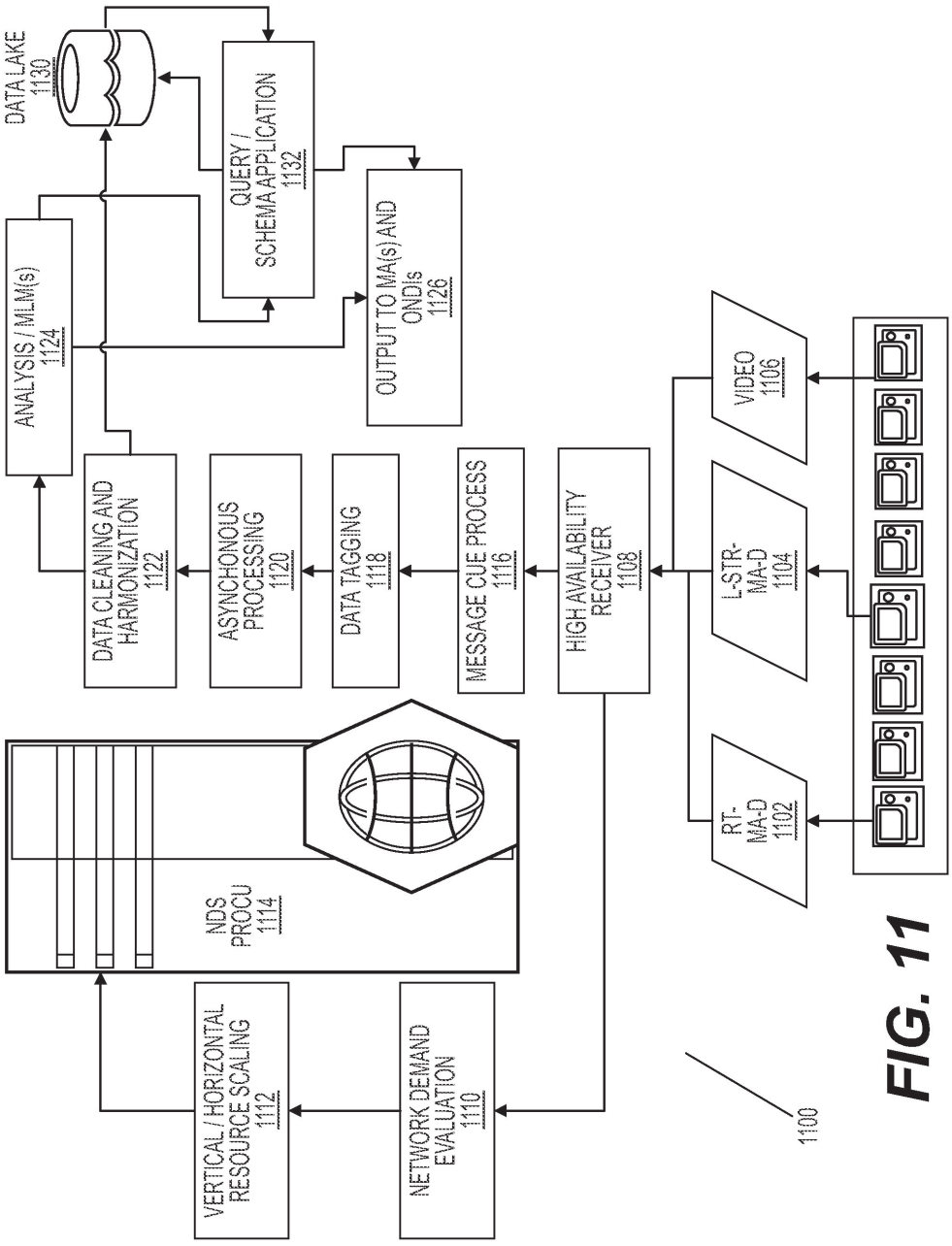

DATA LAKE
1130
QUERY / SCHEMA APPLICATION
1132
ANALYSIS / MLM(s)
1124
OUTPUT TO MA(s) AND ONDIs
1126
DATA CLEANING AND HARMONIZATION
1122
ASYNCHONOUS PROCESSING
1120
DATA TAGGING
1118
MESSAGE CUE PROCESS
1116
HIGH AVAILABILITY RECEIVER
1108
VIDEO
1106
L-STR-MA-D
1104
RT-MA-D
1102
NDS PROCU
1114
VERTICAL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

FIG. 11

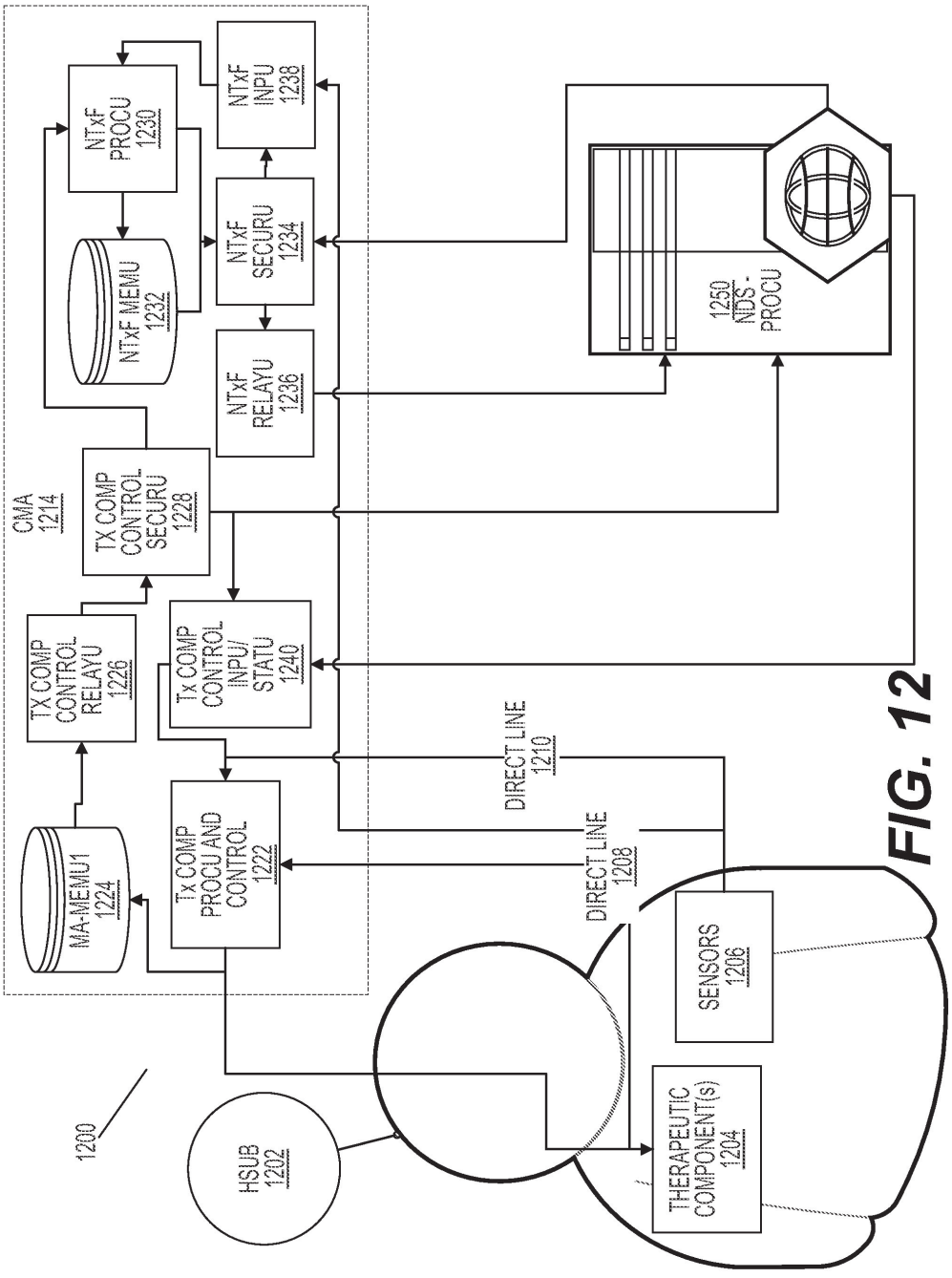

1200
HSUB
1202
THERAPEUTIC
COMPONENT(s)
1204
SENSORS
1206
DIRECT LINE
1208
DIRECT LINE
1210
CMA
1214
MA-MEMU1
1224
Tx COMP
PROCU AND
CONTROL
1222
TX COMP
CONTROL
RELAYU
1226
Tx COMP
CONTROL
INPU/
STATU
1240
TX COMP
CONTROL
SECURU
1228
NTxF
PROCU
1230
NTxF MEMU
1232
NTxF
SECURU
1234
NTxF
INPU
1238
NTxF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

FIG. 12

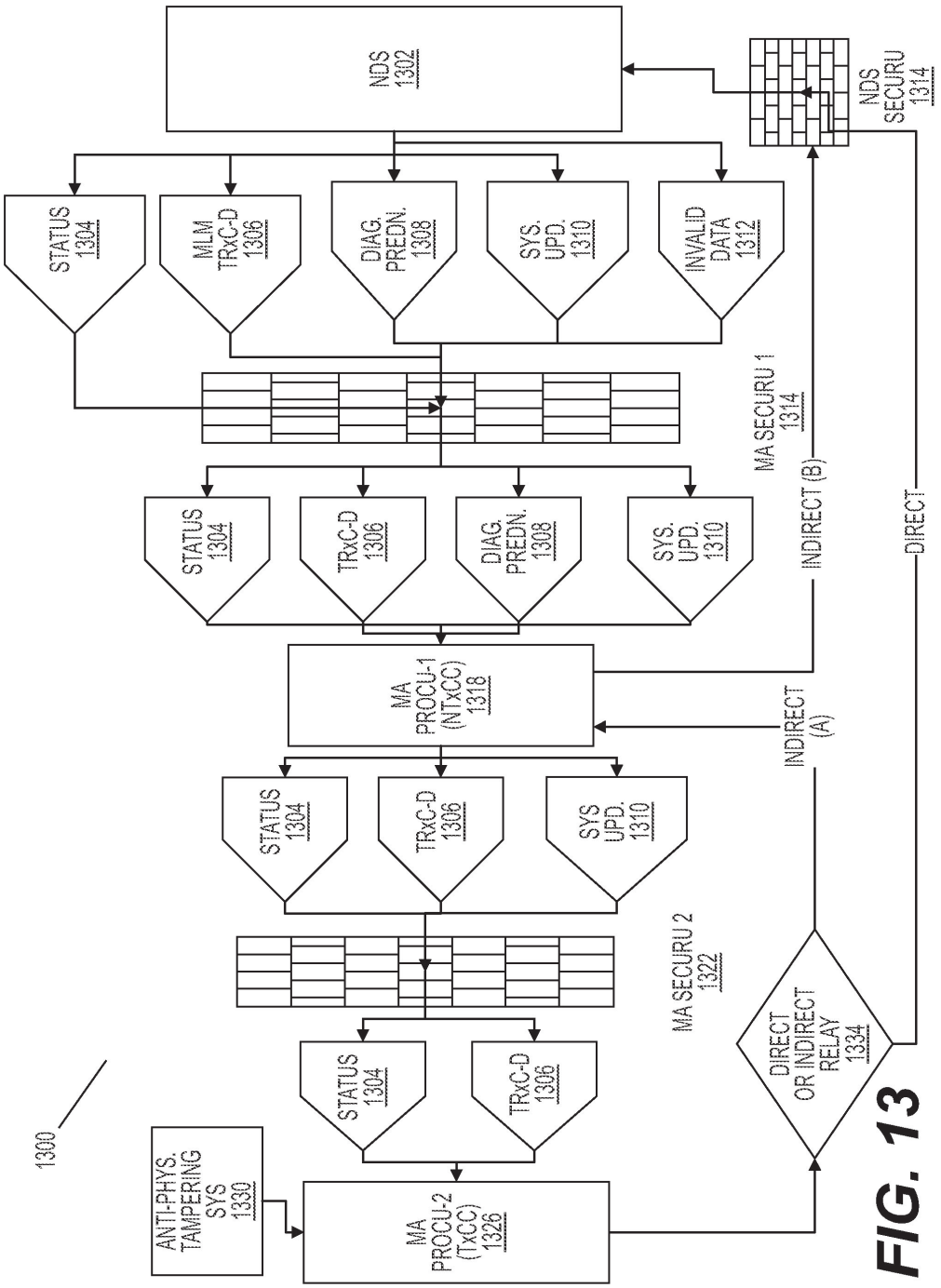

1300
NDS 1302
NDS SECURU 1314
STATUS 1304
MLM TRxC-D 1306
DIAG. PREDN. 1308
SYS. UPD. 1310
INVALID DATA 1312
MA SECURU 1 1314
INDIRECT (B)
DIRECT
STATUS 1304
TRxC-D 1306
DIAG. PREDN. 1308
SYS. UPD. 1310
MA PROCU-1 (NTxCC) 1318
INDIRECT (A)
STATUS 1304
TRxC-D 1306
SYS UPD. 1310
MA SECURU 2 1322
DIRECT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

FIG. 13

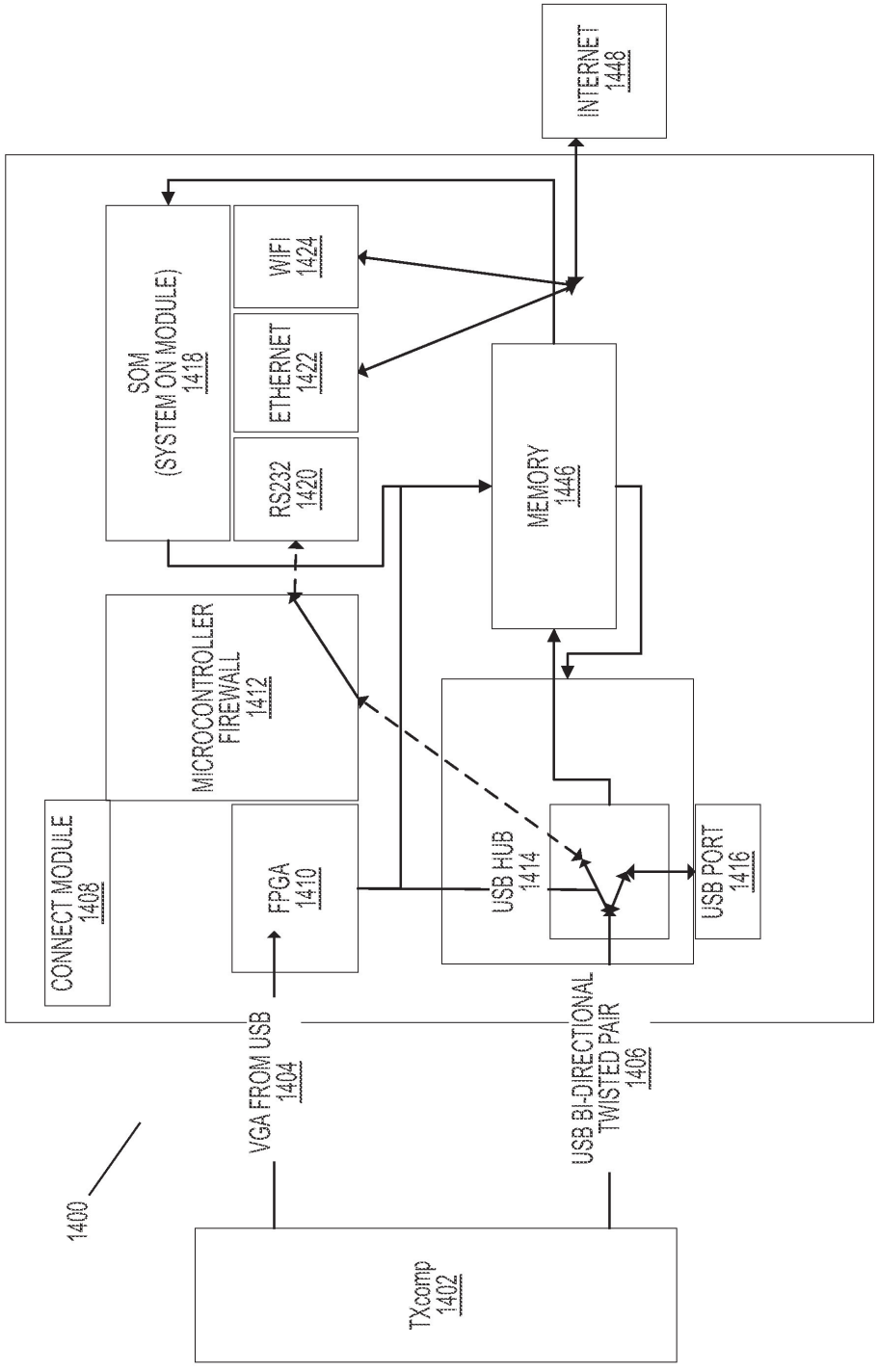

1400
TXcomp
1402
VGA FROM USB
1404
USB BI-DIRECTIONAL
TWISTED PAIR
1406
CONNECT MODULE
1408
FPGA
1410
MICROCONTROLLER
FIREWALL
1412
USB HUB
1414
USB PORT
1416
MEMORY
1446
SOM
(SYSTEM ON MODULE)
1418
RS232
1420
ETHERNET
1422
WIFI
1424
INTERNET
1448

FIG. 14

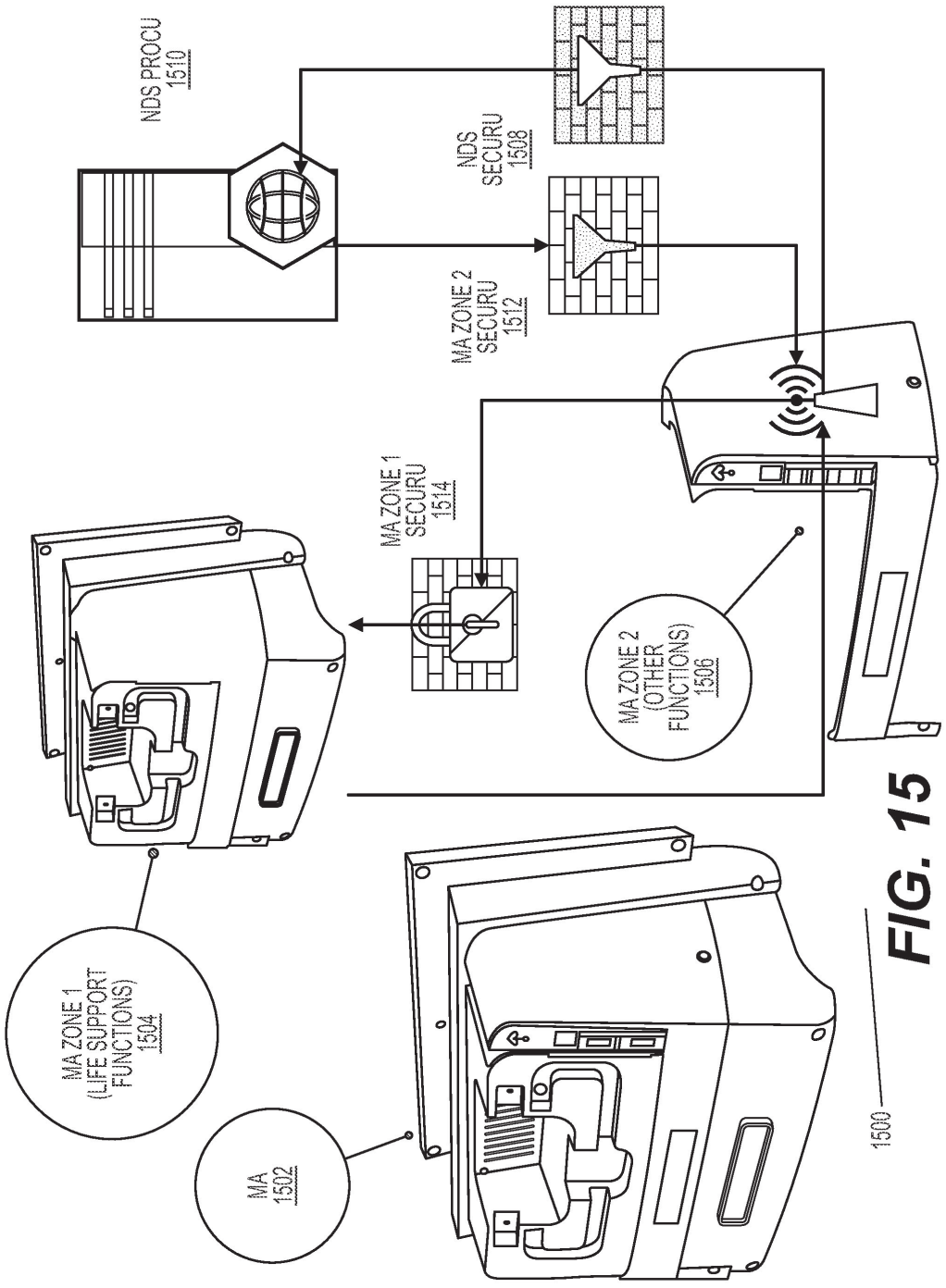

NDS PROCU
1510
NDS
SECURU
1508
MA ZONE 2
SECURU
1512
MA ZONE 1
SECURU
1514
MA ZONE 2
(OTHER
FUNCTIONS)
1506
MA ZONE 1
(LIFE SUPPORT
FUNCTIONS)
1504
MA
1502
1500

FIG. 15

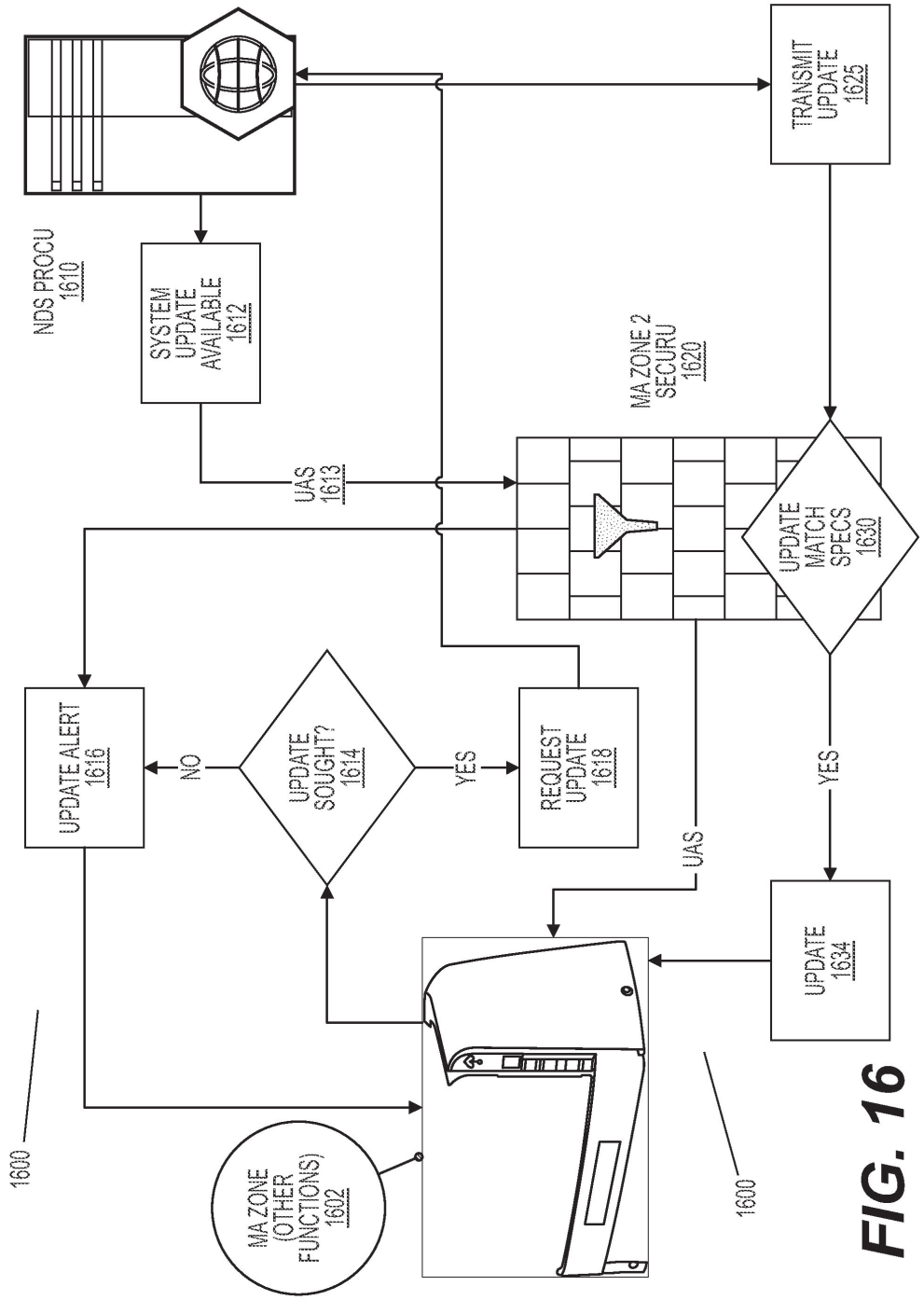

NDS PROCU
1610
SYSTEM
UPDATE
AVAILABLE
1612
UAS
1613
MA ZONE 2
SECURU
1620
TRANSMIT
UPDATE
1625
UPDATE
MATCH
SPECS
1630
UPDATE ALERT
1616
NO
UPDATE
SOUGHT?
1614
YES
REQUEST
UPDATE
1618
UAS
YES
UPDATE
1634
1600
MA ZONE
(OTHER
FUNCTIONS)
1602
1600

FIG. 16

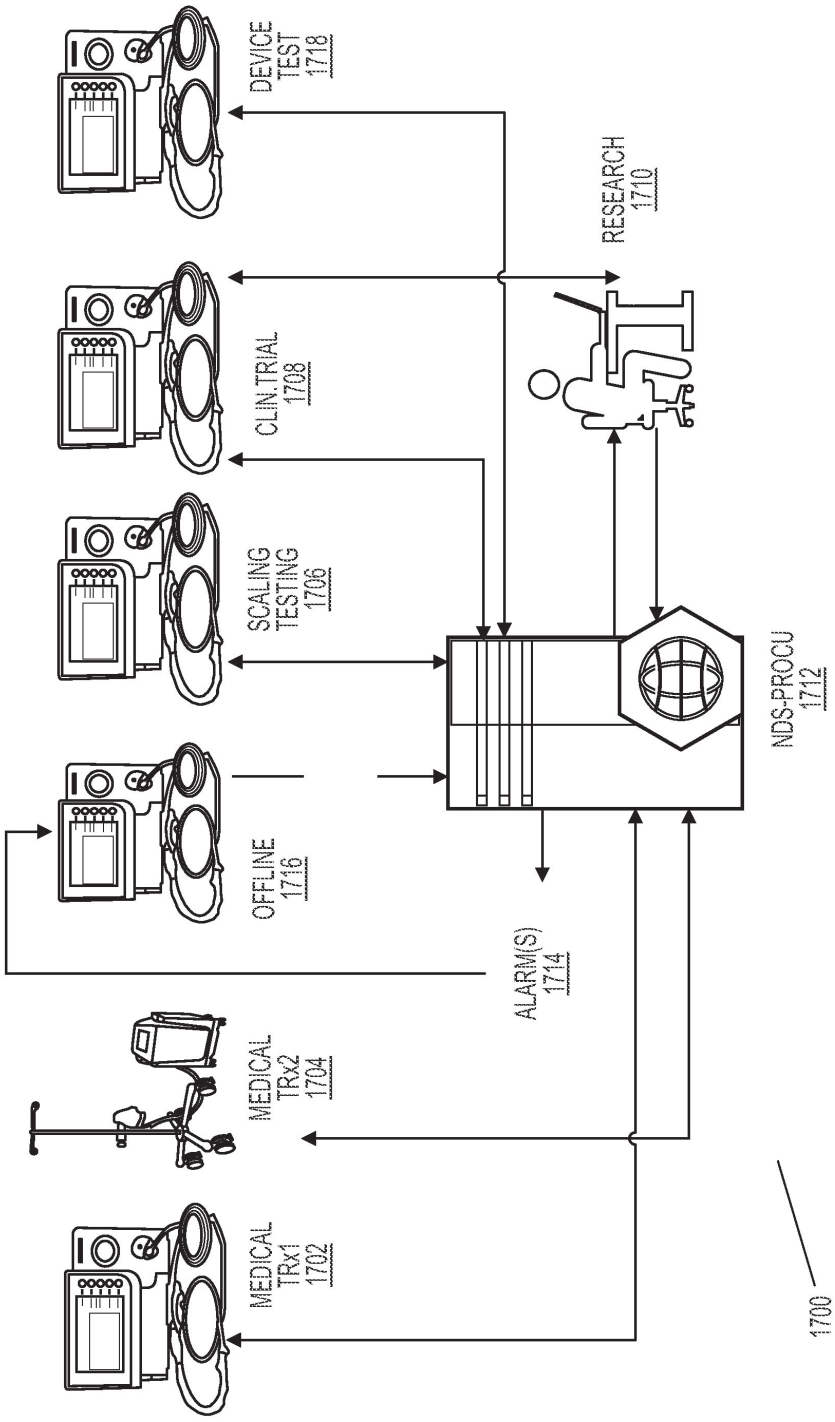

DEVICE TEST 1718
RESEARCH 1710
CLIN.TRIAL 1708
SCALING TESTING 1706
NDS-PROCU 1712
OFFLINE 1716
ALARM(S) 1714
MEDICAL TRx2 1704
MEDICAL TRx1 1702
1700

FIG. 17

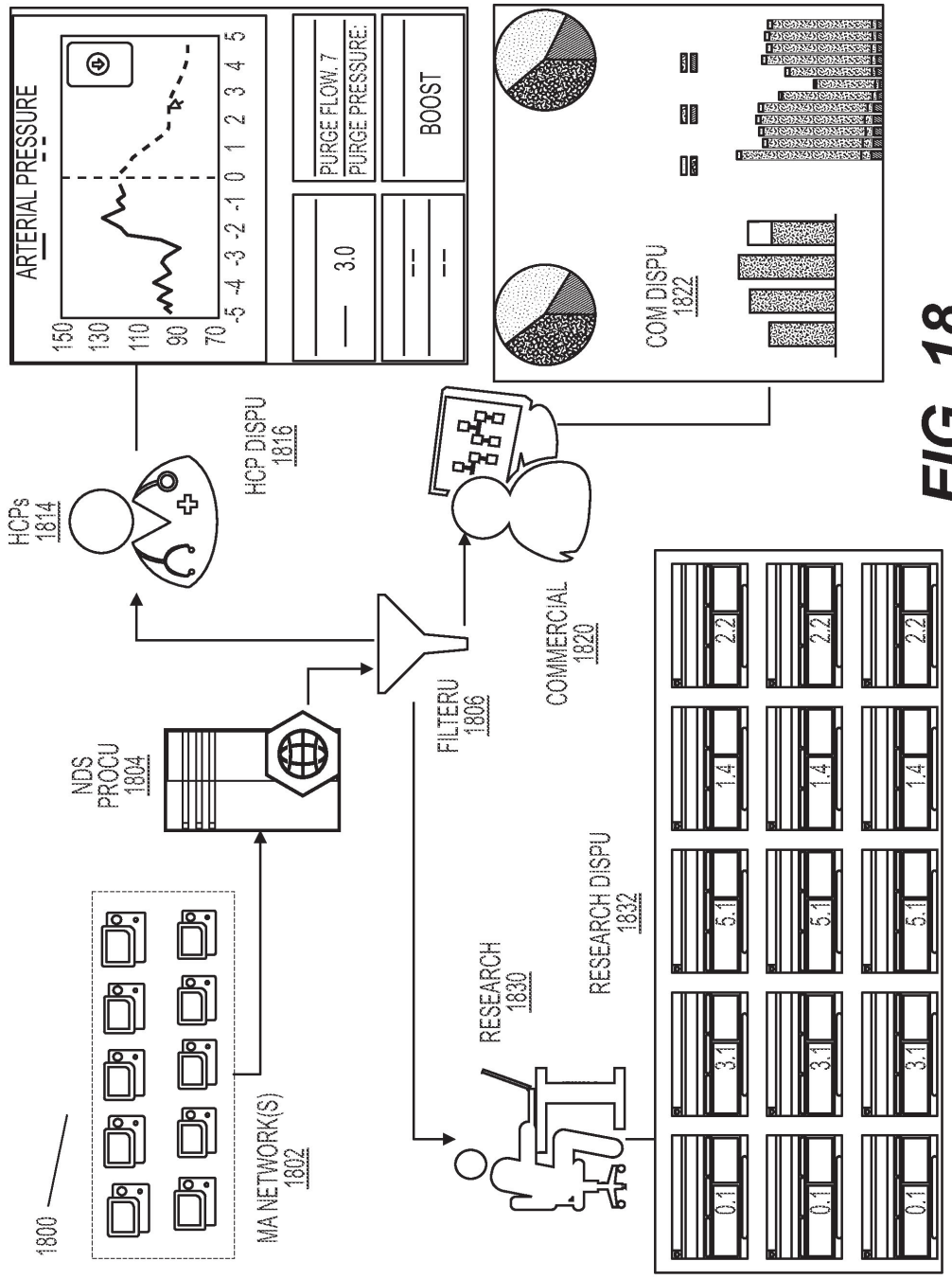

1800
MA NETWORK(S)
1802
NDS
PROCU
1804
FILTERU
1806
HCPs
1814
HCP DISPU
1816
COMMERCIAL
1820
COM DISPU
1822
RESEARCH
1830
RESEARCH DISPU
1832
ARTERIAL PRESSURE
150
130
110
90
70
-5 -4 -3 -2 -1 0 1 2 3 4 5
3.0
PURGE FLOW: 7
PURGE PRESSURE:
BOOST
0.1
3.1
5.1
1.4
2.2

FIG. 18

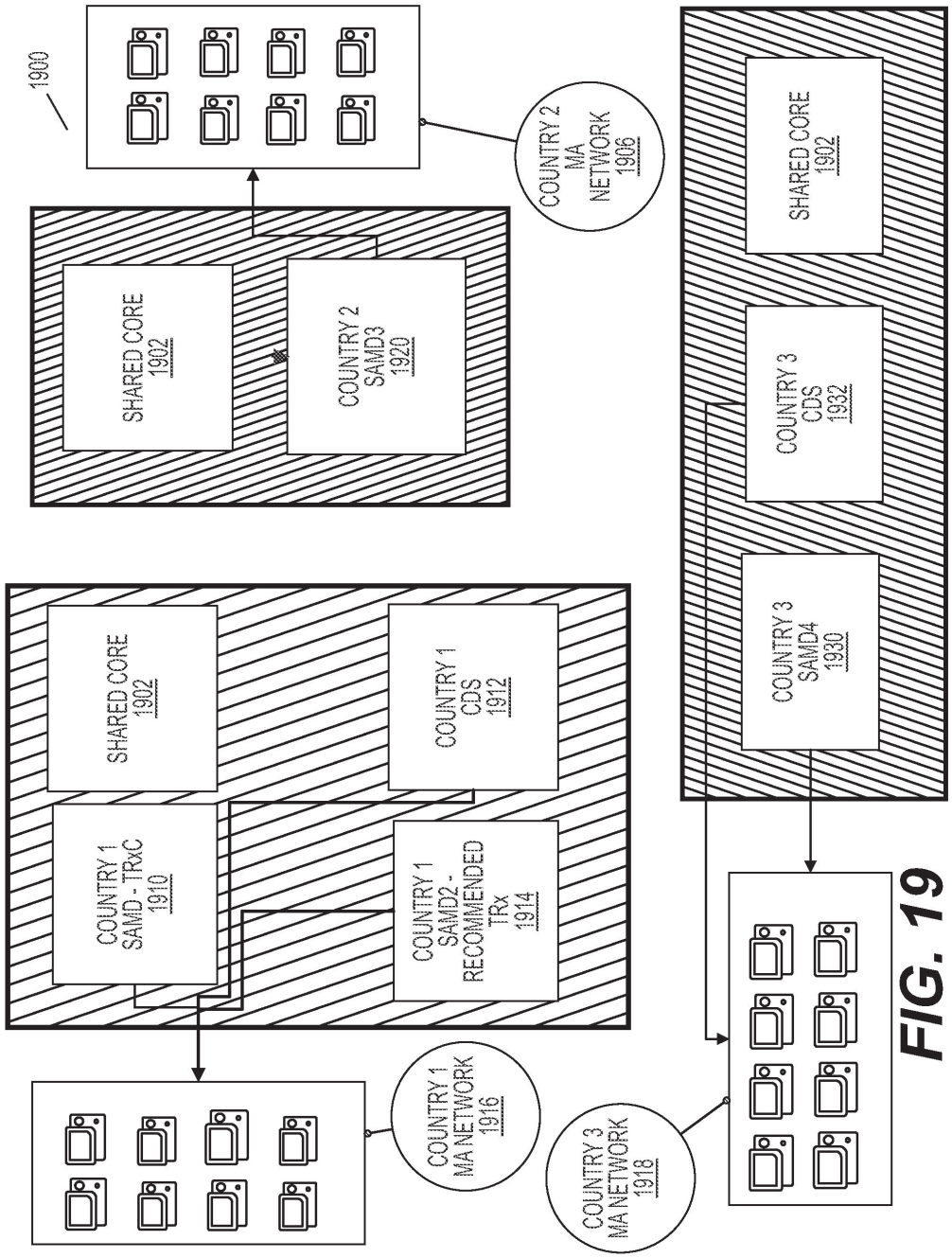

1900
SHARED CORE 1902
COUNTRY 2 SAMD3 1920
COUNTRY 2 MA NETWORK 1906
SHARED CORE 1902
COUNTRY 3 CDS 1932
COUNTRY 3 SAMD4 1930
SHARED CORE 1902
COUNTRY 1 CDS 1912
COUNTRY 1 SAMD - TRxC 1910
COUNTRY 1 SAMD2 - RECOMMENDED TRx 1914
COUNTRY 1 MA NETWORK 1916
COUNTRY 3 MA NETWORK 1918

FIG. 19

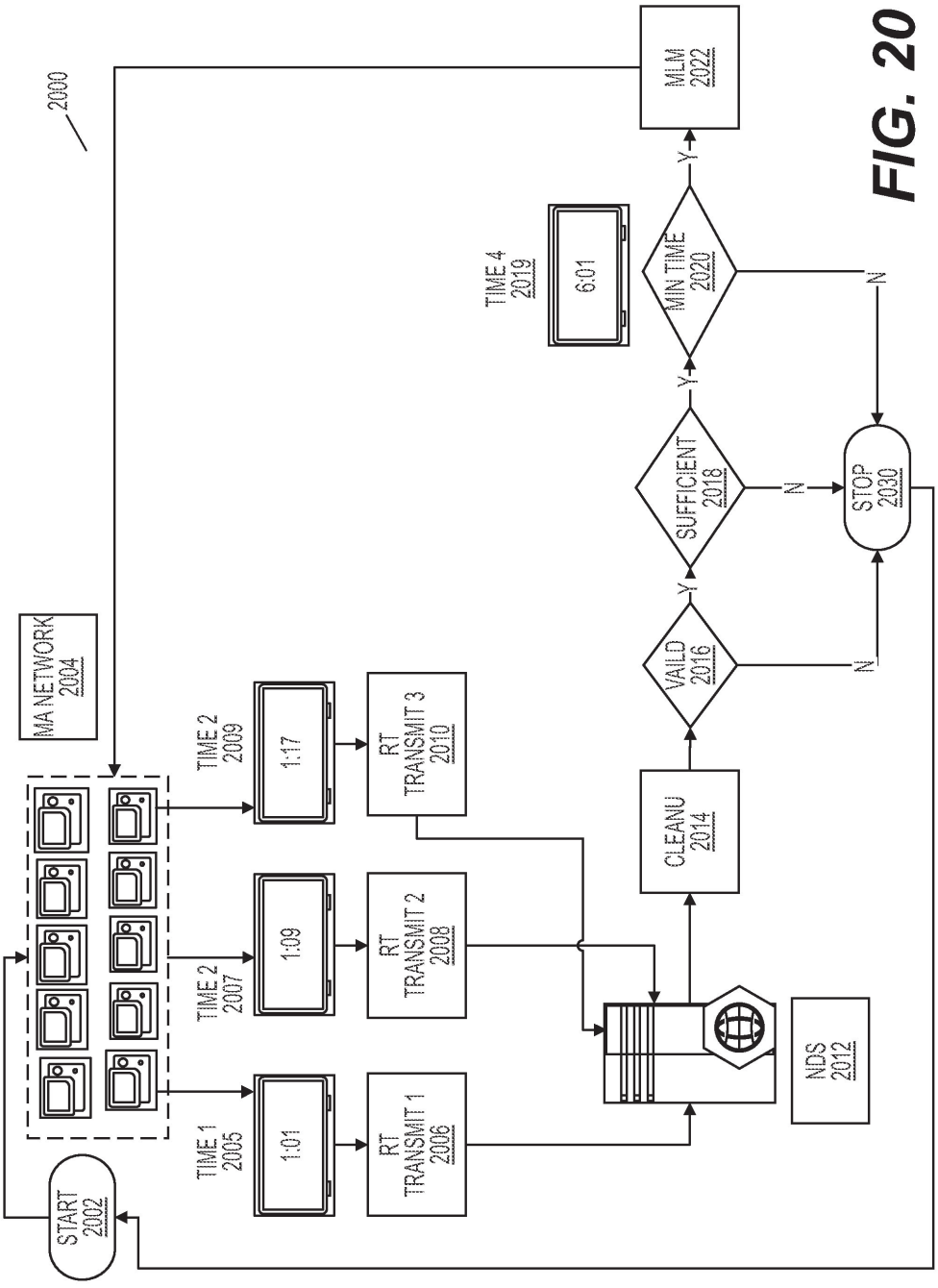

2000
MA NETWORK 2004
START 2002
TIME 1 2005
1:01
RT TRANSMIT 1 2006
TIME 2 2007
1:09
RT TRANSMIT 2 2008
TIME 2 2009
1:17
RT TRANSMIT 3 2010
NDS 2012
CLEANU 2014
VAILD 2016
SUFFICIENT 2018
TIME 4 2019
6:01
MIN TIME 2020
MLM 2022
STOP 2030
Y
N

FIG. 20

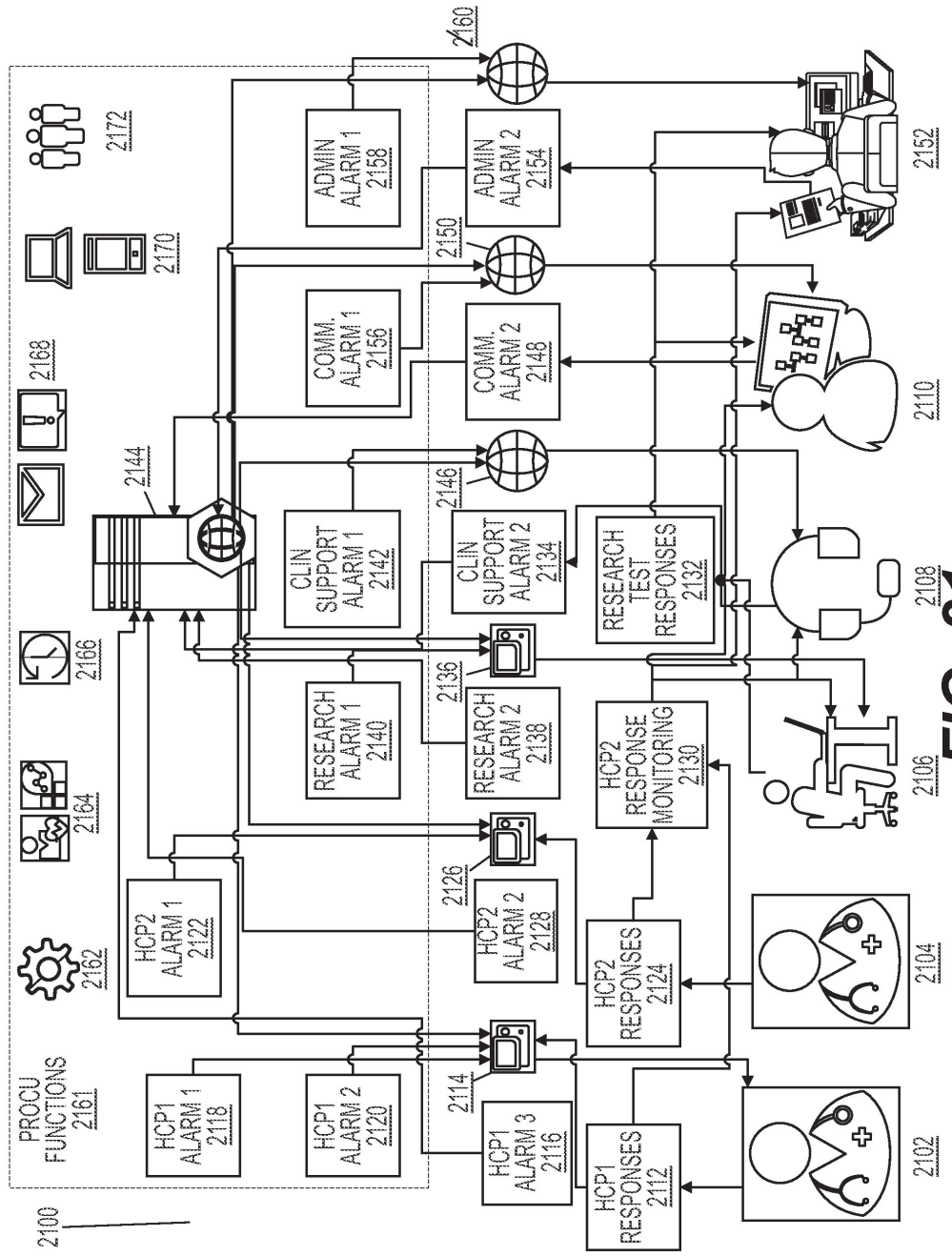

2100
PROCU FUNCTIONS 2161
HCP1 ALARM 1 2118
HCP1 ALARM 2 2120
HCP1 ALARM 3 2116
HCP1 RESPONSES 2112
HCP2 ALARM 1 2122
HCP2 ALARM 2 2128
HCP2 RESPONSES 2124
HCP2 RESPONSE MONITORING 2130
RESEARCH ALARM 1 2140
RESEARCH ALARM 2 2138
RESEARCH TEST RESPONSES 2132
CLIN SUPPORT ALARM 1 2142
CLIN SUPPORT ALARM 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

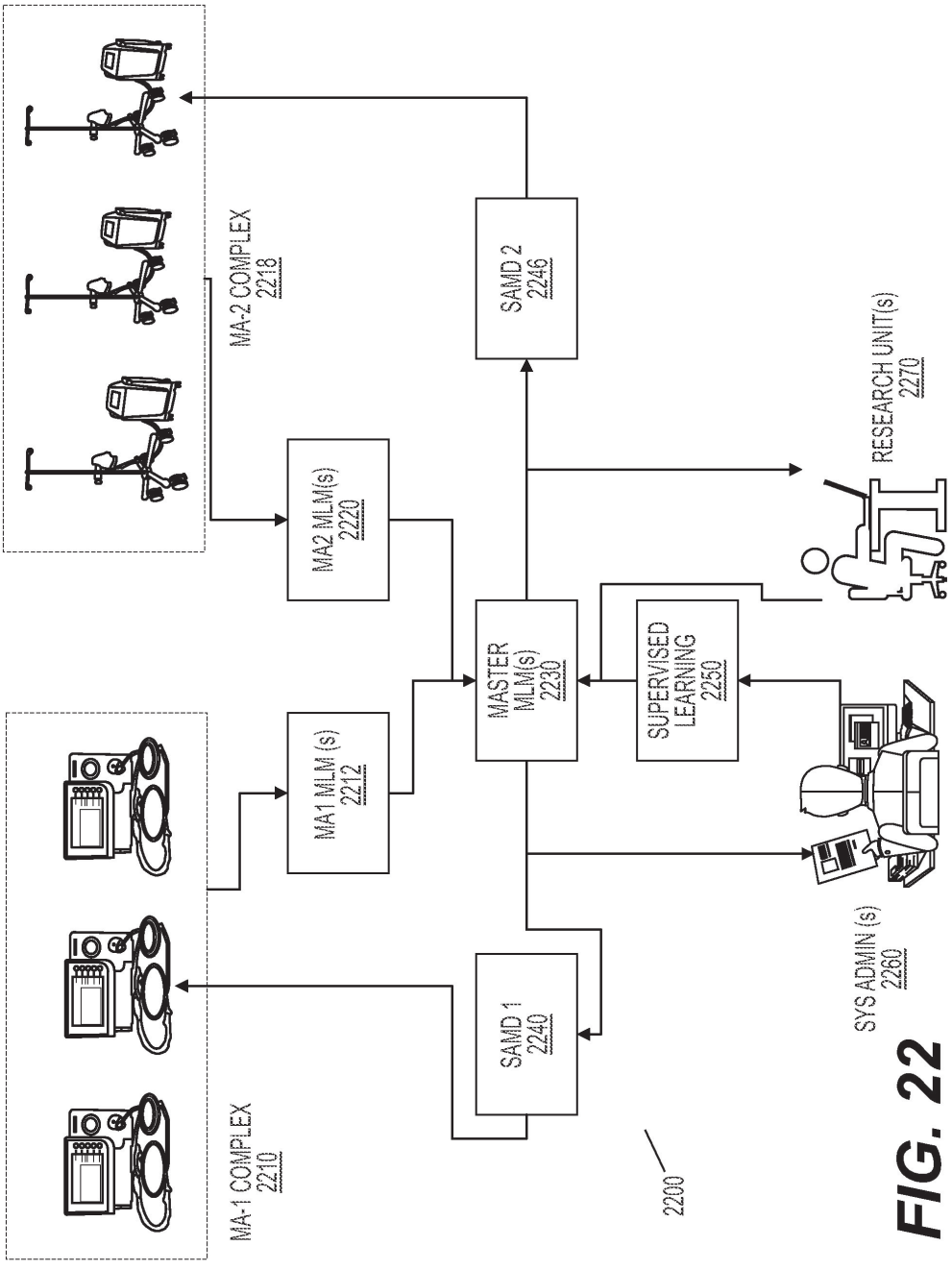

MA-1 COMPLEX
2210
MA-2 COMPLEX
2218
MA1 MLM (s)
2212
MA2 MLM(s)
2220
MASTER
MLM(s)
2230
SAMD 1
2240
SAMD 2
2246
SUPERVISED
LEARNING
2250
RESEARCH UNIT(s)
2270
SYS ADMIN (s)
2260
2200

FIG. 22

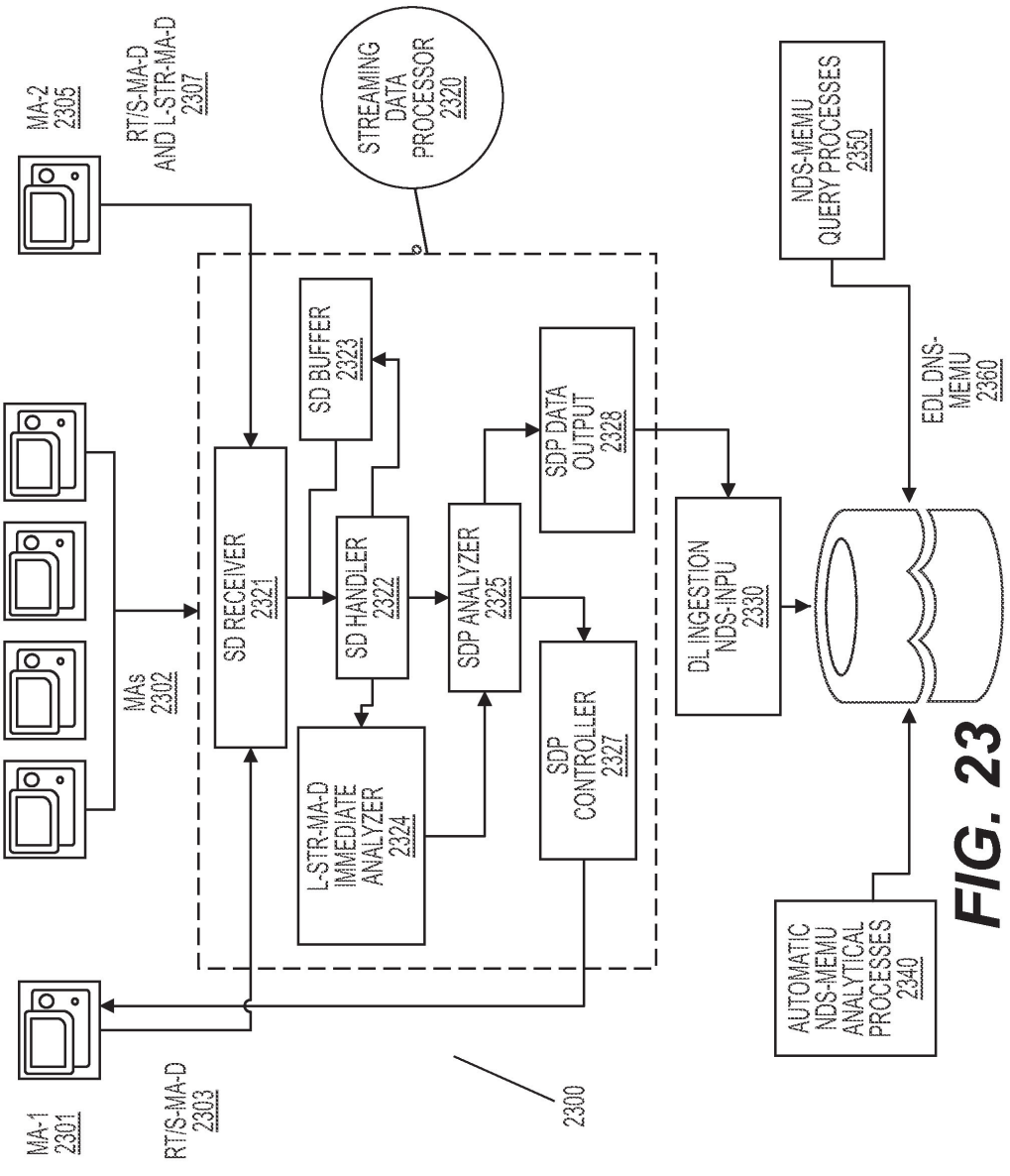

MA-1
2301
RT/S-MA-D
2303
MAs
2302
MA-2
2305
RT/S-MA-D
AND L-STR-MA-D
2307
STREAMING
DATA
PROCESSOR
2320
SD RECEIVER
2321
SD BUFFER
2323
SD HANDLER
2322
L-STR-MA-D
IMMEDIATE
ANALYZER
2324
SDP ANALYZER
2325
SDP DATA
OUTPUT
2328
SDP
CONTROLLER
2327
2300
DL INGESTION
NDS-INPU
2330
NDS-MEMU
QUERY PROCESSES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

FIG. 23

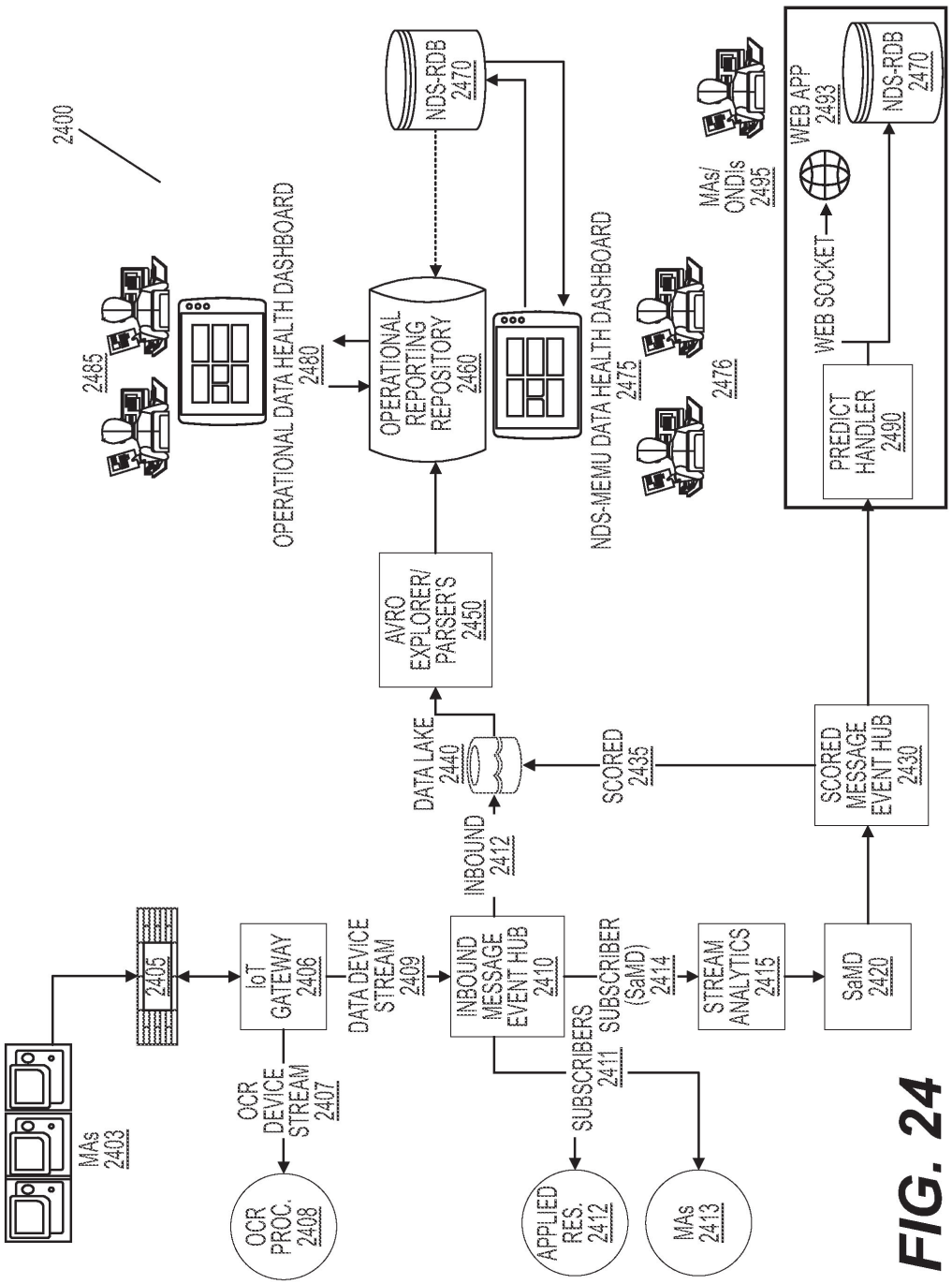

2400
MAs 2403
2405
IoT GATEWAY 2406
OCR DEVICE STREAM 2407
OCR PROC. 2408
DATA DEVICE STREAM 2409
INBOUND MESSAGE EVENT HUB 2410
INBOUND 2412
SUBSCRIBERS 2411
SUBSCRIBER (SaMD) 2414
APPLIED RES. 2412
MAs 2413
STREAM ANALYTICS 2415
SaMD 2420
SCORED MESSAGE EVENT HUB 2430
SCORED 2435
DATA LAKE 2440
AVRO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

FIG. 24

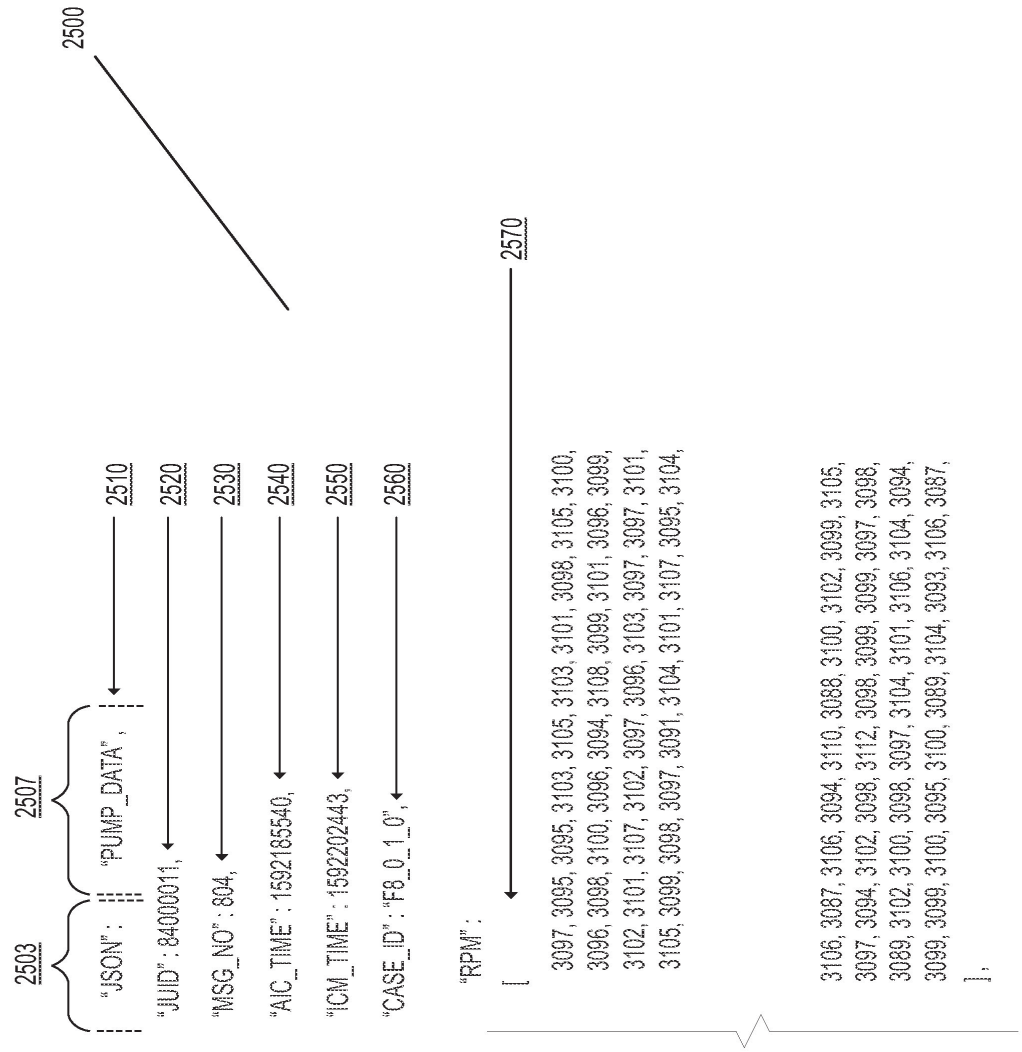

2500
2503
2507
"JSON" : "PUMP_DATA",
2510
"JUID" : 84000011,
2520
"MSG_NO" : 804,
2530
"AIC_TIME" : 1592185540,
2540
"ICM_TIME" : 1592202443,
2550
"CASE_ID" : "F8_0_1_0",
2560
"RPM" :
[
2570
3097, 3095, 3095, 3103, 3105, 3103, 3101, 3098, 3105, 3100,
3096, 3098, 3100, 3096, 3094, 3108, 3099, 3101, 3096, 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

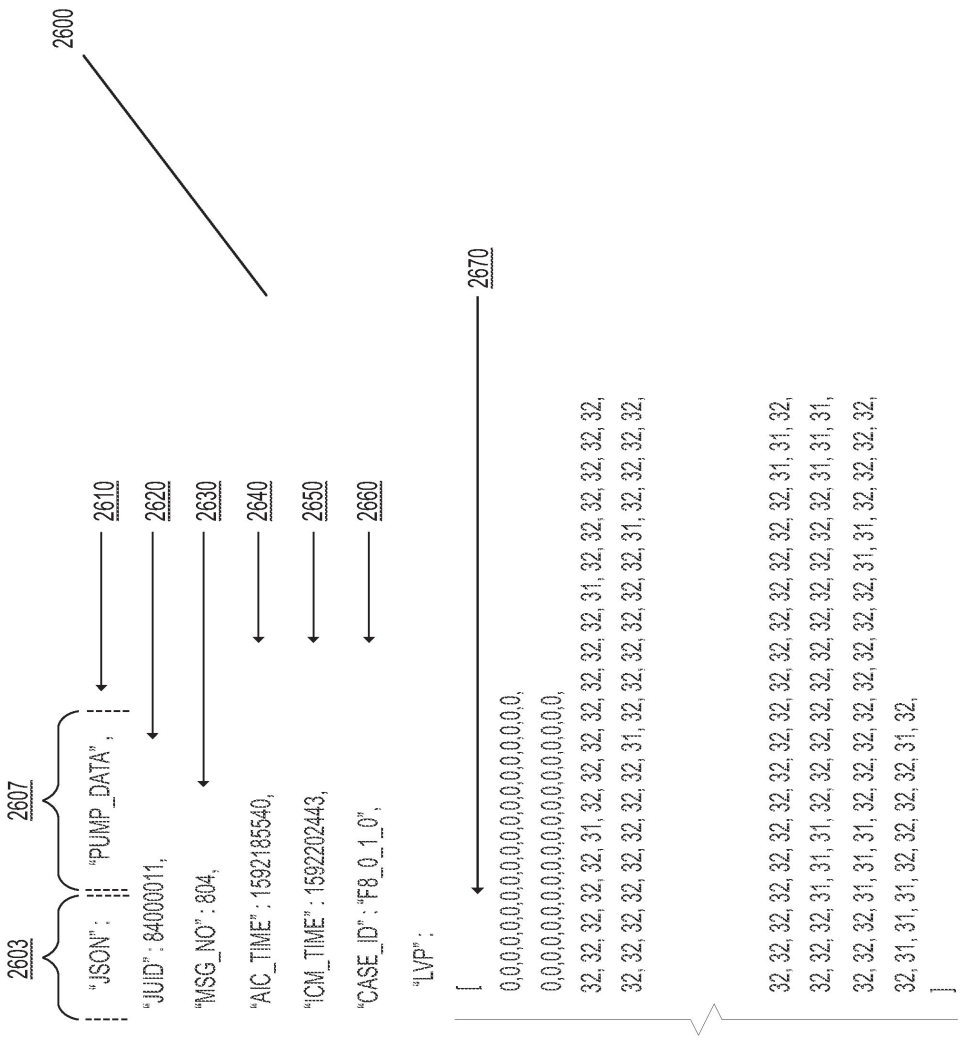

2600
2603
2607
"JSON" : "PUMP_DATA",
2610
"JUID" : 84000011,
2620
"MSG_NO" : 804,
2630
"AIC_TIME" : 1592185540,
2640
"ICM_TIME" : 1592202443,
2650
"CASE_ID" : "F8_0_1_0",
2660
"LVP":
[
2670
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
32, 32, 32, 32, 32, 31, 32, 32, 32, 32, 32, 31,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

FIG. 26

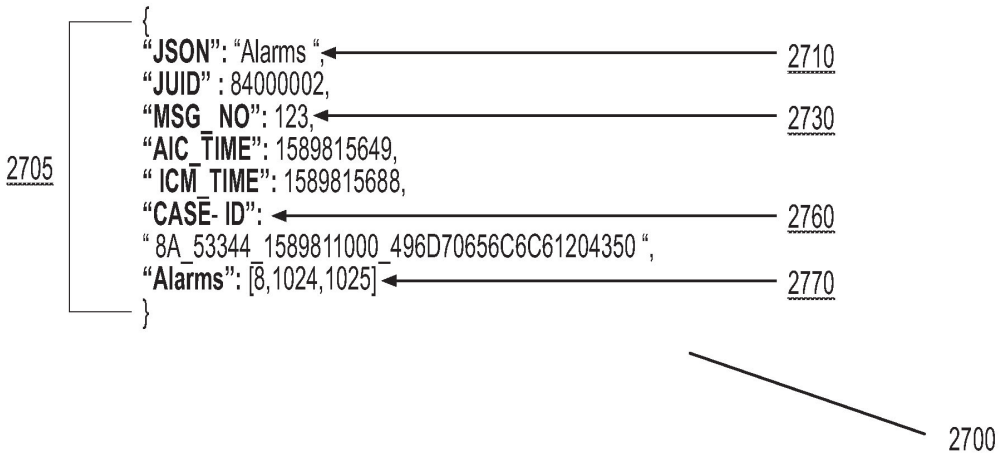

{
"JSON": "Alarms ",
"JUID" : 84000002,
"MSG_NO": 123,
"AIC_TIME": 1589815649,
" ICM_TIME": 1589815688,
"CASE- ID":
" 8A_53344_1589811000_496D70656C6C61204350 ",
"Alarms": [8,1024,1025]
}
2710
2730
2760
2770
2705
2700

FIG. 27

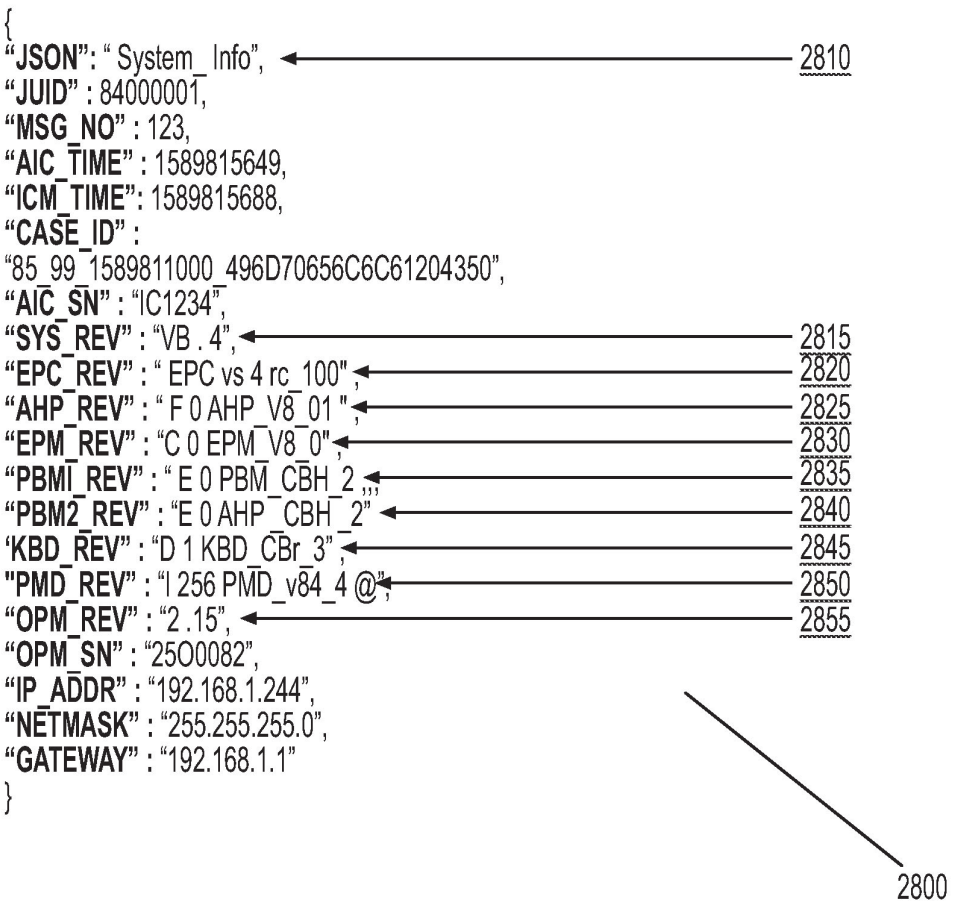

{
"JSON": " System_ Info",
"JUID" : 84000001,
"MSG_NO" : 123,
"AIC_TIME" : 1589815649,
"ICM_TIME": 1589815688,
"CASE_ID" :
"85_99_1589811000_496D70656C6C61204350",
"AIC_SN" : "IC1234",
"SYS_REV" : "VB . 4",
"EPC_REV" : " EPC vs 4 rc_100",
"AHP_REV" : " F 0 AHP_V8_01 ",
"EPM_REV" : "C 0 EPM_V8_0",
"PBM1_REV" : " 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