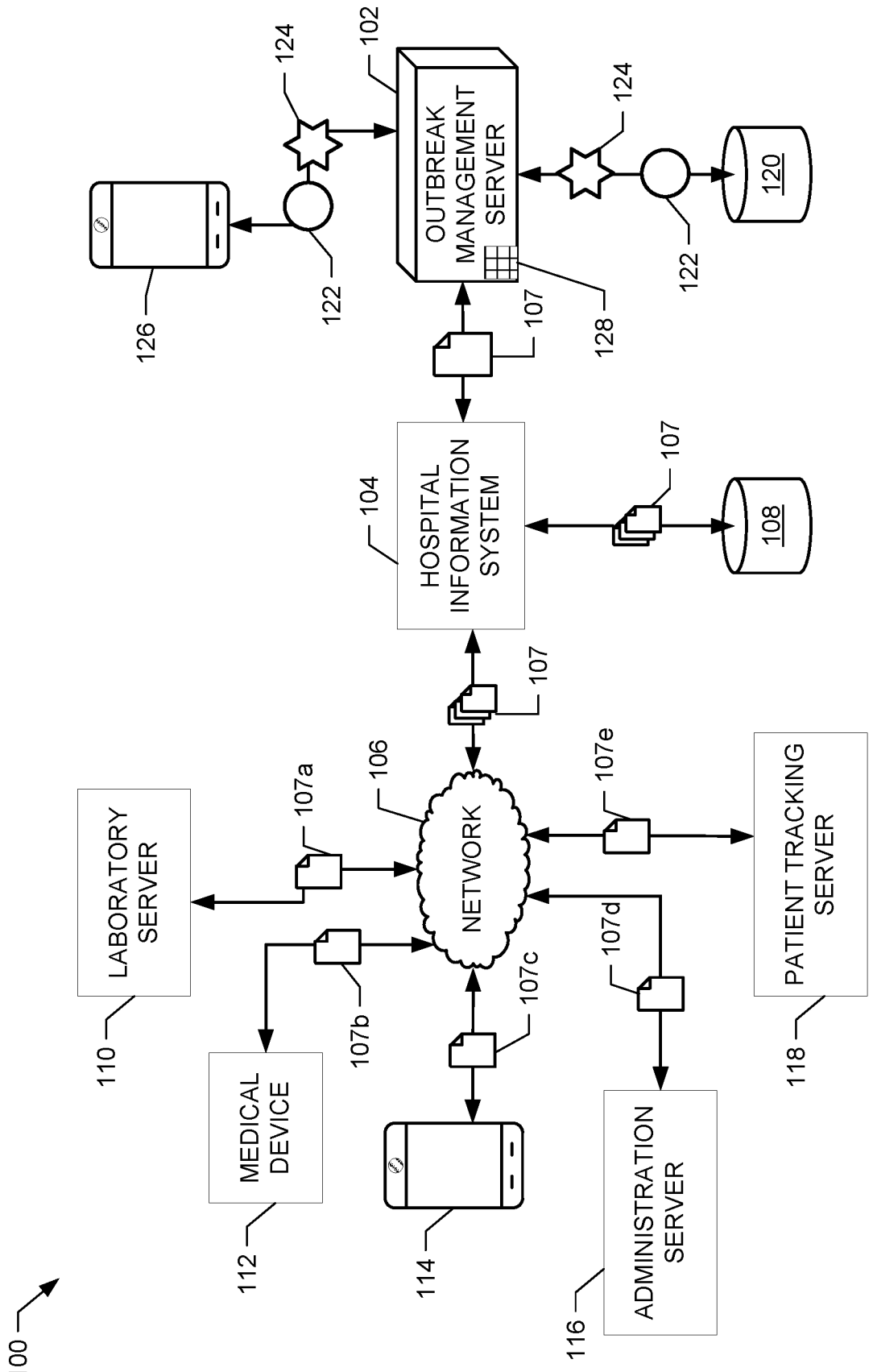

100
LABORATORY SERVER
110
MEDICAL DEVICE
112
114
ADMINISTRATION SERVER
116
PATIENT TRACKING SERVER
118
NETWORK
106
107a
107b
107c
107d
107e
107
HOSPITAL INFORMATION SYSTEM
104
108
OUTBREAK MANAGEMENT SERVER
102
120
122
124
126
128

FIG. 1

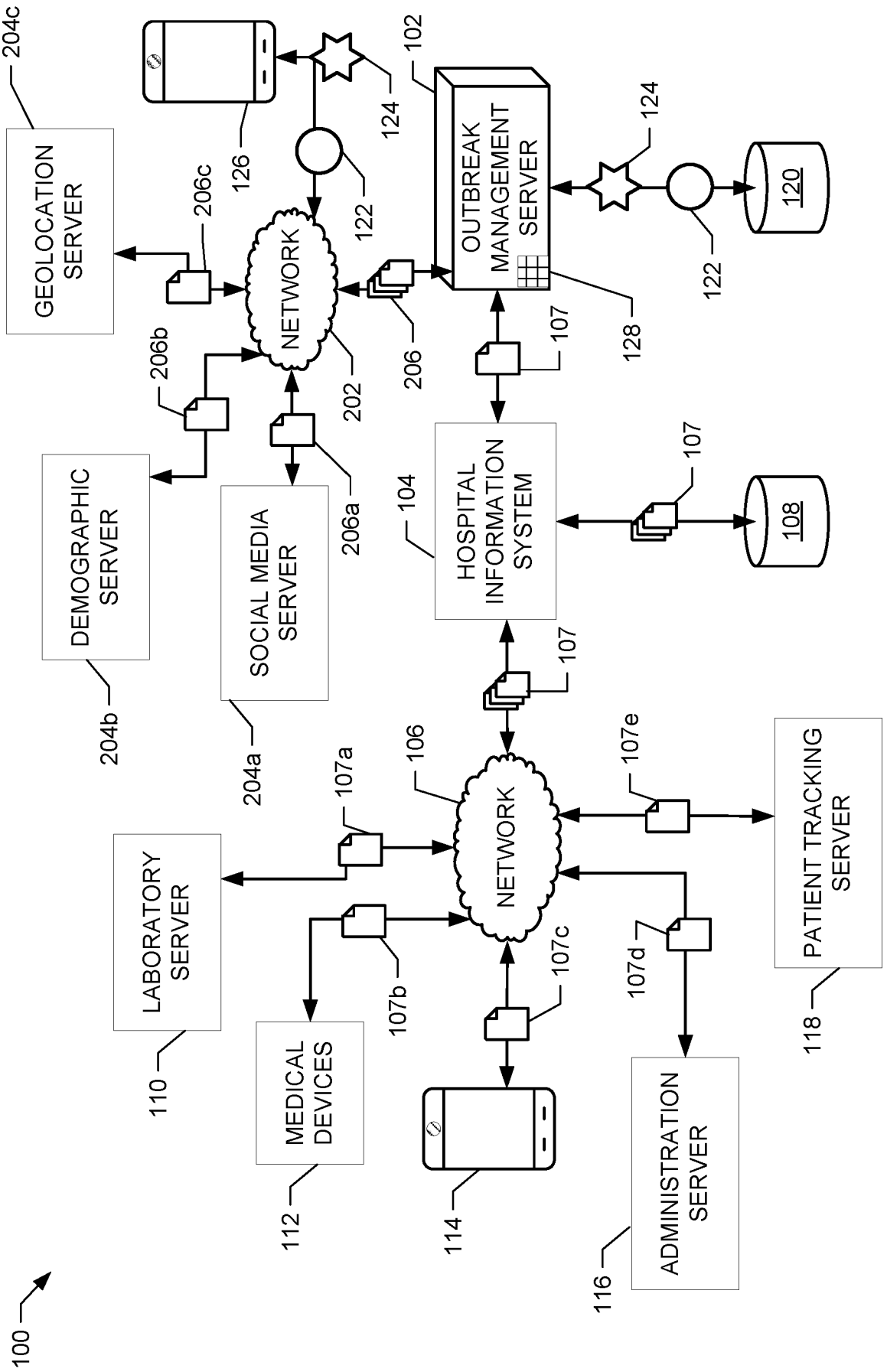

100
GEOLOCATION SERVER
204c
126
124
102
OUTBREAK MANAGEMENT SERVER
124
120
122
206c
NETWORK
122
206b
202
206
128
107
DEMOGRAPHIC SERVER
204b
SOCIAL MEDIA SERVER
204a
206a
104
HOSPITAL INFORMATION SYSTEM
107
108
107
106
107a
NETWORK
107e
LABORATORY SERVER
110
MEDICAL DEVICES
112
107b
107c
114
107d
ADMINISTRATION SERVER
116
PATIENT TRACKING SERVER
118

FIG. 2

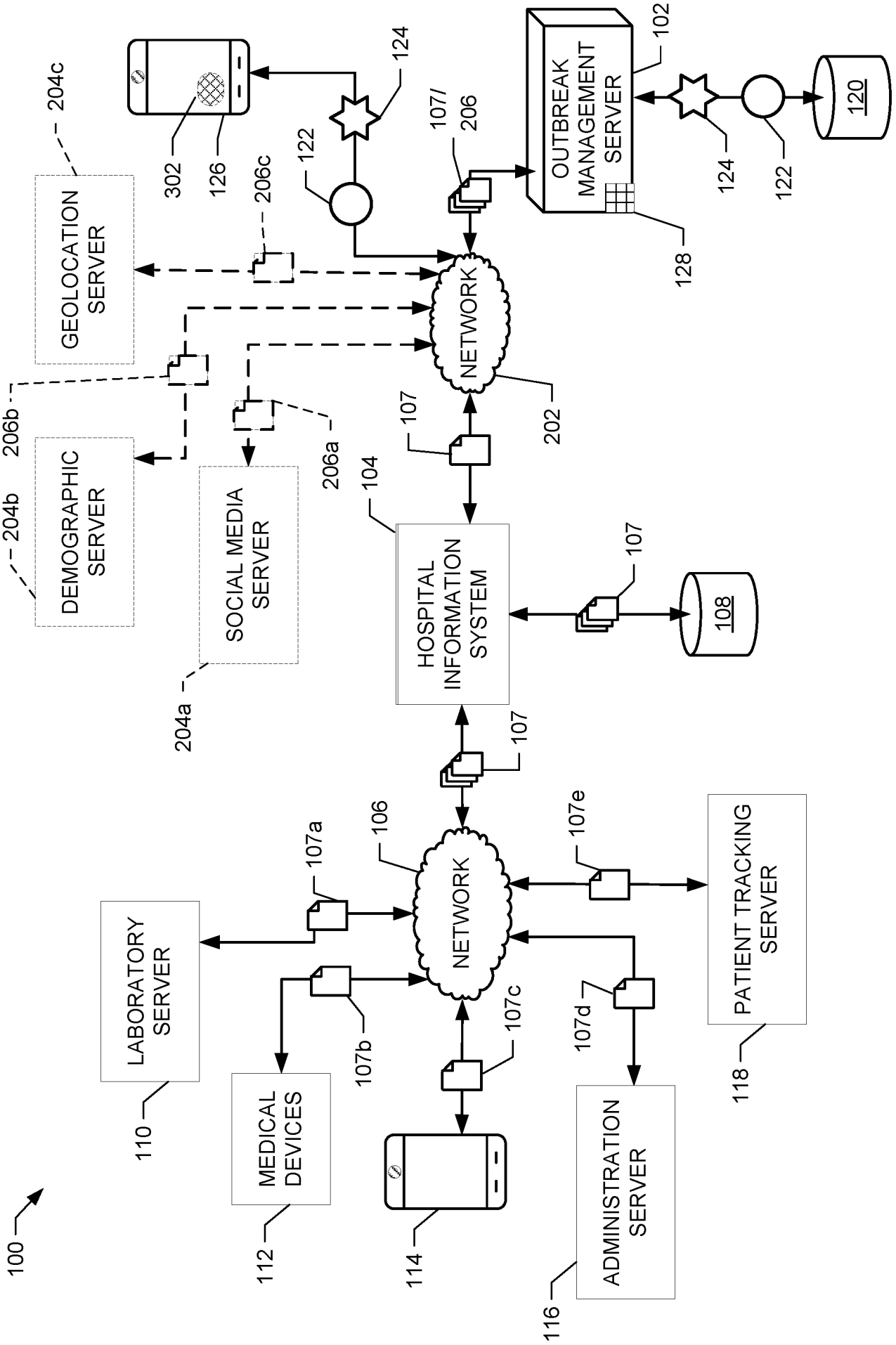

100
110
LABORATORY SERVER
112
MEDICAL DEVICES
114
116
ADMINISTRATION SERVER
118
PATIENT TRACKING SERVER
106
NETWORK
107a
107b
107c
107d
107e
104
HOSPITAL INFORMATION SYSTEM
107
108
204a
SOCIAL MEDIA SERVER
204b
DEMOGRAPHIC SERVER
206b
204c
GEOLOCATION SERVER
206a
206c
202
NETWORK
107
206
OUTBREAK MANAGEMENT SERVER
102
120
122
124
126
128
302

FIG. 3

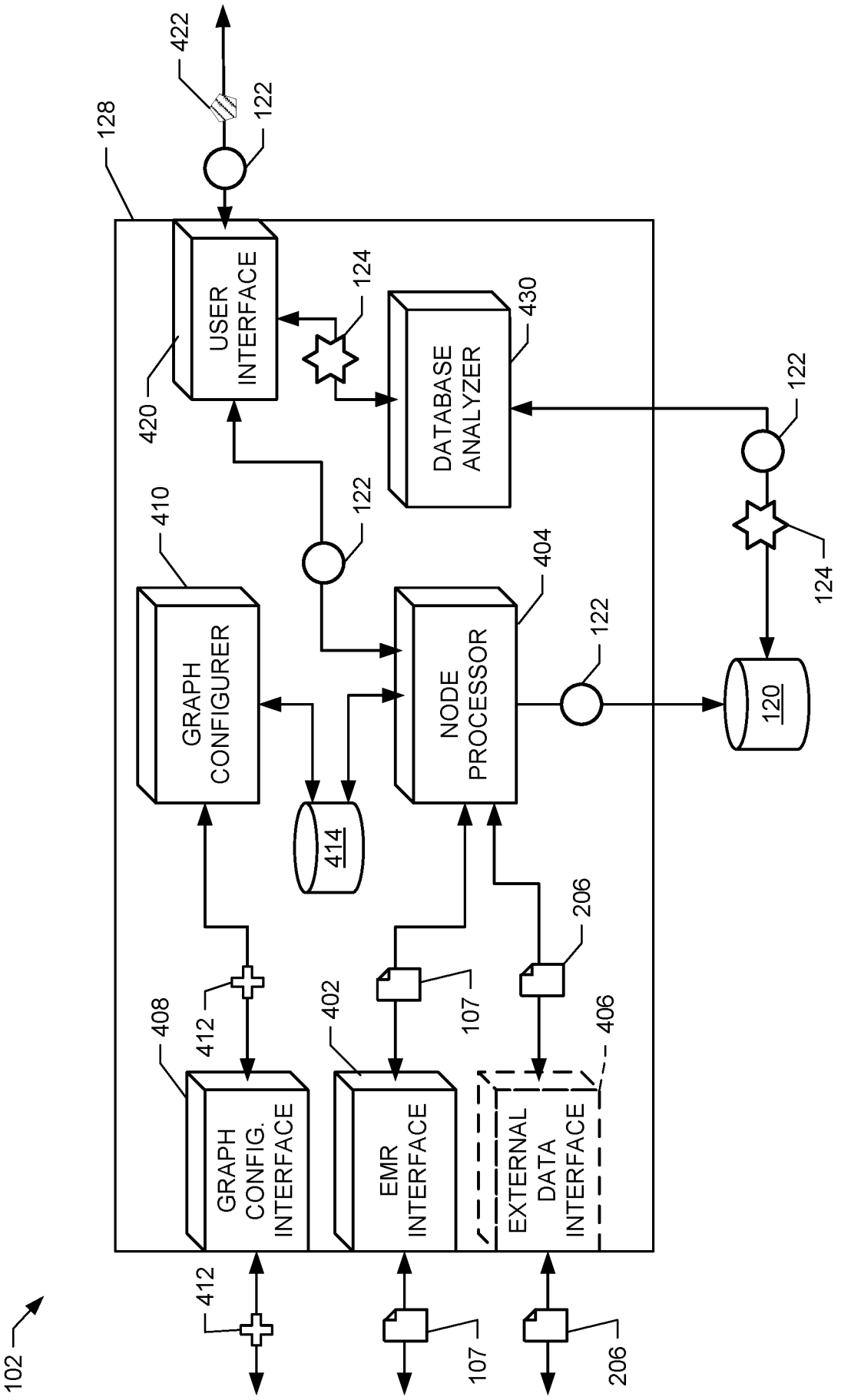

102
128
422
122
USER INTERFACE
420
124
DATABASE ANALYZER
430
122
410
GRAPH CONFIGURER
122
404
NODE PROCESSOR
122
120
124
414
206
408
412
402
107
406
GRAPH CONFIG. INTERFACE
EMR INTERFACE
EXTERNAL DATA INTERFACE
412
107
206

FIG. 4

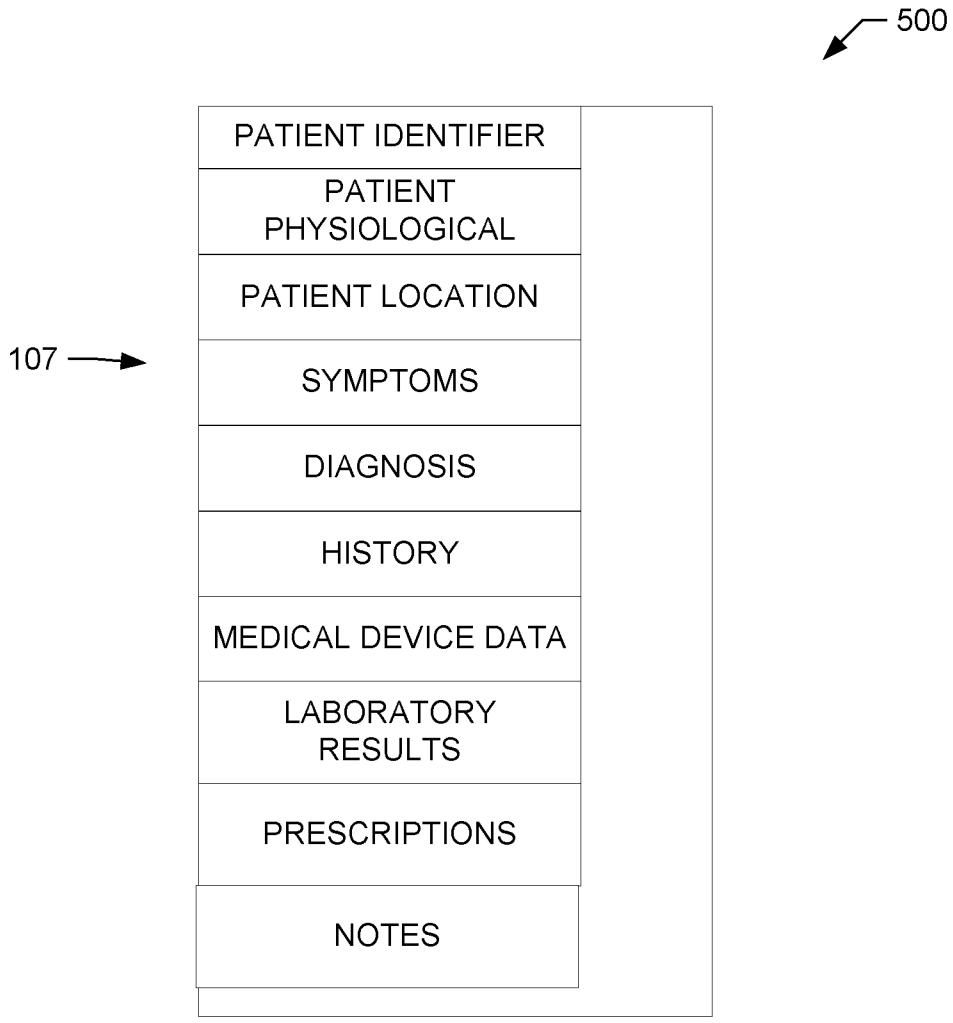

500
PATIENT IDENTIFIER
PATIENT PHYSIOLOGICAL
PATIENT LOCATION
107
SYMPTOMS
DIAGNOSIS
HISTORY
MEDICAL DEVICE DATA
LABORATORY RESULTS
PRESCRIPTIONS
NOTES

FIG. 5



Influenza in Gloucester Winter

Background

Time and Place

Clinical Criteria

Any person with at least one of the following clinical forms:

Influenza-like illness (ILI)

- Sudden onset of symptoms

AND at least one of the following four systemic symptoms:

- Fever or feverishness
- Malaise
- Headache
- Myalgia

AND at least one of the following three respiratory symptoms:

- Cough
- Sore throat
- Shortness of breath

Acute respiratory infection (ARI)

- Sudden onset of symptoms

AND at least one of the following four respiratory symptoms:

- Cough
- Sore throat
- Shortness of breath
- Coryza

AND a clinician's judgement that the illness is due to an infection

FIG. 6



Laboratory Criteria for Diagnosis

At least one the following four:

- Isolation of influenza virus from a clinical specimen
- Detection of influenza virus nucleci acid in a clinical specimen
- Identification of influenza virus antigen by DFA test in a clinical specimen
- Influenza specific antibody response

Sub typing of the influenza isolate should be performed, if possible.

Epidemiological Criteria

Primary mode of transmission

Person-to-person contact

Other modes of transmission

Case Classification

POSSIBLE CASE

Any person meeting the clinical criteria (ILI or ARI)

PROBABLE CASE

Any person meeting the clinical criteria (ILI or ARI) and with an epidemiological link

CONFIRMED CASE

Any person meeting the clinical (ILI or ARI) and the laboratory criteria

FIG. 7

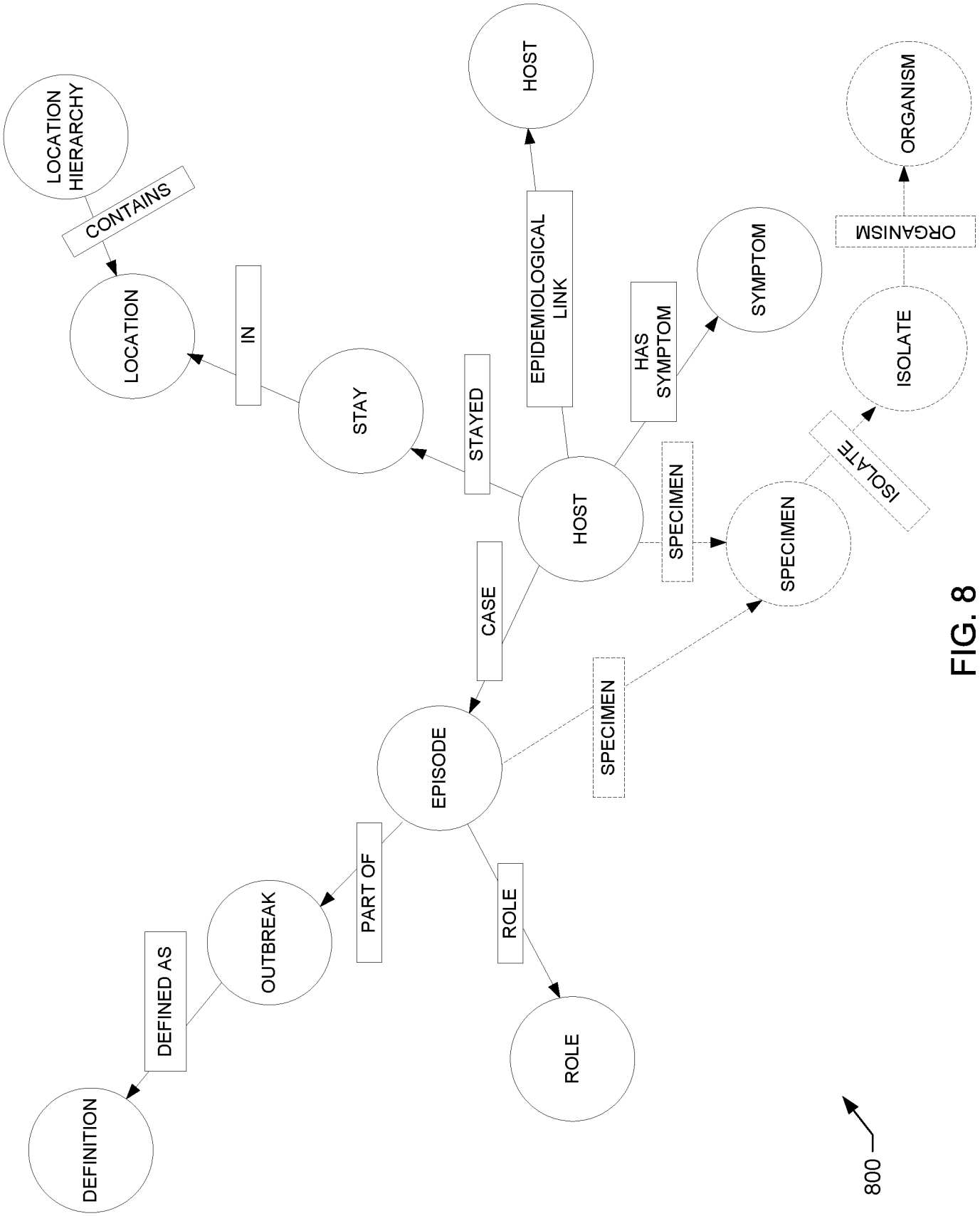

LOCATION HIERARCHY
CONTAINS
LOCATION
IN
STAY
STAYED
HOST
EPIDEMIOLOGICAL LINK
HAS SYMPTOM
SYMPTOM
HOST
SPECIMEN
SPECIMEN
ISOLATE
ISOLATE
ORGANISM
ORGANISM
CASE
EPISODE
SPECIMEN
PART OF
OUTBREAK
DEFINED AS
DEFINITION
ROLE
ROLE
800

FIG. 8

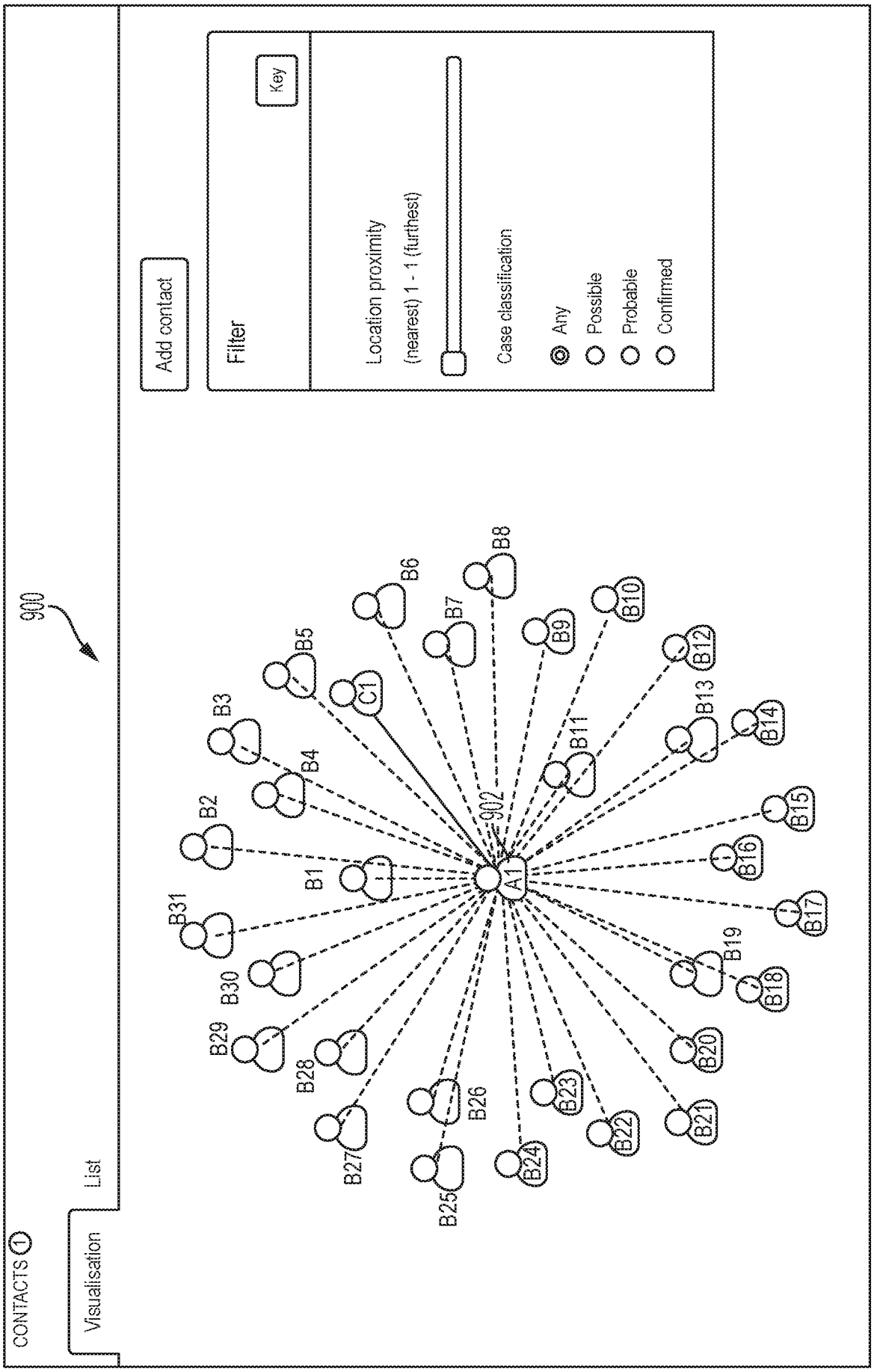

CONTACTS
Visualisation
List
900
Add contact
Filter
Key
Location proximity
(nearest) 1 - 1 (furthest)
Case classification
Any
Possible
Probable
Confirmed
902
A1
B1
B2
B3
B4
B5
C1
B6
B7
B8
B9
B10
B11
B12
B13
B14
B15
B16
B17
B18
B19
B20
B21
B22
B23
B24
B25
B26
B27
B28
B29
B30
B31

FIG. 9

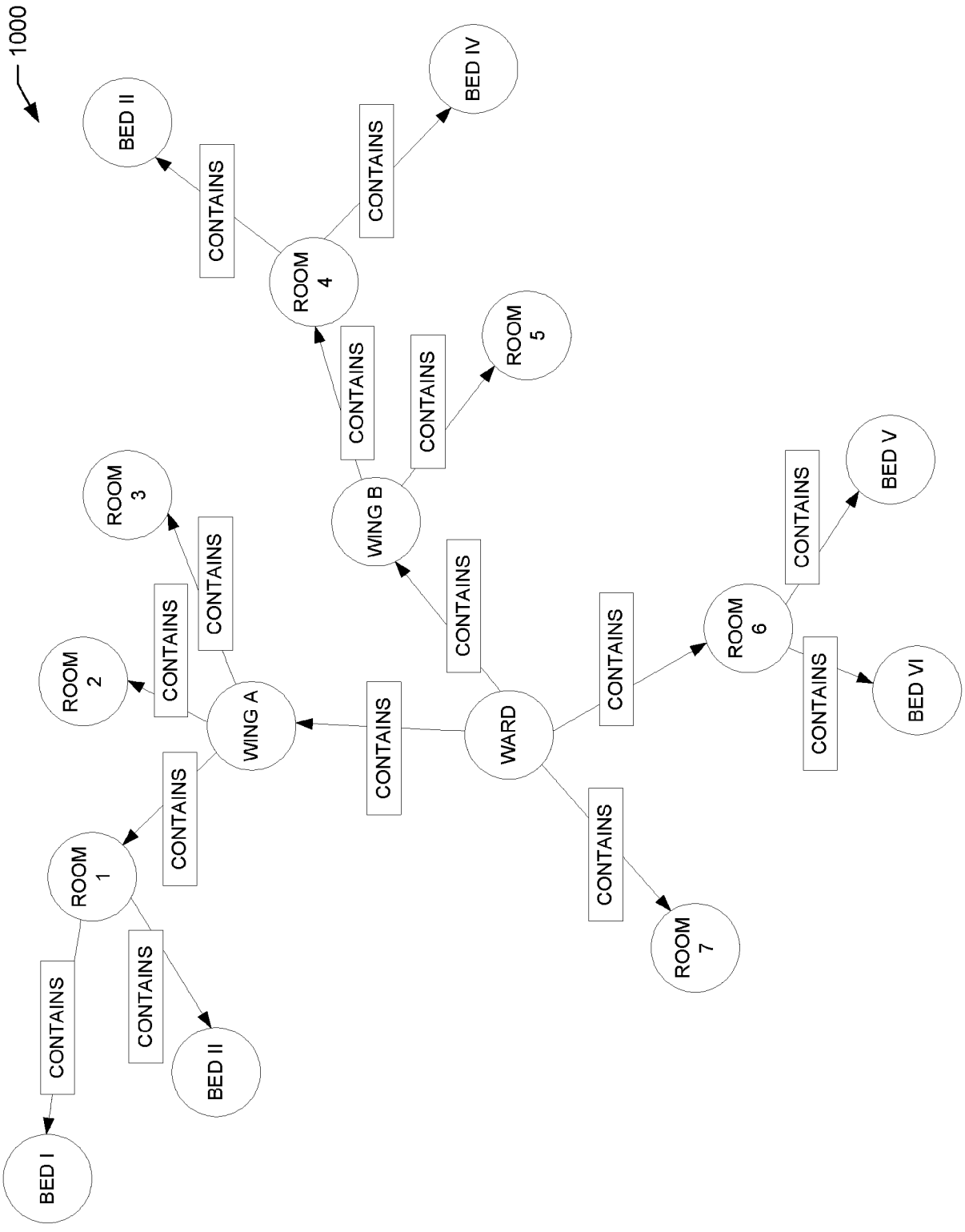

1000
WARD
WING A
WING B
ROOM 1
ROOM 2
ROOM 3
ROOM 4
ROOM 5
ROOM 6
ROOM 7
BED I
BED II
BED II
BED IV
BED V
BED VI
CONTAINS

FIG. 10A

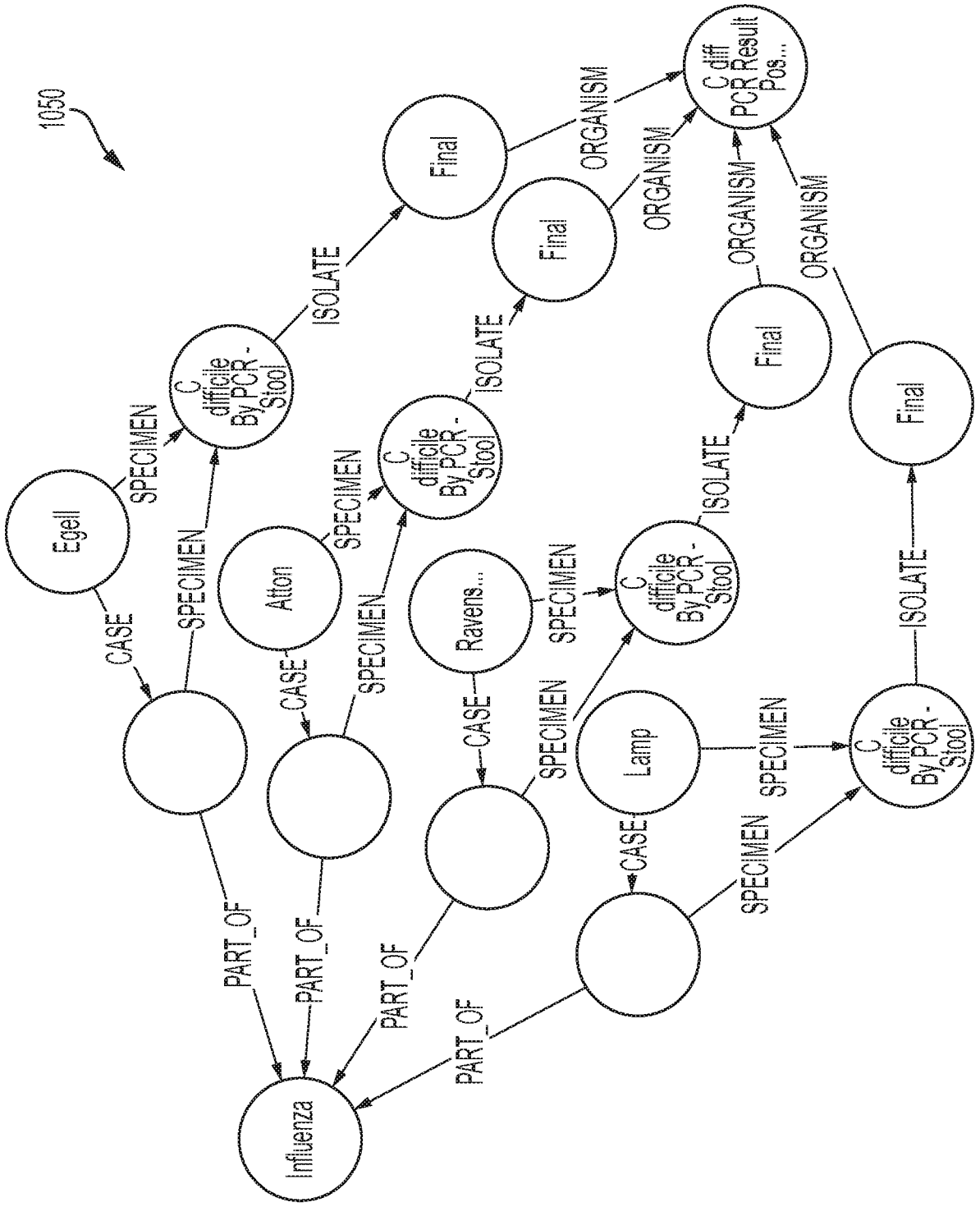

1050
Egell
Atton
Ravens...
Lamp
Influenza
C difficile By PCR - Stool
Final
C diff PCR Result Pos...
CASE
SPECIMEN
ISOLATE
ORGANISM
PART_OF

FIG. 10B

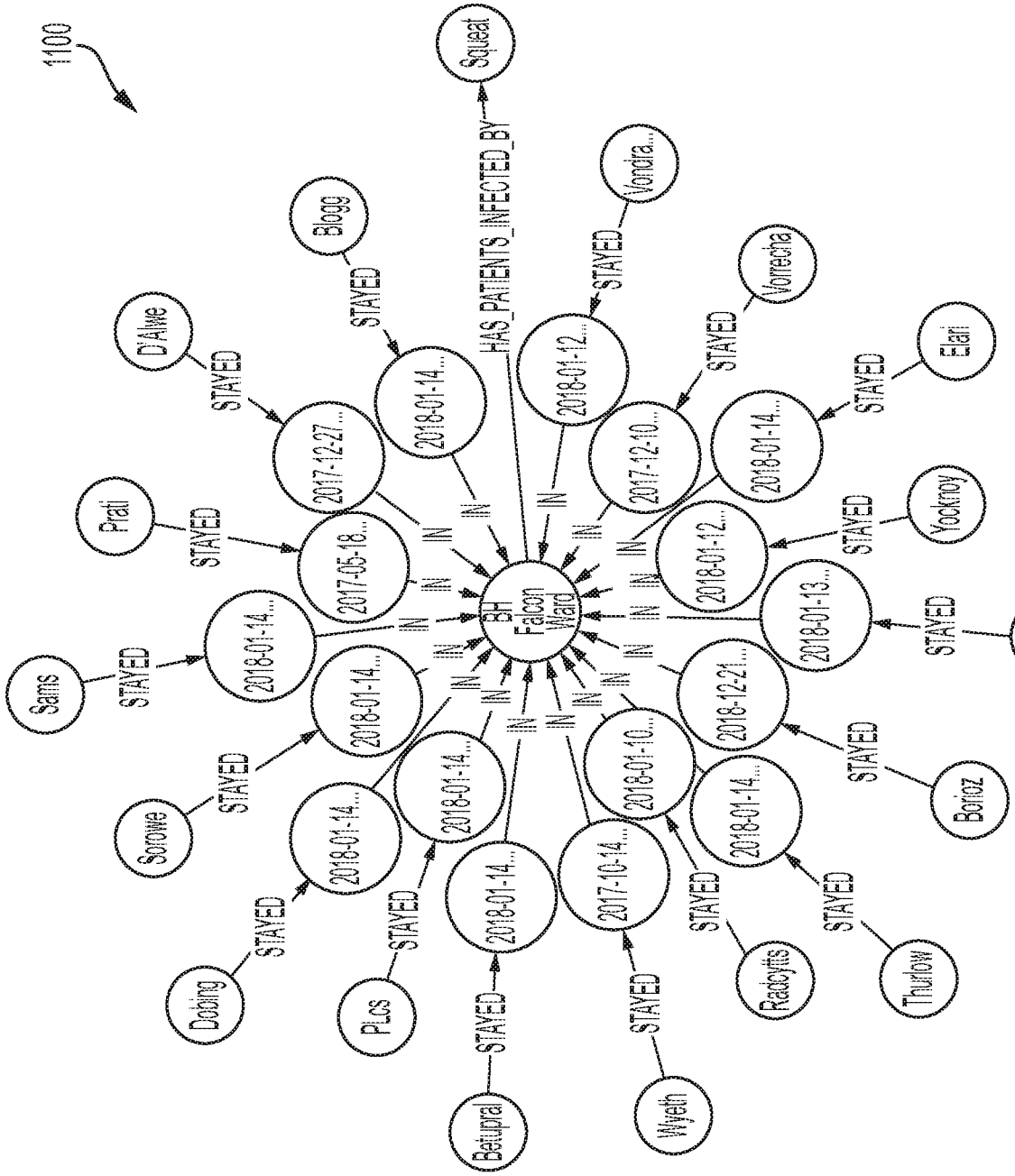

1100
Squeat
HAS_PATIENTS_INFECTED_BY
BH Falcon Ward
IN
Blogg
STAYED
2018-01-14...
D'Alwe
STAYED
2017-12-27...
Prati
STAYED
2017-05-18...
Sams
STAYED
2018-01-14...
Sorowe
STAYED
2018-01-14...
Dobing
STAYED
2018-01-14...
Plos
STAYED
2018-01-14...
Betupral
STAYED
2018-01-14...
Wyeth
STAYED
2017-10-14...
Radoyfis
STAYED
2018-01-10...
Thurlow
STAYED
2018-01-14...
Borioz
STAYED
2018-12-21...
Scapels
STAYED
2018-01-13...
Yocknoy
STAYED
2018-01-12...
Elari
STAYED
2018-01-14...
Vorrecha
STAYED
2017-12-10...
Vondra...
STAYED
2018-01-12...

FIG. 11

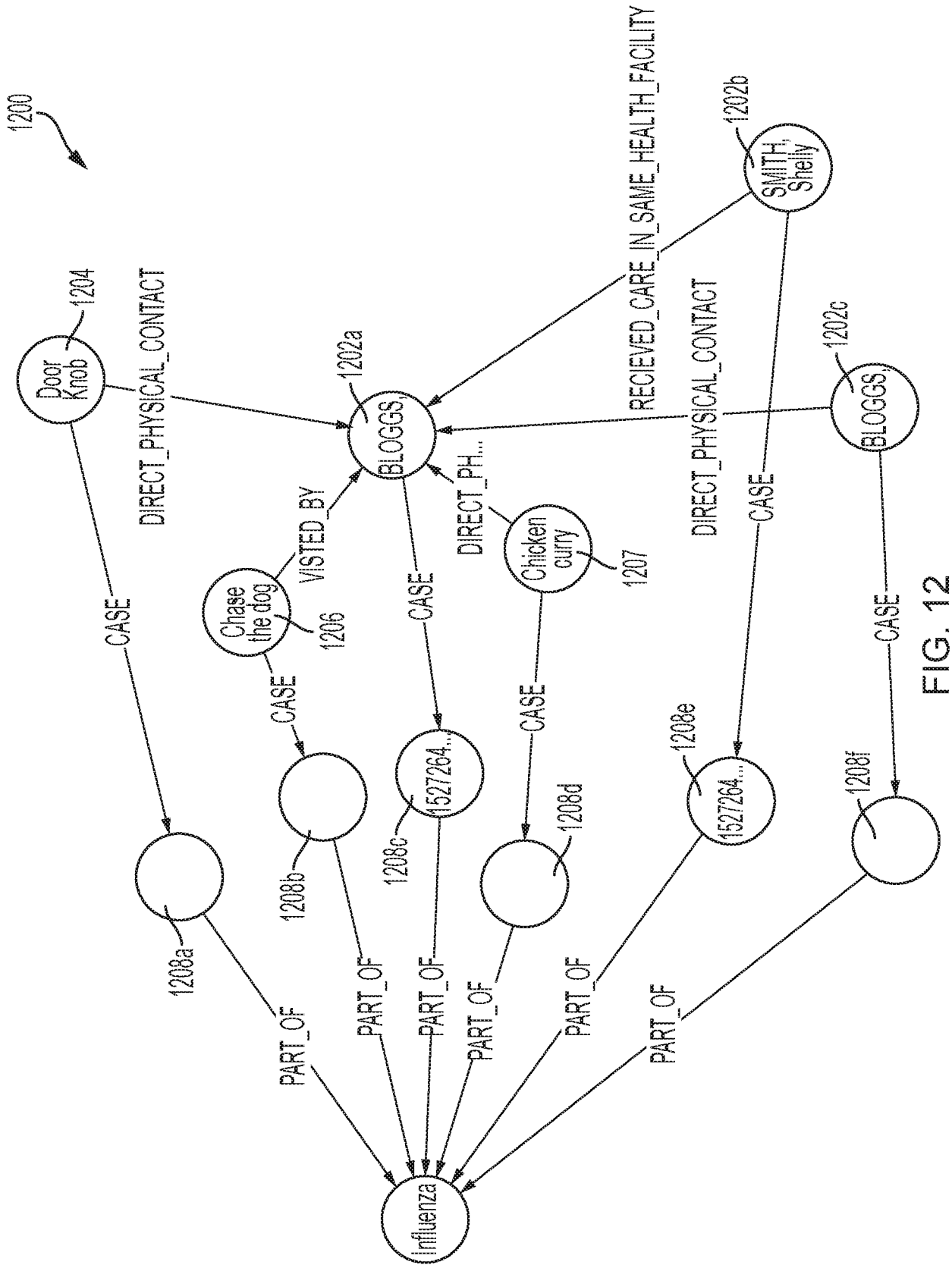

1200
Door Knob
1204
DIRECT_PHYSICAL_CONTACT
BLOGGS
1202a
RECIEVED_CARE_IN_SAME_HEALTH_FACILITY
SMITH, Shelly
1202b
DIRECT_PHYSICAL_CONTACT
BLOGGS,
1202c
CASE
Chase the dog
VISITED_BY
1206
CASE
DIRECT_PH...
Chicken curry
1207
CASE
CASE
CASE
1208a
1208b
1527264...
1208c
1208d
1527264...
1208e
1208f
PART_OF
PART_OF
PART_OF
PART_OF
PART_OF
Influenza

FIG. 12

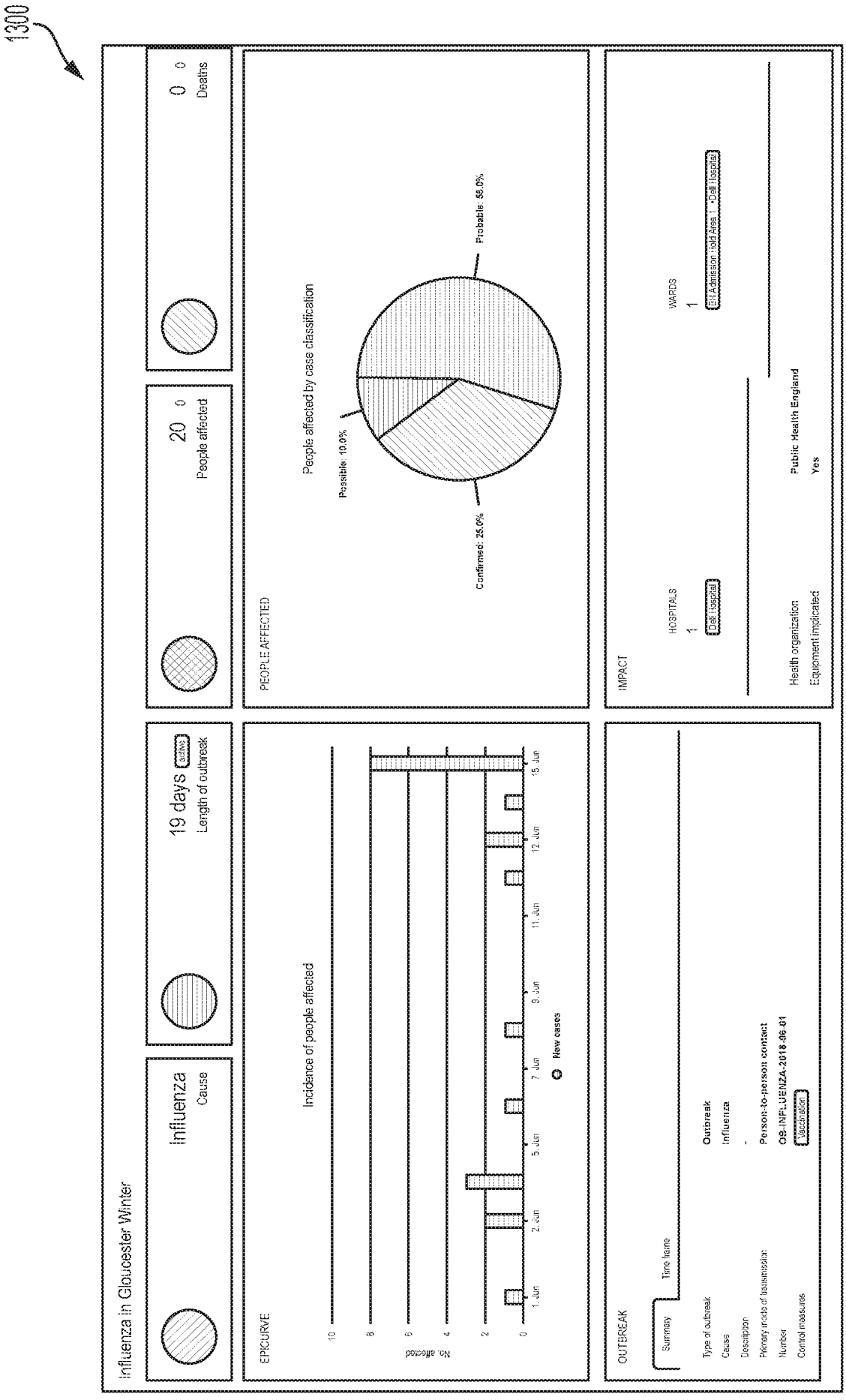

1300
Influenza in Gloucester Winter
Influenza
Cause
19 days
Length of outbreak
Active
20
People affected
0
Deaths
EPICURVE
Incidence of people affected
No. affected
New cases
PEOPLE AFFECTED
People affected by case classification
Possible: 10.0%
Confirmed: 25.0%
Probable: 65.0%
OUTBREAK
Summary
Time frame
Type of outbreak
Outbreak
Cause
Influenza
Description
-
Primary mode of transmission
Person-to-person contact
Number
OB-INFLUENZA-2018-06-01
Control measures
Vaccination
IMPACT
HOSPITALS
1
Dell Hospital
WARDS
1
ER Admission Hold Area 1 - Dell Hospital
Health organization
Public Health England
Equipment implicated
Yes

FIG. 13

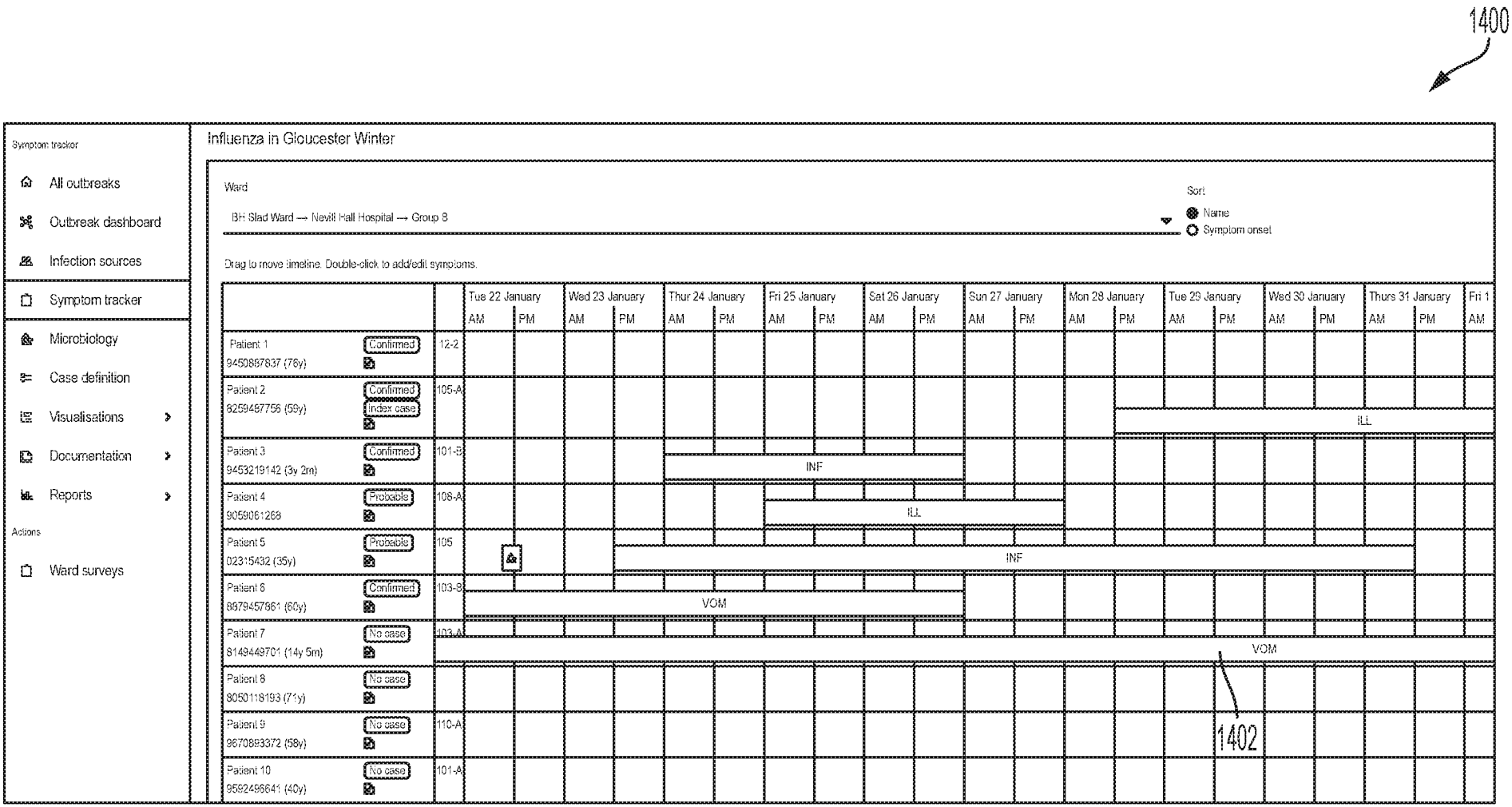

1400
Symptom tracker
All outbreaks
Outbreak dashboard
Infection sources
Symptom tracker
Microbiology
Case definition
Visualisations
Documentation
Reports
Actions
Ward surveys
Influenza in Gloucester Winter
Ward
BH Slad Ward → Nevill Hall Hospital → Group 8
Sort
Name
Symptom onset
Drag to move timeline. Double-click to add/edit symptoms.
Tue 22 January
Wed 23 January
Thur 24 January
Fri 25 January
Sat 26 January
Sun 27 January
Mon 28 January
Tue 29 January
Wed 30 January
Thurs 31 January
Fri 1
AM
PM
Patient 1
9450867837 (76y)
Confirmed
12-2
Patient 2
9259487756 (59y)
Confirmed
Index case
105-A
ILL
Patient 3
9453219142 (3y 2m)
Confirmed
101-B
INF
Patient 4
9059061268
Probable
108-A
ILL
Patient 5
02315432 (35y)
Probable
105
INF
Patient 6
8879457861 (60y)
Confirmed
103-B
VOM
Patient 7
8149449701 (14y 5m)
No case
103-A
VOM
Patient 8
9050118193 (71y)
No case
Patient 9
9670883372 (58y)
No case
110-A
1402
Patient 10
9592496641 (40y)
No case
101-A

FIG. 14

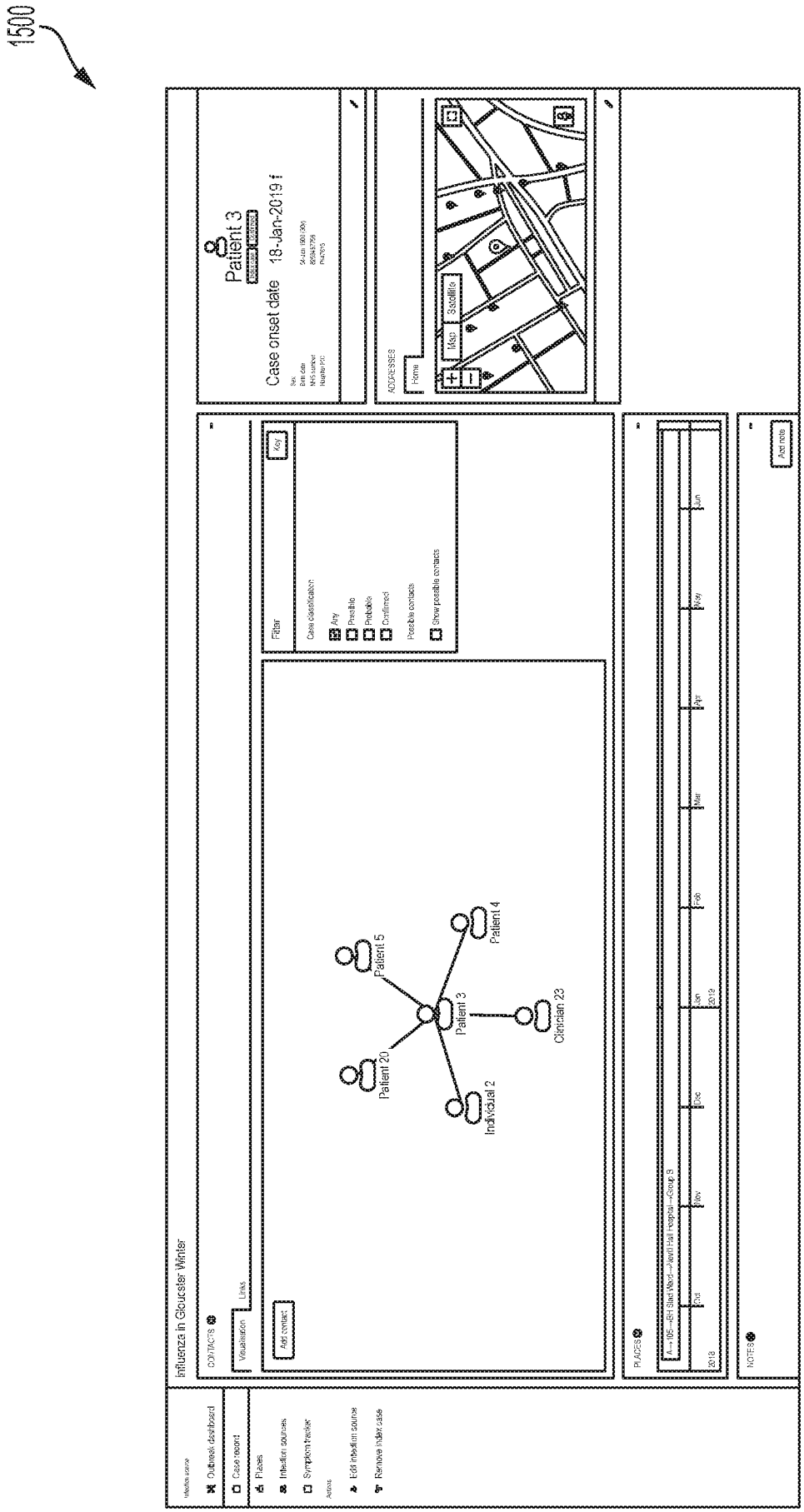

1500
Influenza in Gloucester Winter
Outbreak dashboard
Case record
Places
Infection sources
Symptom tracker
Edit infection source
Remove index case
CONTACTS
Visualisation
Lists
Add contact
Patient 5
Patient 4
Patient 3
Patient 20
Clinician 23
Individual 2
Filter
Key
Case classification:
Any
Possible
Probable
Confirmed
Possible contacts:
Show possible contacts
Patient 3
Case onset date 18-Jan-2019
Sex:
Birth date
NHS number
Nationality
ADDRESSES
Home
Map
Satellite
PLACES
2018
Jan
Feb
Mar
Apr
May
Jun
NOTES
Add note

FIG. 15

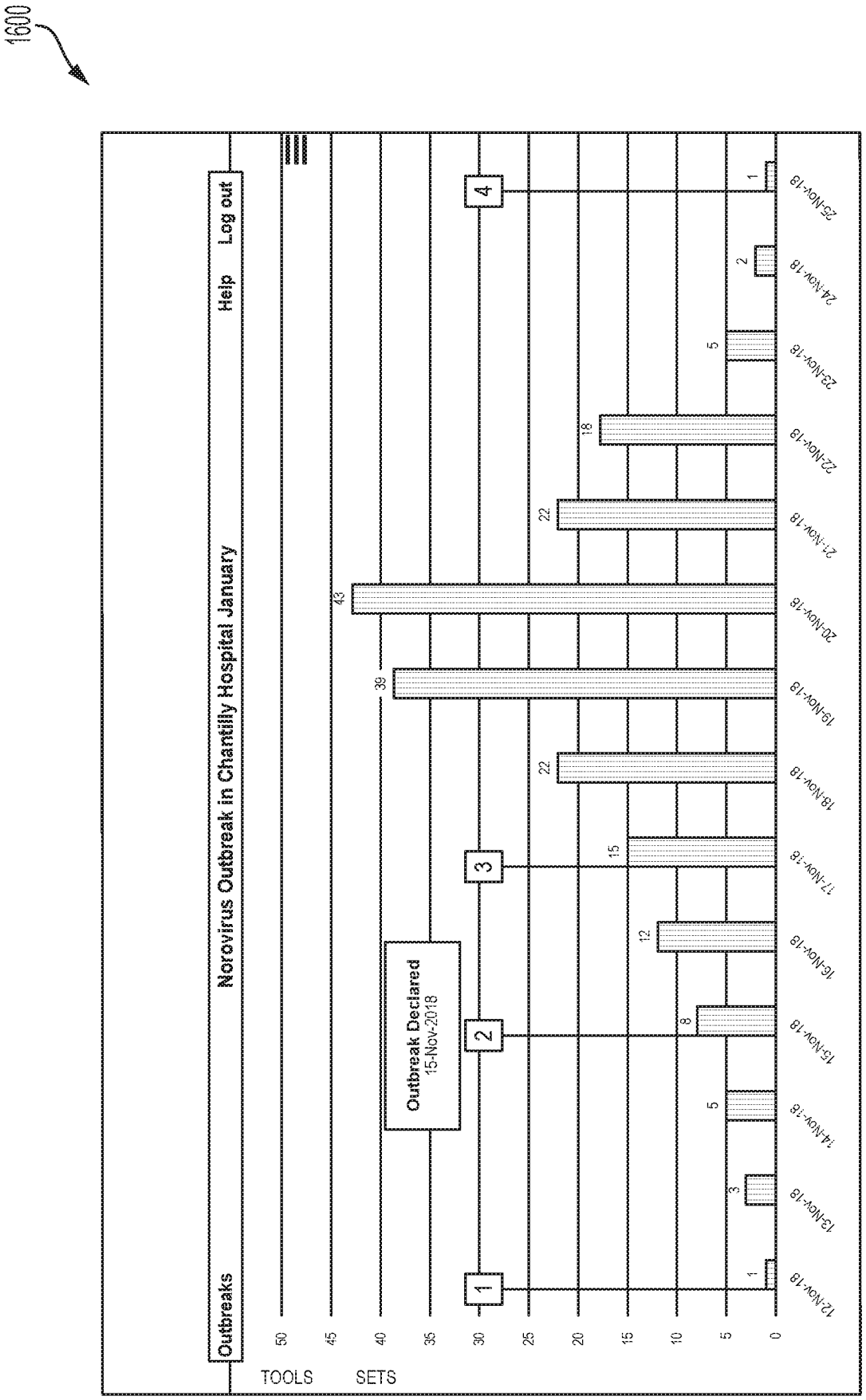

1600
Outbreaks
Norovirus Outbreak in Chantilly Hospital January
Help
Log out
TOOLS
SETS
Outbreak Declared
15-Nov-2018
1
2
3
4
12-Nov-18
13-Nov-18
14-Nov-18
15-Nov-18
16-Nov-18
17-Nov-18
18-Nov-18
19-Nov-18
20-Nov-18
21-Nov-18
22-Nov-18
23-Nov-18
24-Nov-18
25-Nov-18

FIG. 16

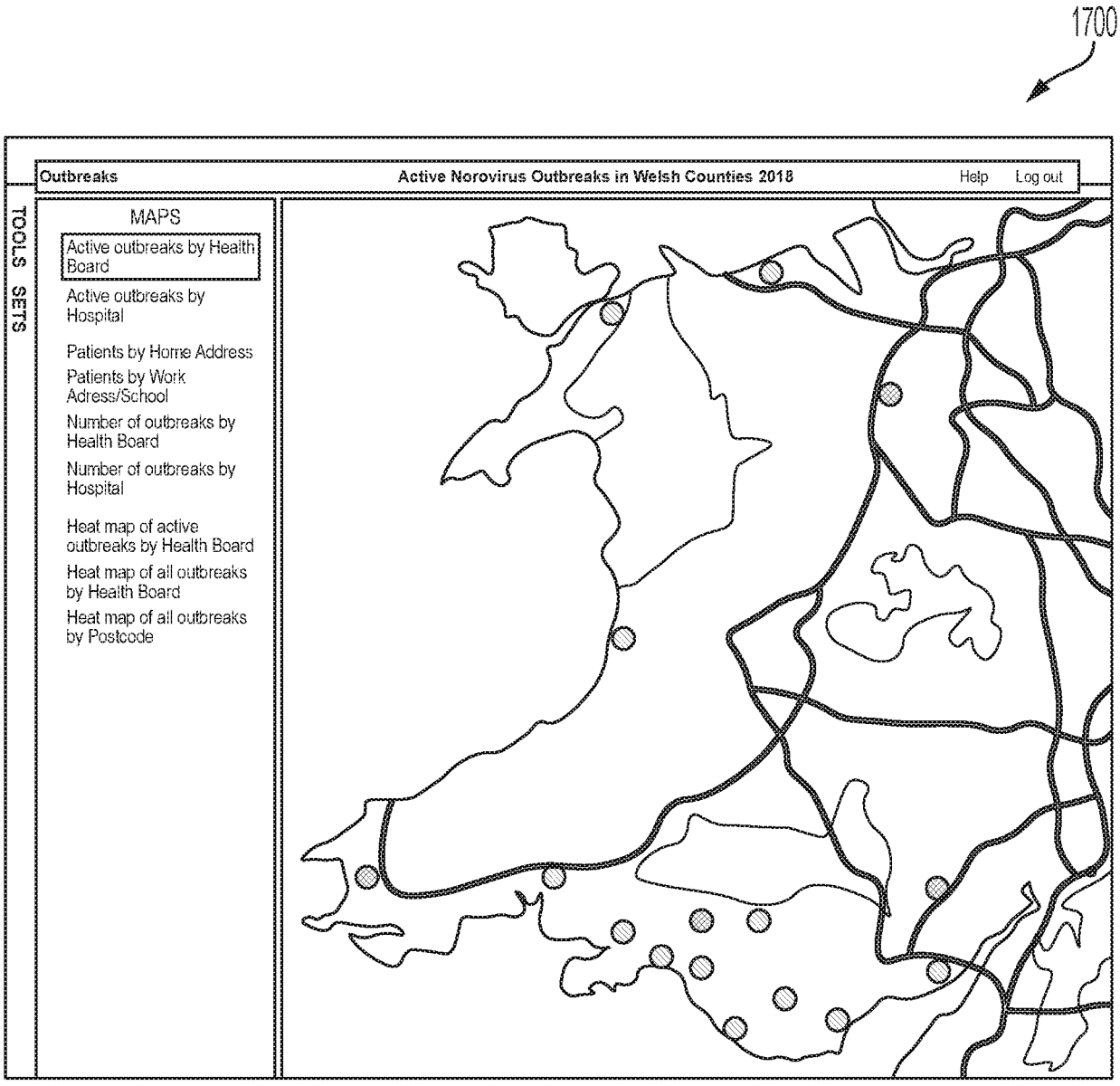

1700
Outbreaks
Active Norovirus Outbreaks in Welsh Counties 2018
Help
Log out
TOOLS
SETS
MAPS
Active outbreaks by Health Board
Active outbreaks by Hospital
Patients by Home Address
Patients by Work Adress/School
Number of outbreaks by Health Board
Number of outbreaks by Hospital
Heat map of active outbreaks by Health Board
Heat map of all outbreaks by Health Board
Heat map of all outbreaks by Postcode

FIG. 17

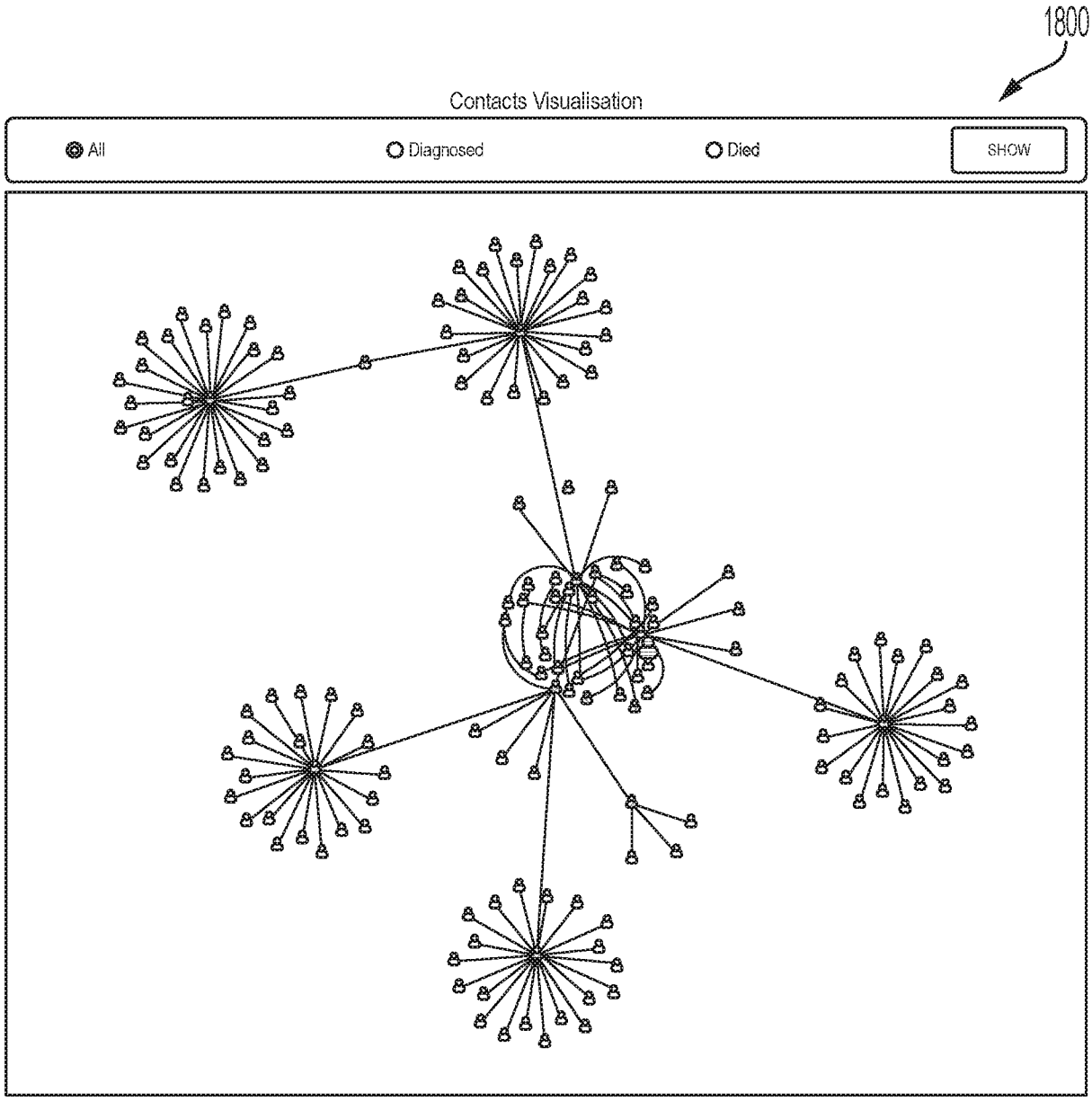


FIG. 18

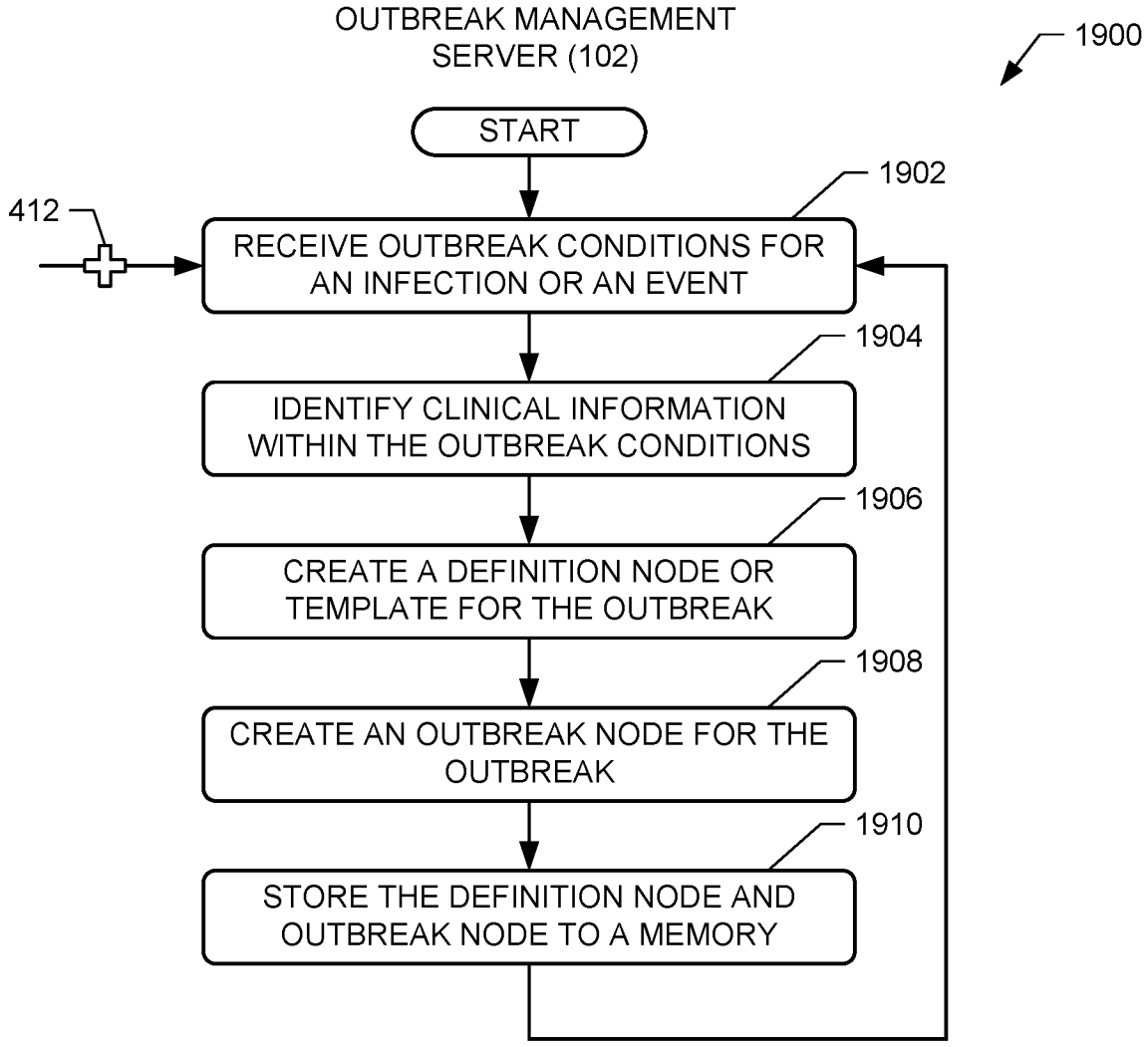

OUTBREAK MANAGEMENT SERVER (102)
1900
START
1902
412
RECEIVE OUTBREAK CONDITIONS FOR AN INFECTION OR AN EVENT
1904
IDENTIFY CLINICAL INFORMATION WITHIN THE OUTBREAK CONDITIONS
1906
CREATE A DEFINITION NODE OR TEMPLATE FOR THE OUTBREAK
1908
CREATE AN OUTBREAK NODE FOR THE OUTBREAK
1910
STORE THE DEFINITION NODE AND OUTBREAK NODE TO A MEMORY

FIG. 19

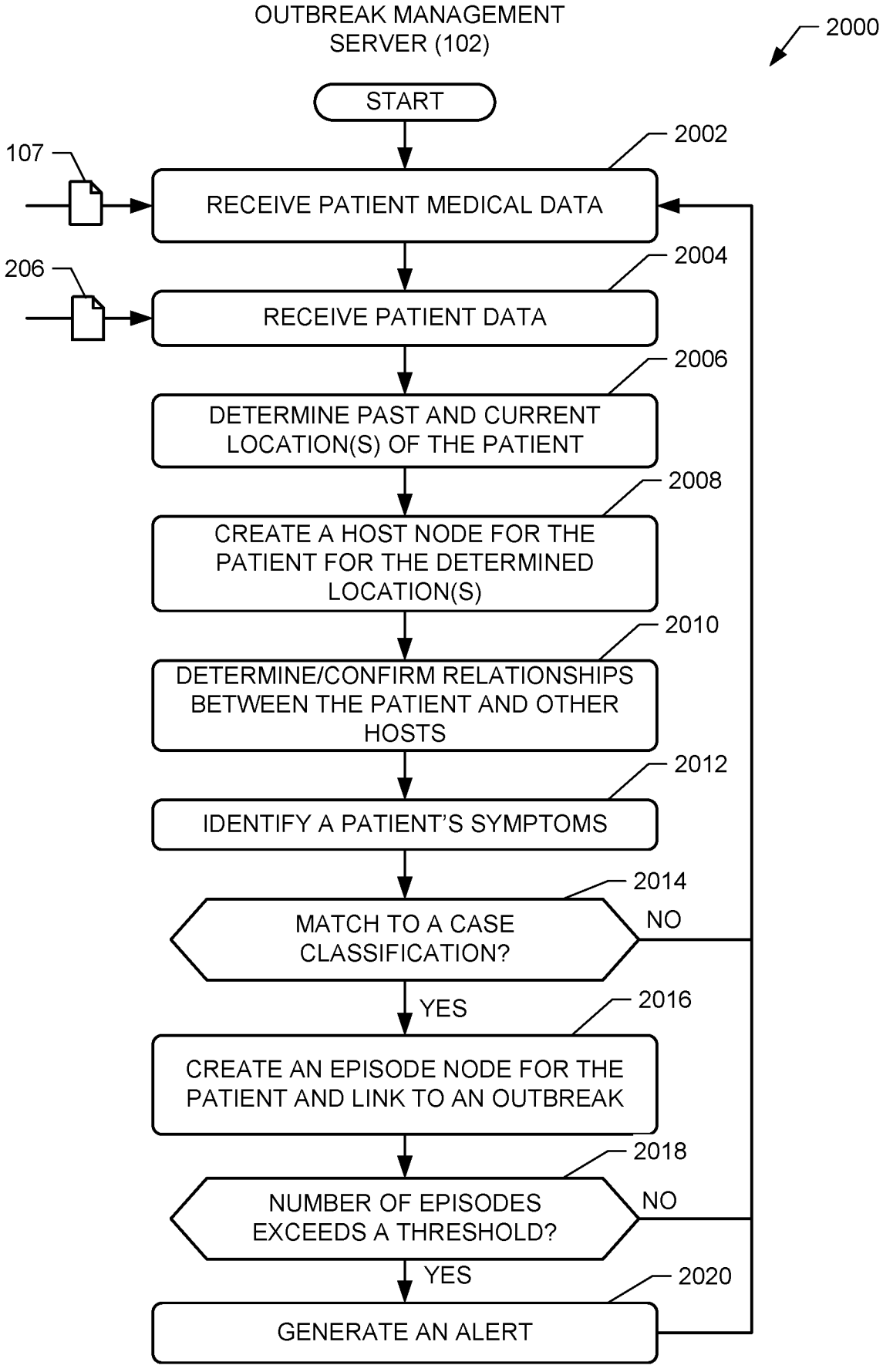

OUTBREAK MANAGEMENT SERVER (102)
2000
START
107
2002
RECEIVE PATIENT MEDICAL DATA
206
2004
RECEIVE PATIENT DATA
2006
DETERMINE PAST AND CURRENT LOCATION(S) OF THE PATIENT
2008
CREATE A HOST NODE FOR THE PATIENT FOR THE DETERMINED LOCATION(S)
2010
DETERMINE/CONFIRM RELATIONSHIPS BETWEEN THE PATIENT AND OTHER HOSTS
2012
IDENTIFY A PATIENT'S SYMPTOMS
2014
MATCH TO A CASE CLASSIFICATION?
NO
YES
2016
CREATE AN EPISODE NODE FOR THE PATIENT AND LINK TO AN OUTBREAK
2018
NUMBER OF EPISODES EXCEEDS A THRESHOLD?
NO
YES
2020
GENERATE AN ALERT

FIG. 20