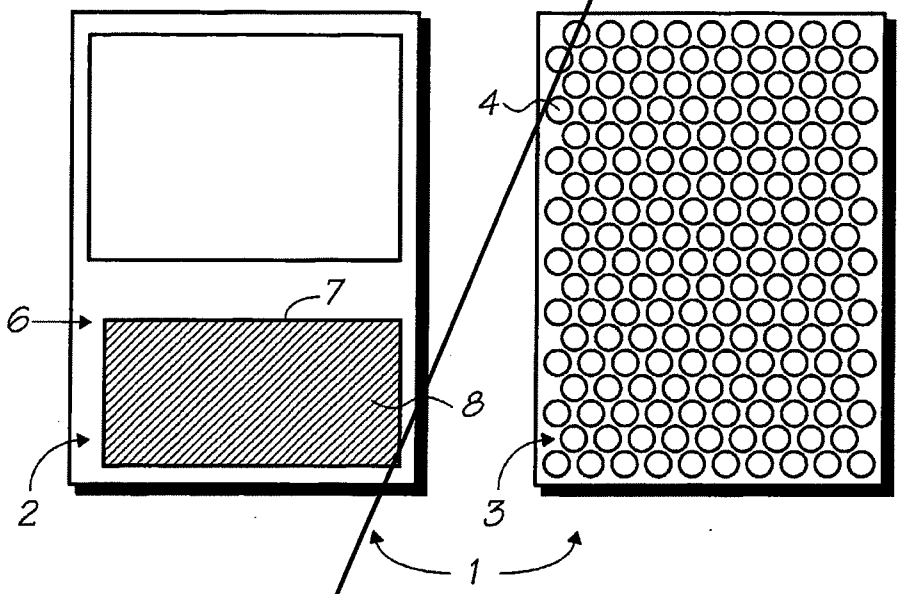

FIG. 1

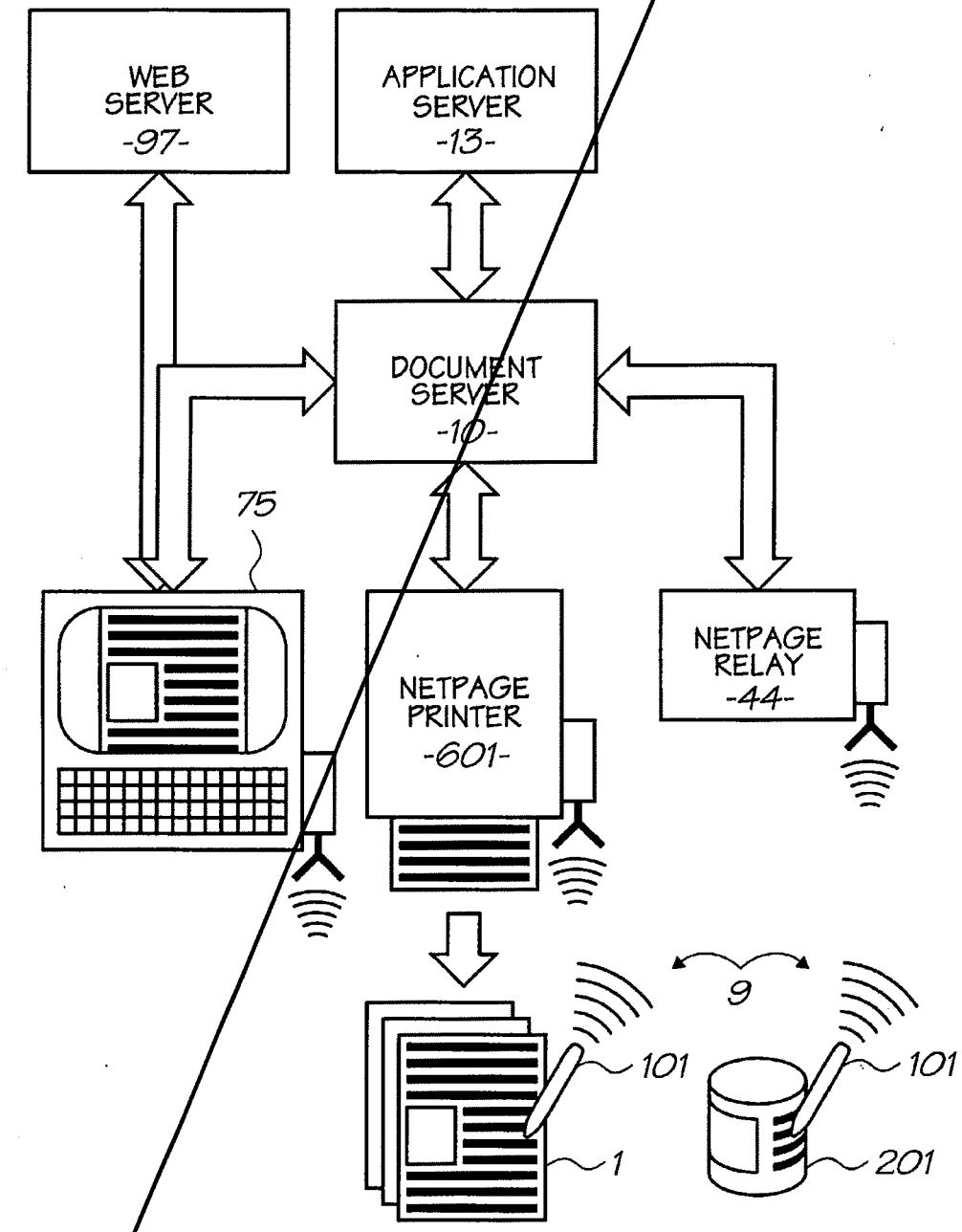
WEB SERVER -97-
APPLICATION SERVER -13-
DOCUMENT SERVER -10-
75
NETPAGE PRINTER -601-
NETPAGE RELAY -44-
9
101
101
1
201

FIG. 2

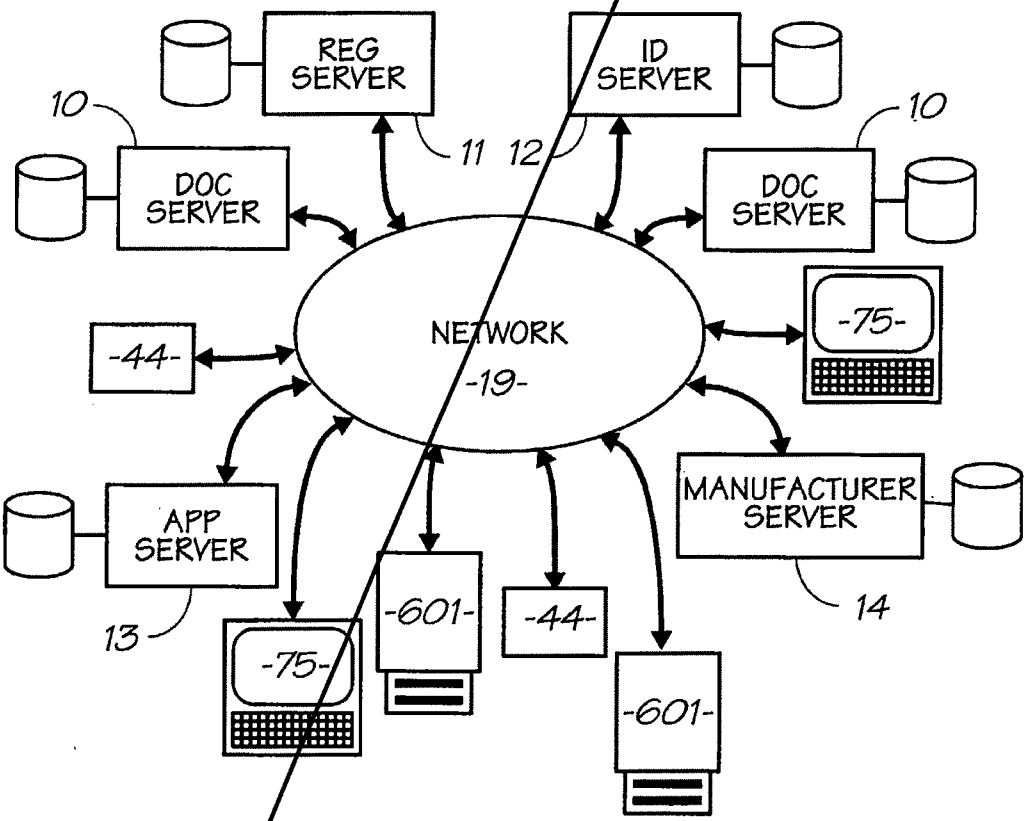
REG SERVER
ID SERVER
10
DOC SERVER
11
12
DOC SERVER
10
NETWORK
-19-
-44-
-75-
APP SERVER
13
MANUFACTURER SERVER
14
-75-
-601-
-44-
-601-

FIG. 3

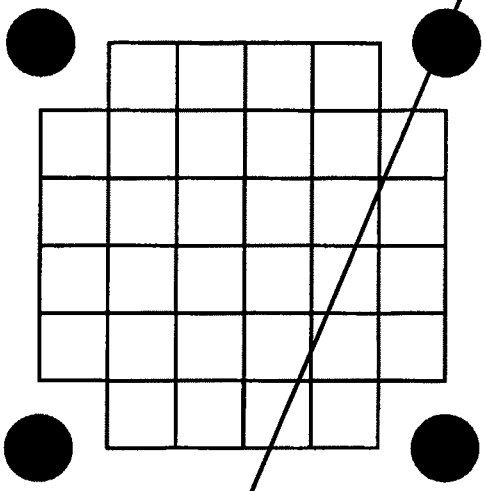

FIG. 4

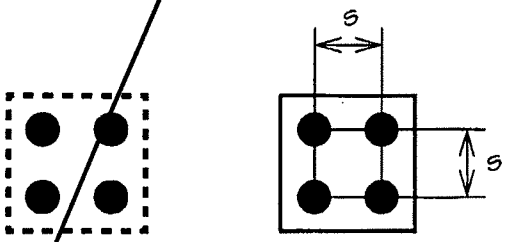

FIG. 5

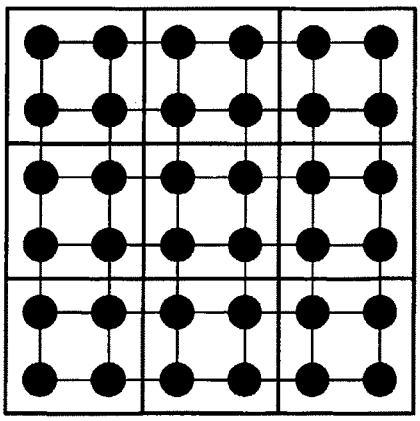

FIG. 6

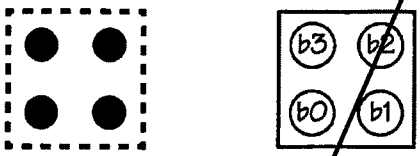

FIG. 7

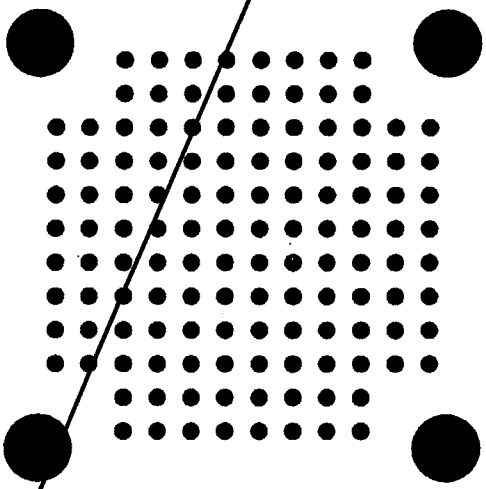

FIG. 8

00	10
01	11

FIG. 9

00	10	00	10	00	10
01	11	01	11	01	11
00	10	00	10	00	10
01	11	01	11	01	11

FIG. 10

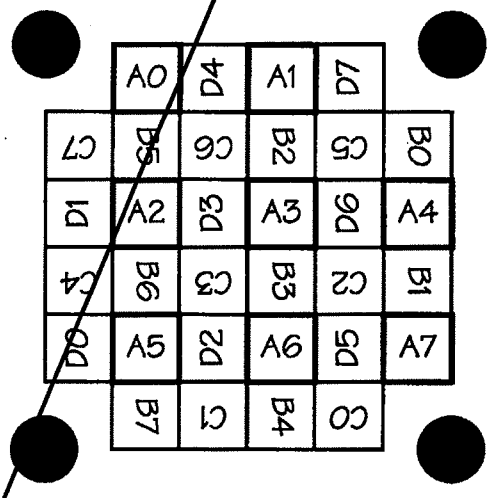

FIG. 11

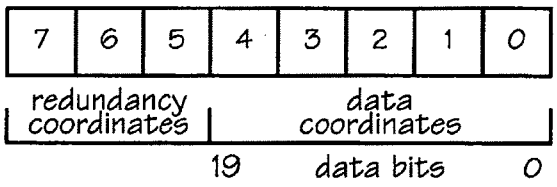

FIG. 12

3	2	1
4	-	0
5	6	7

FIG. 13

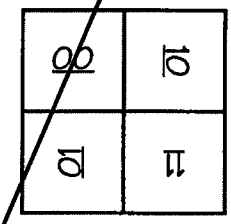

FIG. 14

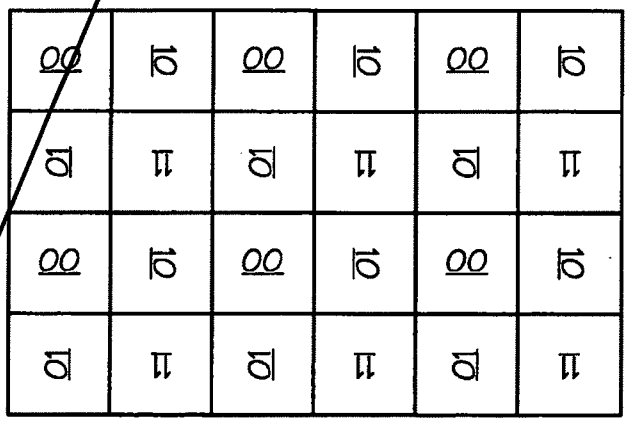

FIG. 15

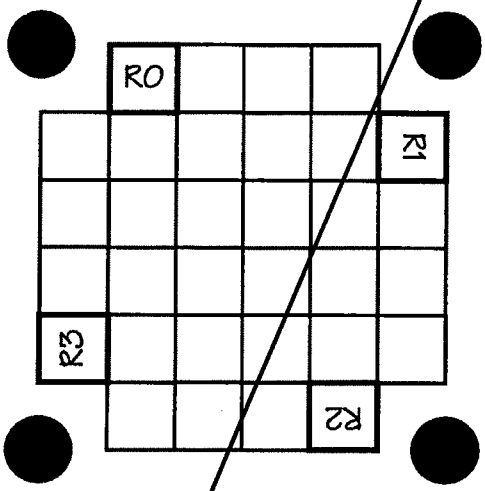

FIG. 16

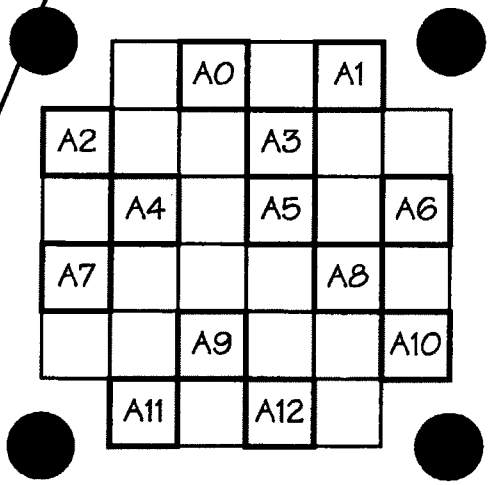

FIG. 17

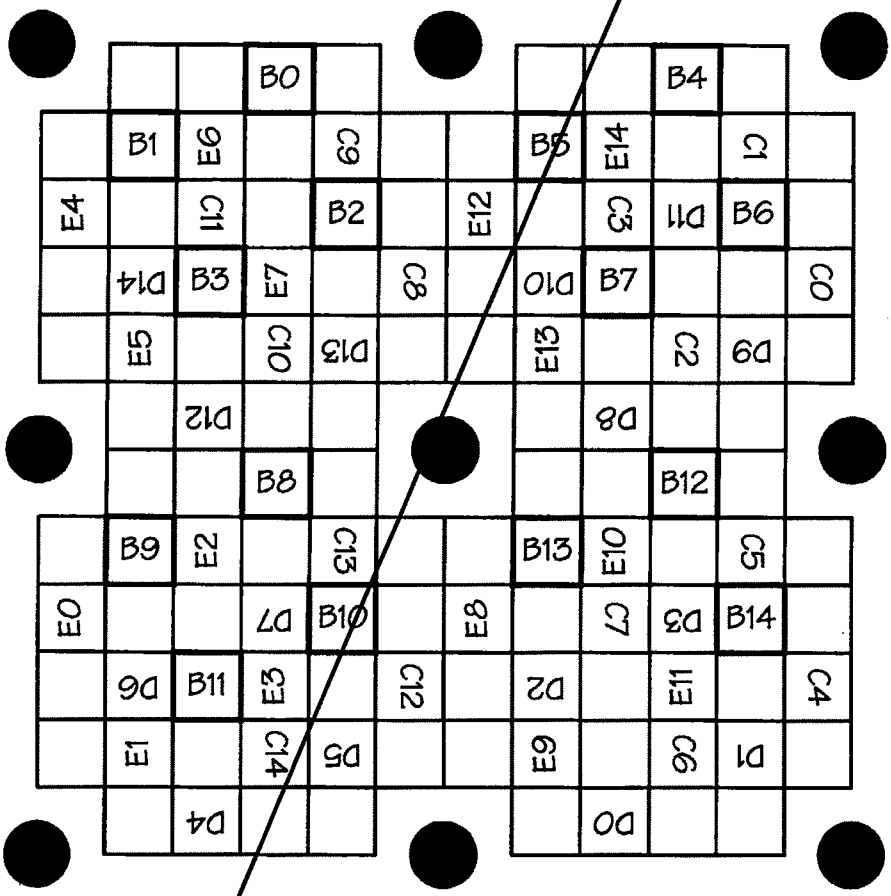
B0
B4
B1
E6
C9
B5
E14
C1
E4
C11
B2
E12
C3
D11
B6
D14
B3
E7
C8
D10
B7
C0
E5
C10
D13
E13
C2
D9
D12
D8
B8
B12
B9
E2
C13
B13
E10
C5
E0
D7
B10
E8
C7
D3
B14
D6
B11
E3
C12
D2
E11
C4
E1
C14
D5
E9
C6
D1
D4
D0

FIG. 18

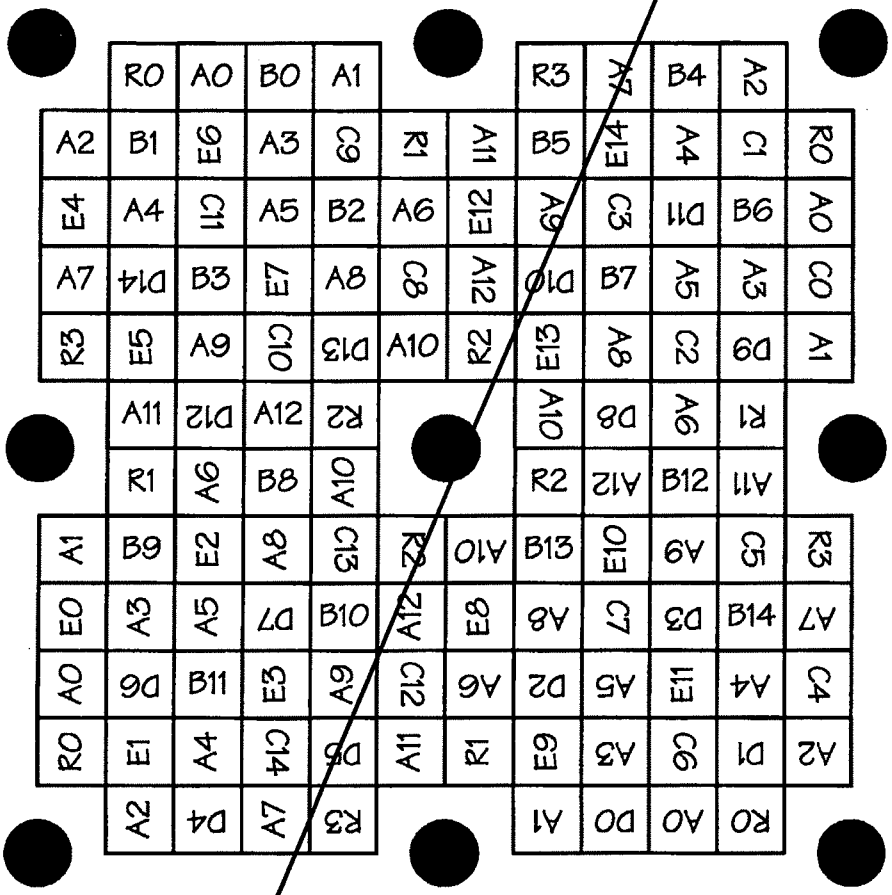
R0 A0 B0 A1 R3 A7 B4 A2
A2 B1 E6 A3 C9 R1 A11 B5 E14 A4 C1 R0
E4 A4 C11 A5 B2 A6 E12 A9 C3 D11 B6 A0
A7 D14 B3 E7 A8 C8 A12 D10 B7 A5 A3 C0
R3 E5 A9 C10 D13 A10 R2 E13 A8 C2 D9 A1
A11 D12 A12 R2 A10 D8 A6 R1
R1 A6 B8 A10 R2 A12 B12 A11
A1 B9 E2 A8 C13 R2 A10 B13 E10 A9 C5 R3
E0 A3 A5 D7 B10 A12 E8 A8 C7 D3 B14 A7
A0 D6 B11 E3 A9 C12 A6 D2 A5 E11 A4 C4
R0 E1 A4 C14 D5 A11 R1 E9 A3 C6 D1 A2
A2 D4 A7 R3 A1 D0 A0 R0

FIG. 19

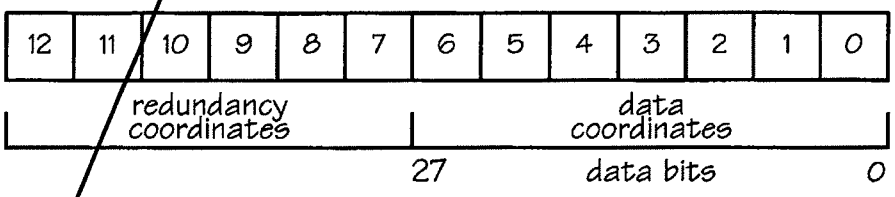
12 11 10 9 8 7 6 5 4 3 2 1 0
redundancy coordinates
data coordinates
27
data bits
0

FIG. 20

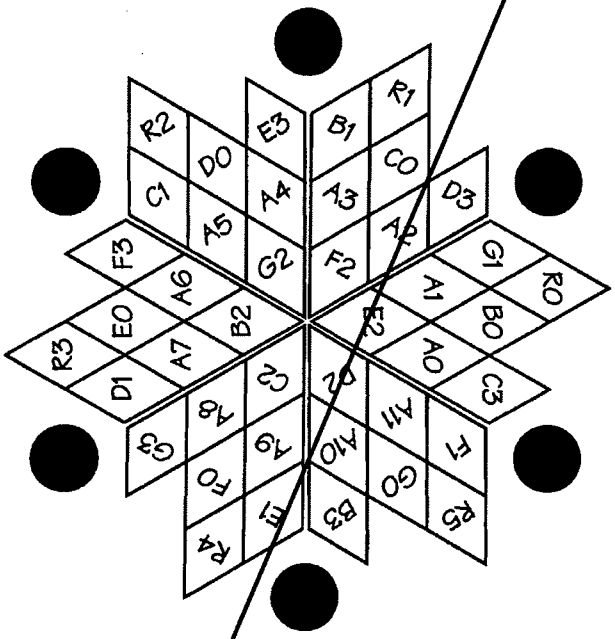
R2
E3
B1
R1
D0
C0
C1
A4
A3
D3
A5
A2
F3
G2
F2
G1
A6
A1
R0
E0
B2
E2
B0
R3
A7
A0
D1
C2
C3
A8
A11
G3
A9
A10
F1
F0
G0
E1
B3
R5
R4

FIG. 21

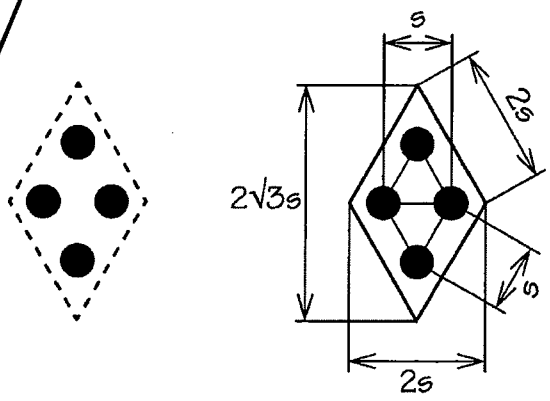
s
2s
2√3s
s
2s

FIG. 22

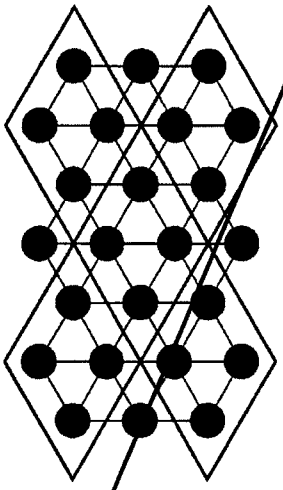

FIG. 23

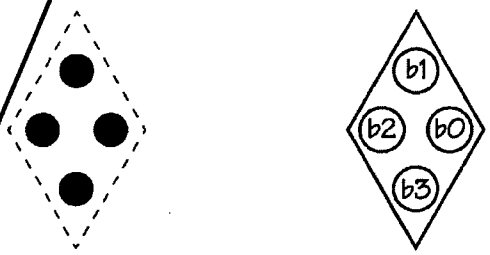

FIG. 24

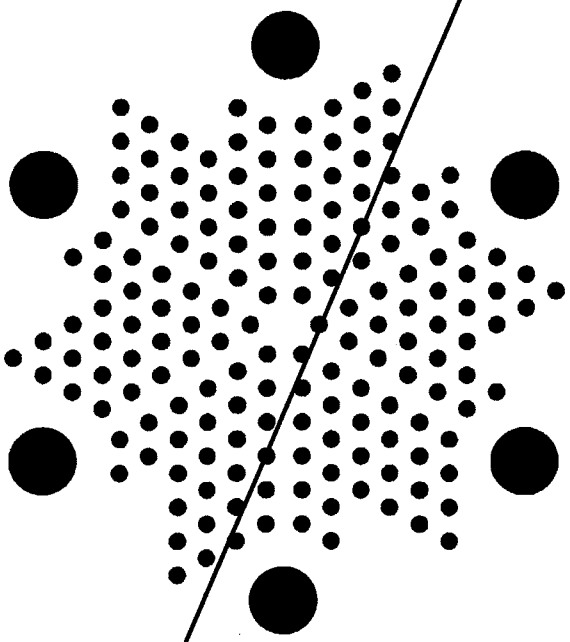

FIG. 25

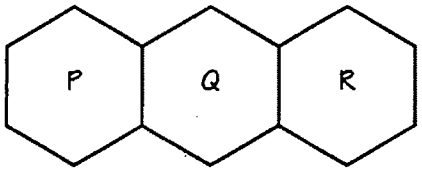

FIG. 26

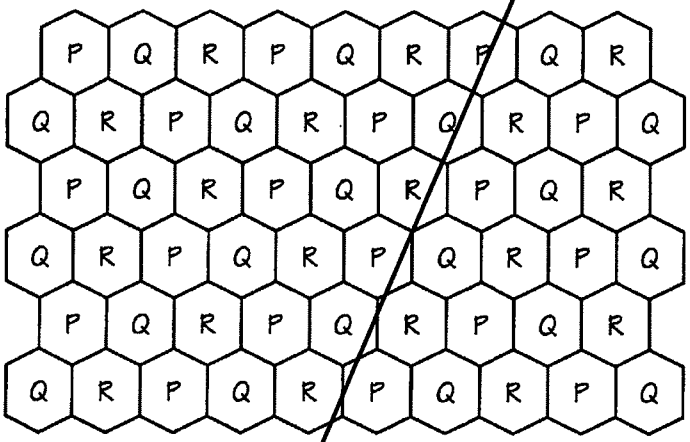
P Q R P Q R P Q R
Q R P Q R P Q R P Q
P Q R P Q R P Q R
Q R P Q R P Q R P Q
P Q R P Q R P Q R
Q R P Q R P Q R P Q

FIG. 27

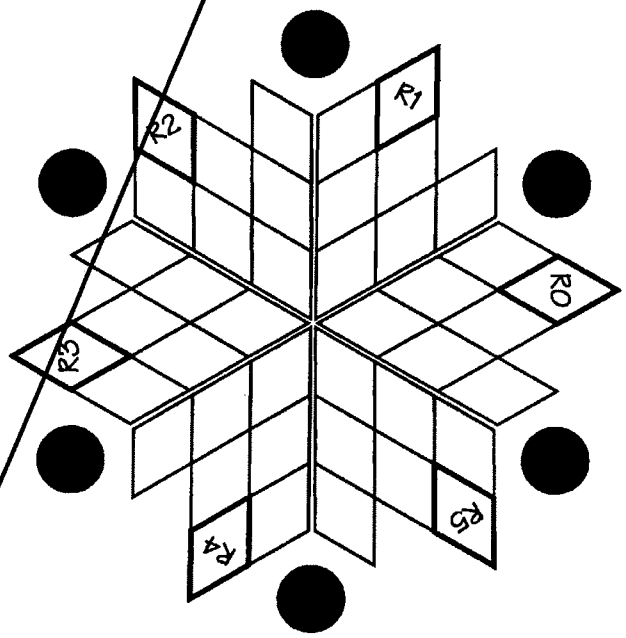
R1
R2
R0
R3
R5
R4

FIG. 28

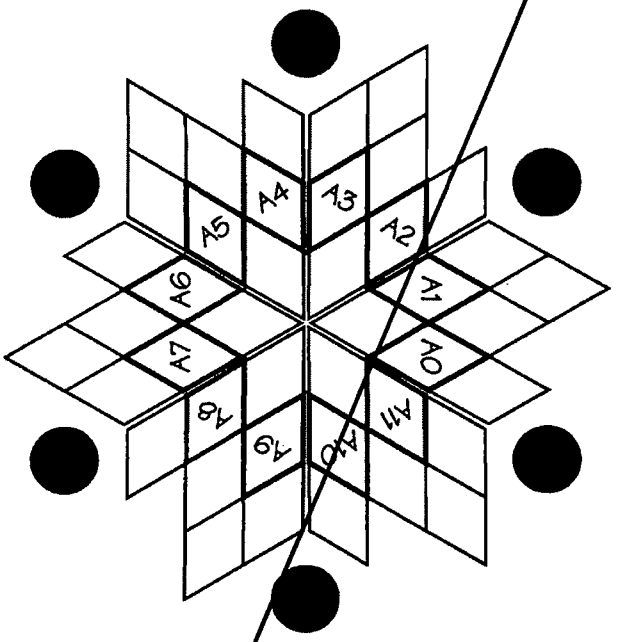
A4
A3
A5
A2
A6
A1
A7
A0
A8
A9
A10
A11

FIG. 29

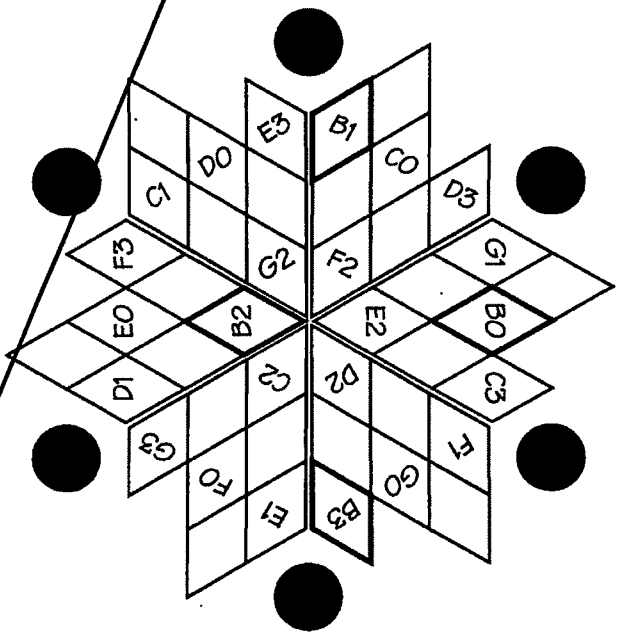
E3
B1
D0
C0
C1
D3
F3
G2
F2
G1
E0
B2
E2
B0
D1
C2
D2
C3
G3
F0
E1
B3
G0
F1

FIG. 30

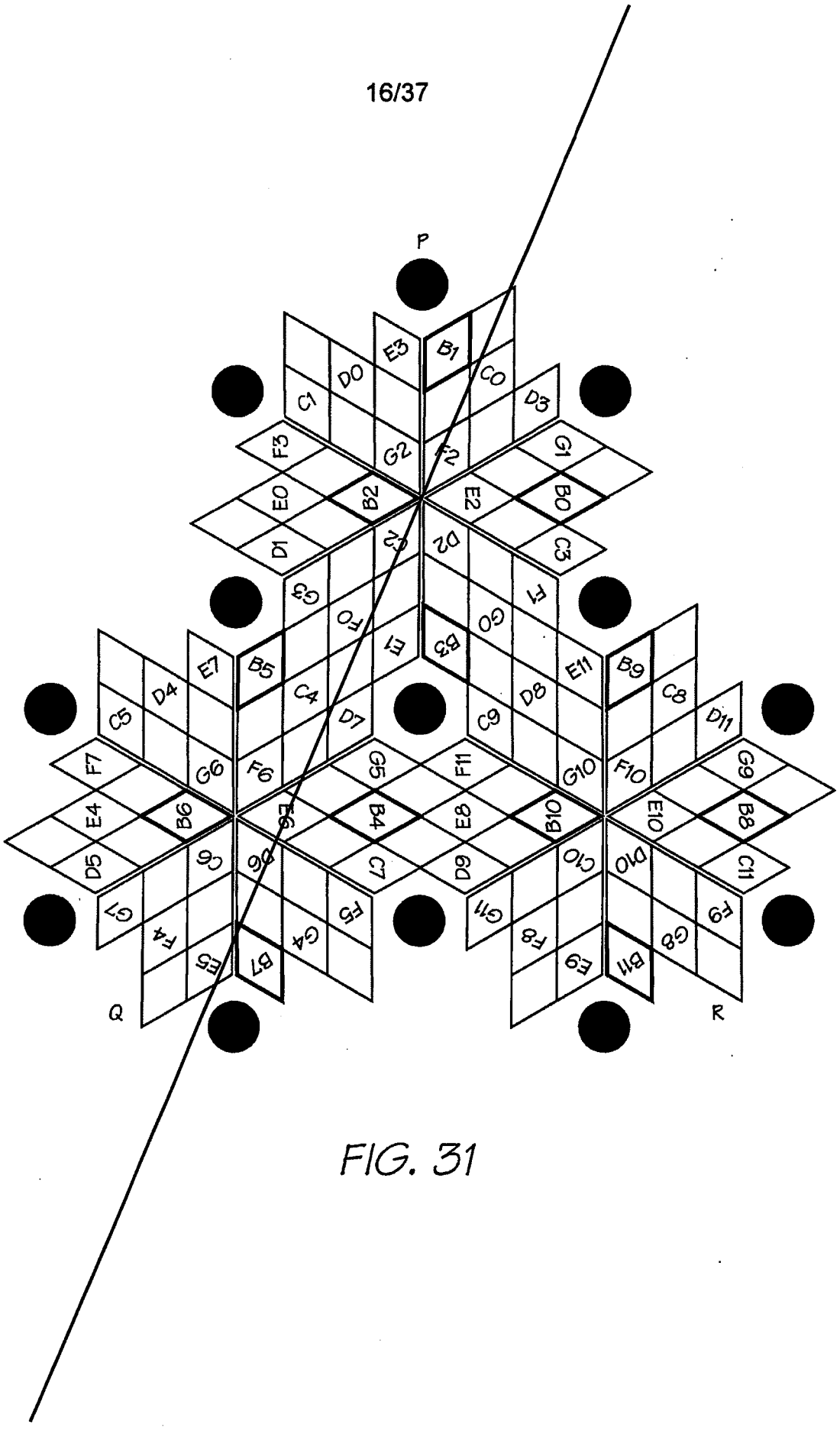
P
Q
R
E3
B1
C0
D0
C1
D3
F3
G2
F2
G1
E0
B2
E2
B0
D1
C2
D2
C3
G3
F0
E1
B3
G0
F1
E7
B5
C4
D7
E11
B9
C8
D4
C5
D8
C9
D11
F7
G6
F6
G5
F11
G10
F10
G9
E4
B6
E5
B4
E8
B10
E10
B8
D5
C6
D6
C7
D9
C10
D10
C11
G7
F4
E6
B7
F5
G4
G11
F8
E9
B11
G8
F9

FIG. 31

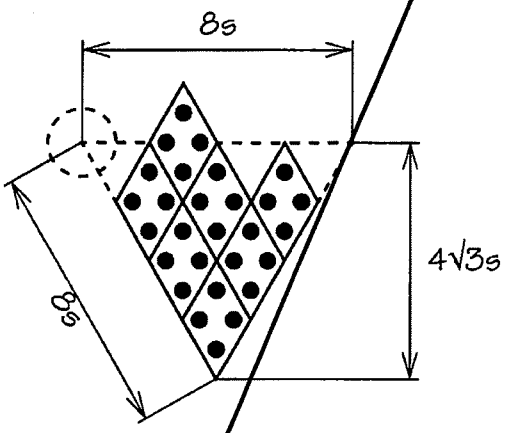

FIG. 32

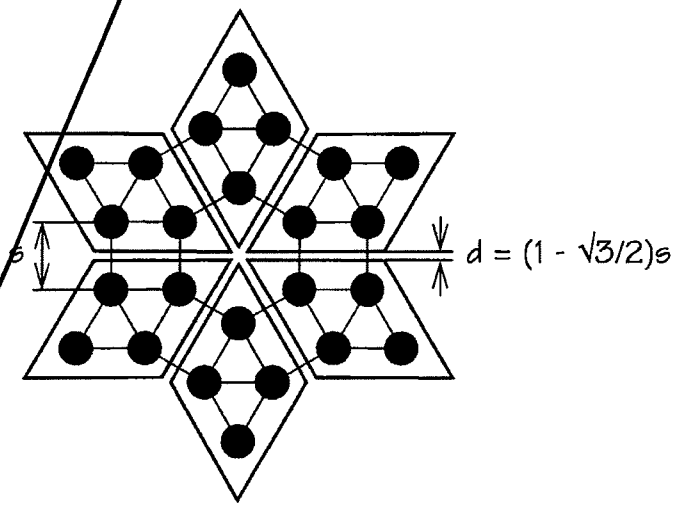

FIG. 33

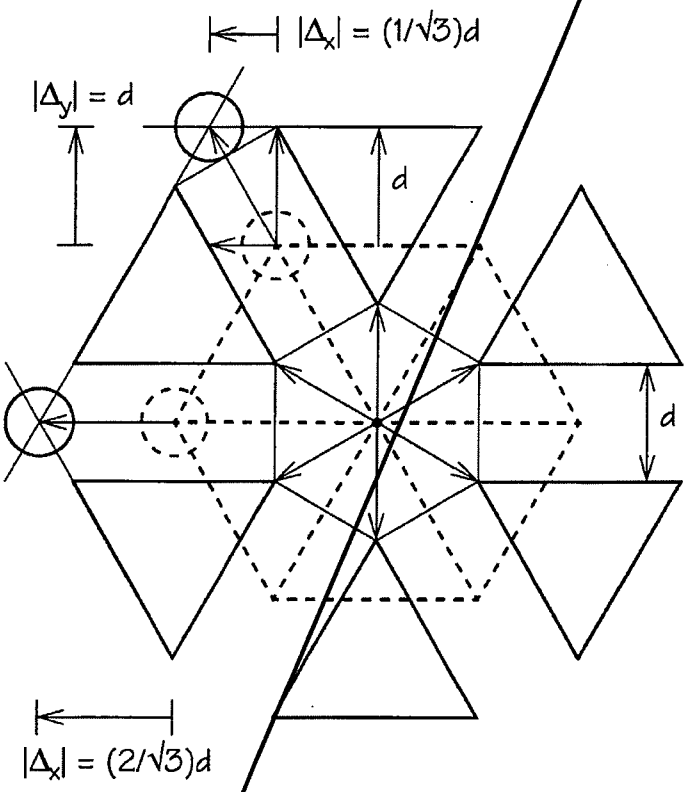
$|\Delta_x| = (1/\sqrt{3})d$
$|\Delta_y| = d$
d
d
$|\Delta_x| = (2/\sqrt{3})d$

FIG. 34

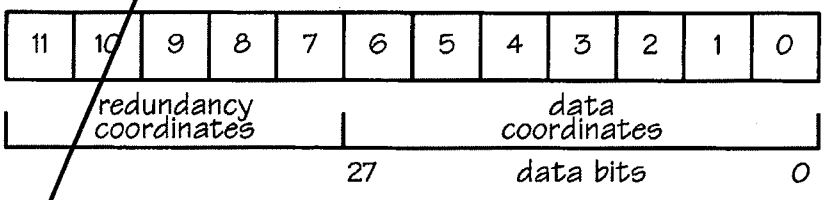
11
10
9
8
7
6
5
4
3
2
1
0
redundancy coordinates
data coordinates
27
data bits
0

FIG. 35

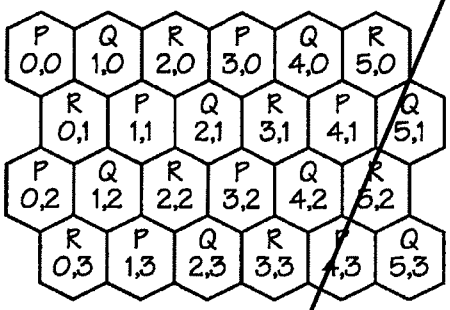

FIG. 36

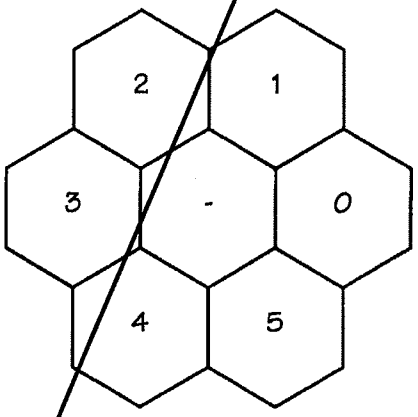

FIG. 37

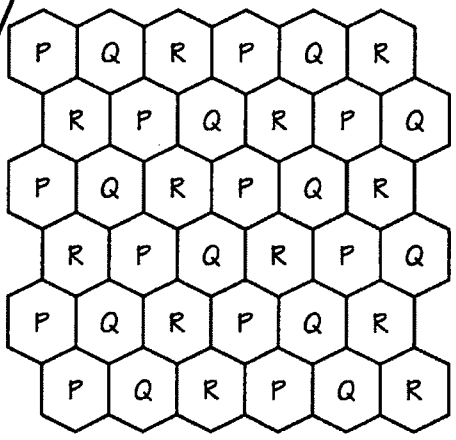

FIG. 38

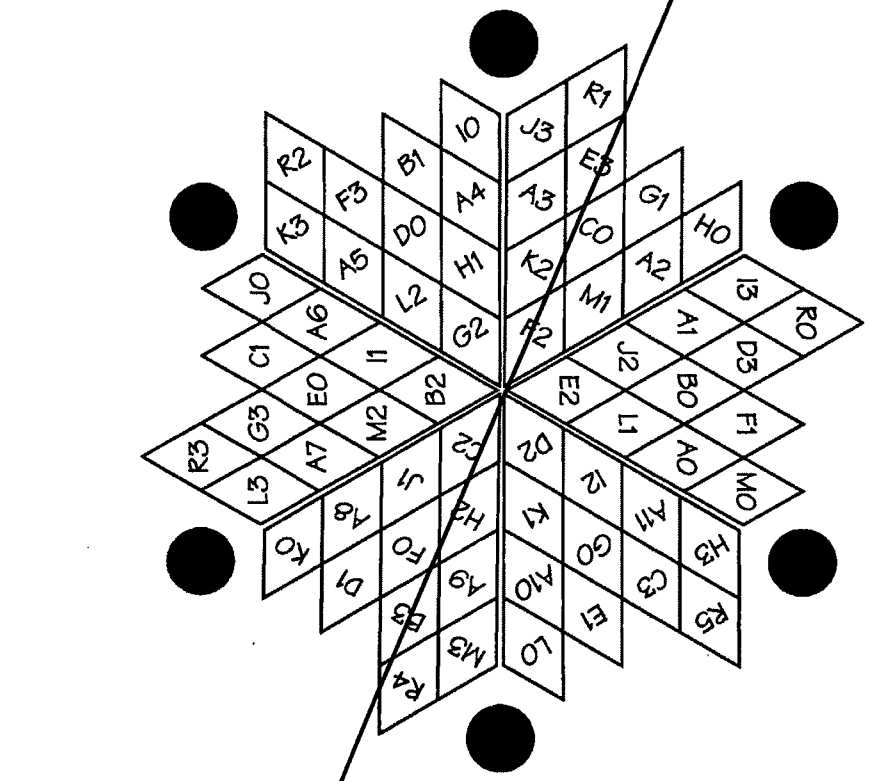
I0
J3
R1
R2
B1
E3
F3
A4
A3
G1
K3
D0
C0
H0
A5
H1
K2
A2
J0
L2
M1
I3
A6
G2
F2
A1
R0
C1
I1
J2
D3
E0
B2
E2
B0
G3
M2
L1
F1
R3
A7
C2
D2
A0
M0
L3
J1
I2
A8
H3
K1
A11
K0
F0
G0
H2
D1
A9
A10
C3
B3
E1
E2
M3
L0
R4

FIG. 39

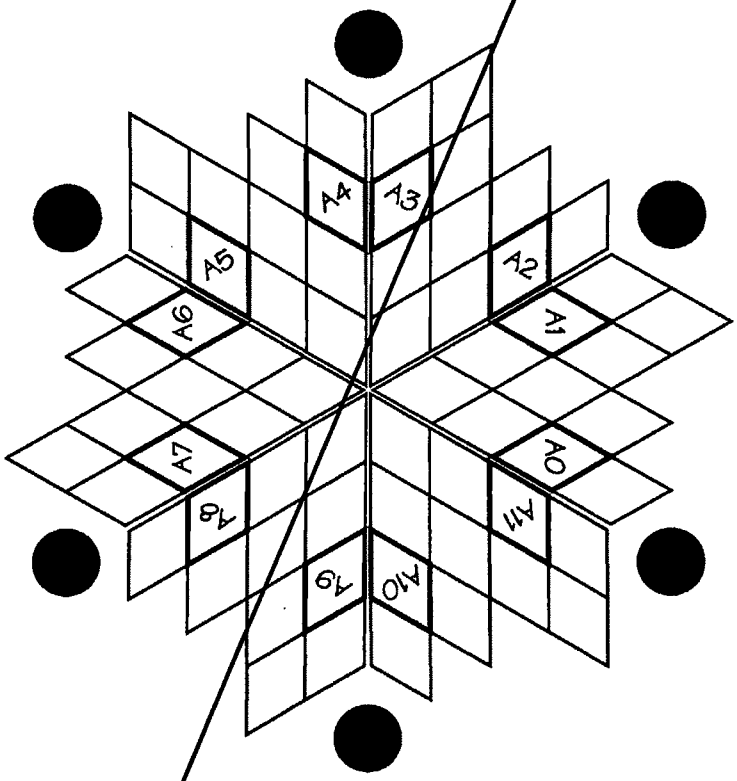

FIG. 40

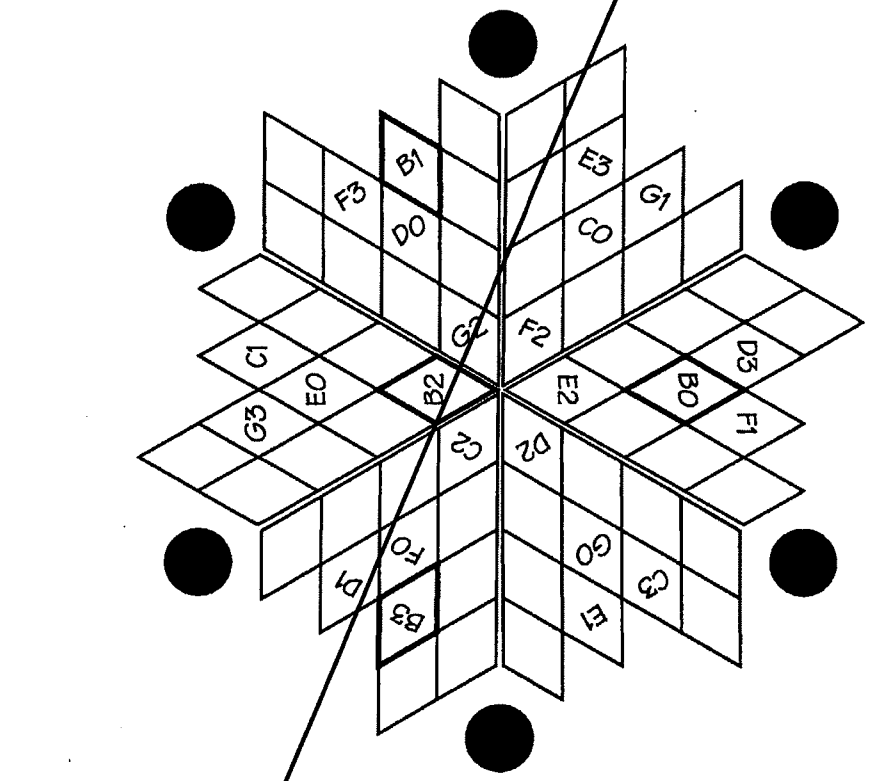

FIG. 41

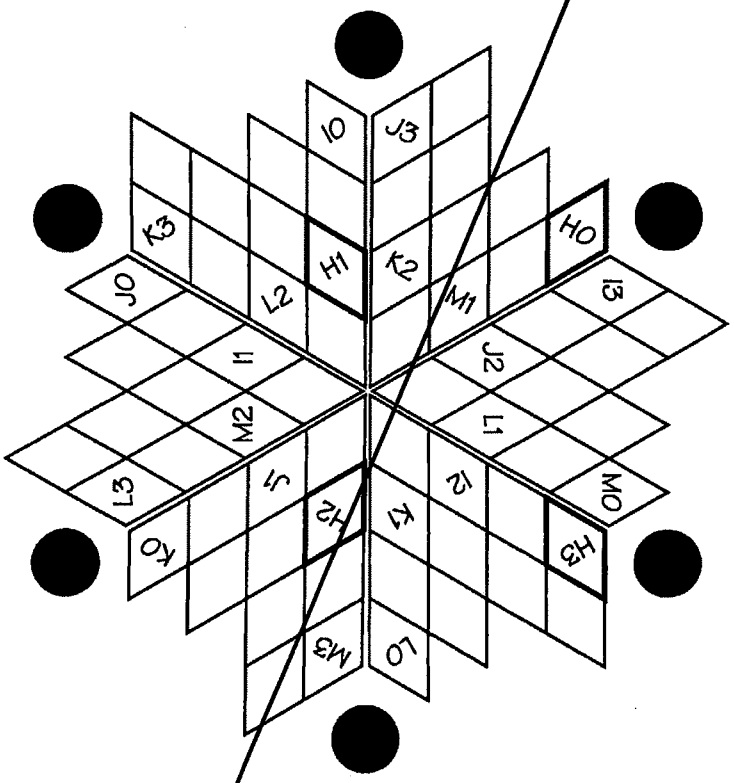
I0
J3
K3
H1
K2
H0
J0
L2
M1
I3
I1
J2
M2
L1
L3
J1
I2
M0
K0
H2
K1
H3
M3
L0

FIG. 42

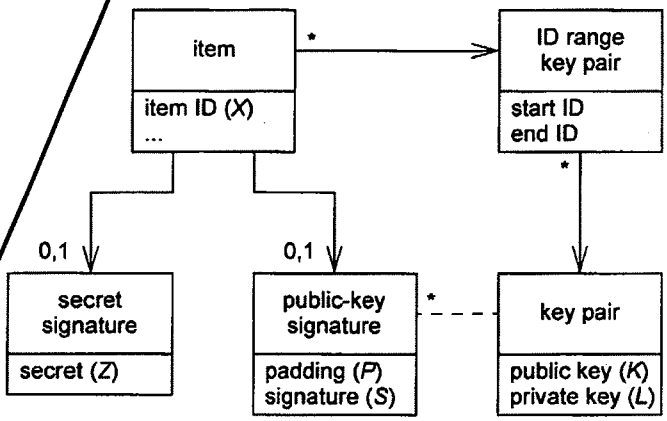
item
item ID (X)
...
*
ID range key pair
start ID
end ID
*
0,1
0,1
secret signature
secret (Z)
public-key signature
padding (P)
signature (S)
*
key pair
public key (K)
private key (L)

FIG. 43

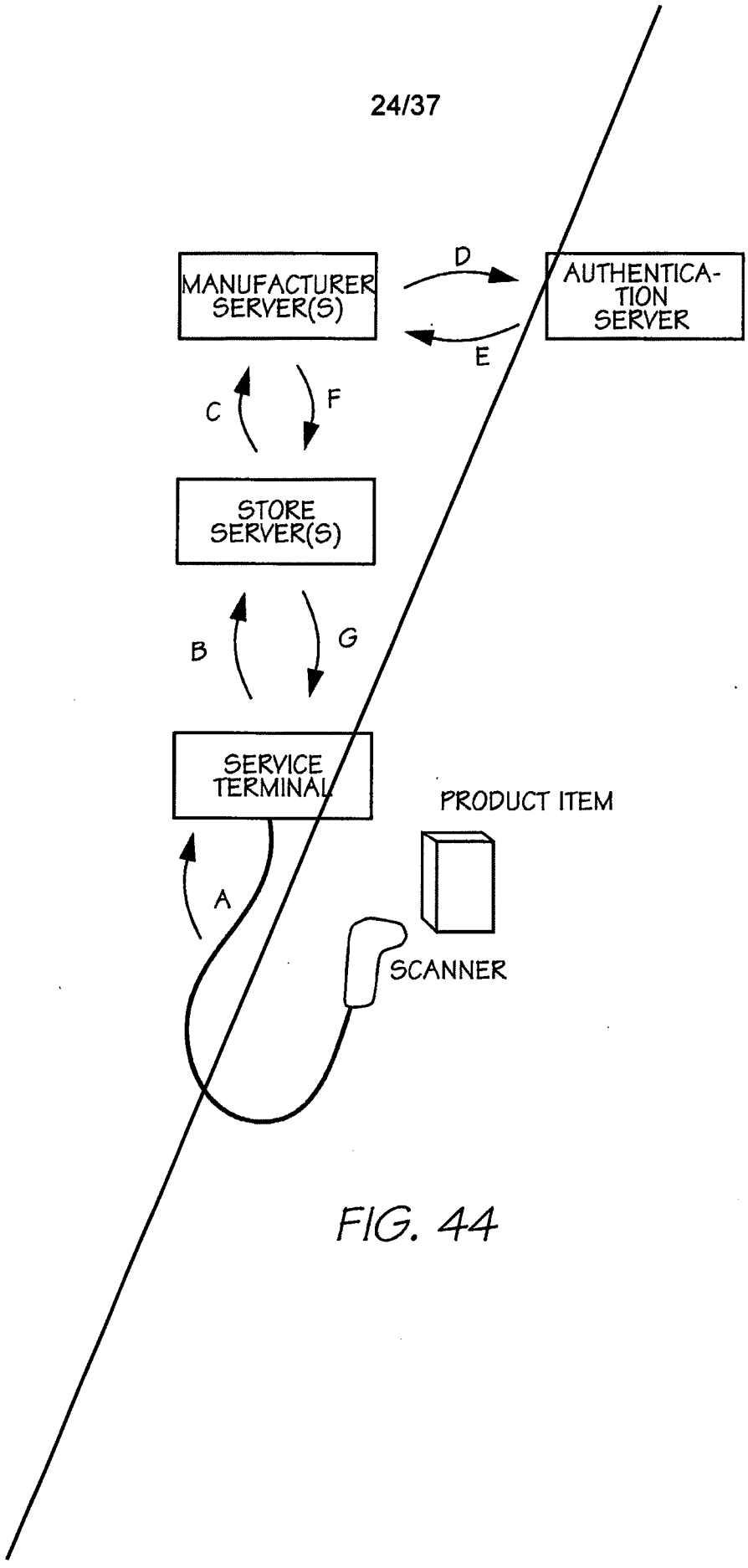
MANUFACTURER SERVER(S)
AUTHENTICA-TION SERVER
D
E
C
F
STORE SERVER(S)
B
G
SERVICE TERMINAL
PRODUCT ITEM
A
SCANNER

FIG. 44

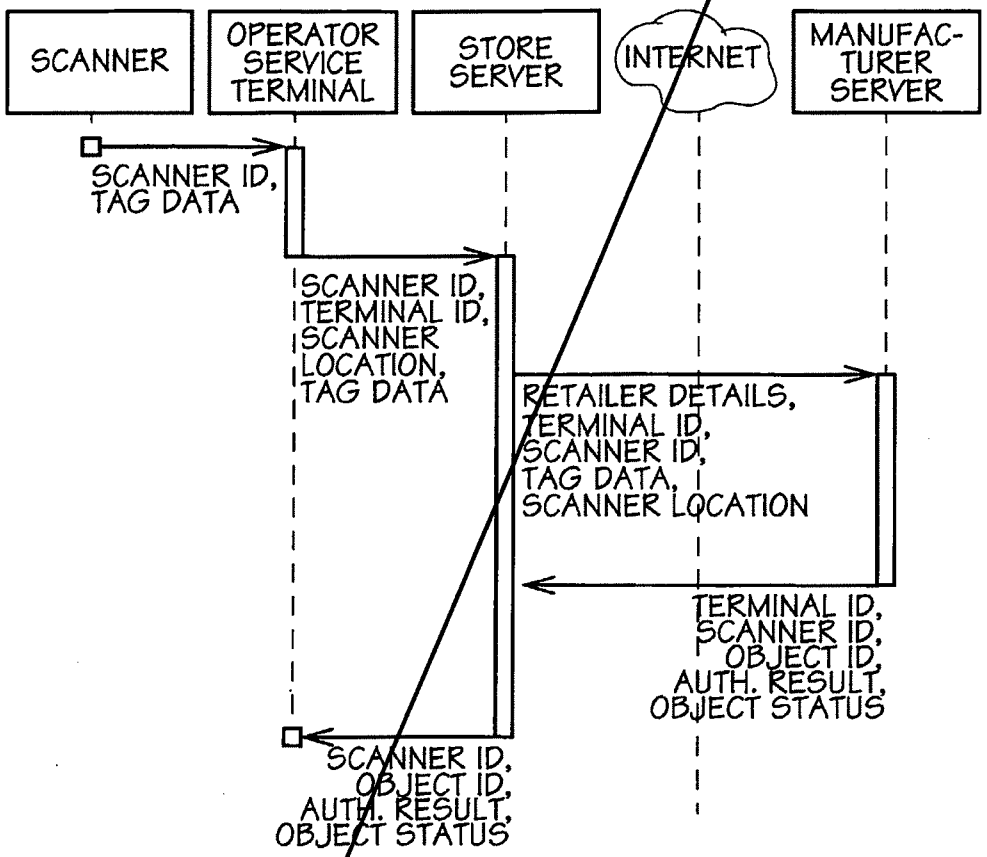
SCANNER
OPERATOR SERVICE TERMINAL
STORE SERVER
INTERNET
MANUFAC-TURER SERVER
SCANNER ID, TAG DATA
SCANNER ID, TERMINAL ID, SCANNER LOCATION, TAG DATA
RETAILER DETAILS, TERMINAL ID, SCANNER ID, TAG DATA, SCANNER LOCATION
TERMINAL ID, SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS
SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS

FIG. 45

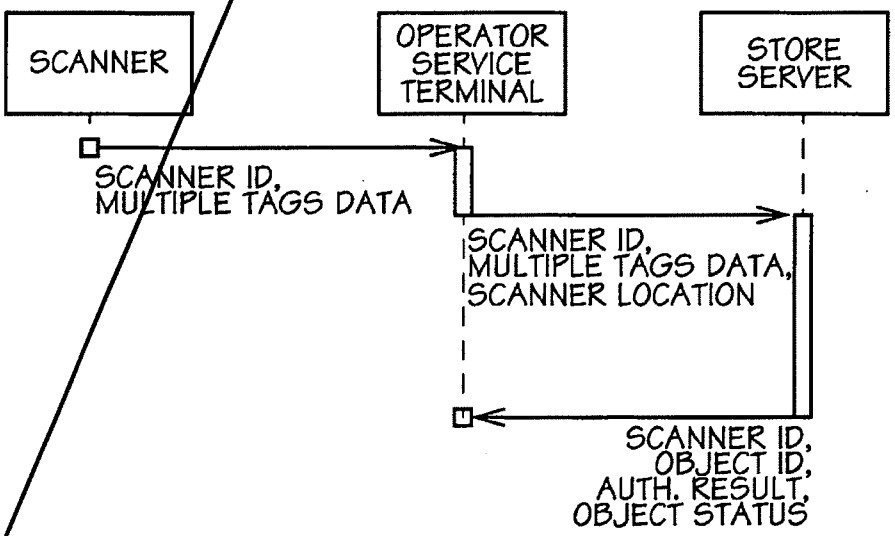
SCANNER
OPERATOR SERVICE TERMINAL
STORE SERVER
SCANNER ID, MULTIPLE TAGS DATA
SCANNER ID, MULTIPLE TAGS DATA, SCANNER LOCATION
SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS

FIG. 46

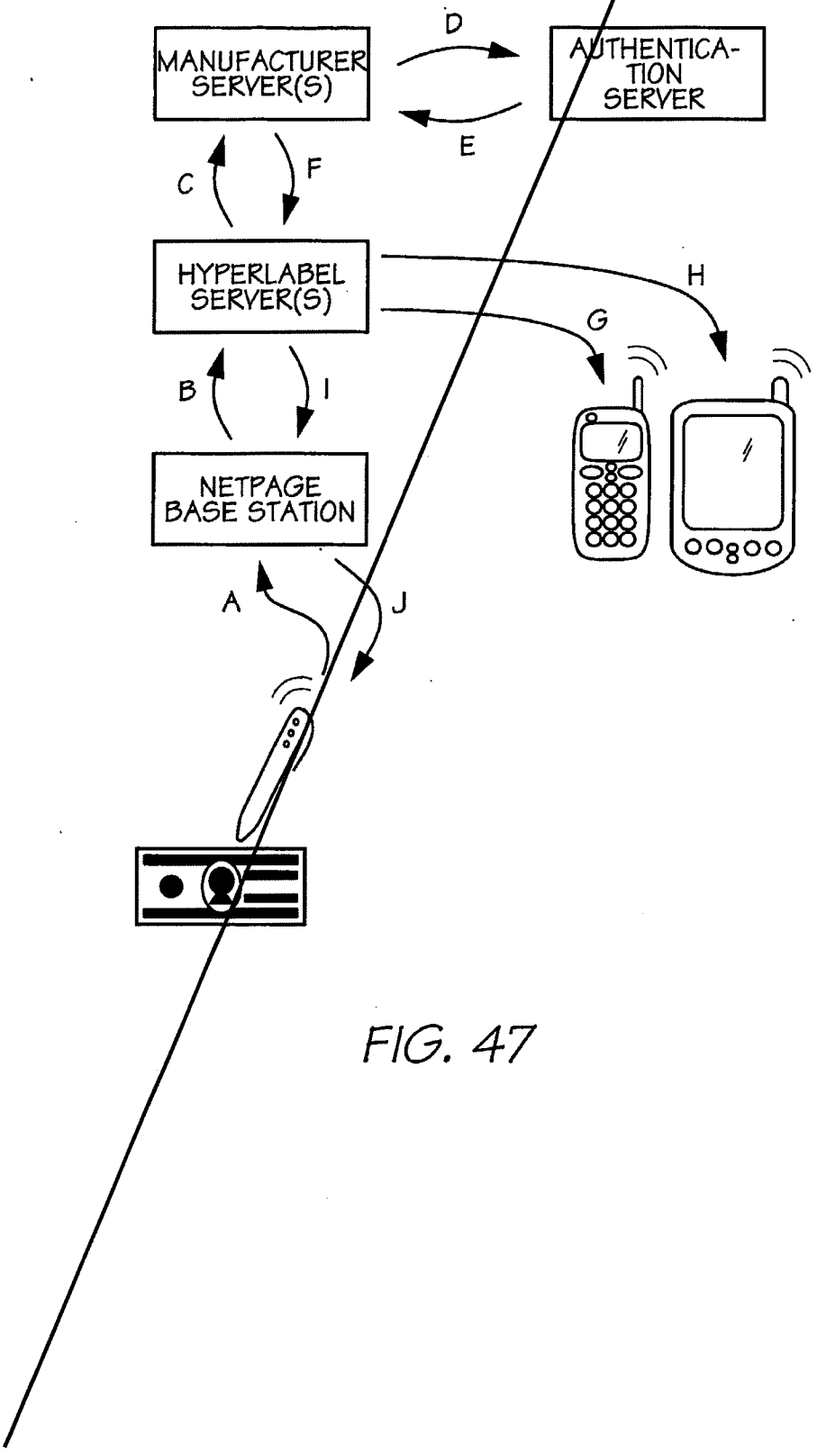
MANUFACTURER SERVER(S)
AUTHENTICA-TION SERVER
D
E
C
F
HYPERLABEL SERVER(S)
H
G
B
I
NETPAGE BASE STATION
A
J

FIG. 47

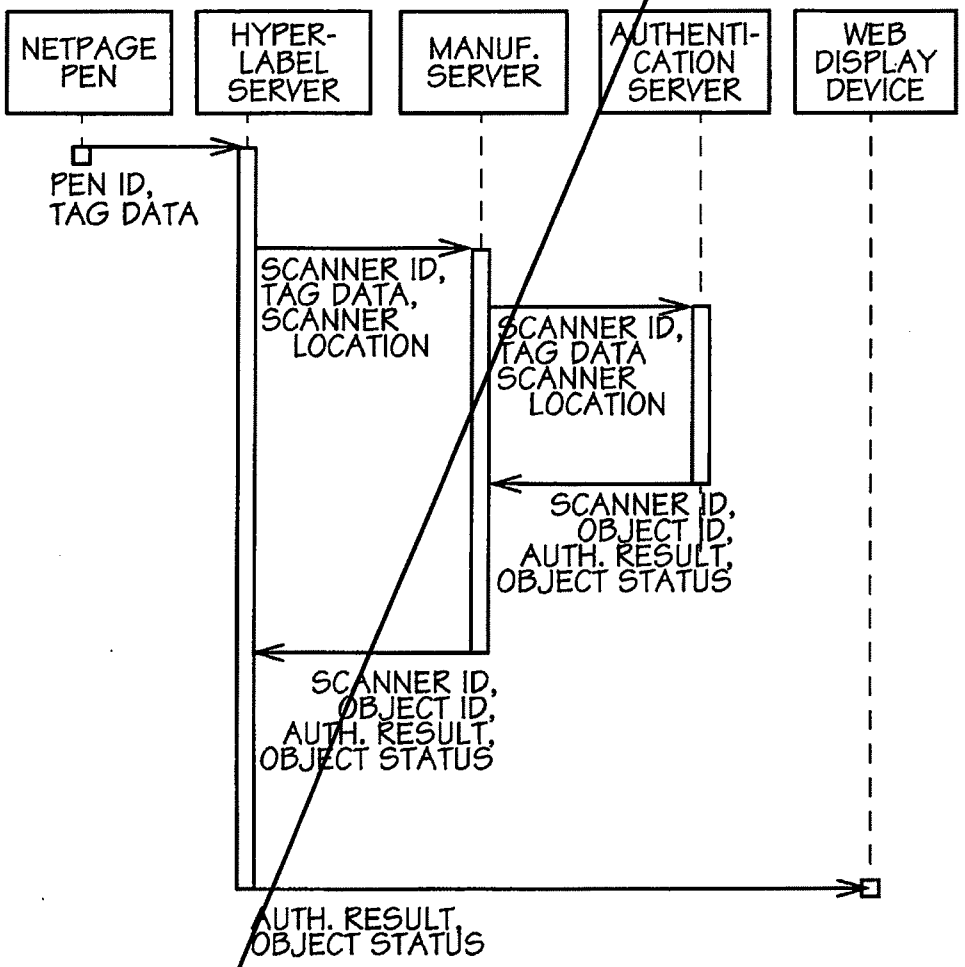
NETPAGE PEN
HYPER-LABEL SERVER
MANUF. SERVER
AUTHENTI-CATION SERVER
WEB DISPLAY DEVICE
PEN ID, TAG DATA
SCANNER ID, TAG DATA, SCANNER LOCATION
SCANNER ID, TAG DATA SCANNER LOCATION
SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS
SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS
AUTH. RESULT, OBJECT STATUS

FIG. 48

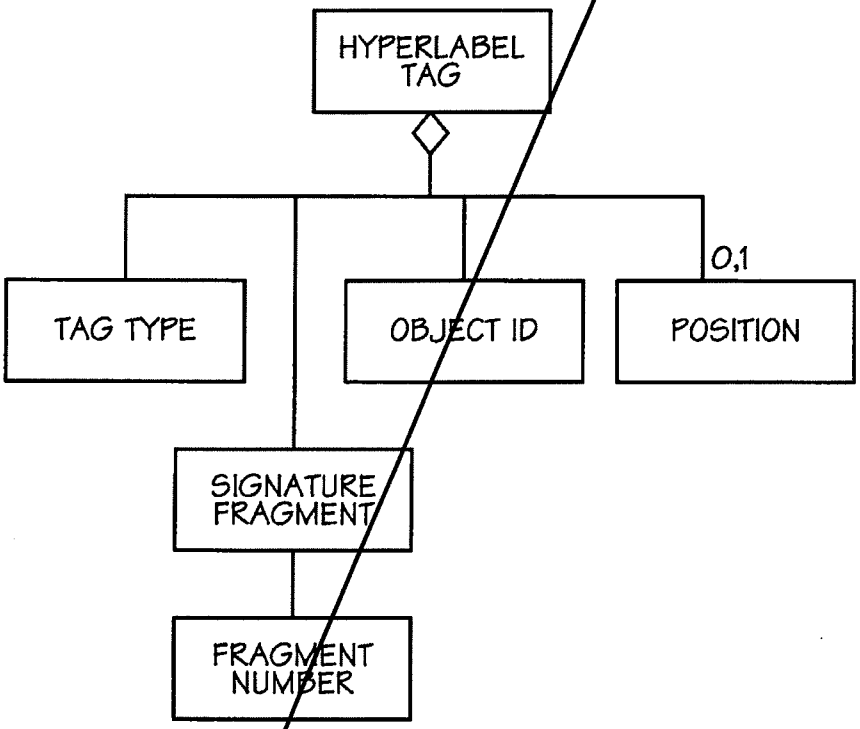
HYPERLABEL TAG
0,1
TAG TYPE
OBJECT ID
POSITION
SIGNATURE FRAGMENT
FRAGMENT NUMBER

FIG. 49

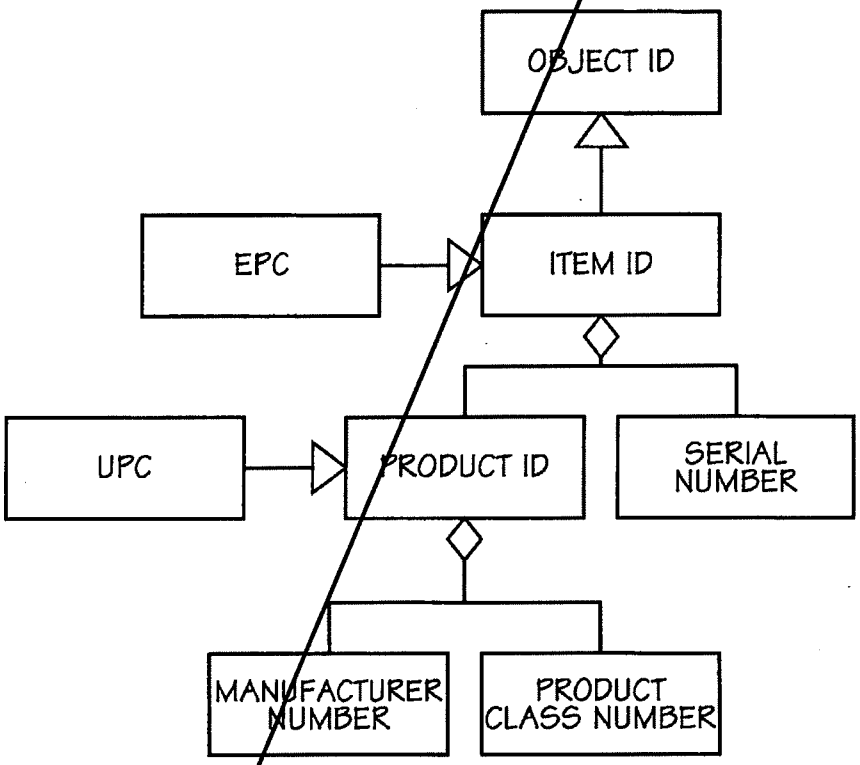
OBJECT ID
EPC
ITEM ID
UPC
PRODUCT ID
SERIAL NUMBER
MANUFACTURER NUMBER
PRODUCT CLASS NUMBER

FIG. 50

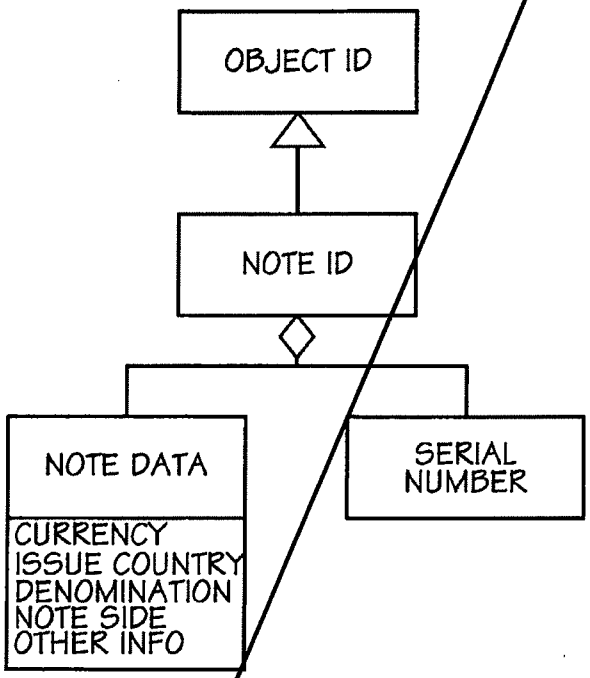
OBJECT ID
NOTE ID
NOTE DATA
CURRENCY
ISSUE COUNTRY
DENOMINATION
NOTE SIDE
OTHER INFO
SERIAL NUMBER

FIG. 51

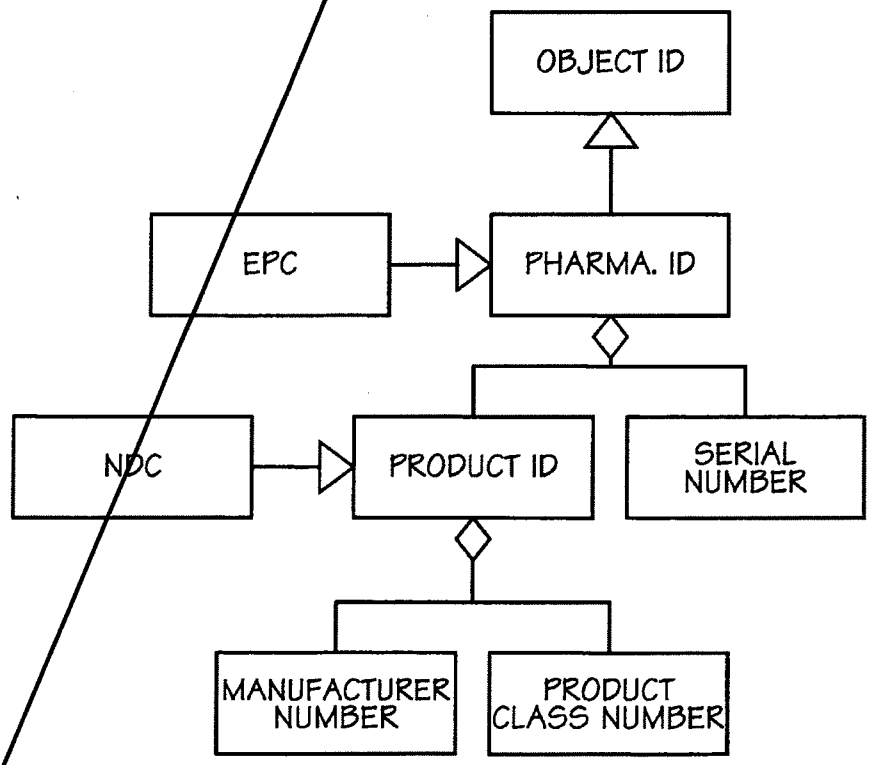
OBJECT ID
EPC
PHARMA. ID
NDC
PRODUCT ID
SERIAL NUMBER
MANUFACTURER NUMBER
PRODUCT CLASS NUMBER

FIG. 52

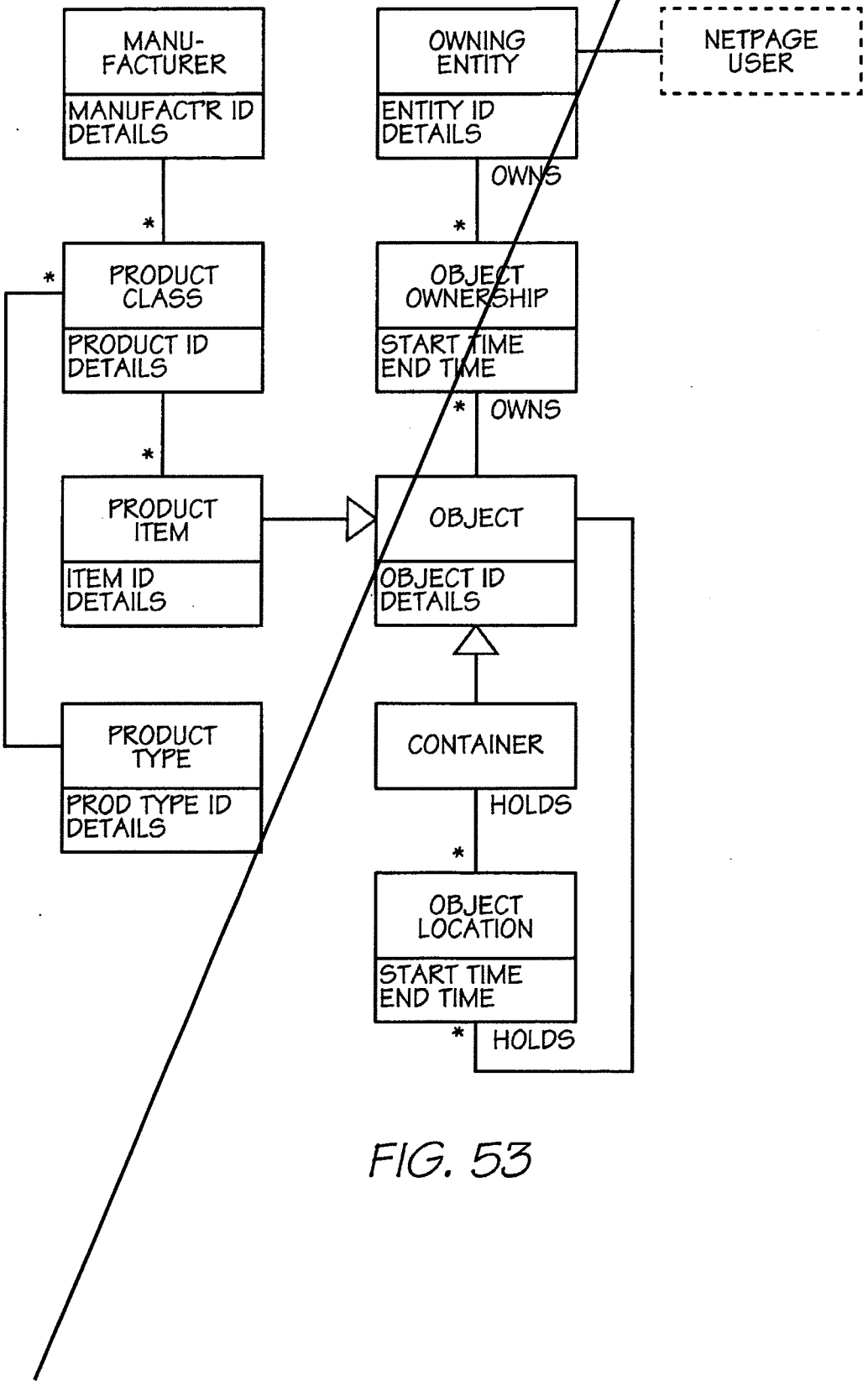
MANU-
FACTURER
MANUFACT'R ID
DETAILS
OWNING
ENTITY
ENTITY ID
DETAILS
NETPAGE
USER
OWNS
*
PRODUCT
CLASS
PRODUCT ID
DETAILS
OBJECT
OWNERSHIP
START TIME
END TIME
OWNS
PRODUCT
ITEM
ITEM ID
DETAILS
OBJECT
OBJECT ID
DETAILS
PRODUCT
TYPE
PROD TYPE ID
DETAILS
CONTAINER
HOLDS
OBJECT
LOCATION
START TIME
END TIME
HOLDS

FIG. 53

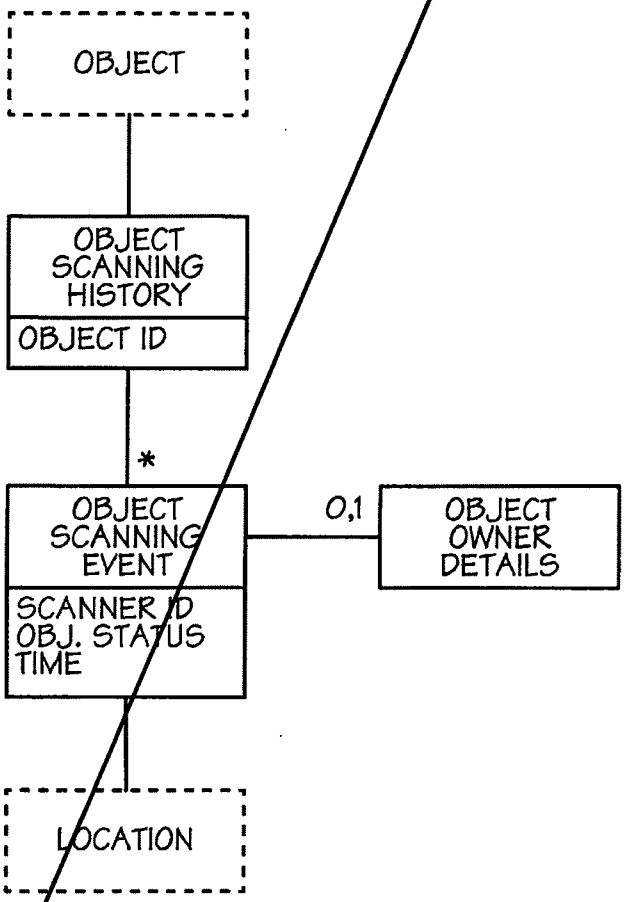
OBJECT
OBJECT SCANNING HISTORY
OBJECT ID
*
OBJECT SCANNING EVENT
SCANNER ID
OBJ. STATUS
TIME
0,1
OBJECT OWNER DETAILS
LOCATION

FIG. 54

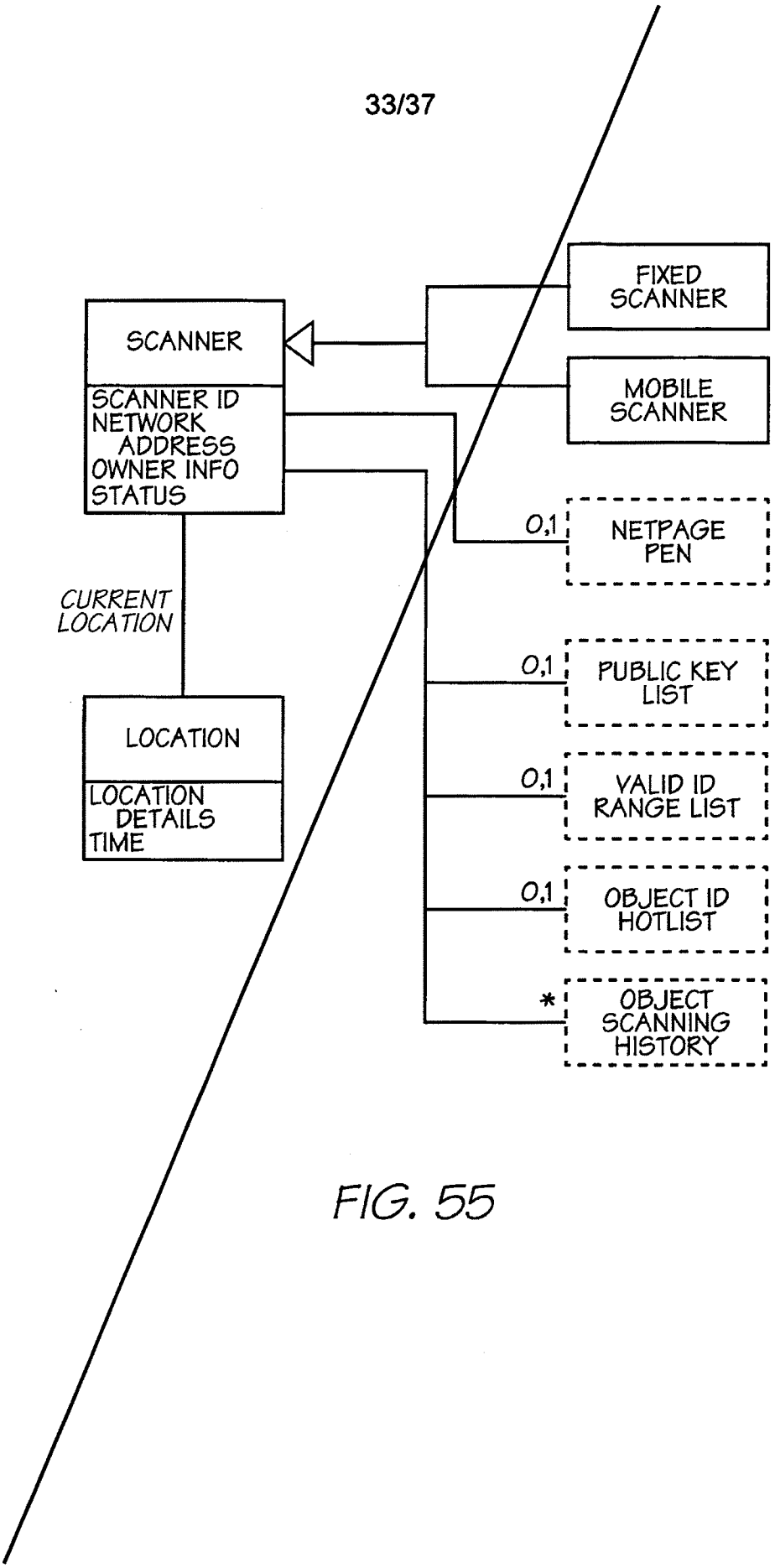
SCANNER
SCANNER ID
NETWORK ADDRESS
OWNER INFO
STATUS
FIXED SCANNER
MOBILE SCANNER
0,1
NETPAGE PEN
CURRENT LOCATION
0,1
PUBLIC KEY LIST
LOCATION
LOCATION DETAILS
TIME
0,1
VALID ID RANGE LIST
0,1
OBJECT ID HOTLIST
*
OBJECT SCANNING HISTORY

FIG. 55

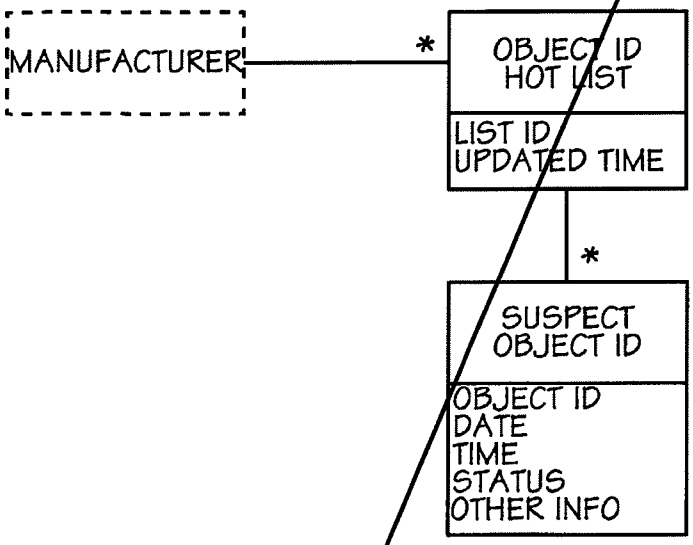
MANUFACTURER
*
OBJECT ID
HOT LIST
LIST ID
UPDATED TIME
*
SUSPECT
OBJECT ID
OBJECT ID
DATE
TIME
STATUS
OTHER INFO

FIG. 56

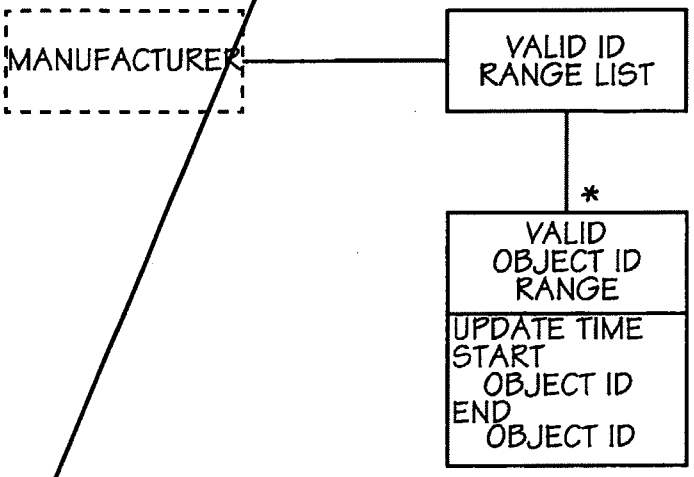
MANUFACTURER
VALID ID
RANGE LIST
*
VALID
OBJECT ID
RANGE
UPDATE TIME
START
OBJECT ID
END
OBJECT ID

FIG. 57

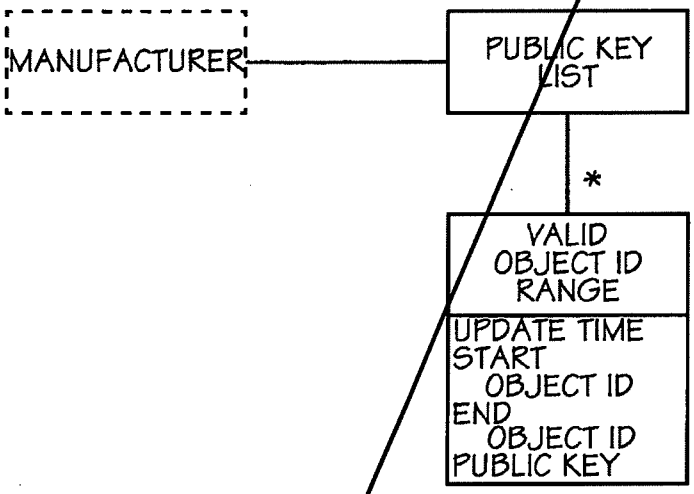
MANUFACTURER
PUBLIC KEY LIST
*
VALID OBJECT ID RANGE
UPDATE TIME
START
OBJECT ID
END
OBJECT ID
PUBLIC KEY

FIG. 58

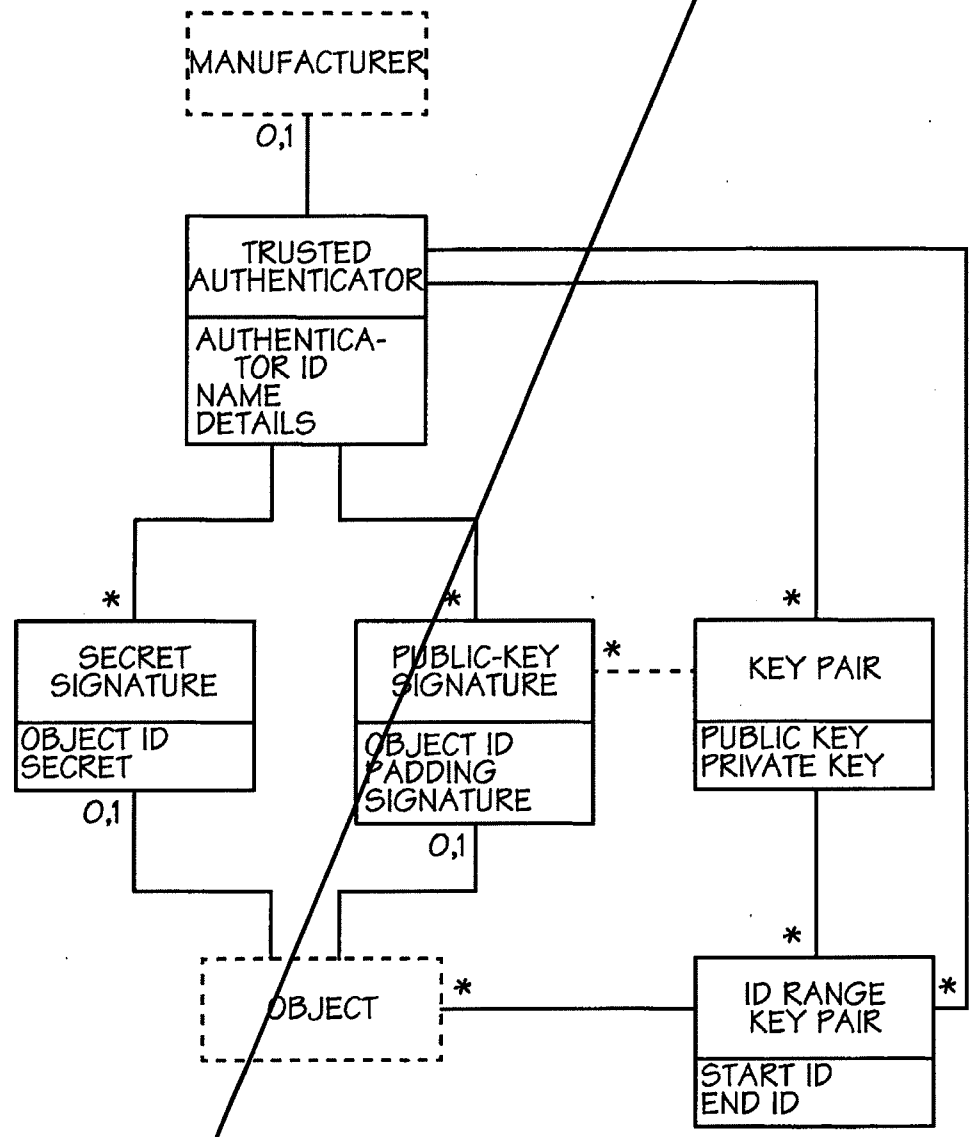
MANUFACTURER
0,1
TRUSTED AUTHENTICATOR
AUTHENTICA-TOR ID
NAME
DETAILS
*
*
*
SECRET SIGNATURE
OBJECT ID
SECRET
PUBLIC-KEY SIGNATURE
OBJECT ID
PADDING
SIGNATURE
*
KEY PAIR
PUBLIC KEY
PRIVATE KEY
0,1
0,1
*
OBJECT
*
ID RANGE KEY PAIR
START ID
END ID
*

FIG. 59

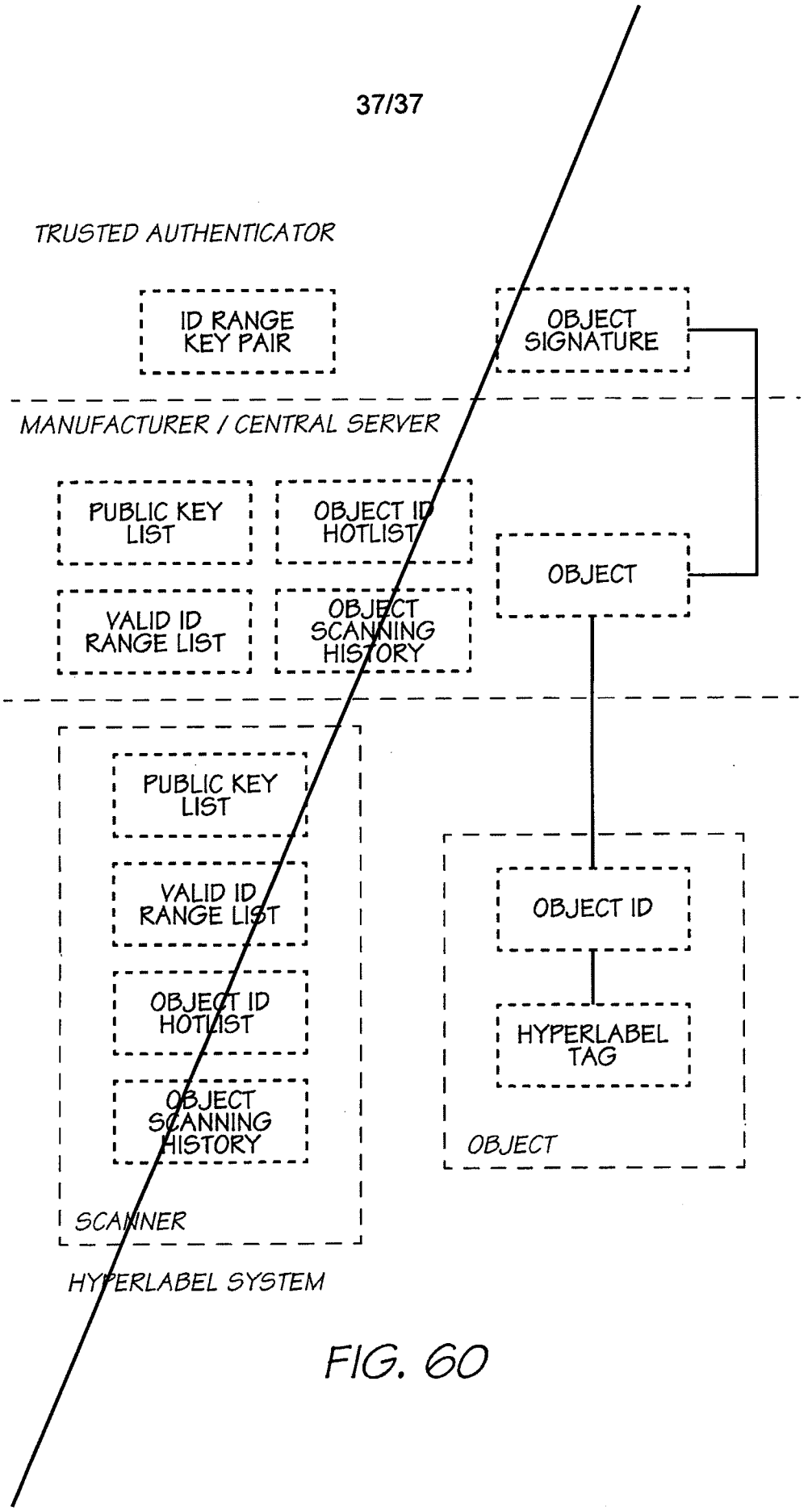
TRUSTED AUTHENTICATOR
ID RANGE KEY PAIR
OBJECT SIGNATURE
MANUFACTURER / CENTRAL SERVER
PUBLIC KEY LIST
OBJECT ID HOTLIST
OBJECT
VALID ID RANGE LIST
OBJECT SCANNING HISTORY
PUBLIC KEY LIST
VALID ID RANGE LIST
OBJECT ID HOTLIST
OBJECT SCANNING HISTORY
SCANNER
OBJECT ID
HYPERLABEL TAG
OBJECT
HYPERLABEL SYSTEM

FIG. 60

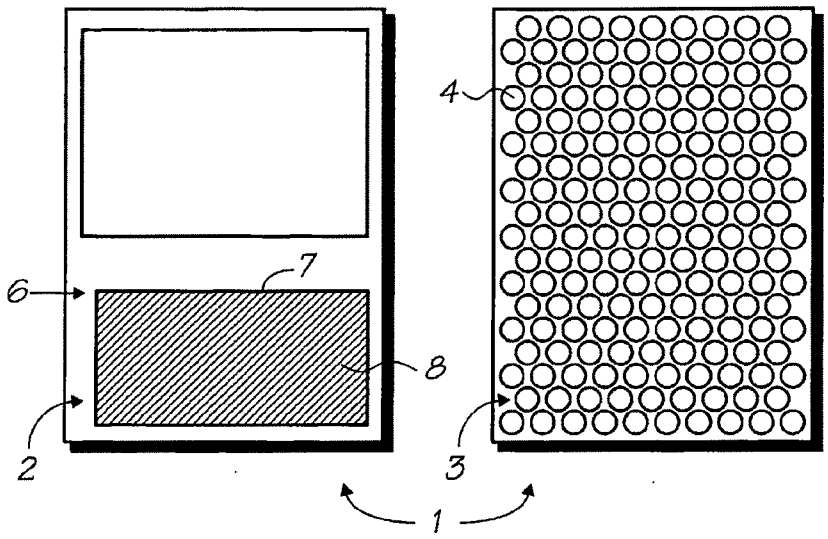

FIG. 1

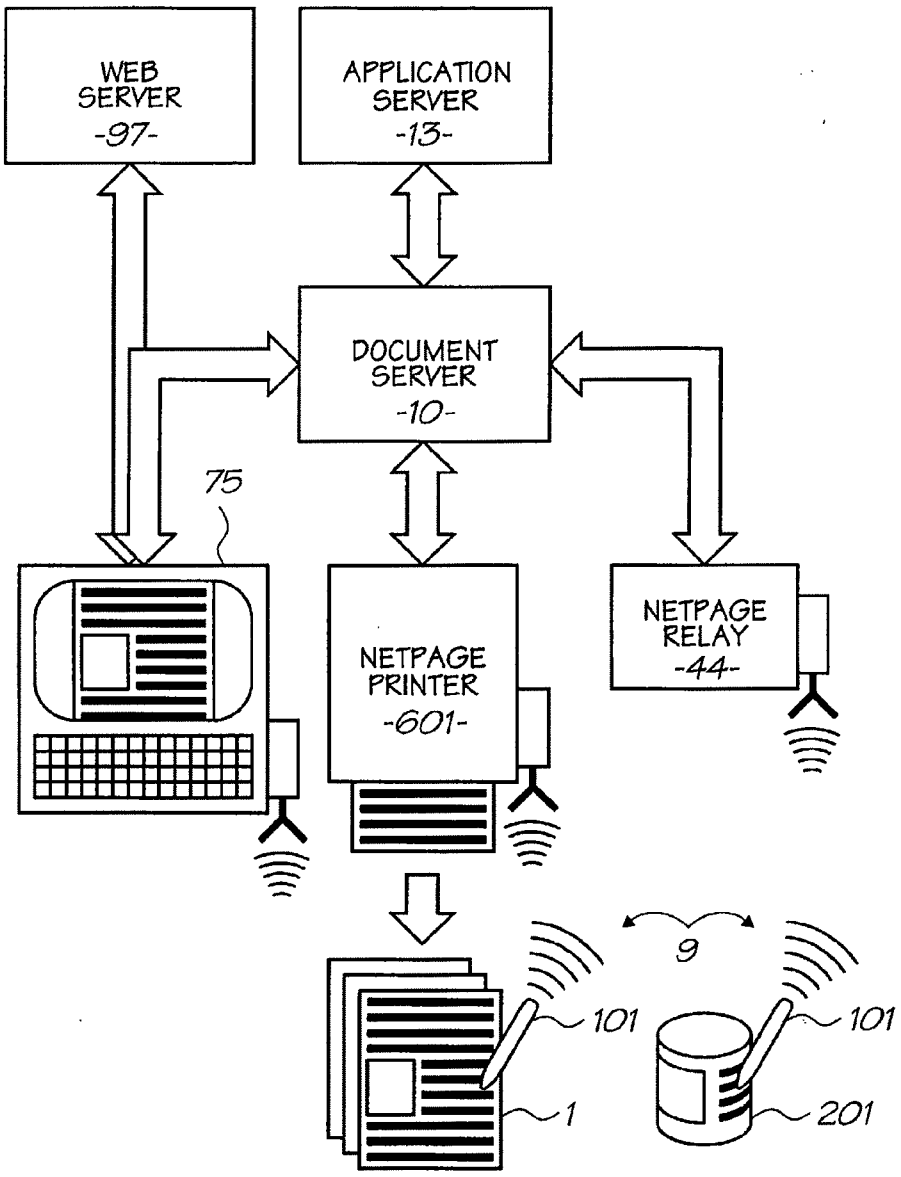
WEB SERVER -97-
APPLICATION SERVER -13-
DOCUMENT SERVER -10-
75
NETPAGE PRINTER -601-
NETPAGE RELAY -44-
9
101
101
1
201

FIG. 2

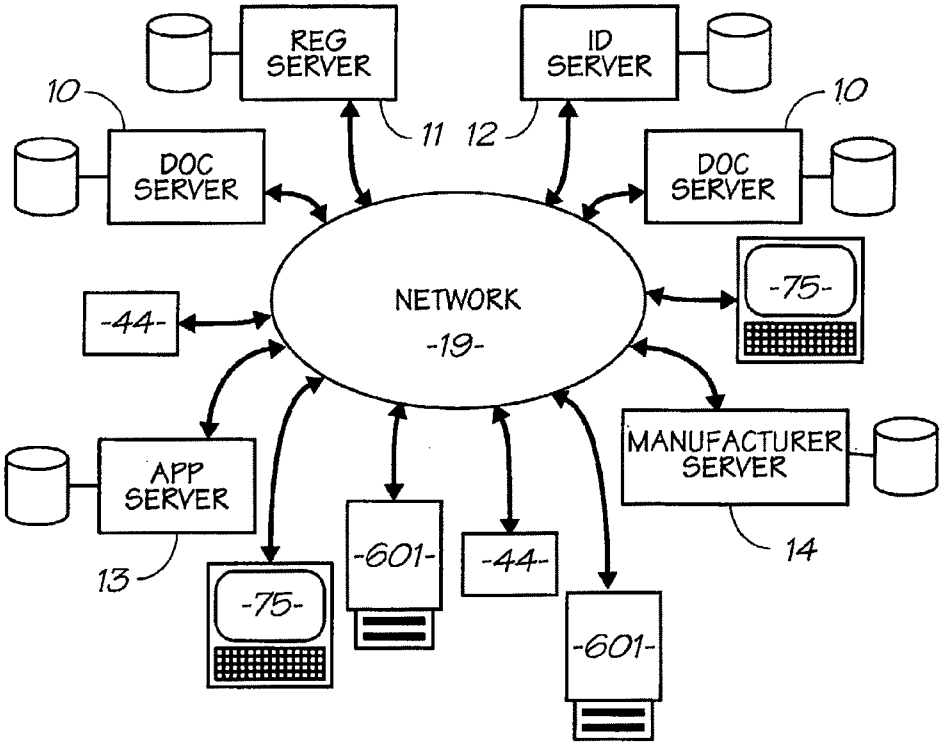
REG SERVER
ID SERVER
10
10
DOC SERVER
DOC SERVER
11
12
NETWORK
-19-
-44-
-75-
APP SERVER
MANUFACTURER SERVER
13
14
-75-
-601-
-44-
-601-

FIG. 3

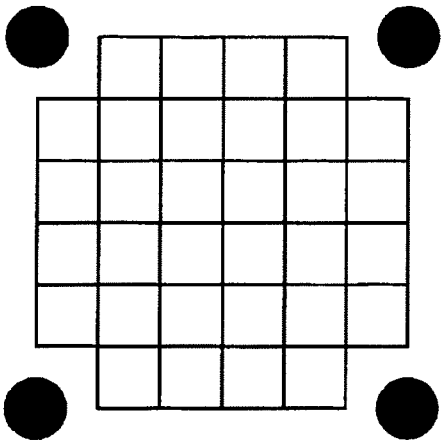

FIG. 4

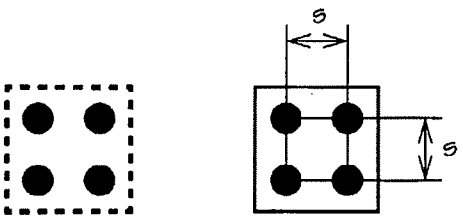

FIG. 5

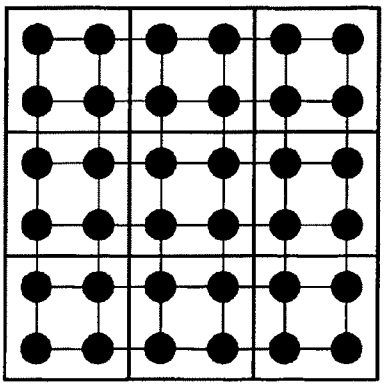

FIG. 6

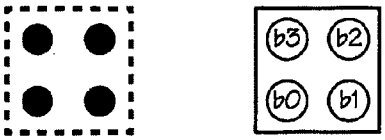

FIG. 7

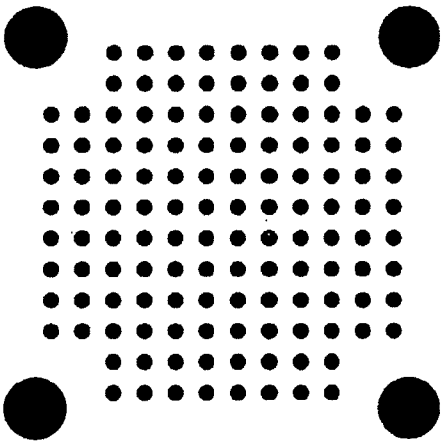

FIG. 8

00	10
01	11

FIG. 9

00	10	00	10	00	10
01	11	01	11	01	11
00	10	00	10	00	10
01	11	01	11	01	11

FIG. 10

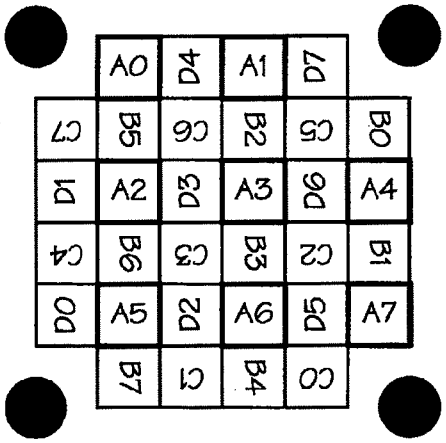

FIG. 11

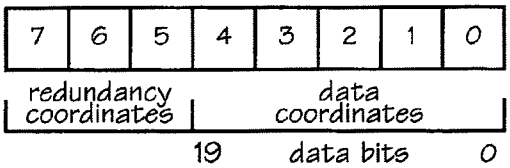

FIG. 12

3	2	1
4	-	0
5	6	7

FIG. 13

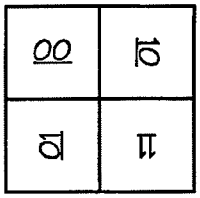

FIG. 14

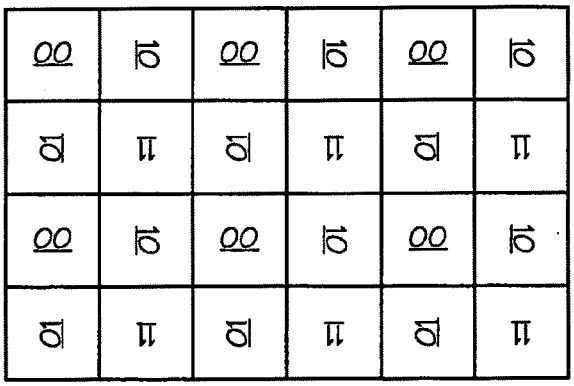

FIG. 15

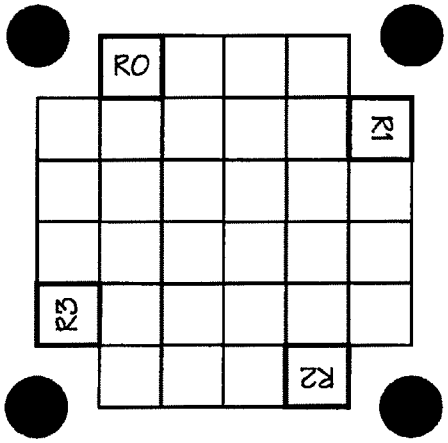

FIG. 16

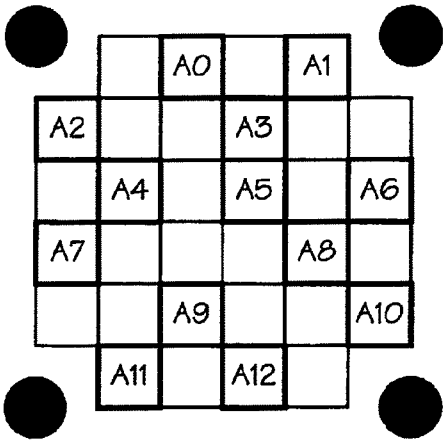

FIG. 17

B0
B4
B1
E6
C9
B5
E14
C1
E4
C11
B2
E12
C3
D11
B6
D14
B3
E7
C8
D10
B7
C0
E5
C10
D13
E13
C2
D9
D12
D8
B8
B12
B9
E2
C13
B13
E10
C5
E0
D7
B10
E8
C7
D3
B14
D6
B11
E3
C12
D2
E11
C4
E1
C14
D5
E9
C6
D1
D4
D0

FIG. 18

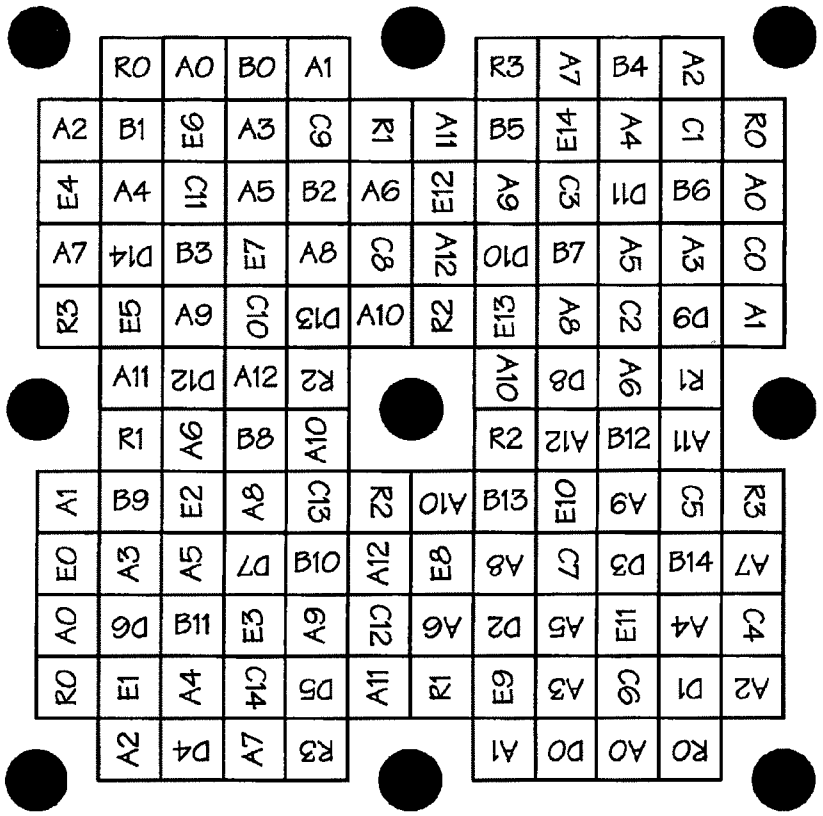
R0 A0 B0 A1
A2 B1 E6 A3 C9 R1 A11
E4 A4 C11 A5 B2 A6 E12
A7 D14 B3 E7 A8 C8 A12
R3 E5 A9 C10 D13 A10 R2
A11 D12 A12 R2
R1 A6 B8 A10
A1 B9 E2 A8 C13 R2 A10
E0 A3 A5 D7 B10 A12 E8
A0 D6 B11 E3 A9 C12 A6
R0 E1 A4 C14 D5 A11 R1
A2 D4 A7 R3
R3 A7 B4 A2
B5 E14 A4 C1 R0
A9 C3 D11 B6 A0
D10 B7 A5 A3 C0
E13 A8 C2 D9 A1
A10 D8 A6 R1
R2 A12 B12 A11
B13 E10 A9 C5 R3
A8 C7 D3 B14 A7
D2 A5 E11 A4 C4
E9 A3 C9 D1 A2
A1 D0 A0 R0

FIG. 19

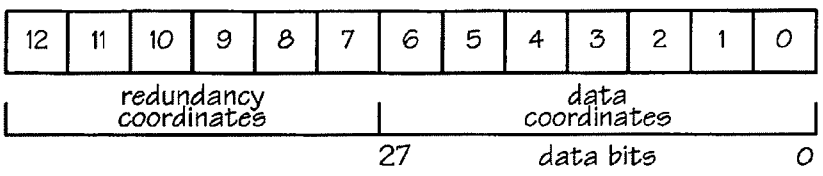
12 11 10 9 8 7 6 5 4 3 2 1 0
redundancy coordinates
data coordinates
27
data bits
0

FIG. 20

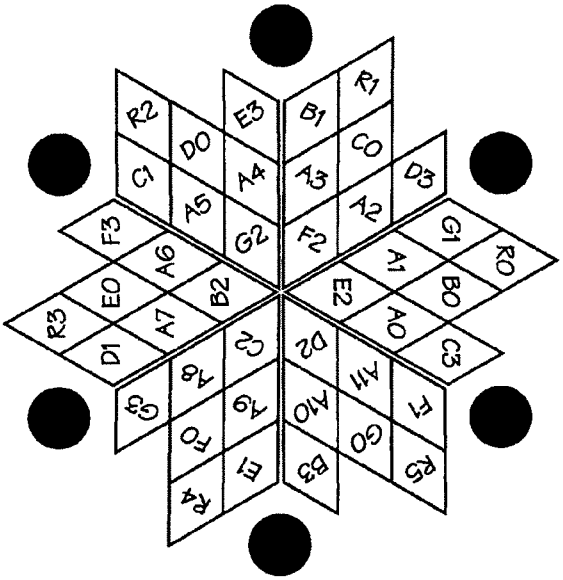
R2
E3
B1
R1
D0
C0
C1
A4
A3
D3
A5
A2
F3
G2
F2
G1
A6
A1
R0
E0
B2
E2
B0
R3
A7
A0
C3
D1
C2
D2
A11
G3
A8
A9
A10
E1
F0
G0
E1
R4
B3
R5

FIG. 21

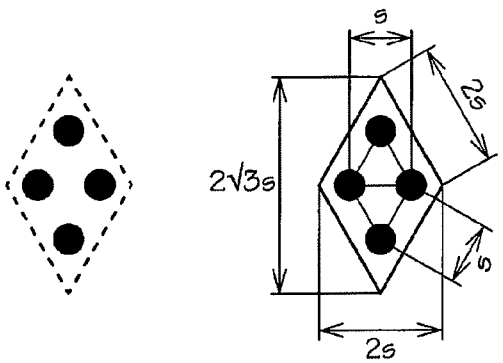
s
2s
2√3s
s
2s

FIG. 22

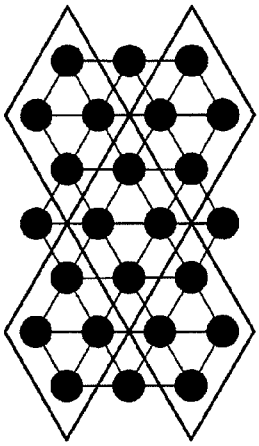

FIG. 23

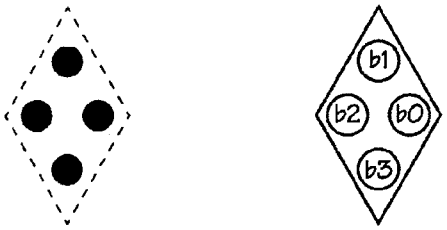

FIG. 24

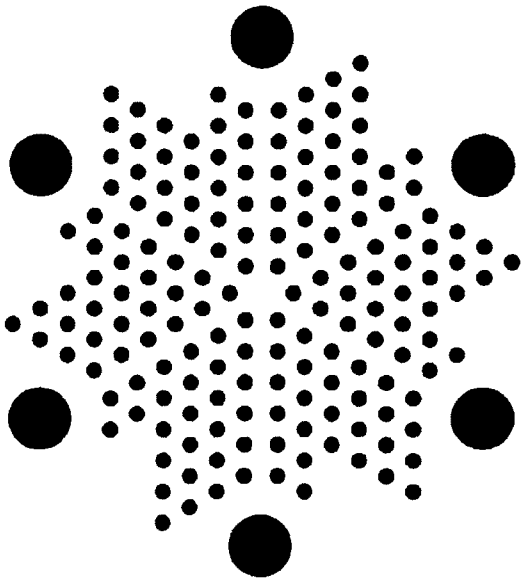

FIG. 25

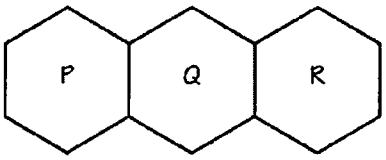

FIG. 26

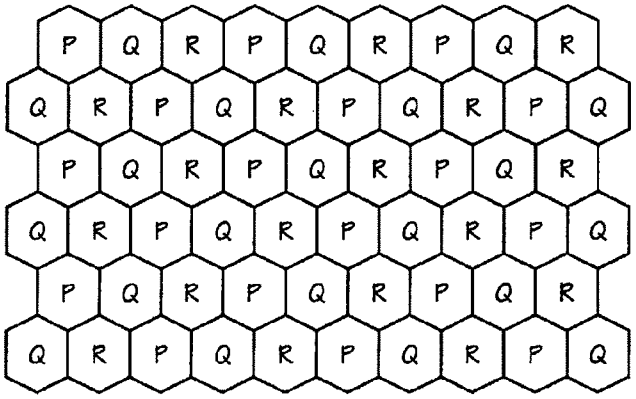
P Q R P Q R P Q R
Q R P Q R P Q R P Q
P Q R P Q R P Q R
Q R P Q R P Q R P Q
P Q R P Q R P Q R
Q R P Q R P Q R P Q

FIG. 27

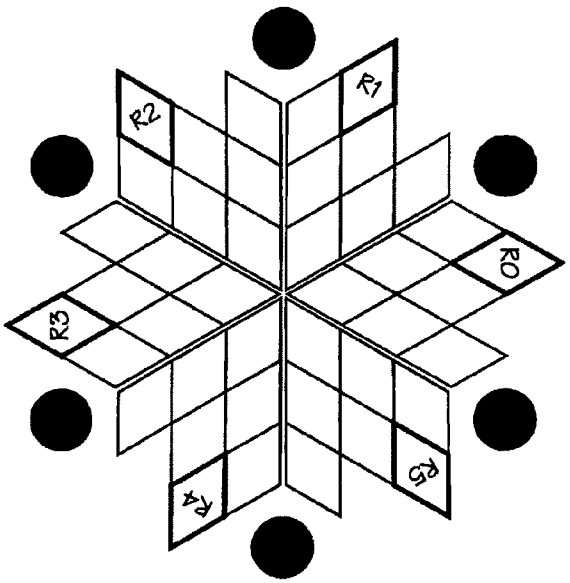
R1
R2
R0
R3

FIG. 28

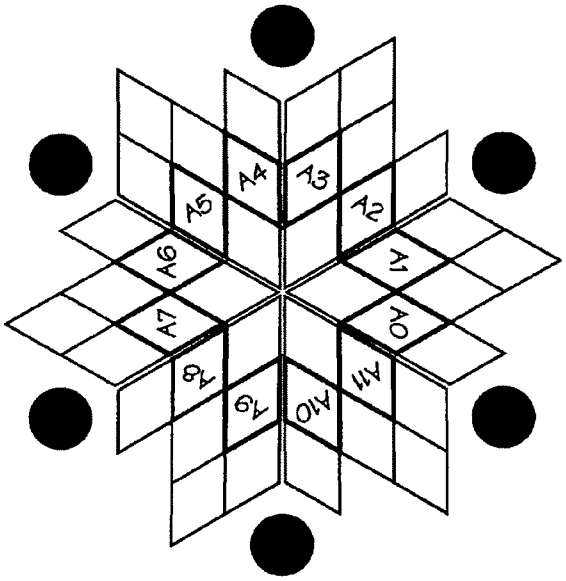
A4
A3
A5
A2
A6
A1
A7
A0
A8
A11
A9
A10

FIG. 29

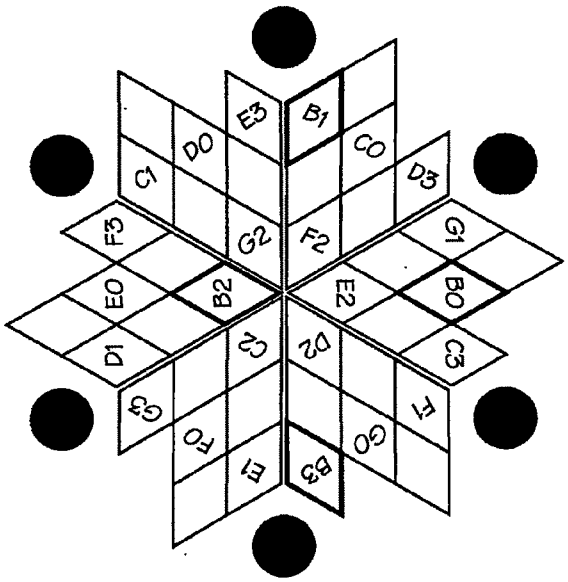
E3
B1
D0
C0
C1
D3
F3
G2
F2
G1
E0
B2
E2
B0
D1
C2
D2
C3
G3
F0
E1
G0
F1
B3

FIG. 30

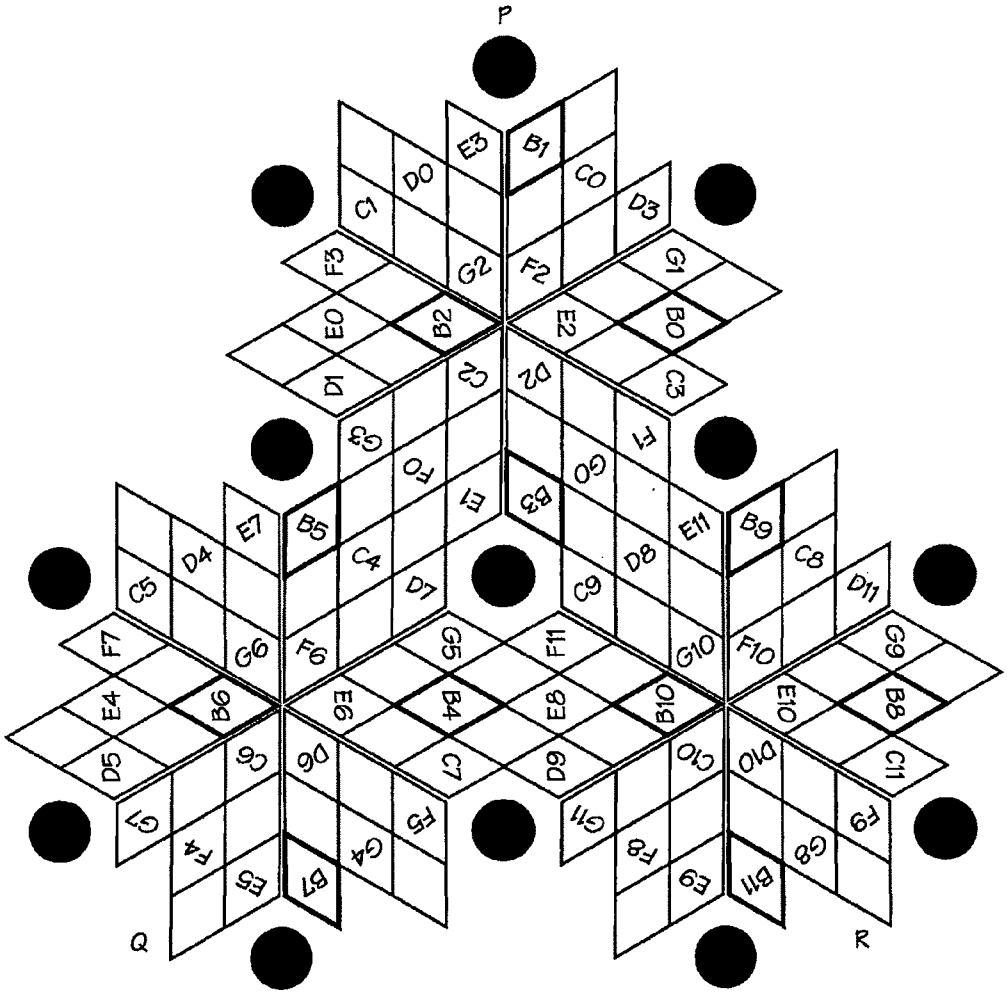
P
Q
R
E3
B1
D0
C0
C1
D3
F3
G2
F2
G1
E0
B2
E2
B0
D1
C2
D2
C3
G3
F0
F1
G0
E1
B3
E7
B5
E11
B9
D4
C4
D8
C8
C5
D7
C9
D11
F7
G6
F6
G5
F11
G10
F10
G9
E4
B6
E6
B4
E8
B10
E10
B8
D5
C6
D6
C7
D9
C10
D10
C11
G7
F4
E5
B7
G4
F5
G11
F8
E9
B11
G8
F9

FIG. 31

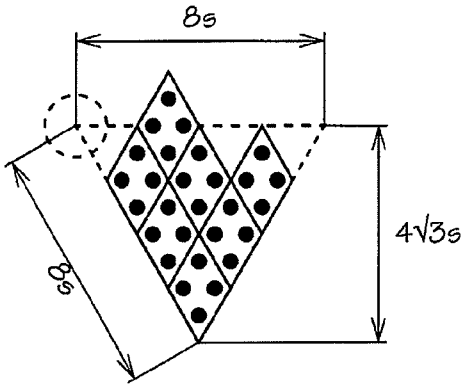

FIG. 32

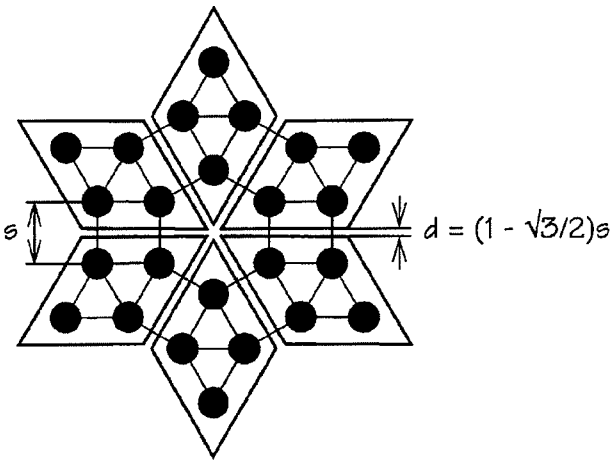

FIG. 33

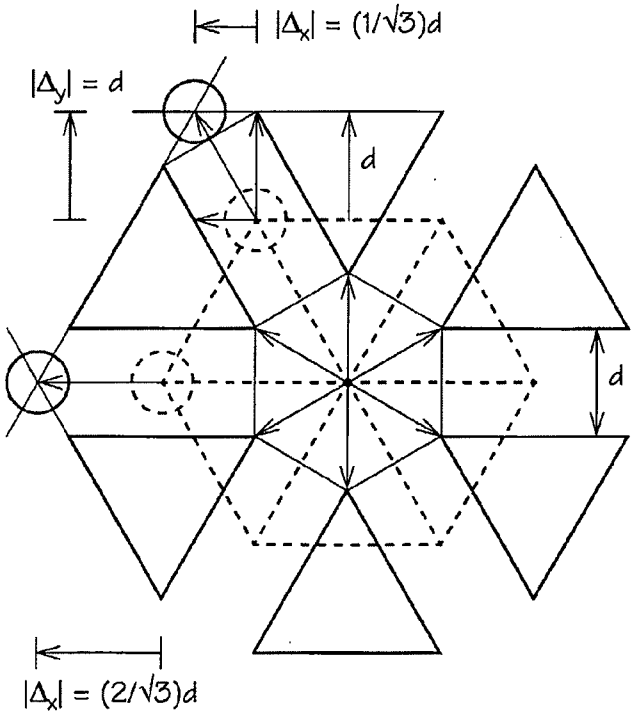
|Δx| = (1/√3)d
|Δy| = d
d
d
|Δx| = (2/√3)d

FIG. 34

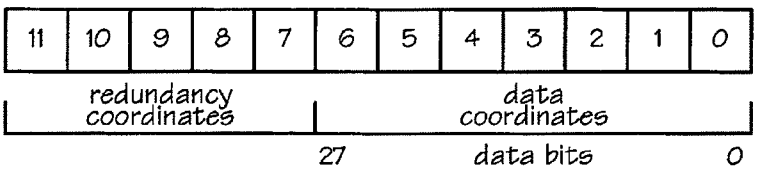
11
10
9
8
7
6
5
4
3
2
1
0
redundancy coordinates
data coordinates
27
data bits
0

FIG. 35

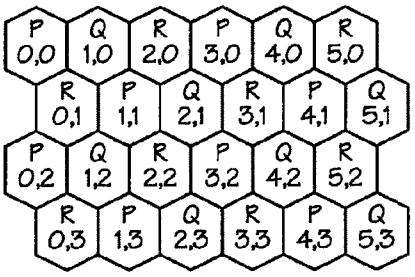

FIG. 36

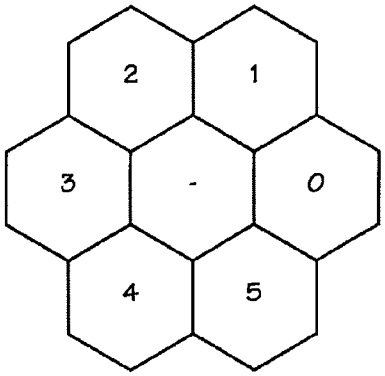

FIG. 37

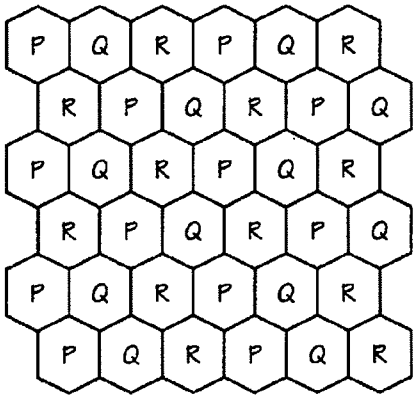

FIG. 38

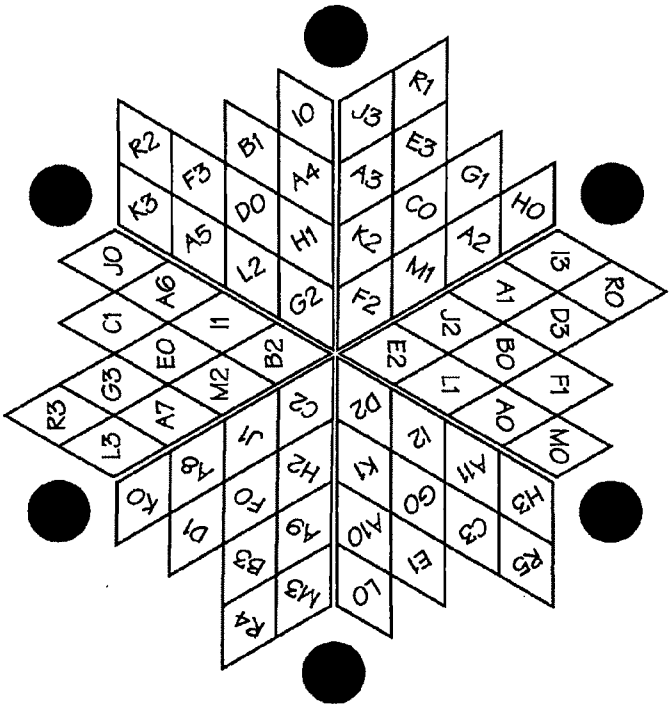
R1
J3
E3
G1
H0
A2
I3
R0
D3
F1
M0
A0
I2
A11
H3
R5
C3
E1
L0
A10
K1
G0
D2
C2
H2
A9
M3
R4
B3
D1
F0
K0
A8
J1
R3
L3
G3
A7
M2
B2
C1
E0
I1
J0
A6
K3
A5
D0
L2
G2
H1
A4
B1
I0
R2
F3
J2
E2
L1
B0
A1
J3
A3
K2
F2
C0
M1

FIG. 39

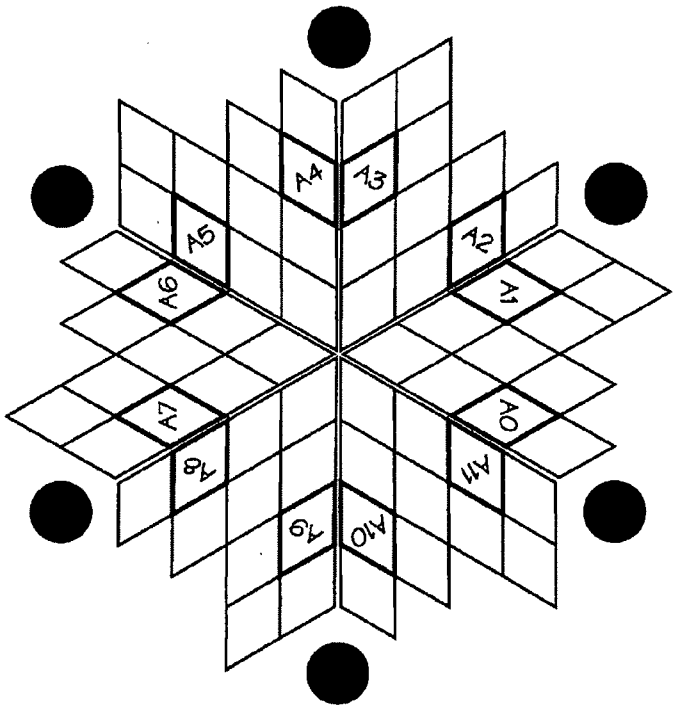

FIG. 40

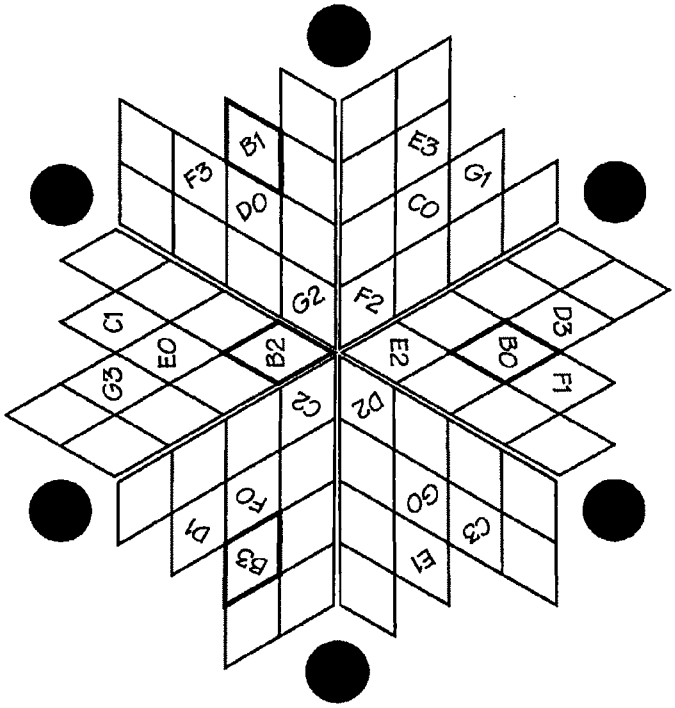

FIG. 41

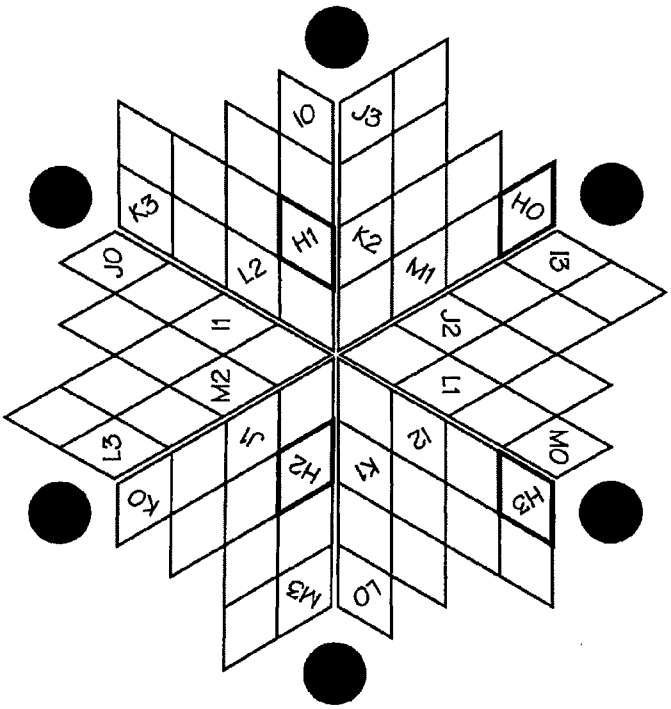
I0
J3
K3
H1
K2
H0
J0
L2
M1
I3
I1
J2
M2
L1
L3
J1
H2
K1
I2
K0
M0
H3
M3
L0

FIG. 42

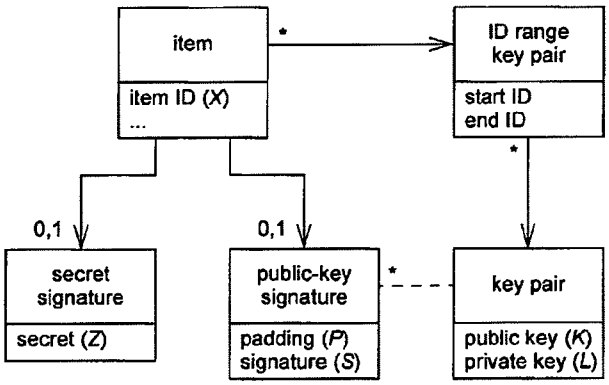
item
item ID (X)
...
*
ID range
key pair
start ID
end ID
*
0,1
0,1
secret
signature
secret (Z)
public-key
signature
padding (P)
signature (S)
*
key pair
public key (K)
private key (L)

FIG. 43

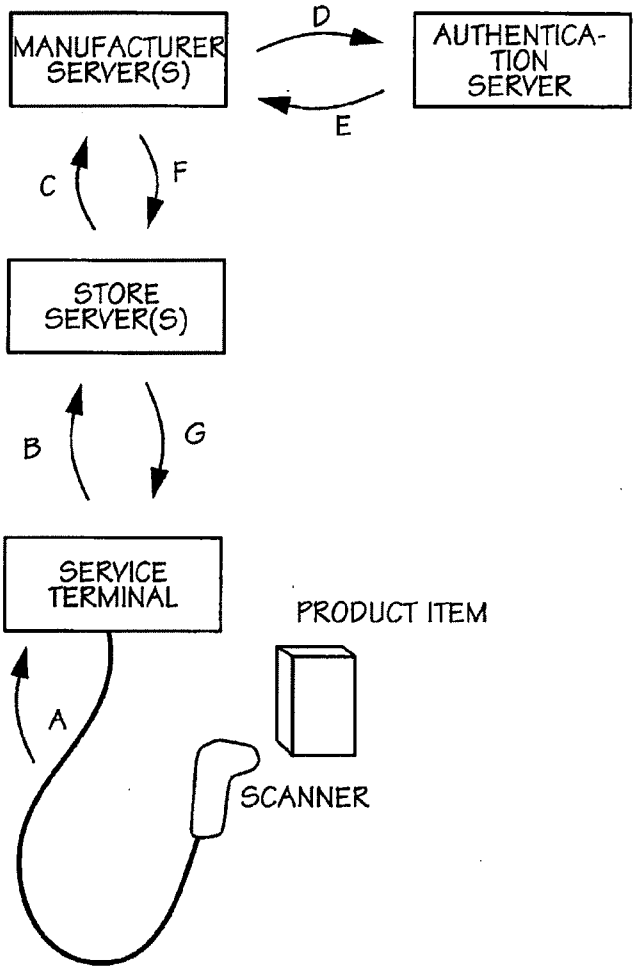
MANUFACTURER SERVER(S)
D
AUTHENTICA-TION SERVER
E
C
F
STORE SERVER(S)
B
G
SERVICE TERMINAL
PRODUCT ITEM
A
SCANNER

FIG. 44

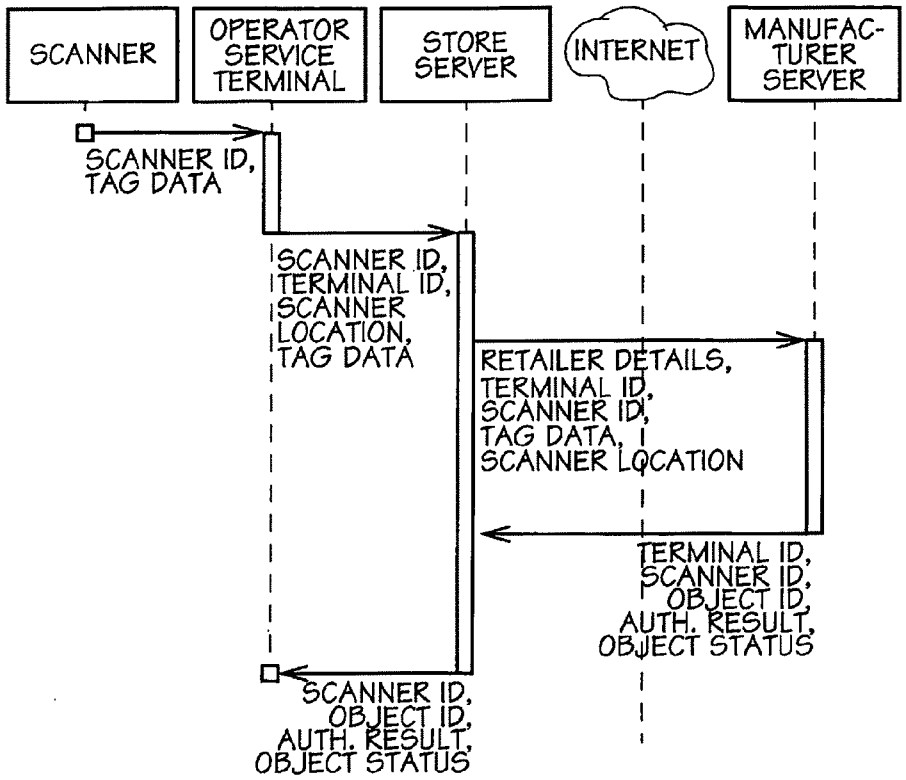
SCANNER
OPERATOR SERVICE TERMINAL
STORE SERVER
INTERNET
MANUFAC-TURER SERVER
SCANNER ID, TAG DATA
SCANNER ID, TERMINAL ID, SCANNER LOCATION, TAG DATA
RETAILER DETAILS, TERMINAL ID, SCANNER ID, TAG DATA, SCANNER LOCATION
TERMINAL ID, SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS
SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS

FIG. 45

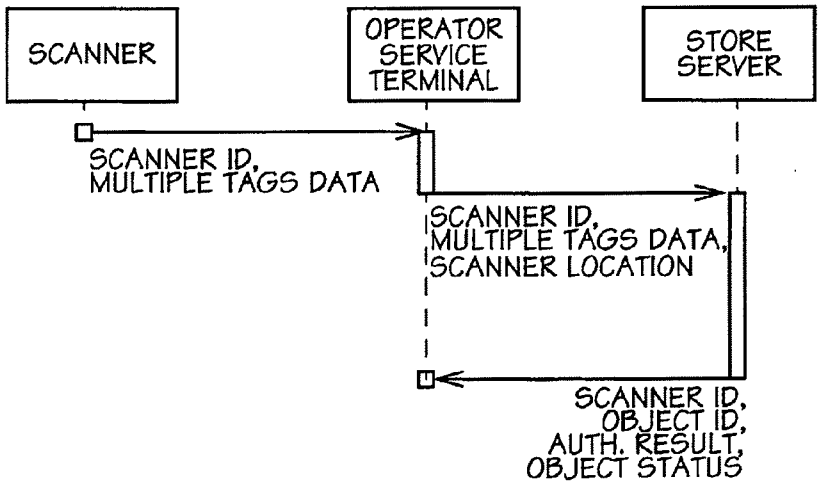
SCANNER
OPERATOR SERVICE TERMINAL
STORE SERVER
SCANNER ID, MULTIPLE TAGS DATA
SCANNER ID, MULTIPLE TAGS DATA, SCANNER LOCATION
SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS

FIG. 46

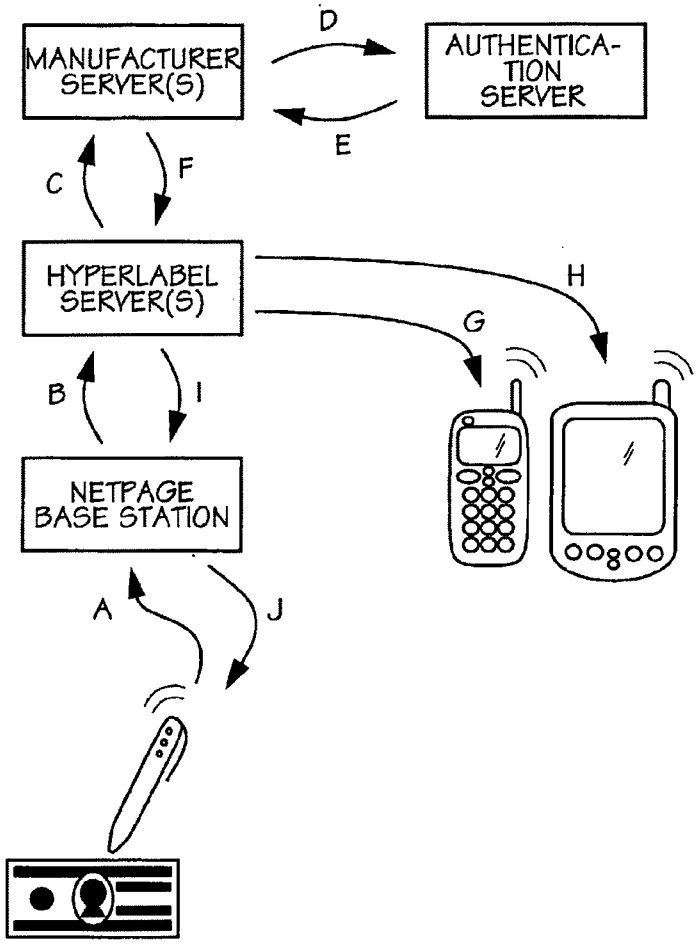
MANUFACTURER SERVER(S)
AUTHENTICA-TION SERVER
D
E
C
F
HYPERLABEL SERVER(S)
H
G
B
I
NETPAGE BASE STATION
A
J

FIG. 47

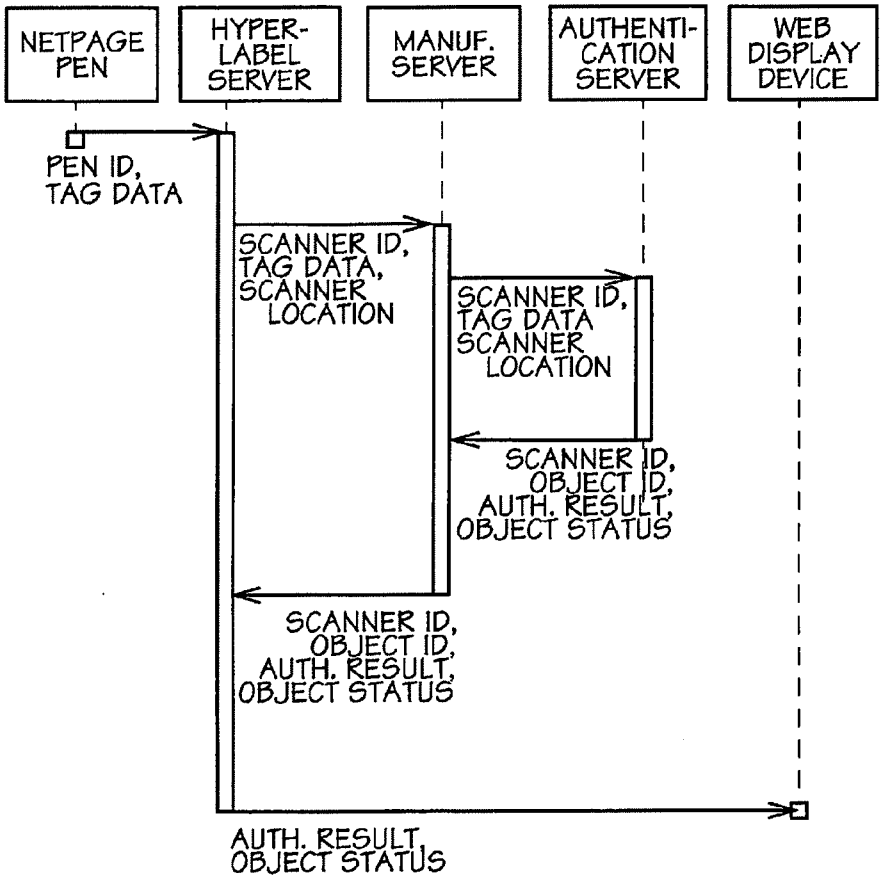
NETPAGE PEN
HYPER-LABEL SERVER
MANUF. SERVER
AUTHENTI-CATION SERVER
WEB DISPLAY DEVICE
PEN ID, TAG DATA
SCANNER ID, TAG DATA, SCANNER LOCATION
SCANNER ID, TAG DATA SCANNER LOCATION
SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS
SCANNER ID, OBJECT ID, AUTH. RESULT, OBJECT STATUS
AUTH. RESULT, OBJECT STATUS

FIG. 48

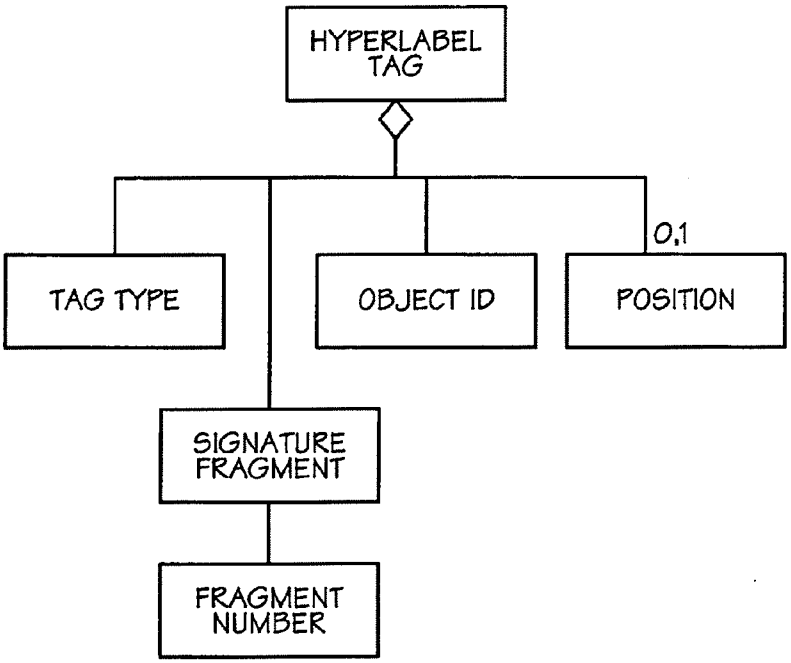
HYPERLABEL TAG
0,1
TAG TYPE
OBJECT ID
POSITION
SIGNATURE FRAGMENT
FRAGMENT NUMBER

FIG. 49

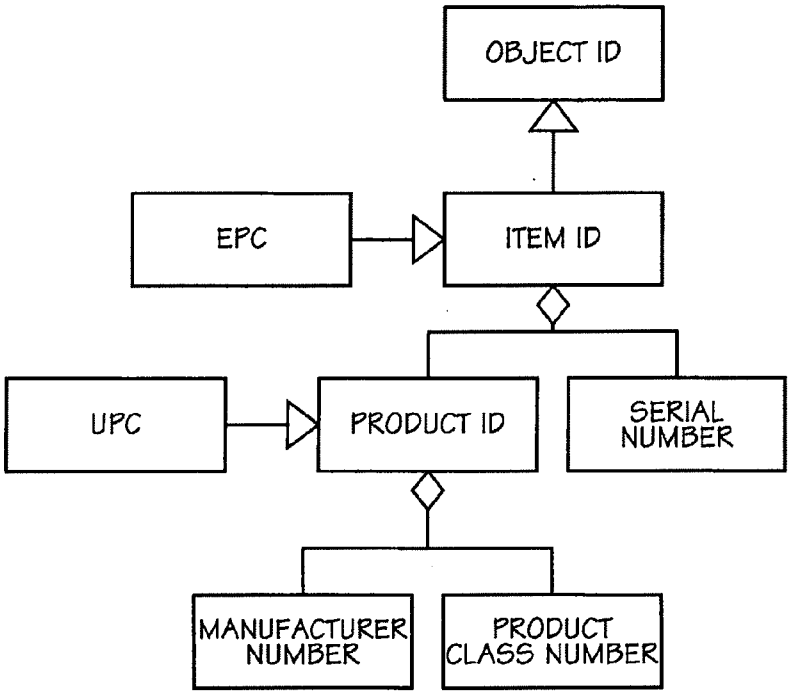
OBJECT ID
EPC
ITEM ID
UPC
PRODUCT ID
SERIAL NUMBER
MANUFACTURER NUMBER
PRODUCT CLASS NUMBER

FIG. 50

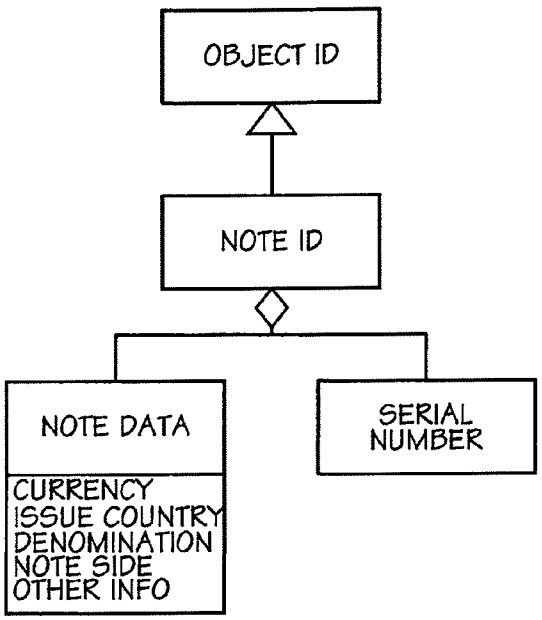
OBJECT ID
NOTE ID
NOTE DATA
CURRENCY
ISSUE COUNTRY
DENOMINATION
NOTE SIDE
OTHER INFO
SERIAL NUMBER

FIG. 51

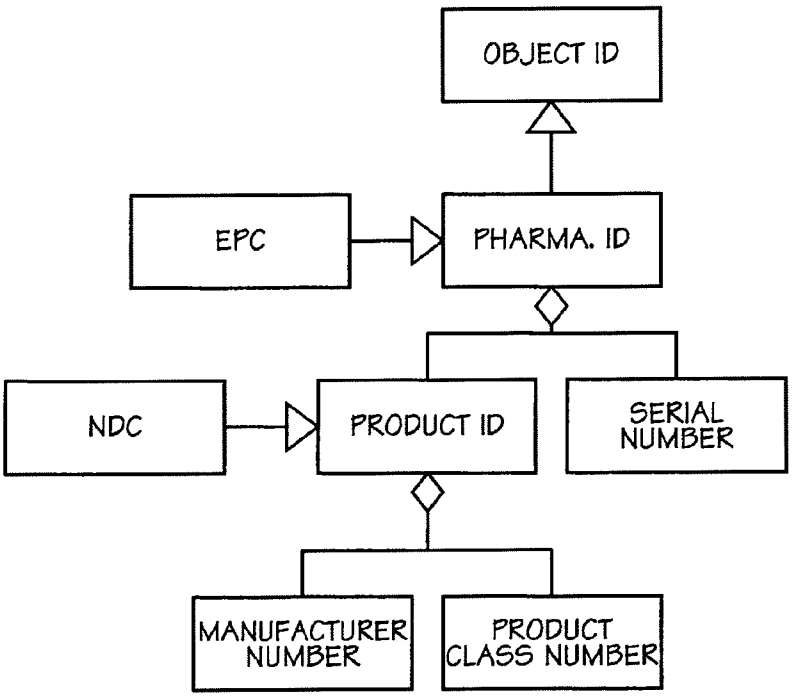
OBJECT ID
EPC
PHARMA. ID
NDC
PRODUCT ID
SERIAL NUMBER
MANUFACTURER NUMBER
PRODUCT CLASS NUMBER

FIG. 52

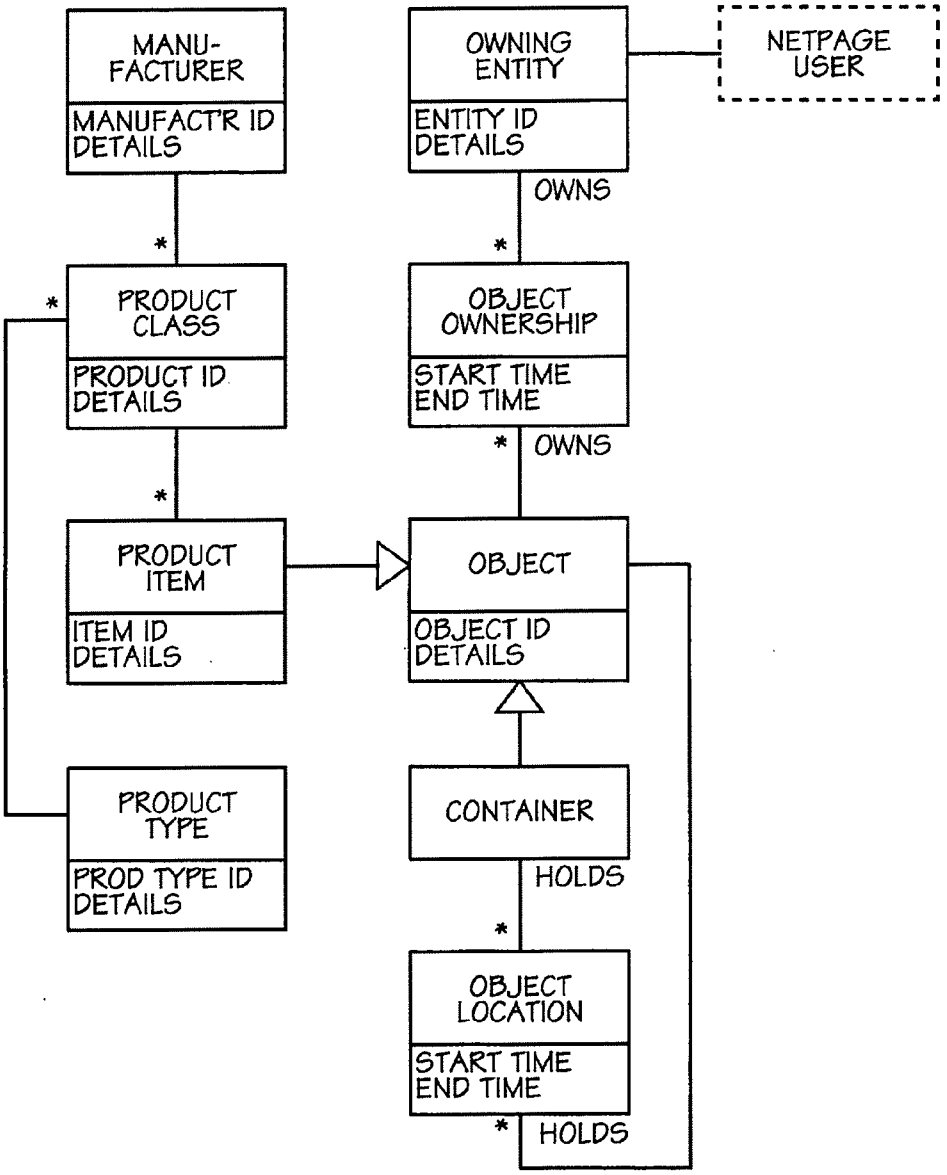
MANU-
FACTURER
MANUFACT'R ID
DETAILS
OWNING
ENTITY
ENTITY ID
DETAILS
NETPAGE
USER
OWNS
PRODUCT
CLASS
PRODUCT ID
DETAILS
OBJECT
OWNERSHIP
START TIME
END TIME
OWNS
PRODUCT
ITEM
ITEM ID
DETAILS
OBJECT
OBJECT ID
DETAILS
PRODUCT
TYPE
PROD TYPE ID
DETAILS
CONTAINER
HOLDS
OBJECT
LOCATION
START TIME
END TIME
HOLDS

FIG. 53

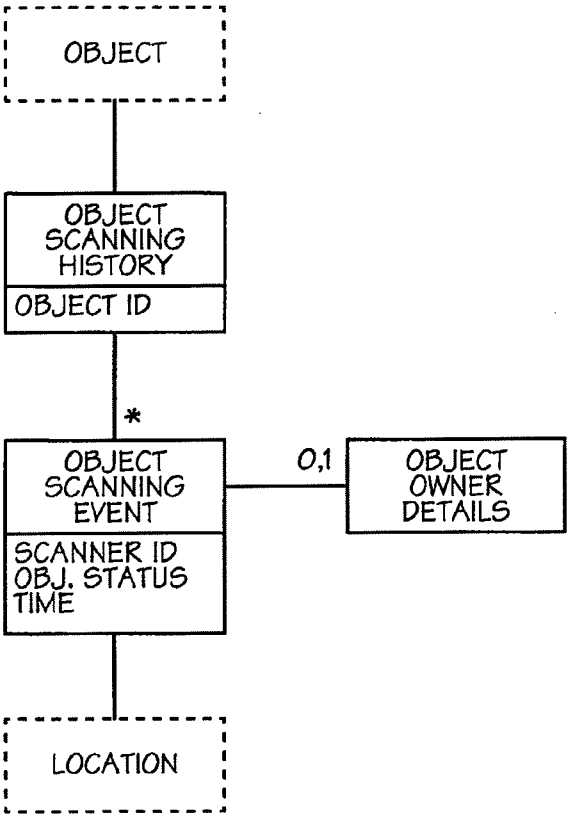
OBJECT
OBJECT SCANNING HISTORY
OBJECT ID
*
OBJECT SCANNING EVENT
SCANNER ID
OBJ. STATUS
TIME
0,1
OBJECT OWNER DETAILS
LOCATION

FIG. 54

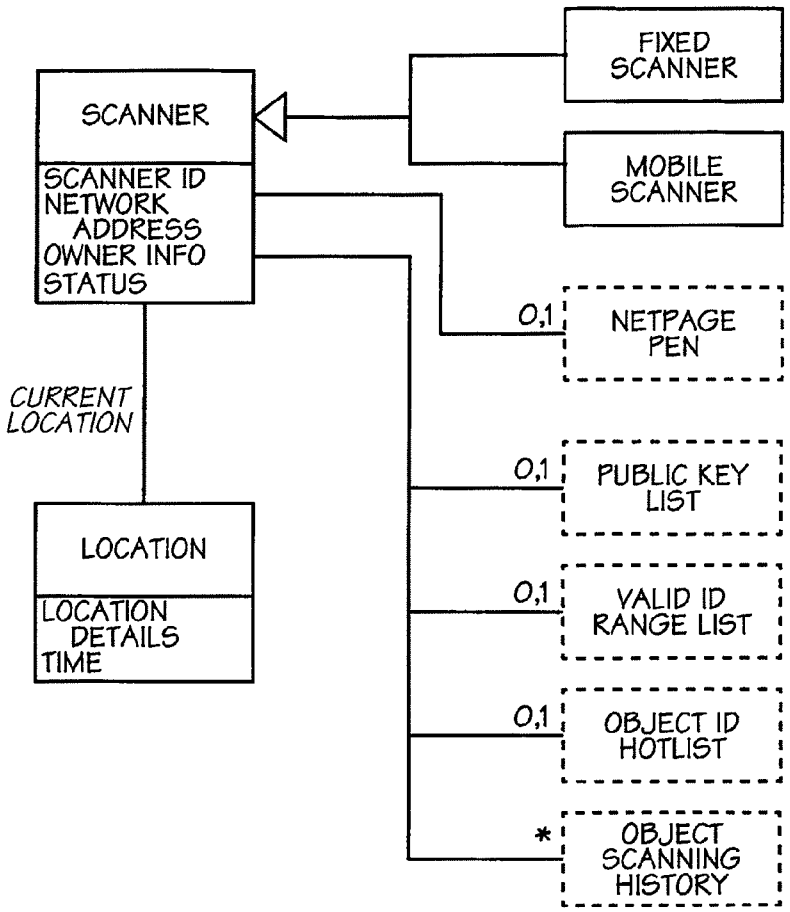
SCANNER
SCANNER ID
NETWORK ADDRESS
OWNER INFO
STATUS
FIXED SCANNER
MOBILE SCANNER
0,1
NETPAGE PEN
CURRENT LOCATION
0,1
PUBLIC KEY LIST
LOCATION
LOCATION DETAILS
TIME
0,1
VALID ID RANGE LIST
0,1
OBJECT ID HOTLIST
*
OBJECT SCANNING HISTORY

FIG. 55

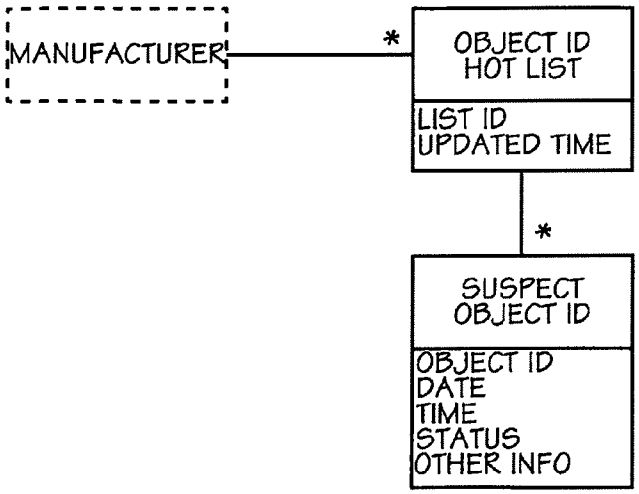
MANUFACTURER
*
OBJECT ID
HOT LIST
LIST ID
UPDATED TIME
*
SUSPECT
OBJECT ID
OBJECT ID
DATE
TIME
STATUS
OTHER INFO

FIG. 56

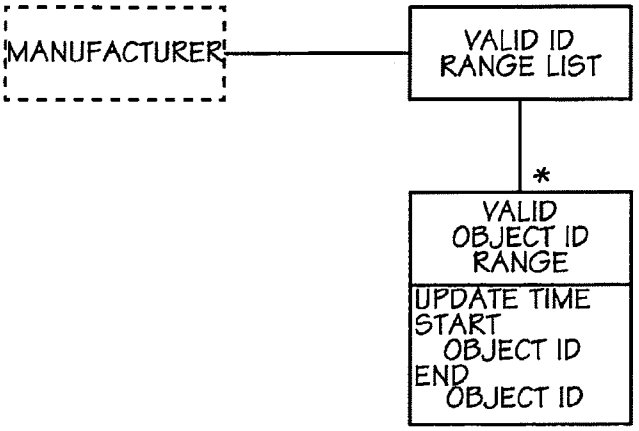
MANUFACTURER
VALID ID
RANGE LIST
*
VALID
OBJECT ID
RANGE
UPDATE TIME
START
OBJECT ID
END
OBJECT ID

FIG. 57

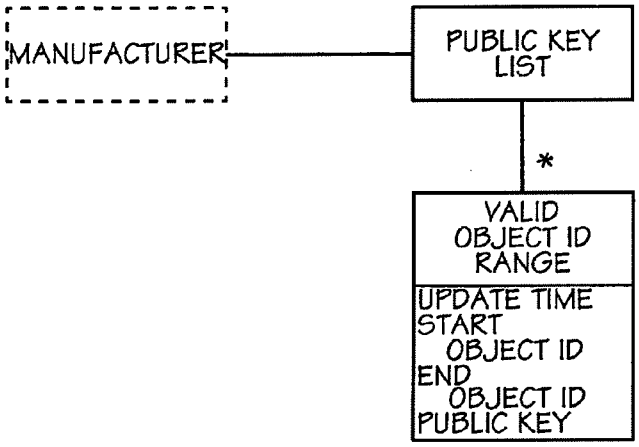
MANUFACTURER
PUBLIC KEY LIST
*
VALID OBJECT ID RANGE
UPDATE TIME
START OBJECT ID
END OBJECT ID
PUBLIC KEY

FIG. 58

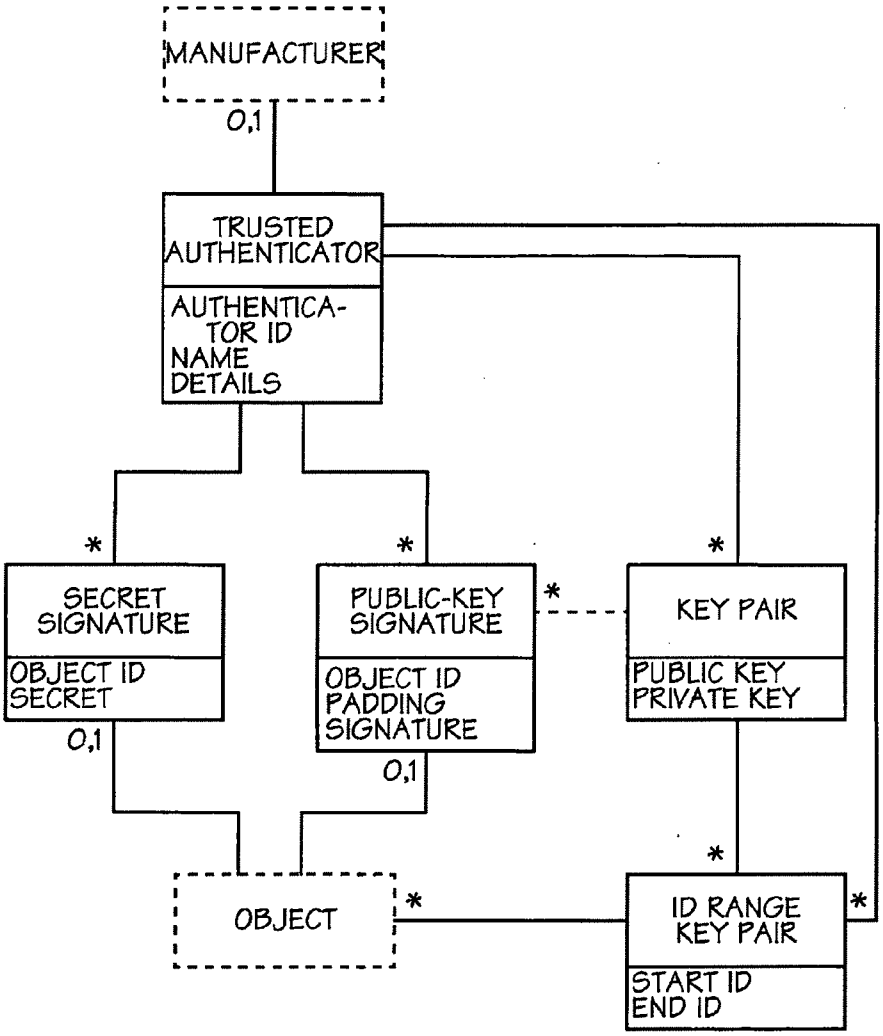
MANUFACTURER
0,1
TRUSTED AUTHENTICATOR
AUTHENTICA-TOR ID
NAME
DETAILS
*
*
*
SECRET SIGNATURE
OBJECT ID
SECRET
PUBLIC-KEY SIGNATURE
OBJECT ID
PADDING
SIGNATURE
KEY PAIR
PUBLIC KEY
PRIVATE KEY
0,1
0,1
*
OBJECT
*
ID RANGE KEY PAIR
START ID
END ID
*

FIG. 59

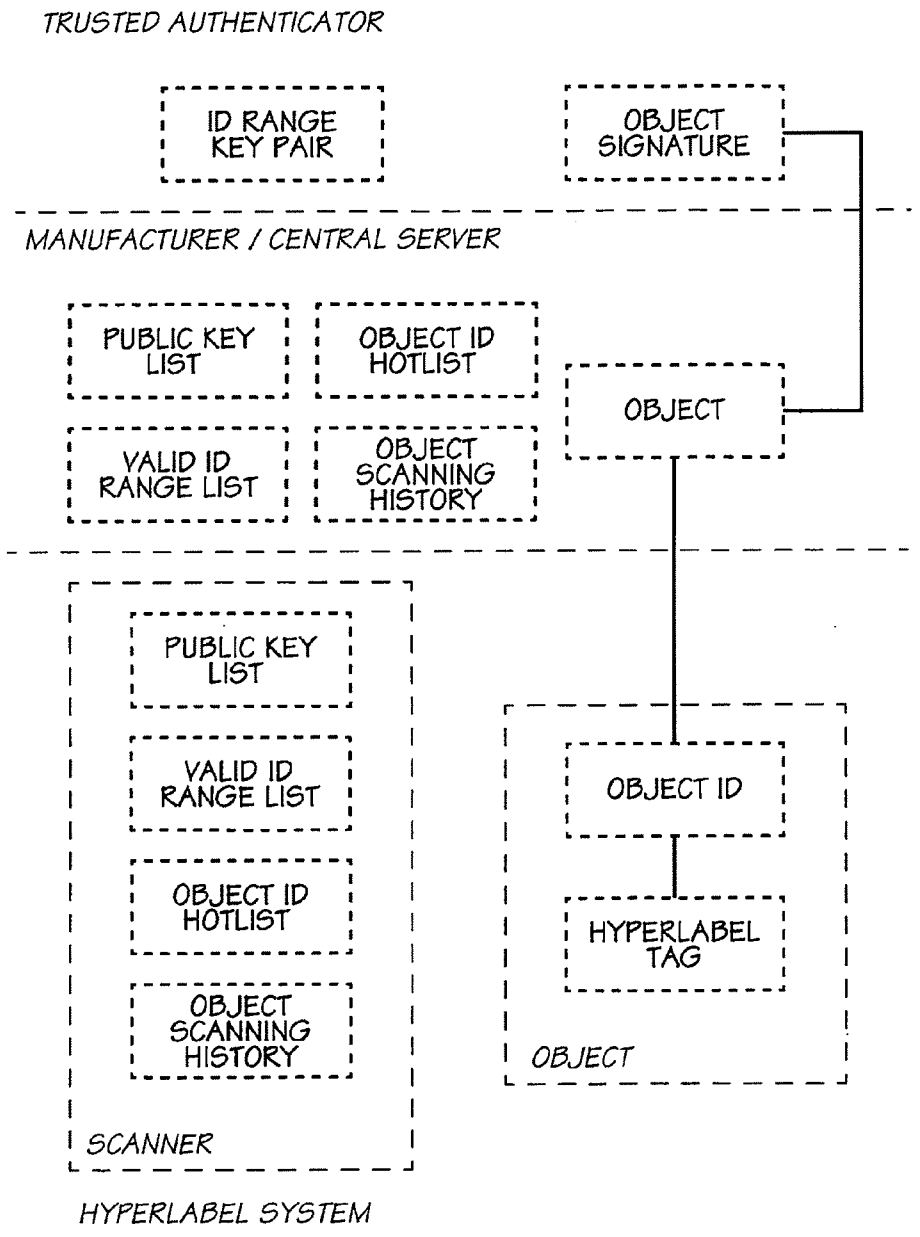
TRUSTED AUTHENTICATOR
ID RANGE KEY PAIR
OBJECT SIGNATURE
MANUFACTURER / CENTRAL SERVER
PUBLIC KEY LIST
OBJECT ID HOTLIST
OBJECT
VALID ID RANGE LIST
OBJECT SCANNING HISTORY
PUBLIC KEY LIST
VALID ID RANGE LIST
OBJECT ID HOTLIST
OBJECT SCANNING HISTORY
SCANNER
OBJECT ID
HYPERLABEL TAG
OBJECT
HYPERLABEL SYSTEM

FIG. 60