FIG. 1

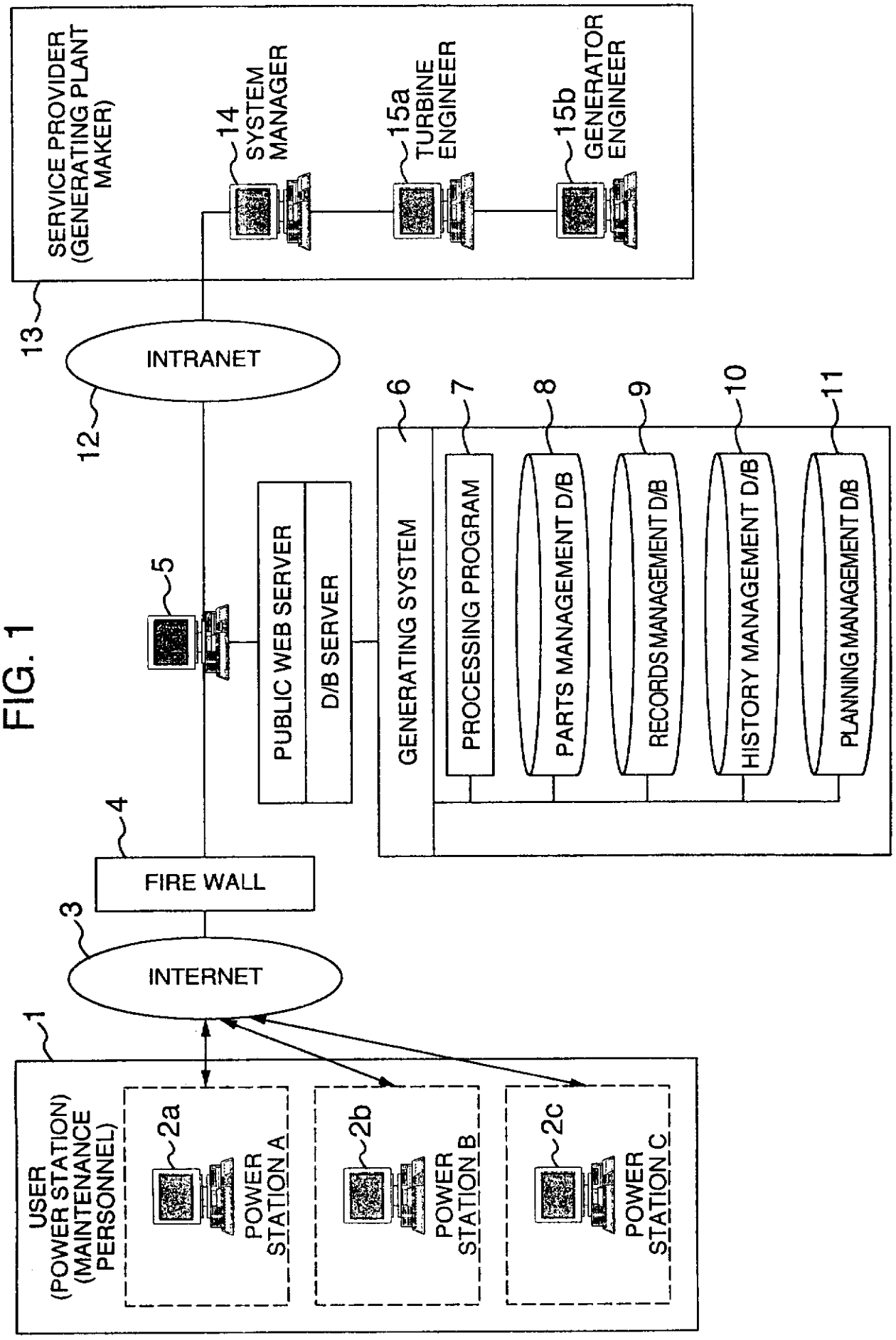
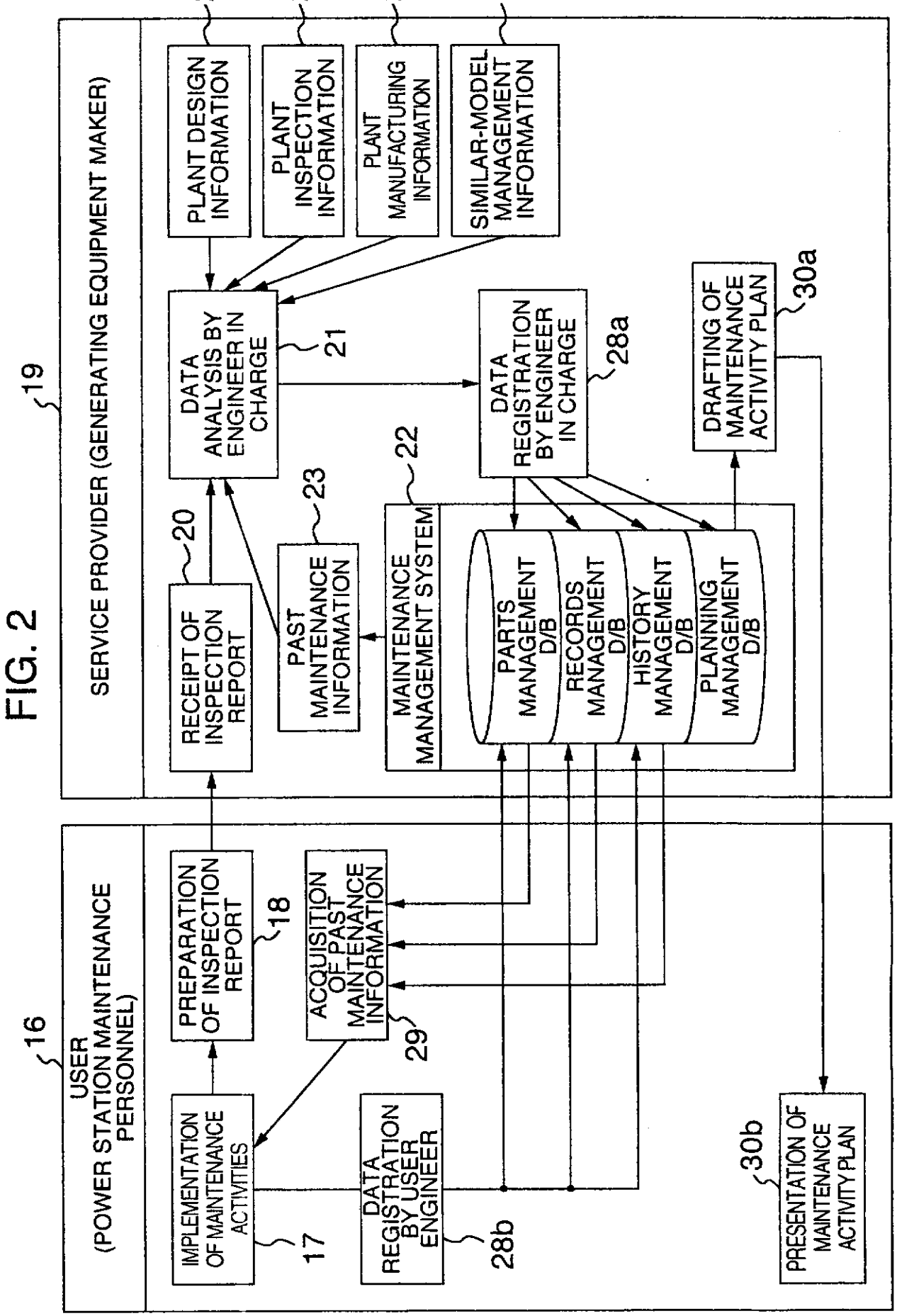

SERVICE PROVIDER (GENERATING PLANT MAKER)
14 SYSTEM MANAGER
15a TURBINE ENGINEER
15b GENERATOR ENGINEER
13
INTRANET
12
6
7
8
9
10
11
5
PUBLIC WEB SERVER
D/B SERVER
GENERATING SYSTEM
PROCESSING PROGRAM
PARTS MANAGEMENT D/B
RECORDS MANAGEMENT D/B
HISTORY MANAGEMENT D/B
PLANNING MANAGEMENT D/B
4
FIRE WALL
3
INTERNET
1
USER (POWER STATION) (MAINTENANCE PERSONNEL)
2a
POWER STATION A
2b
POWER STATION B
2c
POWER STATION C

FIG. 2


16
USER
(POWER STATION MAINTENANCE PERSONNEL)
19
SERVICE PROVIDER (GENERATING EQUIPMENT MAKER)
24
PLANT DESIGN INFORMATION
25
PLANT INSPECTION INFORMATION
26
PLANT MANUFACTURING INFORMATION
27
SIMILAR-MODEL MANAGEMENT INFORMATION
DATA ANALYSIS BY ENGINEER IN CHARGE
21
DATA REGISTRATION BY ENGINEER IN CHARGE
28a
DRAFTING OF MAINTENANCE ACTIVITY PLAN
30a
20
RECEIPT OF INSPECTION REPORT
23
PAST MAINTENANCE INFORMATION
22
MAINTENANCE MANAGEMENT SYSTEM
PARTS MANAGEMENT D/B
RECORDS MANAGEMENT D/B
HISTORY MANAGEMENT D/B
PLANNING MANAGEMENT D/B
PREPARATION OF INSPECTION REPORT
18
ACQUISITION OF PAST MAINTENANCE INFORMATION
29
IMPLEMENTATION OF MAINTENANCE ACTIVITIES
17
DATA REGISTRATION BY USER ENGINEER
28b
30b
PRESENTATION OF MAINTENANCE ACTIVITY PLAN

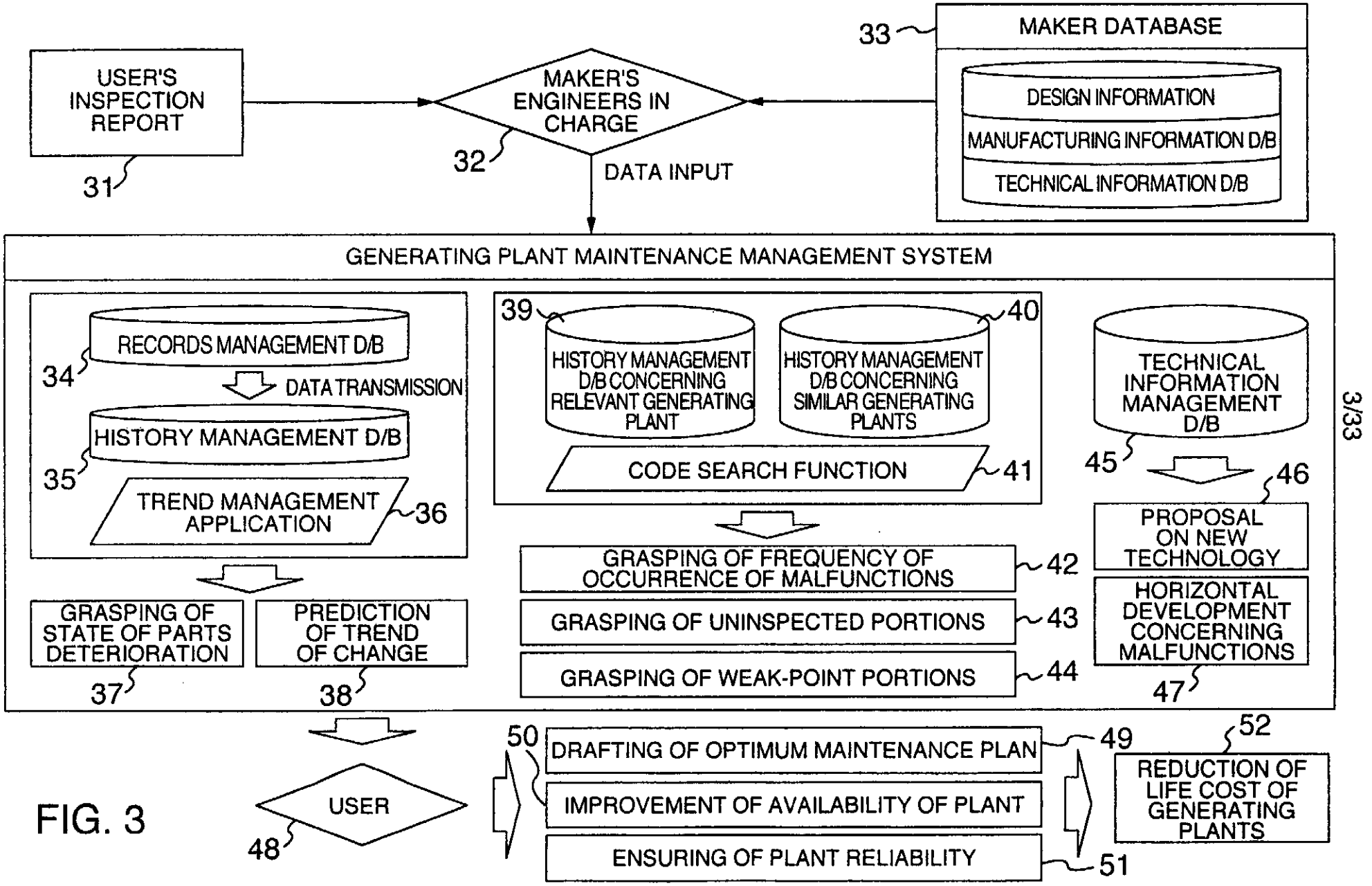


FIG. 3

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FIG. 4

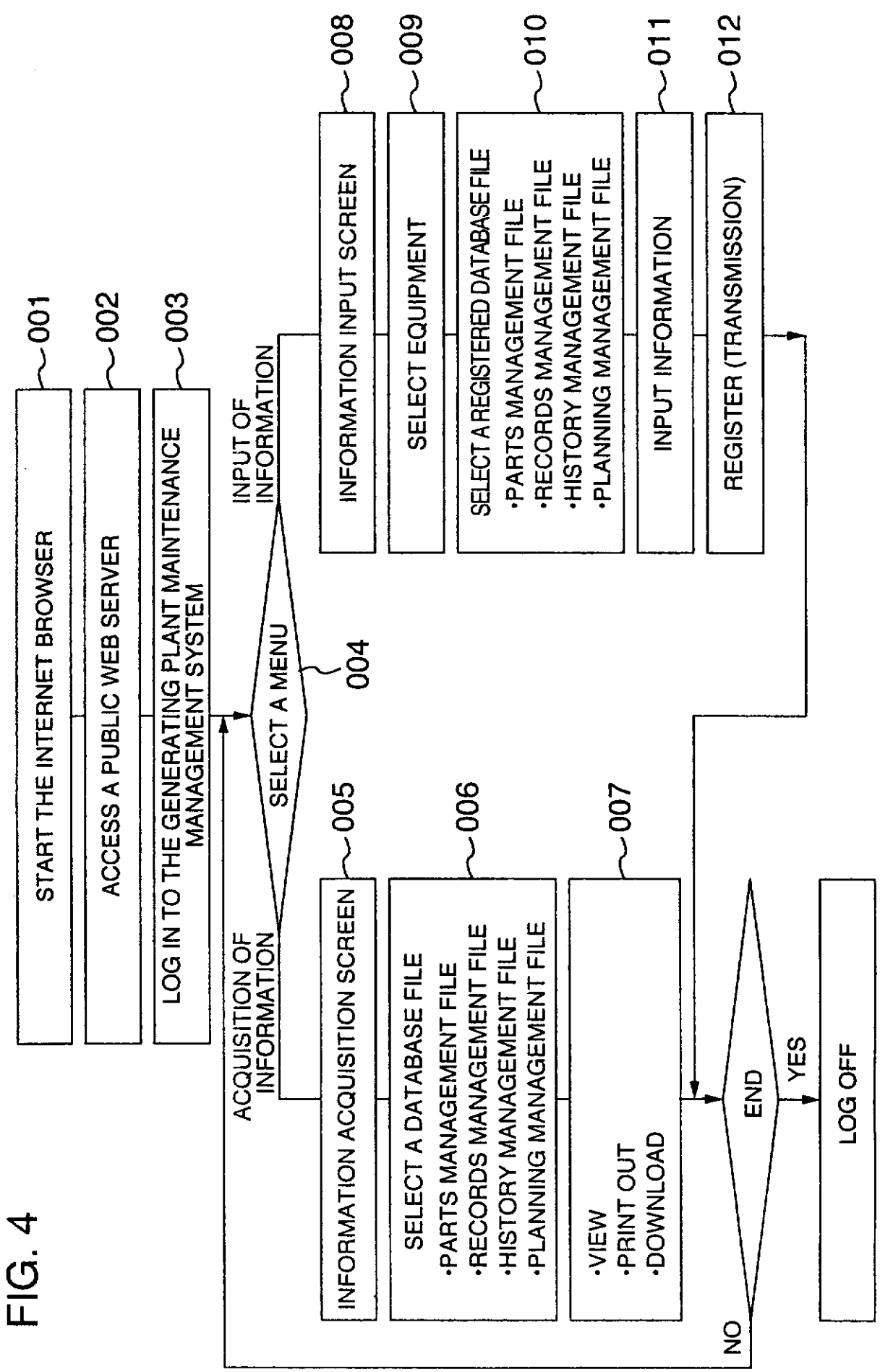

START THE INTERNET BROWSER
001
ACCESS A PUBLIC WEB SERVER
002
LOG IN TO THE GENERATING PLANT MAINTENANCE MANAGEMENT SYSTEM
003
INPUT OF INFORMATION
SELECT A MENU
004
INFORMATION INPUT SCREEN
008
SELECT EQUIPMENT
009
SELECT A REGISTERED DATABASE FILE
·PARTS MANAGEMENT FILE
·RECORDS MANAGEMENT FILE
·HISTORY MANAGEMENT FILE
·PLANNING MANAGEMENT FILE
010
INPUT INFORMATION
011
REGISTER (TRANSMISSION)
012
ACQUISITION OF INFORMATION
INFORMATION ACQUISITION SCREEN
005
SELECT A DATABASE FILE
·PARTS MANAGEMENT FILE
·RECORDS MANAGEMENT FILE
·HISTORY MANAGEMENT FILE
·PLANNING MANAGEMENT FILE
006
·VIEW
·PRINT OUT
·DOWNLOAD
007
END
YES
NO
LOG OFF

FIG. 5

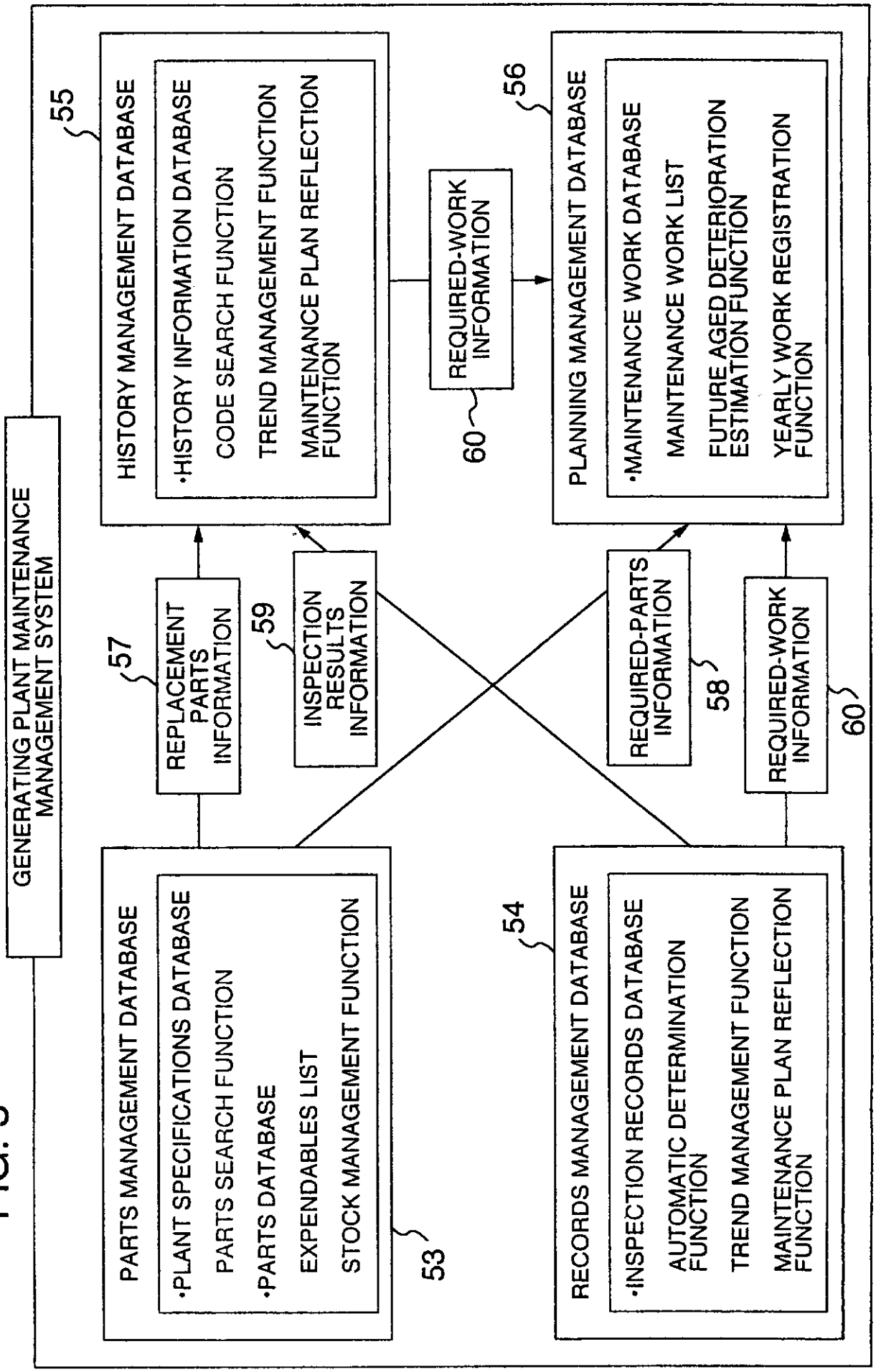

GENERATING PLANT MAINTENANCE MANAGEMENT SYSTEM
55
HISTORY MANAGEMENT DATABASE
•HISTORY INFORMATION DATABASE
CODE SEARCH FUNCTION
TREND MANAGEMENT FUNCTION
MAINTENANCE PLAN REFLECTION FUNCTION
56
PLANNING MANAGEMENT DATABASE
•MAINTENANCE WORK DATABASE
MAINTENANCE WORK LIST
FUTURE AGED DETERIORATION ESTIMATION FUNCTION
YEARLY WORK REGISTRATION FUNCTION
REQUIRED-WORK INFORMATION
60
57
REPLACEMENT PARTS INFORMATION
59
INSPECTION RESULTS INFORMATION
REQUIRED-PARTS INFORMATION
58
REQUIRED-WORK INFORMATION
60
PARTS MANAGEMENT DATABASE
•PLANT SPECIFICATIONS DATABASE
PARTS SEARCH FUNCTION
•PARTS DATABASE
EXPENDABLES LIST
STOCK MANAGEMENT FUNCTION
53
54
RECORDS MANAGEMENT DATABASE
•INSPECTION RECORDS DATABASE
AUTOMATIC DETERMINATION FUNCTION
TREND MANAGEMENT FUNCTION
MAINTENANCE PLAN REFLECTION FUNCTION

FIG. 6

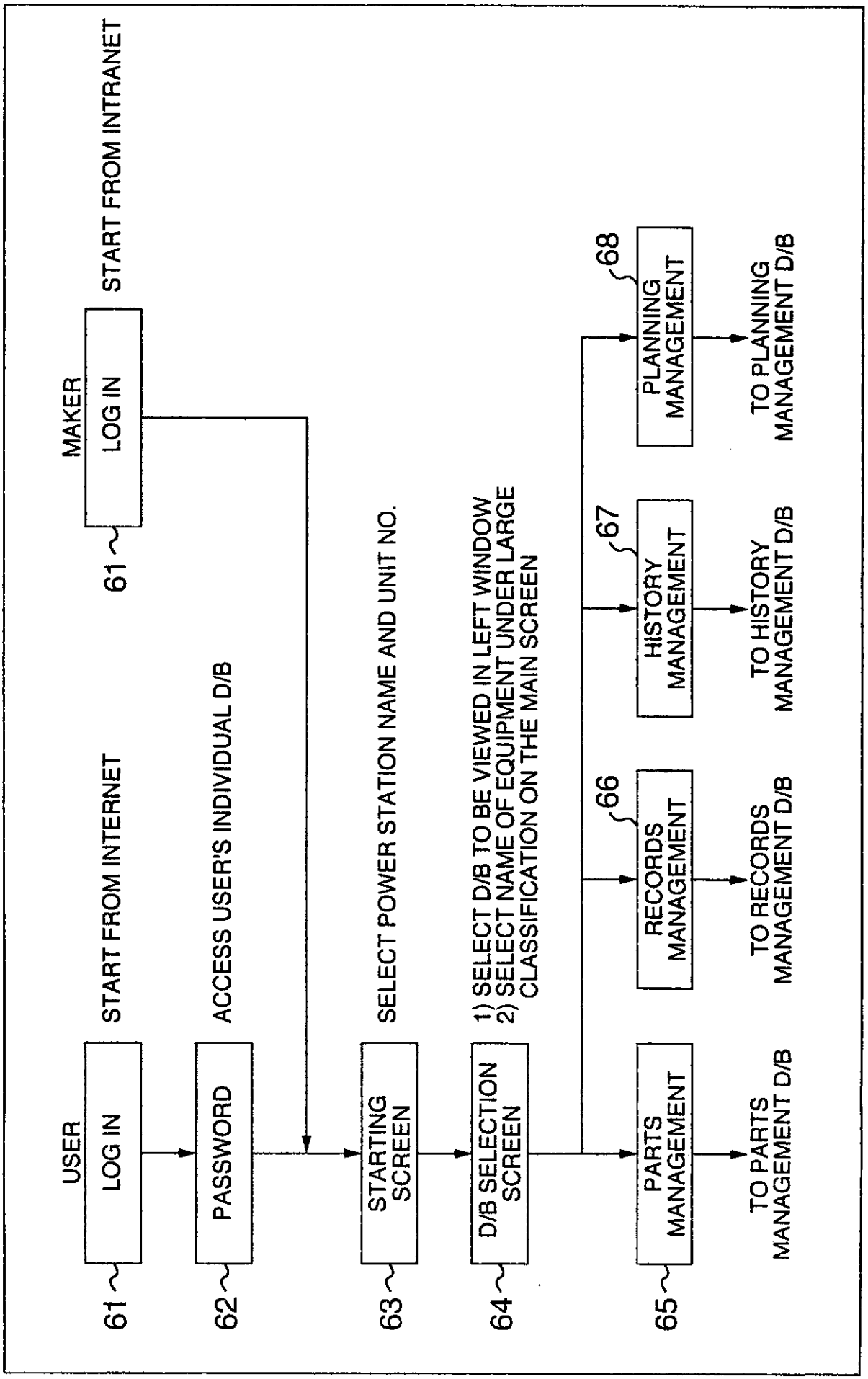

USER
LOG IN
61
START FROM INTERNET
PASSWORD
62
ACCESS USER'S INDIVIDUAL D/B
STARTING SCREEN
63
SELECT POWER STATION NAME AND UNIT NO.
D/B SELECTION SCREEN
64
1) SELECT D/B TO BE VIEWED IN LEFT WINDOW
2) SELECT NAME OF EQUIPMENT UNDER LARGE CLASSIFICATION ON THE MAIN SCREEN
PARTS MANAGEMENT
65
TO PARTS MANAGEMENT D/B
RECORDS MANAGEMENT
66
TO RECORDS MANAGEMENT D/B
HISTORY MANAGEMENT
67
TO HISTORY MANAGEMENT D/B
PLANNING MANAGEMENT
68
TO PLANNING MANAGEMENT D/B
MAKER
LOG IN
61
START FROM INTRANET

FIG. 7

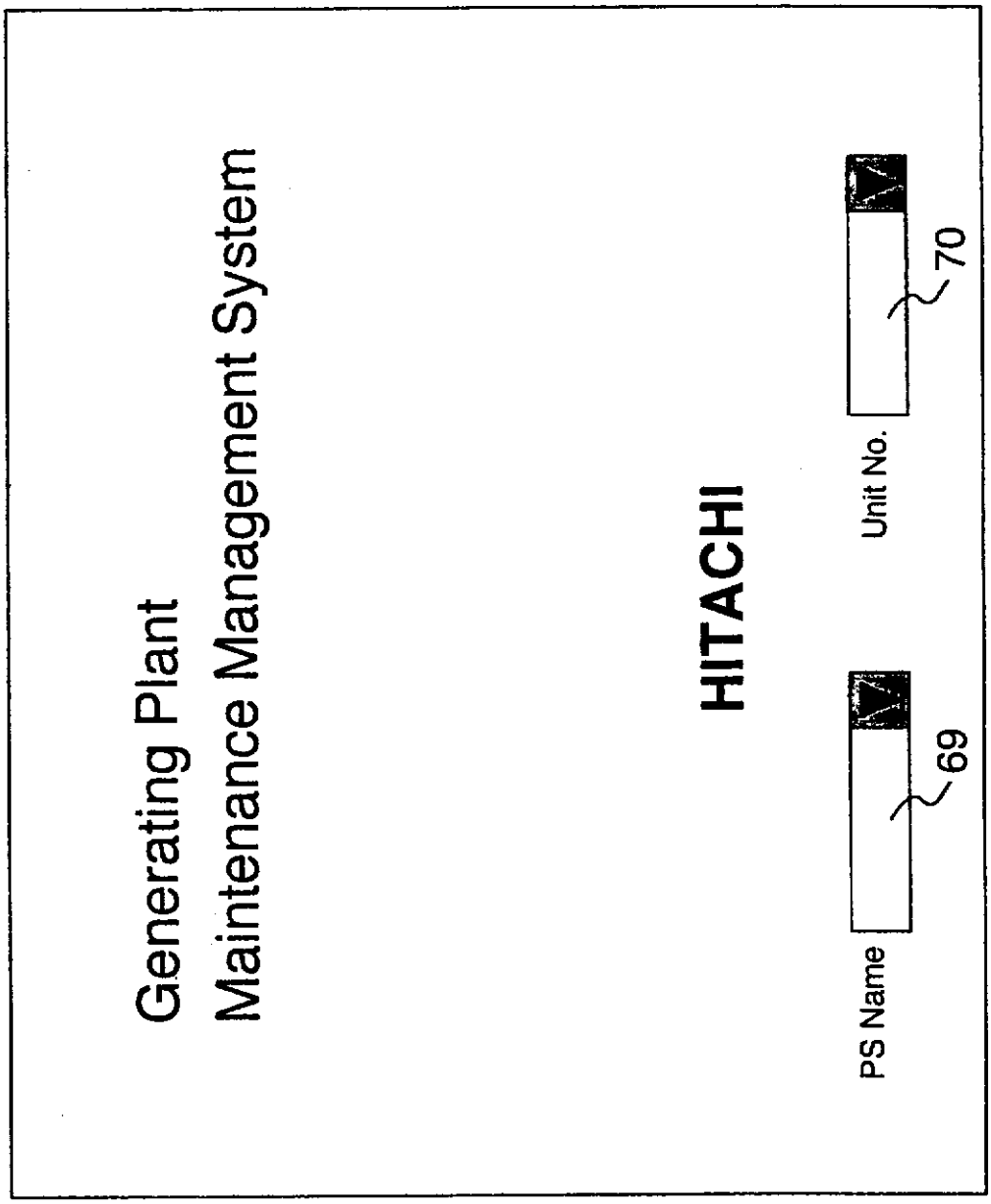

Generating Plant
Maintenance Management System
HITACHI
Unit No.
70
PS Name
69

FIG. 8

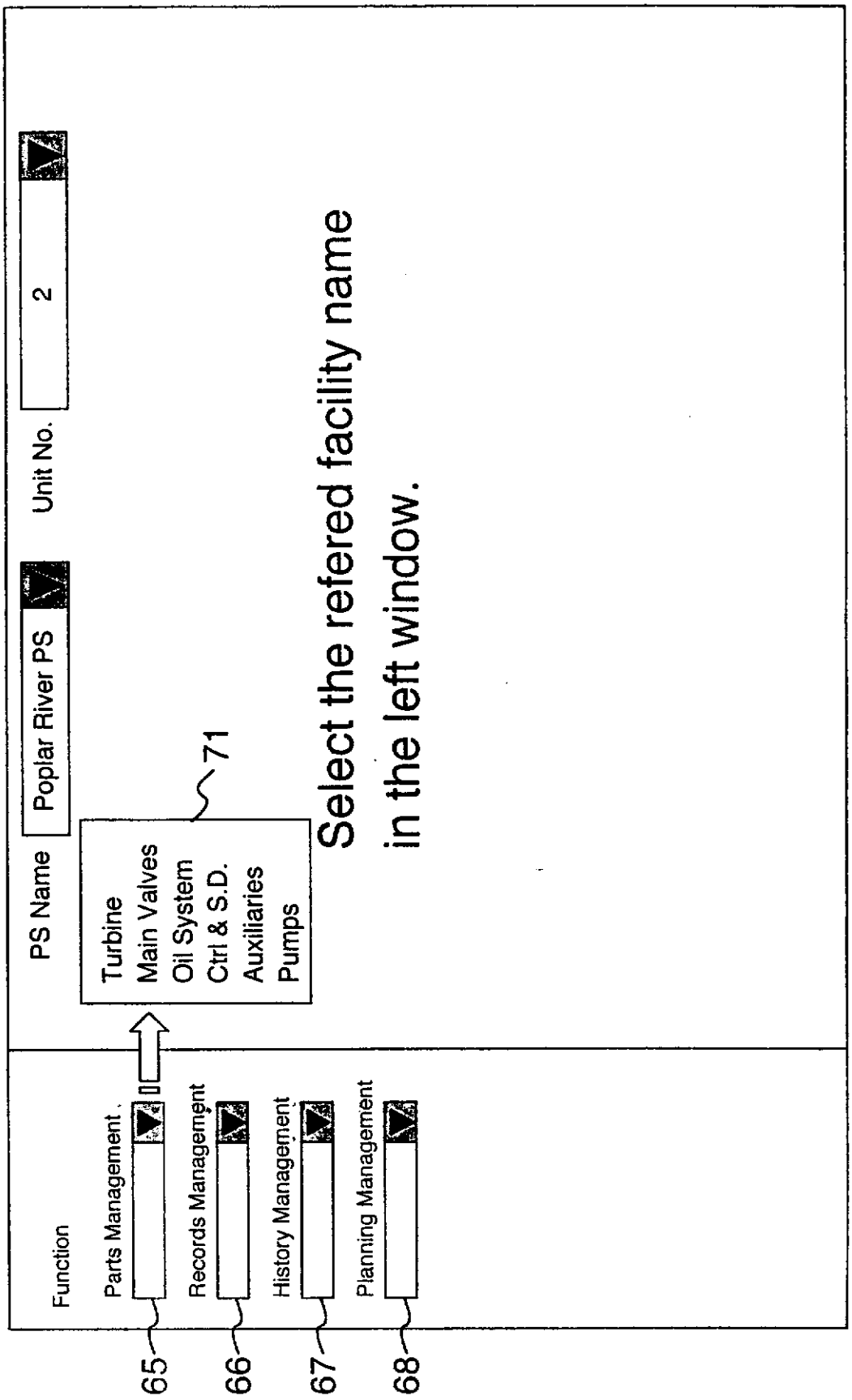

Function
Parts Management
Records Management
History Management
Planning Management
65
66
67
68
PS Name
Poplar River PS
Unit No.
2
Turbine
Main Valves
Oil System
Ctrl & S.D.
Auxiliaries
Pumps
71
Select the refered facility name
in the left window.

FIG. 9

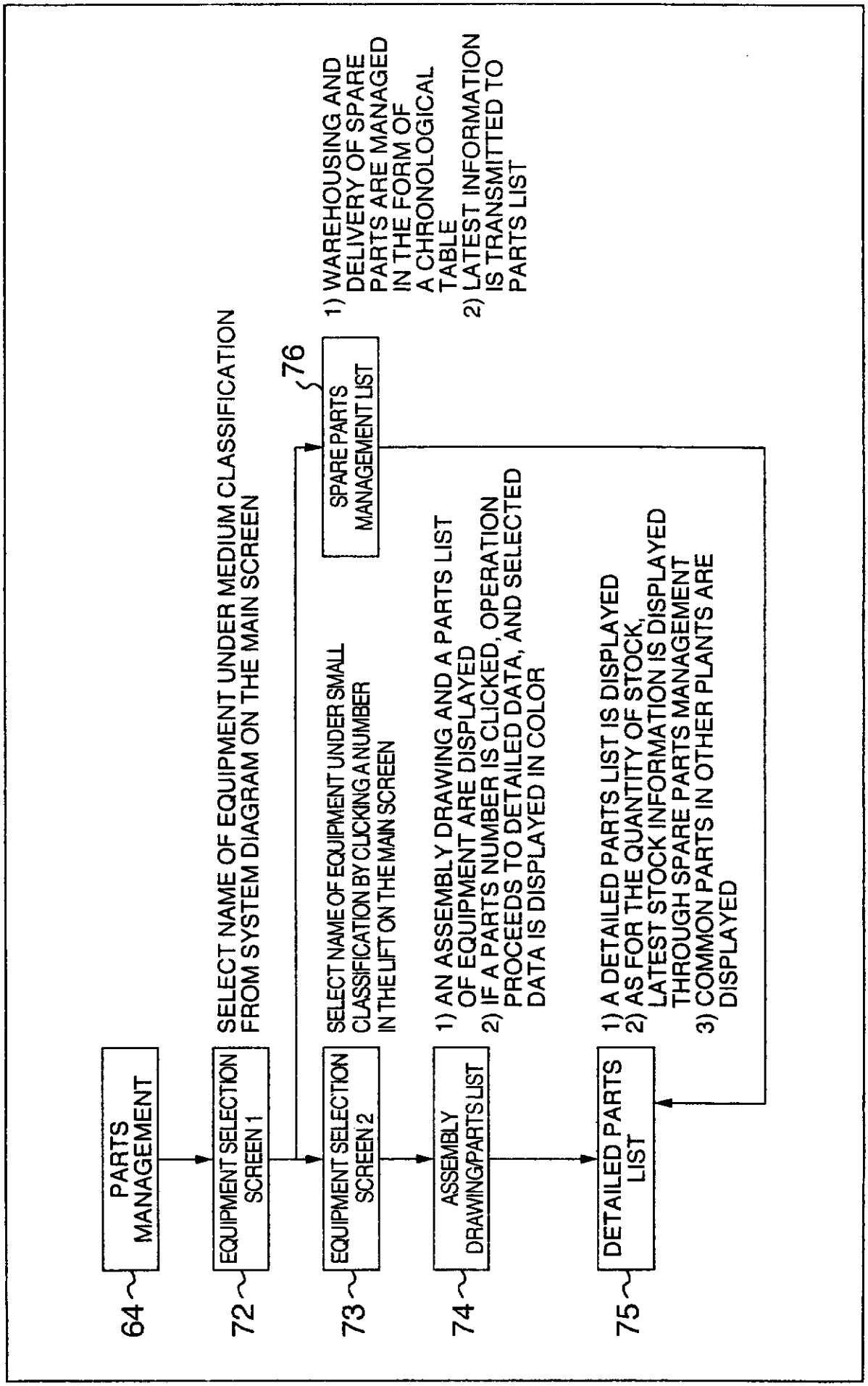

PARTS MANAGEMENT
64
EQUIPMENT SELECTION SCREEN 1
72
SELECT NAME OF EQUIPMENT UNDER MEDIUM CLASSIFICATION FROM SYSTEM DIAGRAM ON THE MAIN SCREEN
EQUIPMENT SELECTION SCREEN 2
73
SELECT NAME OF EQUIPMENT UNDER SMALL CLASSIFICATION BY CLICKING A NUMBER IN THE LIFT ON THE MAIN SCREEN
ASSEMBLY DRAWING/PARTS LIST
74
1) AN ASSEMBLY DRAWING AND A PARTS LIST OF EQUIPMENT ARE DISPLAYED
2) IF A PARTS NUMBER IS CLICKED, OPERATION PROCEEDS TO DETAILED DATA, AND SELECTED DATA IS DISPLAYED IN COLOR
DETAILED PARTS LIST
75
1) A DETAILED PARTS LIST IS DISPLAYED
2) AS FOR THE QUANTITY OF STOCK, LATEST STOCK INFORMATION IS DISPLAYED THROUGH SPARE PARTS MANAGEMENT
3) COMMON PARTS IN OTHER PLANTS ARE DISPLAYED
SPARE PARTS MANAGEMENT LIST
76
1) WAREHOUSING AND DELIVERY OF SPARE PARTS ARE MANAGED IN THE FORM OF A CHRONOLOGICAL TABLE
2) LATEST INFORMATION IS TRANSMITTED TO PARTS LIST

FIG. 10

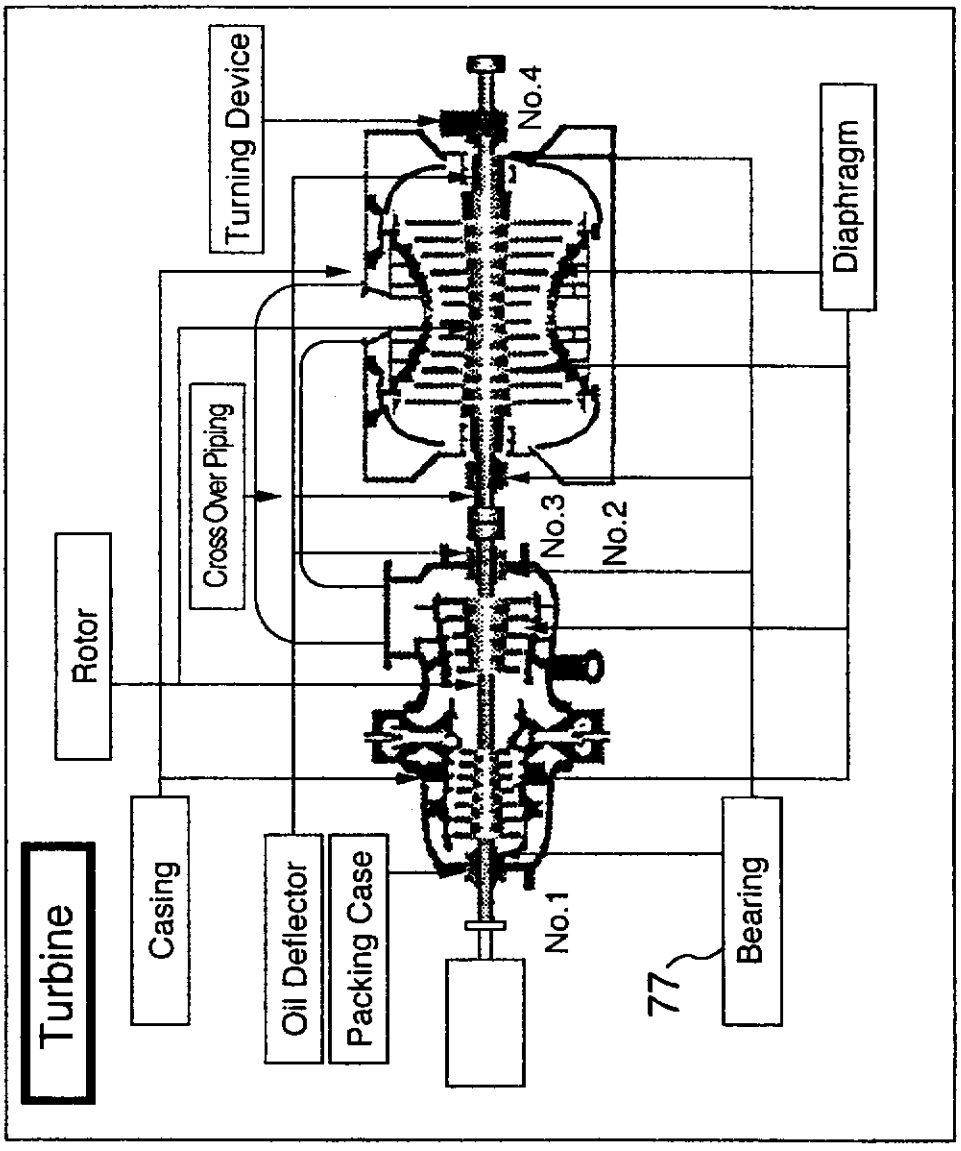

Turbine
Casing
Rotor
Cross Over Piping
Turning Device
Oil Deflector
Packing Case
No.1
No.2
No.3
No.4
77
Bearing
Diaphragm

FIG. 11

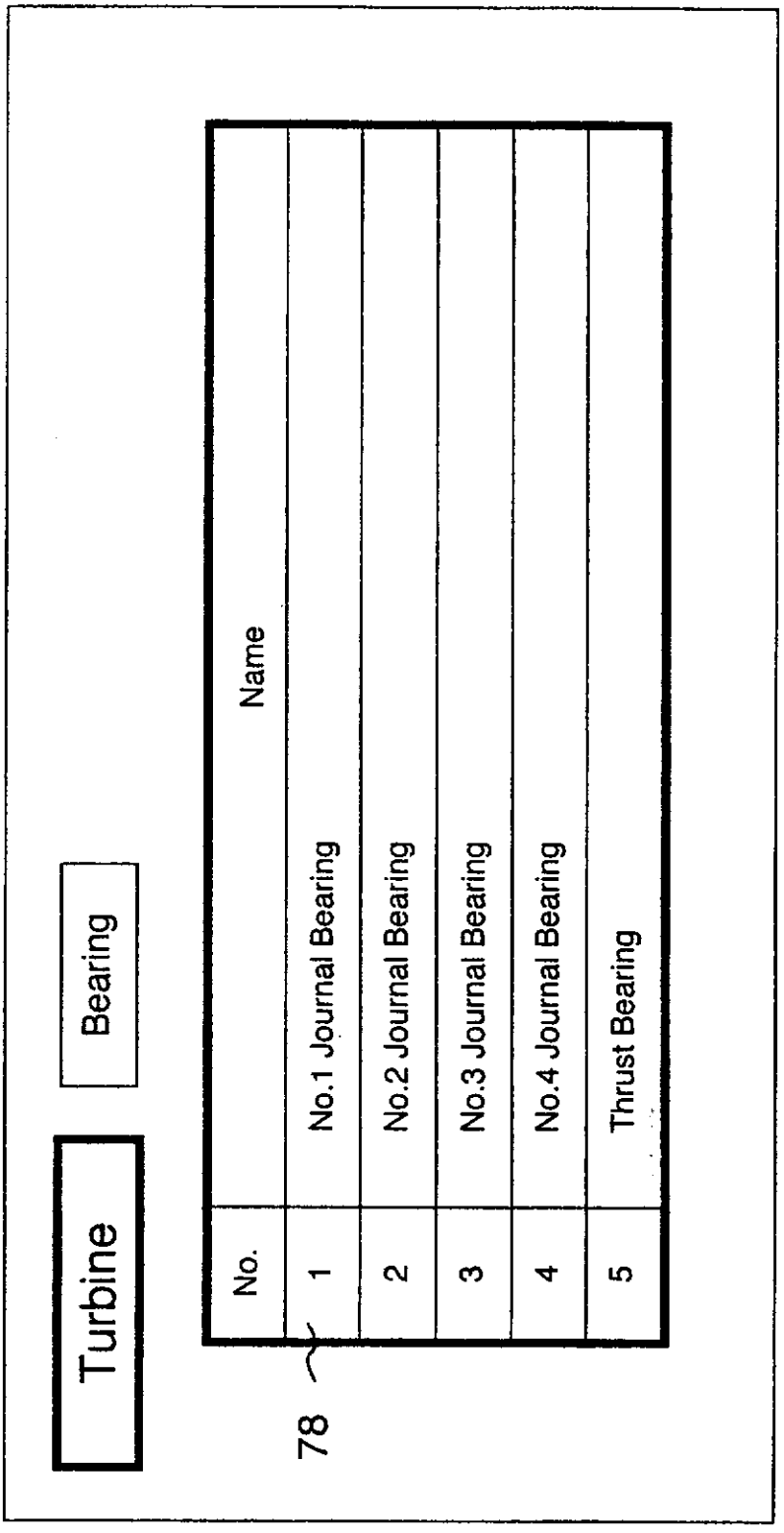
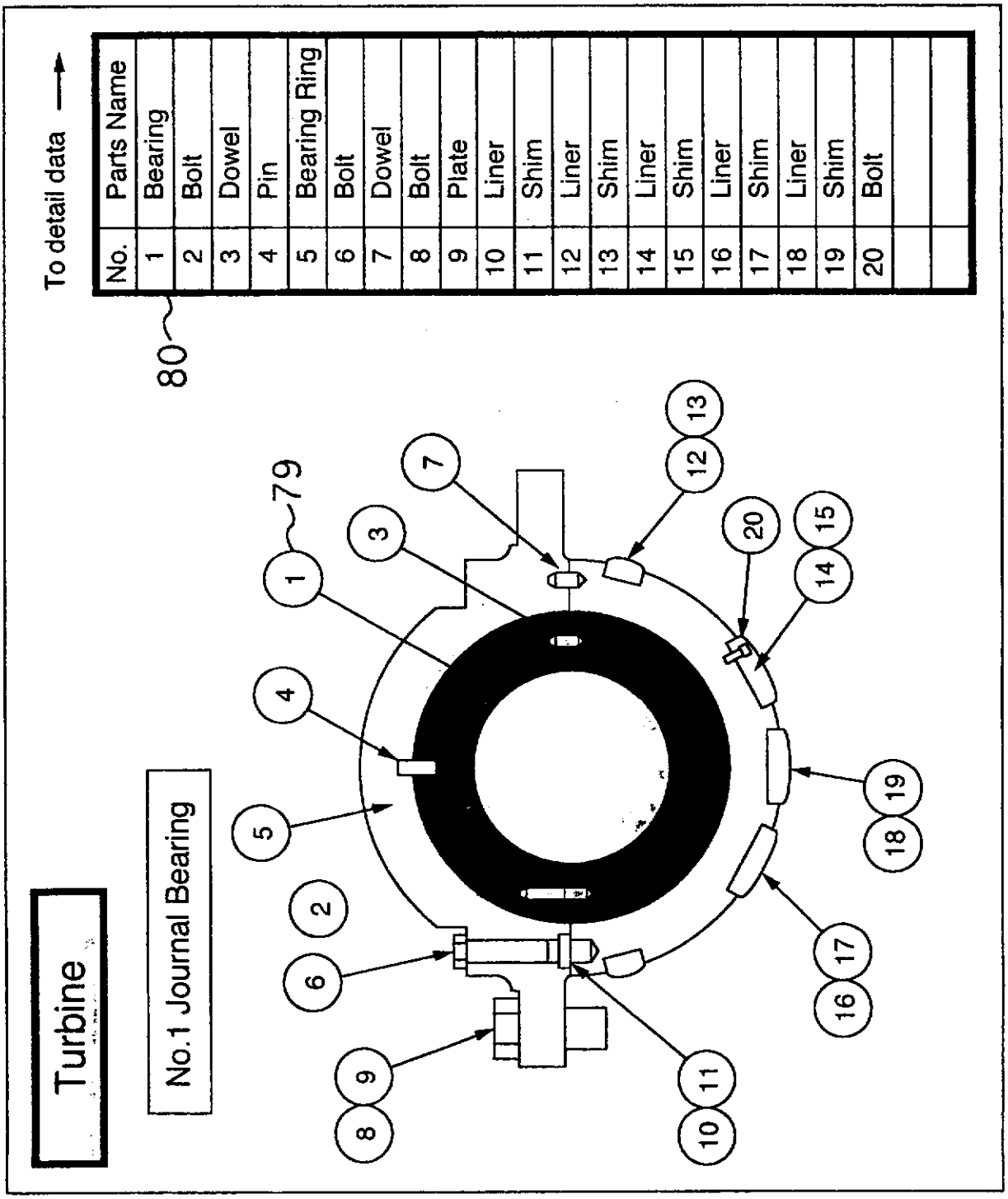
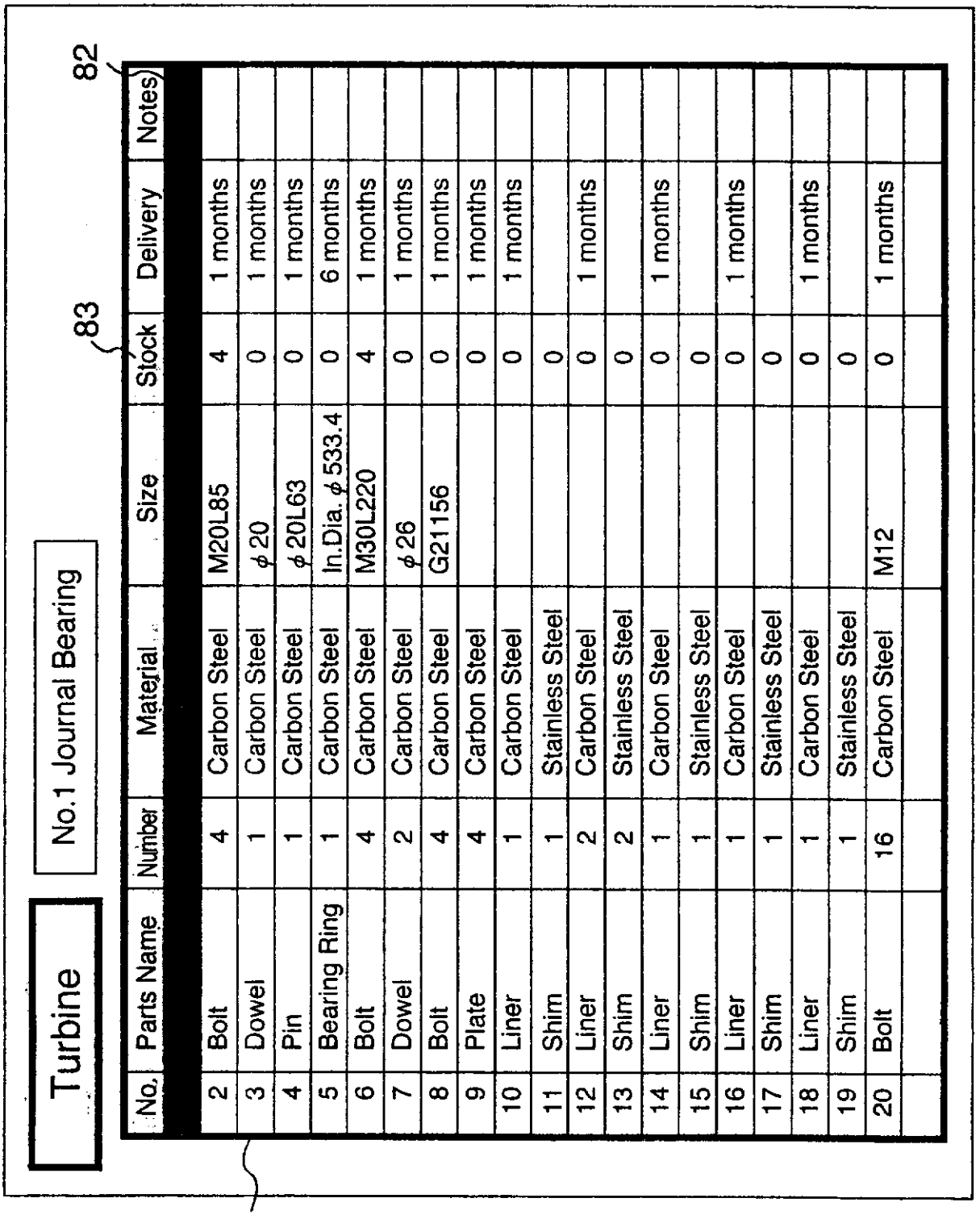

Turbine
Bearing
78
No.
Name
1
No.1 Journal Bearing
2
No.2 Journal Bearing
3
No.3 Journal Bearing
4
No.4 Journal Bearing
5
Thrust Bearing

FIG. 12



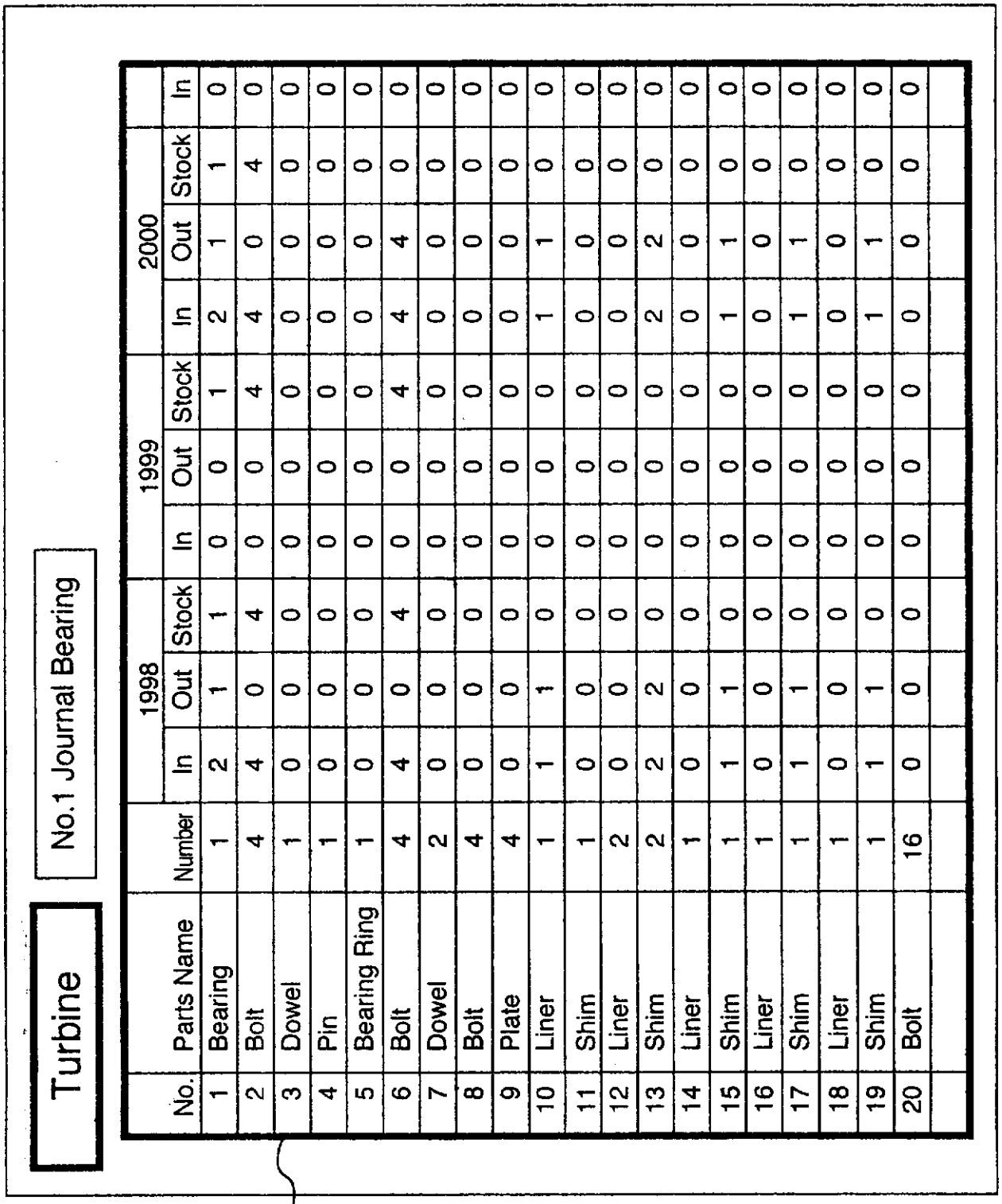
No.	Parts Name
1	Bearing
2	Bolt
3	Dowel
4	Pin
5	Bearing Ring
6	Bolt
7	Dowel
8	Bolt
9	Plate
10	Liner
11	Shim
12	Liner
13	Shim
14	Liner
15	Shim
16	Liner
17	Shim
18	Liner
19	Shim
20	Bolt

FIG. 13



No.	Parts Name	Number	Material	Size	Stock	Delivery	Notes
2	Bolt	4	Carbon Steel	M20L85	4	1 months	
3	Dowel	1	Carbon Steel	ϕ 20	0	1 months	
4	Pin	1	Carbon Steel	ϕ 20L63	0	1 months	
5	Bearing Ring	1	Carbon Steel	In.Dia. ϕ 533.4	0	6 months	
6	Bolt	4	Carbon Steel	M30L220	4	1 months	
7	Dowel	2	Carbon Steel	ϕ 26	0	1 months	
8	Bolt	4	Carbon Steel	G21156	0	1 months	
9	Plate	4	Carbon Steel		0	1 months	
10	Liner	1	Carbon Steel		0	1 months	
11	Shim	1	Stainless Steel		0		
12	Liner	2	Carbon Steel		0	1 months	
13	Shim	2	Stainless Steel		0		
14	Liner	1	Carbon Steel		0	1 months	
15	Shim	1	Stainless Steel		0		
16	Liner	1	Carbon Steel		0	1 months	
17	Shim	1	Stainless Steel		0		
18	Liner	1	Carbon Steel		0	1 months	
19	Shim	1	Stainless Steel		0		
20	Bolt	16	Carbon Steel	M12	0	1 months	

FIG. 14



No.	Parts Name	Number	1998			1999			2000			
			In	Out	Stock	In	Out	Stock	In	Out	Stock	In
1	Bearing	1	2	1	1	0	0	1	2	1	1	0
2	Bolt	4	4	0	4	0	0	4	4	0	4	0
3	Dowel	1	0	0	0	0	0	0	0	0	0	0
4	Pin	1	0	0	0	0	0	0	0	0	0	0
5	Bearing Ring	1	0	0	0	0	0	0	0	0	0	0
6	Bolt	4	4	0	4	0	0	4	4	4	0	0
7	Dowel	2	0	0	0	0	0	0	0	0	0	0
8	Bolt	4	0	0	0	0	0	0	0	0	0	0
9	Plate	4	0	0	0	0	0	0	0	0	0	0
10	Liner	1	1	1	0	0	0	0	1	1	0	0
11	Shim	1	0	0	0	0	0	0	0	0	0	0
12	Liner	2	0	0	0	0	0	0	0	0	0	0
13	Shim	2	2	2	0	0	0	0	2	2	0	0
14	Liner	1	0	0	0	0	0	0	0	0	0	0
15	Shim	1	1	1	0	0	0	0	1	1	0	0
16	Liner	1	0	0	0	0	0	0	0	0	0	0
17	Shim	1	1	1	0	0	0	0	1	1	0	0
18	Liner	1	0	0	0	0	0	0	0	0	0	0
19	Shim	1	1	1	0	0	0	0	1	1	0	0
20	Bolt	16	0	0	0	0	0	0	0	0	0	0

FIG. 15

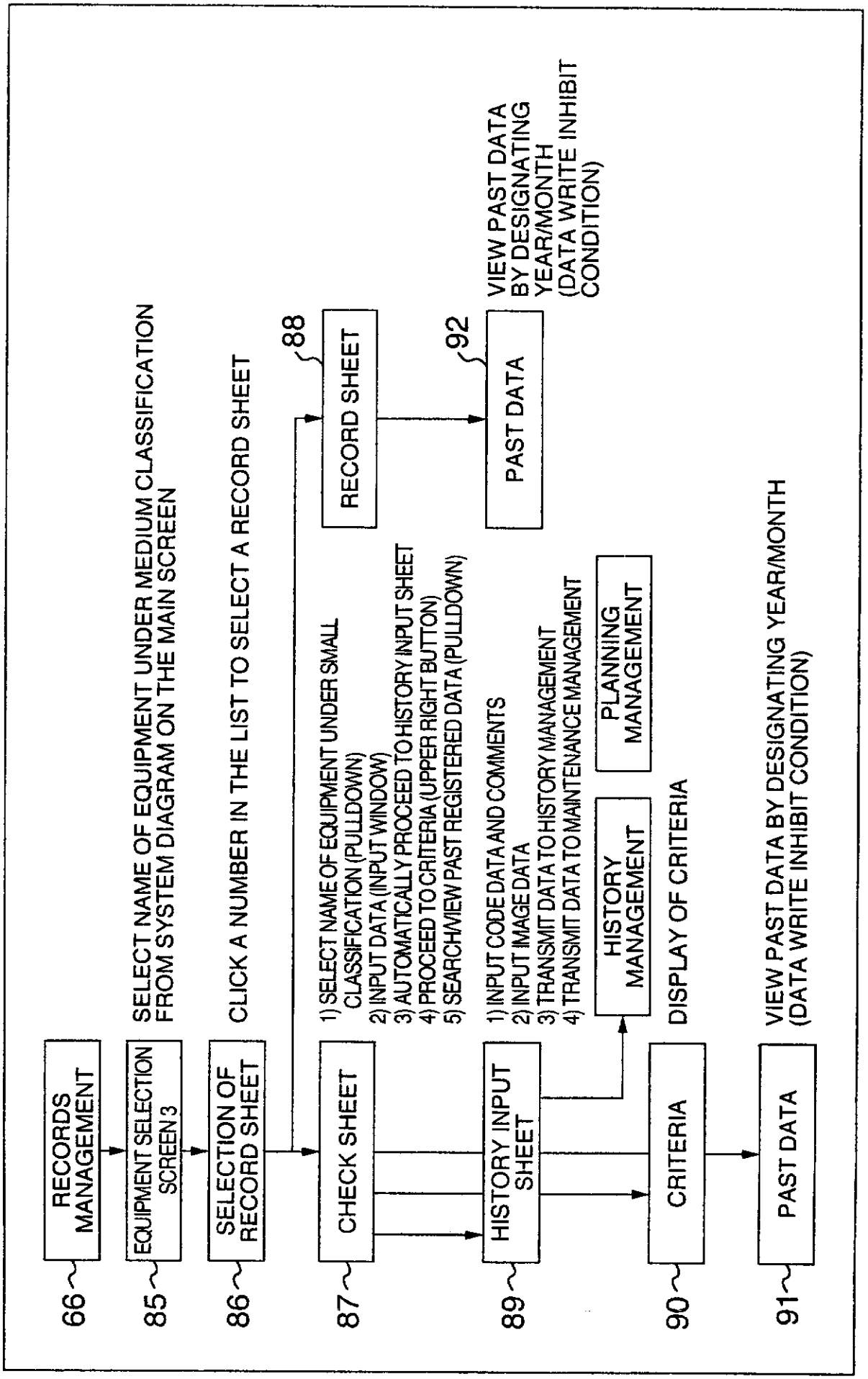

RECORDS MANAGEMENT
66
EQUIPMENT SELECTION SCREEN 3
85
SELECT NAME OF EQUIPMENT UNDER MEDIUM CLASSIFICATION FROM SYSTEM DIAGRAM ON THE MAIN SCREEN
SELECTION OF RECORD SHEET
86
CLICK A NUMBER IN THE LIST TO SELECT A RECORD SHEET
CHECK SHEET
87
1) SELECT NAME OF EQUIPMENT UNDER SMALL CLASSIFICATION (PULLDOWN)
2) INPUT DATA (INPUT WINDOW)
3) AUTOMATICALLY PROCEED TO HISTORY INPUT SHEET
4) PROCEED TO CRITERIA (UPPER RIGHT BUTTON)
5) SEARCH/VIEW PAST REGISTERED DATA (PULLDOWN)
88
RECORD SHEET
92
PAST DATA
VIEW PAST DATA BY DESIGNATING YEAR/MONTH (DATA WRITE INHIBIT CONDITION)
HISTORY INPUT SHEET
89
1) INPUT CODE DATA AND COMMENTS
2) INPUT IMAGE DATA
3) TRANSMIT DATA TO HISTORY MANAGEMENT
4) TRANSMIT DATA TO MAINTENANCE MANAGEMENT
HISTORY MANAGEMENT
PLANNING MANAGEMENT
CRITERIA
90
DISPLAY OF CRITERIA
PAST DATA
91
VIEW PAST DATA BY DESIGNATING YEAR/MONTH (DATA WRITE INHIBIT CONDITION)

FIG. 16

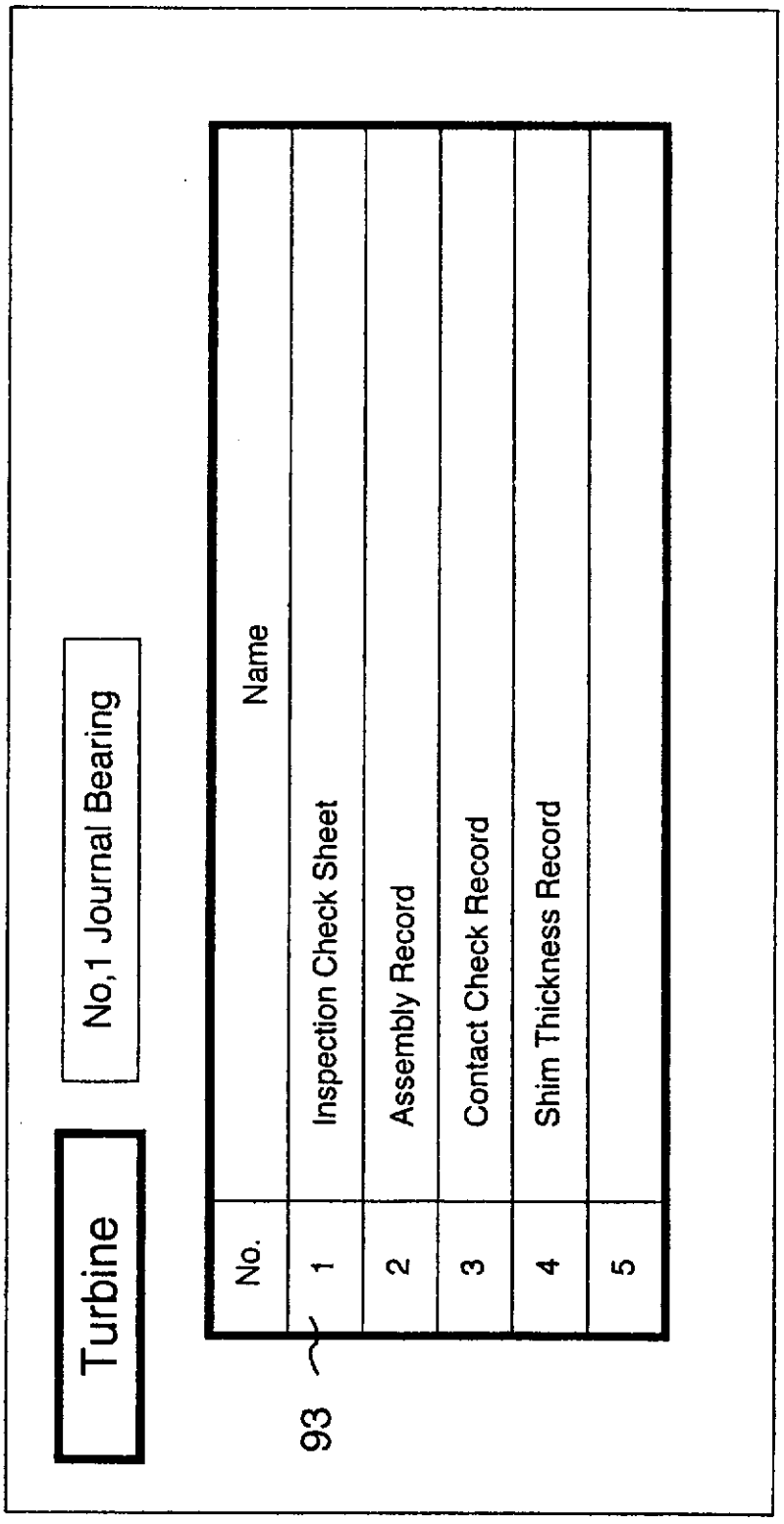

Turbine
No,1 Journal Bearing
No.
Name
1
Inspection Check Sheet
2
Assembly Record
3
Contact Check Record
4
Shim Thickness Record
5
93

FIG. 17

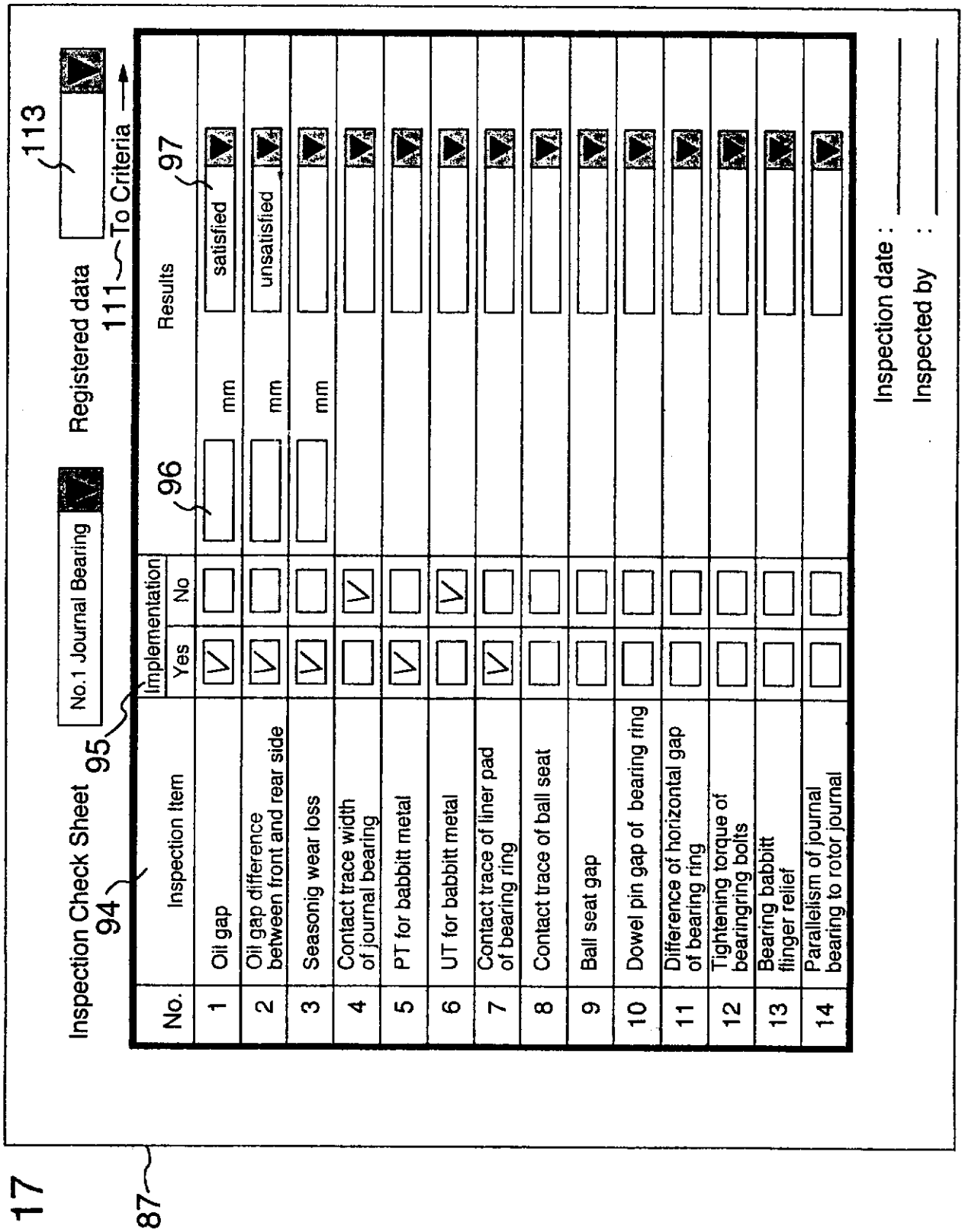

87
Inspection Check Sheet
94
95
No.1 Journal Bearing
Registered data
111
To Criteria
113
No.
Inspection Item
Implementation
Yes
No
96
Results
97
1 Oil gap
mm
satisfied
2 Oil gap difference between front and rear side
mm
unsatisfied
3 Seasonig wear loss
mm
4 Contact trace width of journal bearing
5 PT for babbitt metal
6 UT for babbitt metal
7 Contact trace of liner pad of bearing ring
8 Contact trace of ball seat
9 Ball seat gap
10 Dowel pin gap of bearing ring
11 Difference of horizontal gap of bearing ring
12 Tightening torque of bearingring bolts
13 Bearing babbitt flinger relief
14 Parallelism of journal bearing to rotor journal
Inspection date :
Inspected by :

FIG. 18

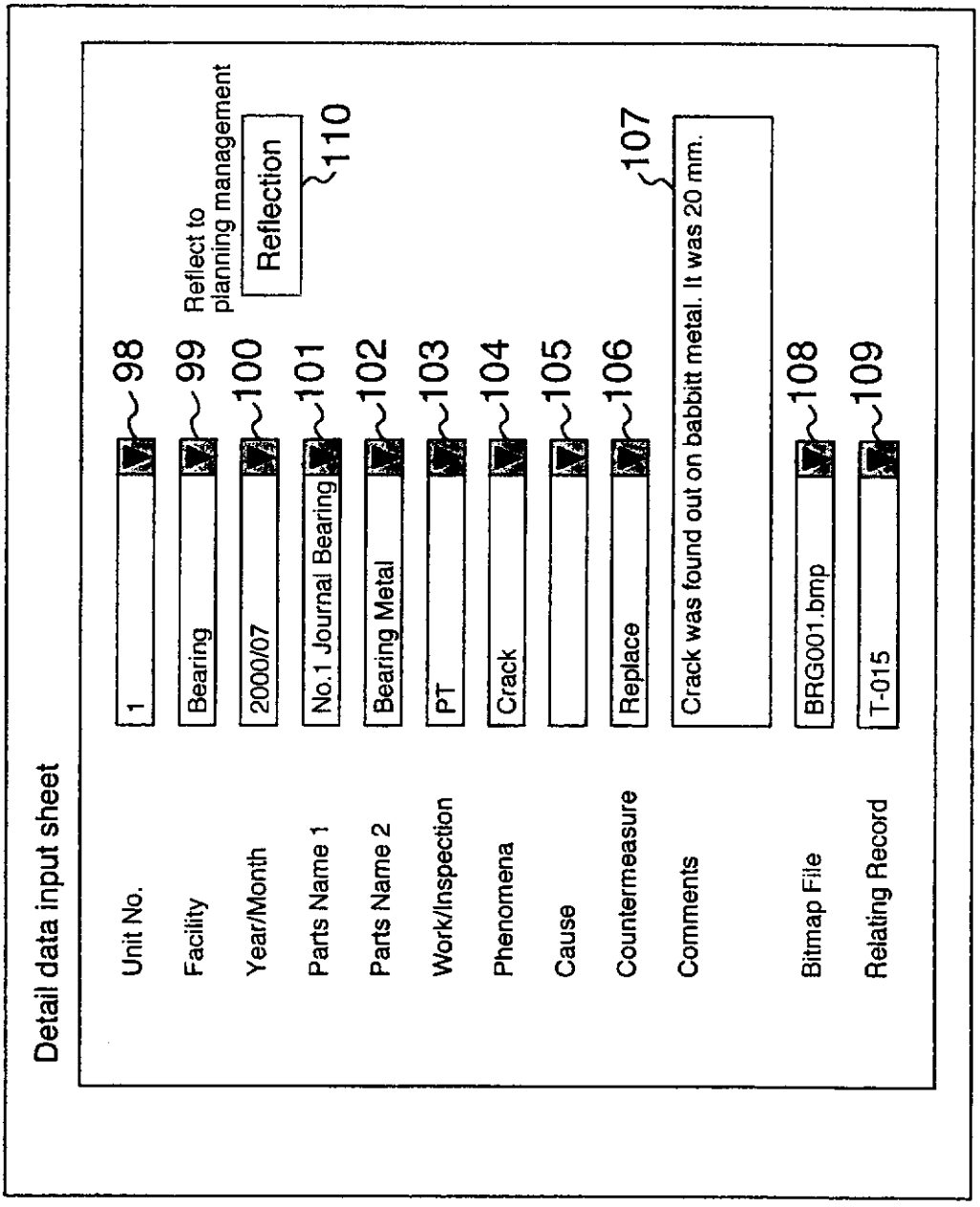

Detail data input sheet
Unit No.
1
98
Facility
Bearing
99
Reflect to planning management
Year/Month
2000/07
100
Reflection
110
Parts Name 1
No.1 Journal Bearing
101
Parts Name 2
Bearing Metal
102
Work/Inspection
PT
103
Phenomena
Crack
104
Cause
105
Countermeasure
Replace
106
Comments
Crack was found out on babbitt metal. It was 20 mm.
107
Bitmap File
BRG001.bmp
108
Relating Record
T-015
109

FIG. 19

No.1 Journal Bearing Inspection Check Sheet

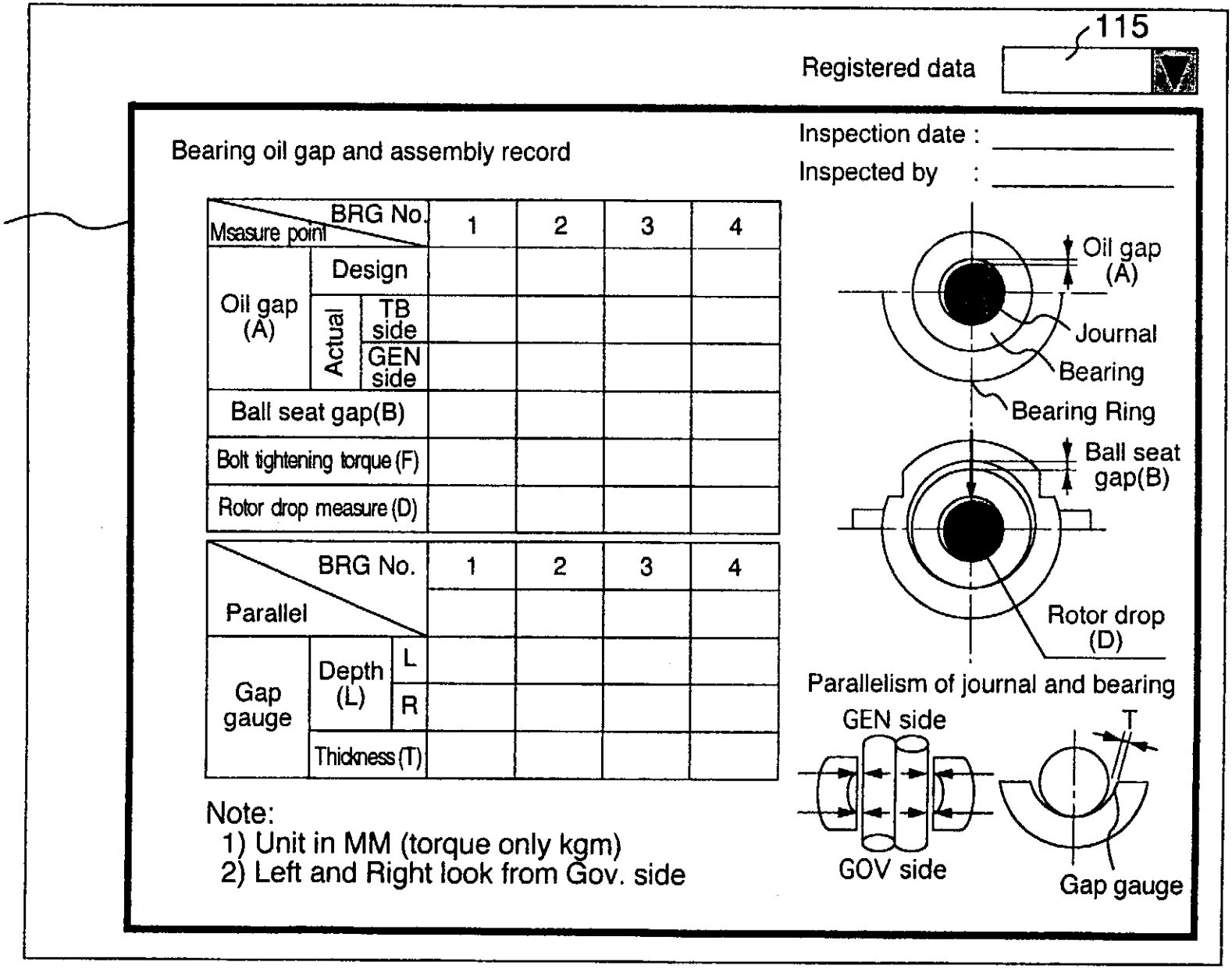
To Check Sheet →

112

No.	Inspection Item	Results
1	Oil gap	Design 0.0013D to 0.0013D+0.1mm Allowance Max. 0.002D(D:Journal Diameter)
2	Oil gap difference between front and rear side	Allowance 0.0002L mm L:Effective bearing width
3	Seasonig wear loss	Allowance Initial gap + 0.08mm
4	Contact trace width of journal bearing	The average value of contact trace width of front, center, rear saide of journal bearing shall be 0.3D to 0.5D.
5	PT for babbitt metal	Periphery direction : Less than 1/3 of a half periphery length Axial direction : Less than 1/4 of total length
6	UT for babbitt metal	Over laying : Unbonded area is less than or equal to 20% or 25x25 Replace : Unbonded area is more than 20%
7	Contact trace of liner pad of bearing ring	Allowance More than 95% at 45° from bottom center line and 80 % to slight contact trace at side liner pads.
8	Contact trace of ball seat	
9	Ball seat gap	
10	Dowel pin gap of bearing ring	
11	Difference of horizontal gap of bearing ring	
12	Tightening torque of bearingring bolts	
13	Bearing babbitt flinger relief	
14	Parallelism of journal bearing to rotor journal	

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FIG. 20



Msasure point \ BRG No.			1	2	3	4
Oil gap (A)	Design					
	Actual	TB side				
		GEN side				
Ball seat gap(B)						
Bolt tightening torque (F)						
Rotor drop measure (D)						

Parallel \ BRG No.			1	2	3	4
Gap gauge	Depth (L)	L				
		R				
	Thickness (T)					

FIG. 21

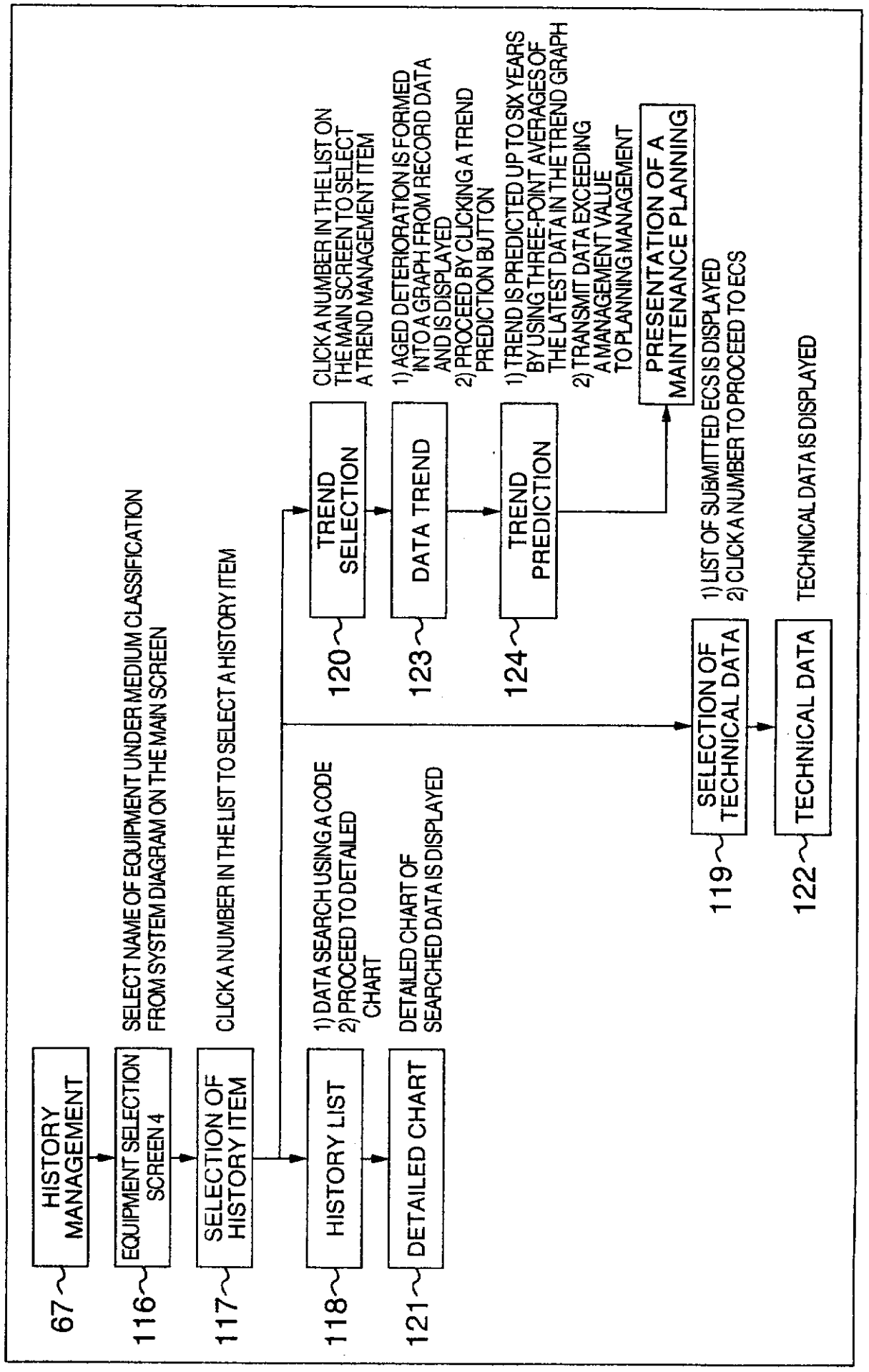

HISTORY MANAGEMENT
67
SELECT NAME OF EQUIPMENT UNDER MEDIUM CLASSIFICATION FROM SYSTEM DIAGRAM ON THE MAIN SCREEN
EQUIPMENT SELECTION SCREEN 4
116
CLICK A NUMBER IN THE LIST TO SELECT A HISTORY ITEM
SELECTION OF HISTORY ITEM
117
1) DATA SEARCH USING A CODE
2) PROCEED TO DETAILED CHART
HISTORY LIST
118
DETAILED CHART OF SEARCHED DATA IS DISPLAYED
DETAILED CHART
121
CLICK A NUMBER IN THE LIST ON THE MAIN SCREEN TO SELECT A TREND MANAGEMENT ITEM
TREND SELECTION
120
1) AGED DETERIORATION IS FORMED INTO A GRAPH FROM RECORD DATA AND IS DISPLAYED
2) PROCEED BY CLICKING A TREND PREDICTION BUTTON
DATA TREND
123
1) TREND IS PREDICTED UP TO SIX YEARS BY USING THREE-POINT AVERAGES OF THE LATEST DATA IN THE TREND GRAPH
2) TRANSMIT DATA EXCEEDING A MANAGEMENT VALUE TO PLANNING MANAGEMENT
TREND PREDICTION
124
PRESENTATION OF A MAINTENANCE PLANNING
1) LIST OF SUBMITTED ECS IS DISPLAYED
2) CLICK A NUMBER TO PROCEED TO ECS
SELECTION OF TECHNICAL DATA
119
TECHNICAL DATA IS DISPLAYED
TECHNICAL DATA
122

FIG. 22

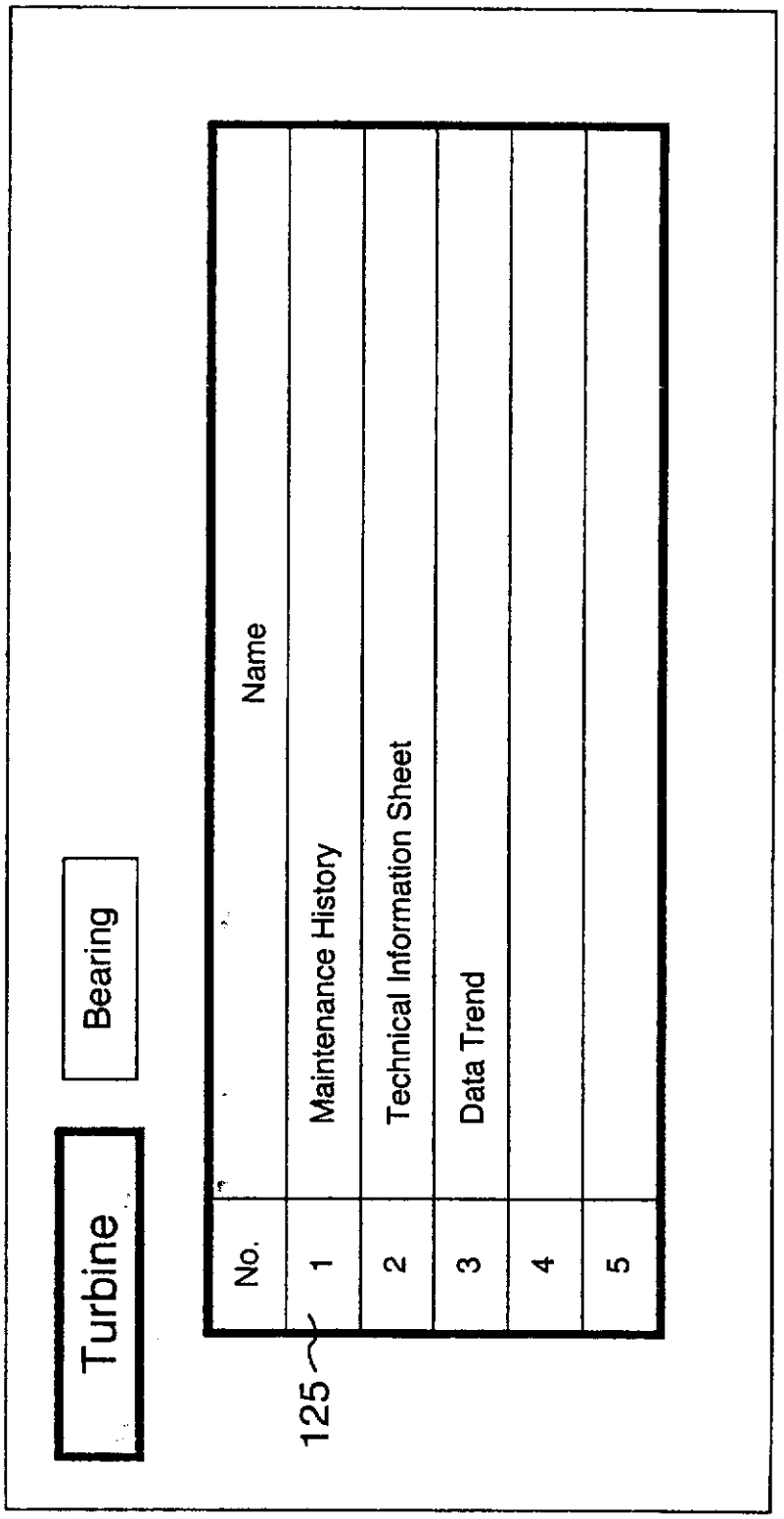

Turbine
Bearing
No.
Name
1
Maintenance History
2
Technical Information Sheet
3
Data Trend
4
5
125

FIG. 23

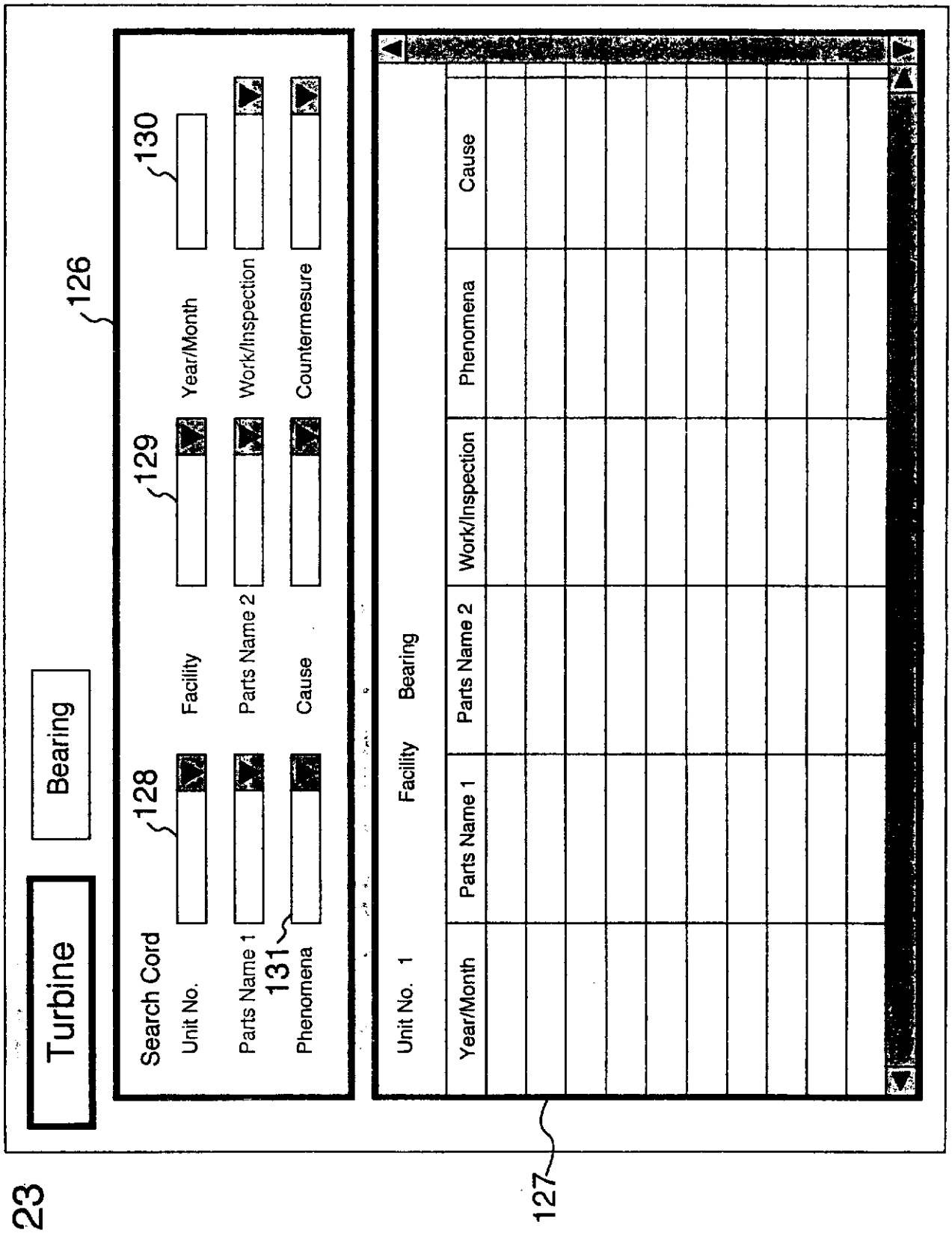

Turbine
Bearing
126
Search Cord
128
Unit No.
Facility
129
Year/Month
130
Parts Name 1
Parts Name 2
Work/Inspection
131
Phenomena
Cause
Countermesure
Unit No. 1
Facility
Bearing
Year/Month
Parts Name 1
Parts Name 2
Work/Inspection
Phenomena
Cause
127

FIG. 24

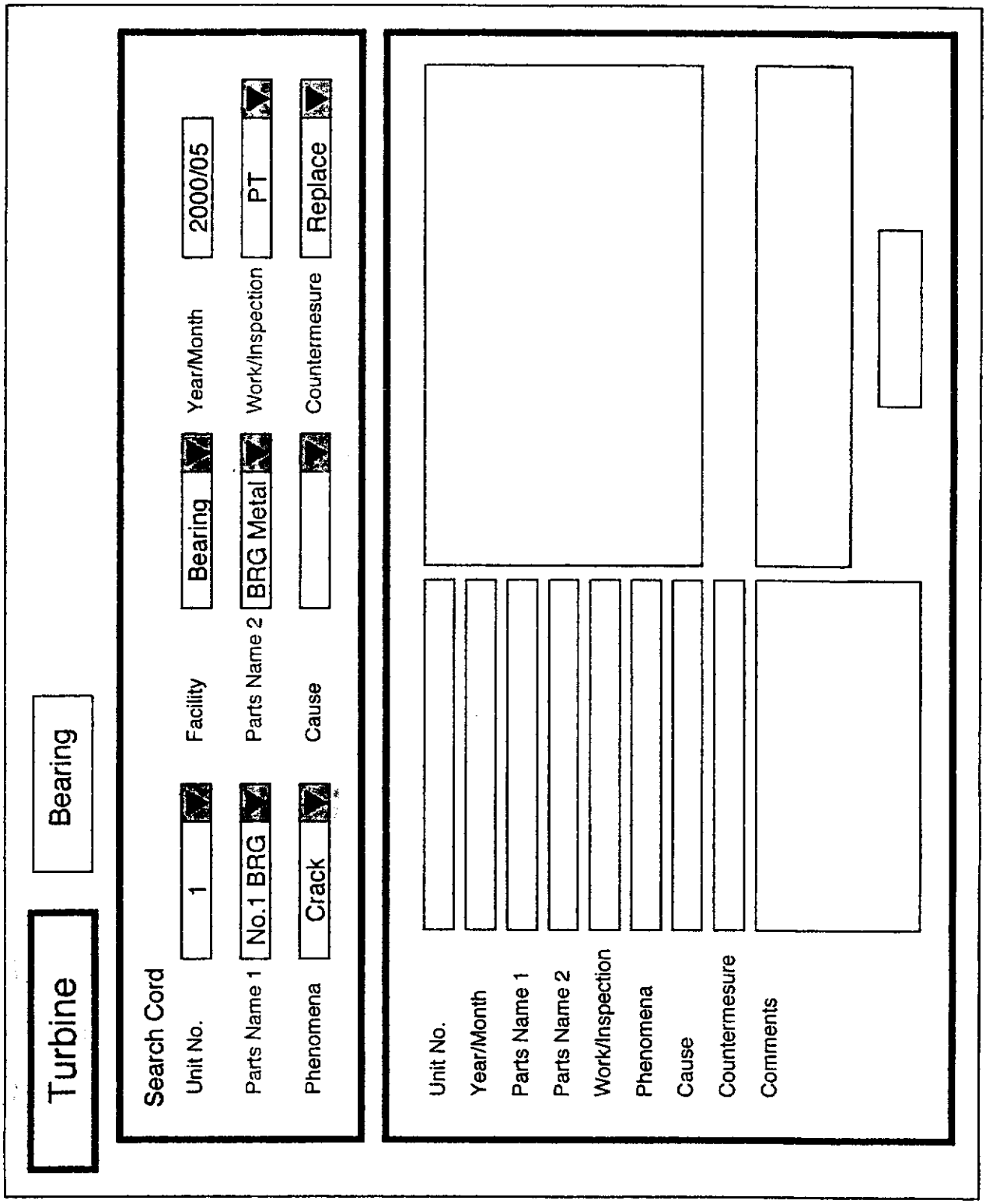

Turbine
Bearing
Search Cord
Unit No.
1
Facility
Bearing
Year/Month
2000/05
Parts Name 1
No.1 BRG
Parts Name 2
BRG Metal
Work/Inspection
PT
Phenomena
Crack
Cause
Countermesure
Replace
Unit No.
Year/Month
Parts Name 1
Parts Name 2
Work/Inspection
Phenomena
Cause
Countermesure
Comments

FIG. 25

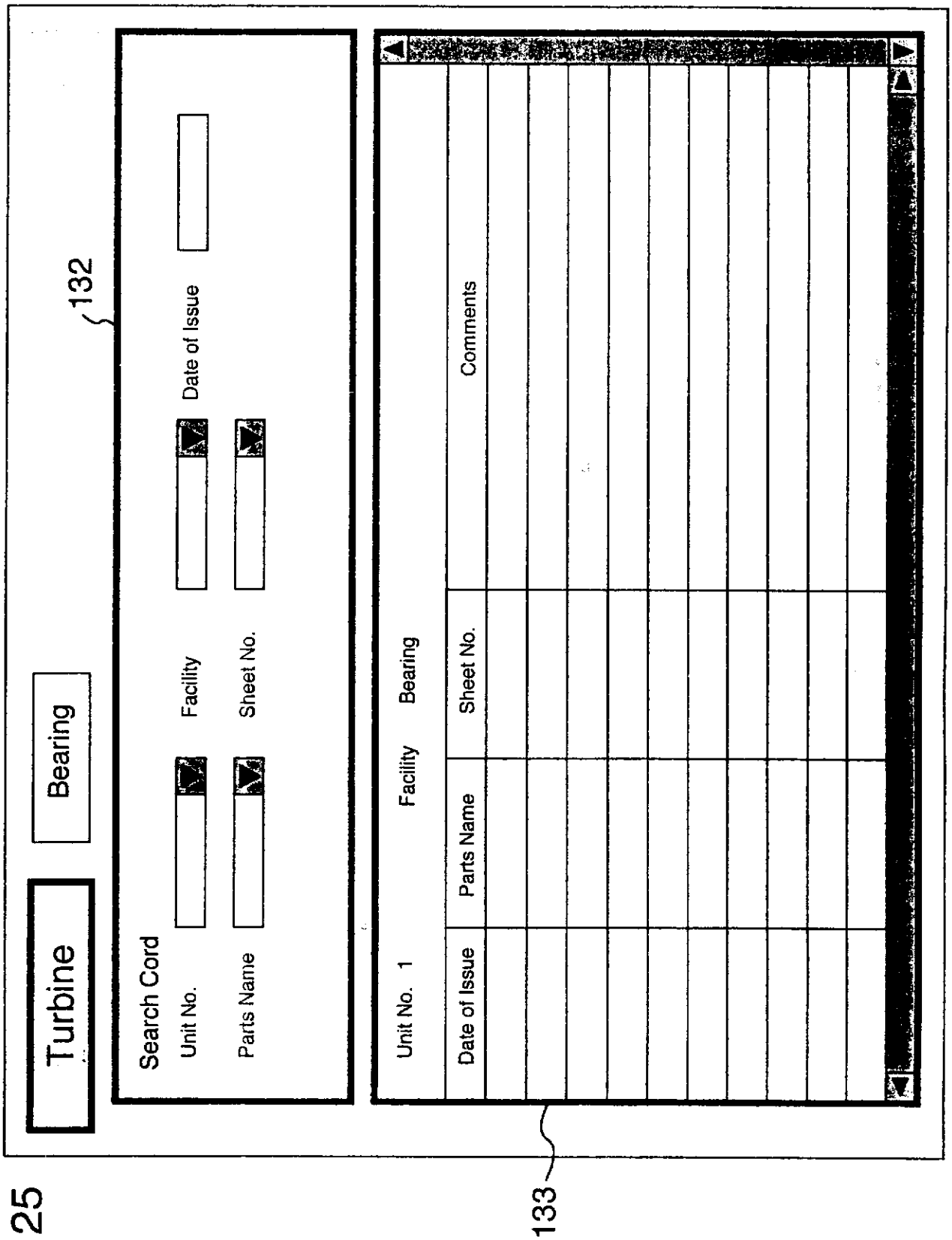

Turbine
Bearing
132
Search Cord
Unit No.
Facility
Date of Issue
Parts Name
Sheet No.
Unit No. 1
Facility
Bearing
Date of Issue
Parts Name
Sheet No.
Comments
133

FIG. 26

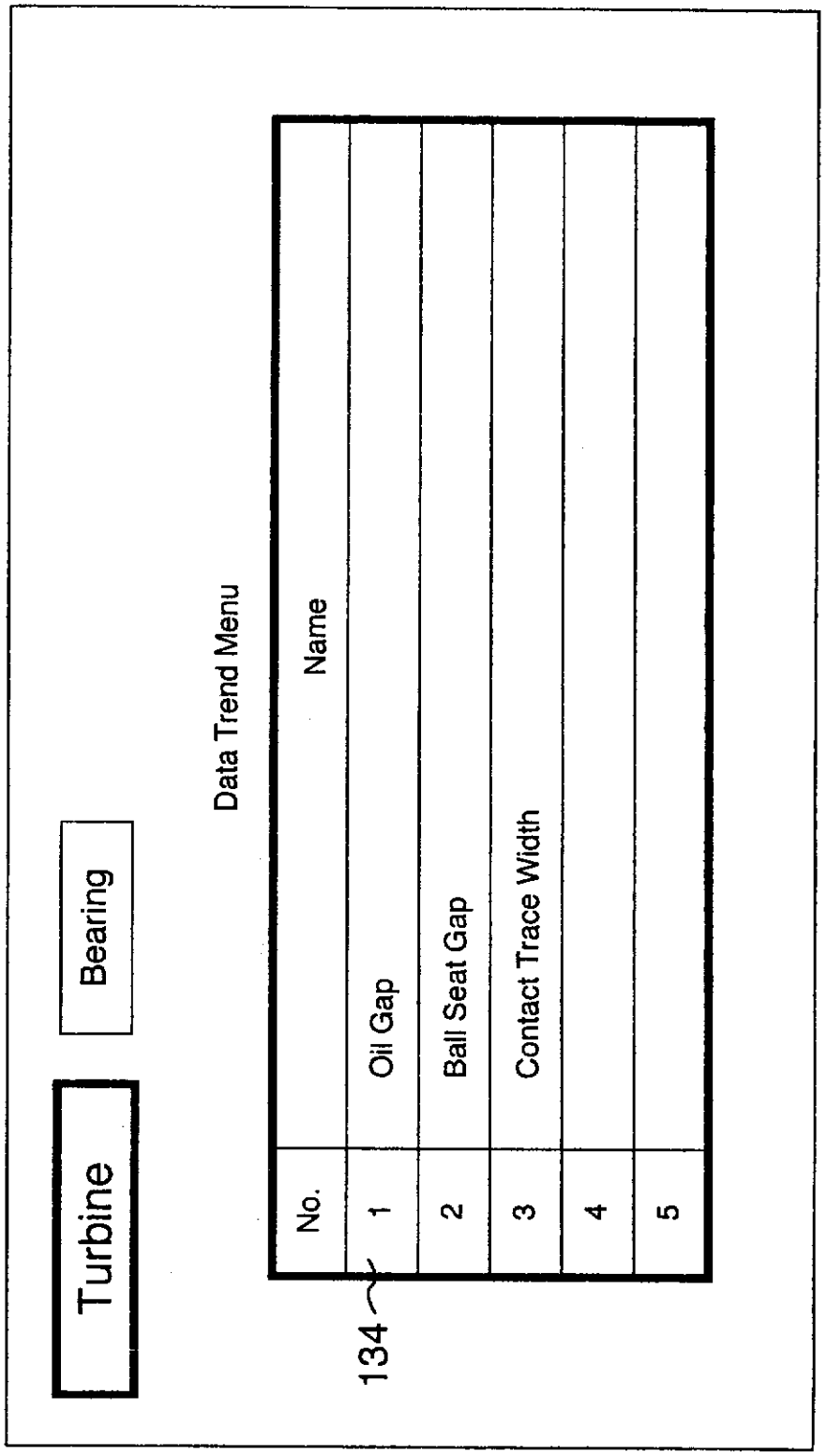

Turbine
Bearing
Data Trend Menu
No.
Name
1
Oil Gap
2
Ball Seat Gap
3
Contact Trace Width
4
5
134

FIG. 27

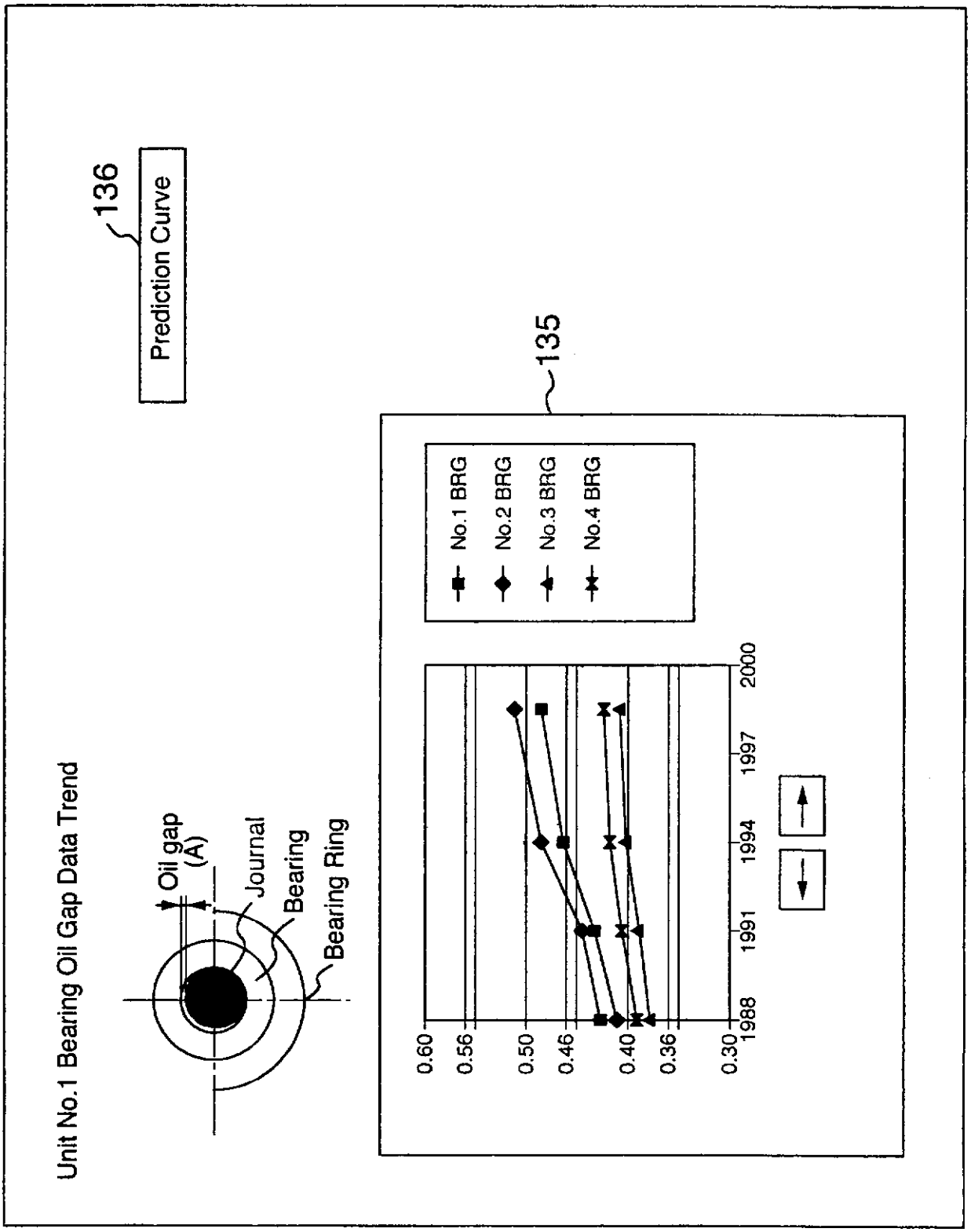

Unit No.1 Bearing Oil Gap Data Trend
Oil gap (A)
Journal
Bearing
Bearing Ring
136
Prediction Curve
135
No.1 BRG
No.2 BRG
No.3 BRG
No.4 BRG
0.60
0.56
0.50
0.46
0.40
0.36
0.30
1988
1991
1994
1997
2000

FIG. 28

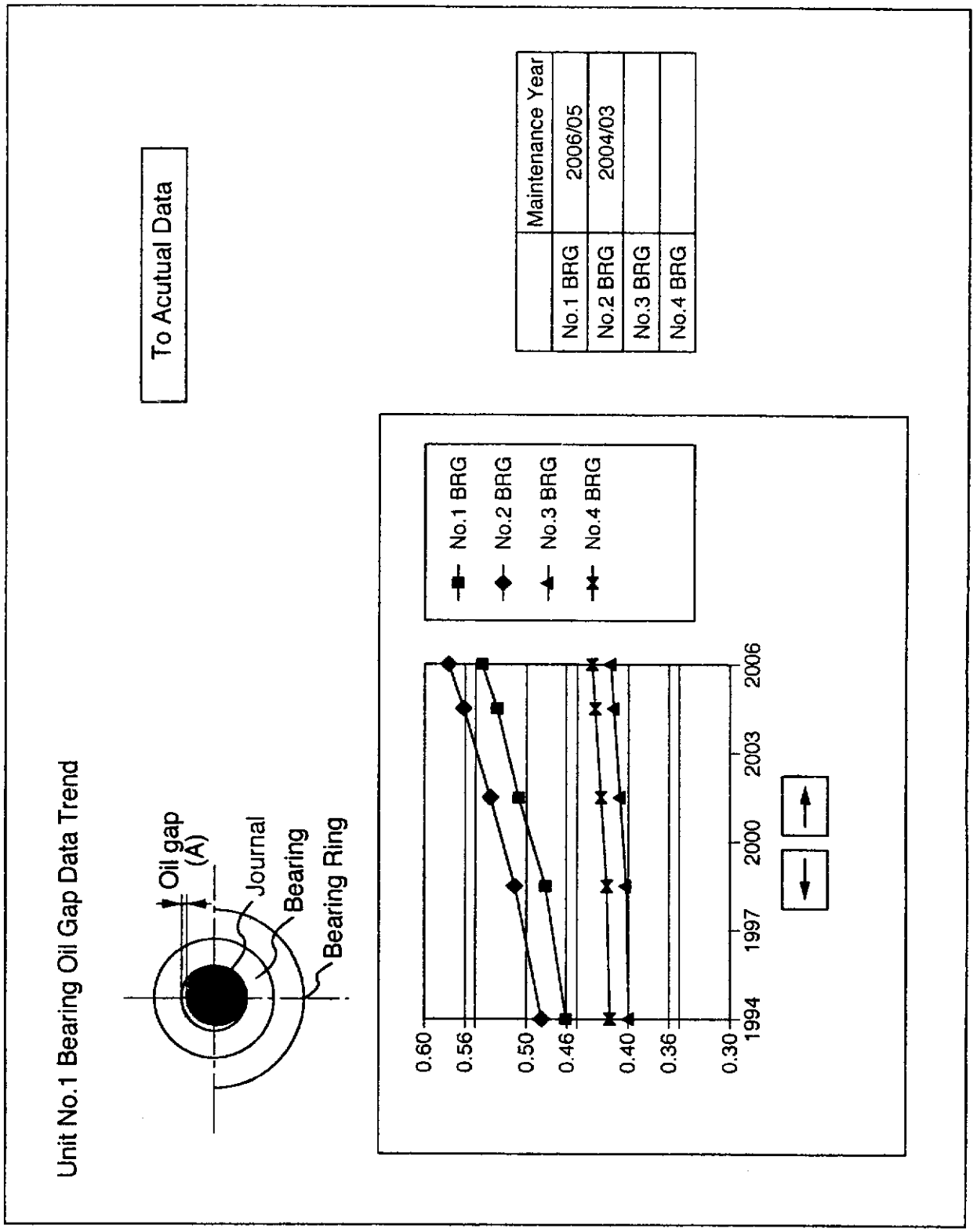

Unit No.1 Bearing Oil Gap Data Trend
Oil gap (A)
Journal
Bearing
Bearing Ring
To Acutual Data
Maintenance Year
No.1 BRG
2006/05
No.2 BRG
2004/03
No.3 BRG
No.4 BRG
No.1 BRG
No.2 BRG
No.3 BRG
No.4 BRG
0.60
0.56
0.50
0.46
0.40
0.36
0.30
1994
1997
2000
2003
2006

FIG. 29

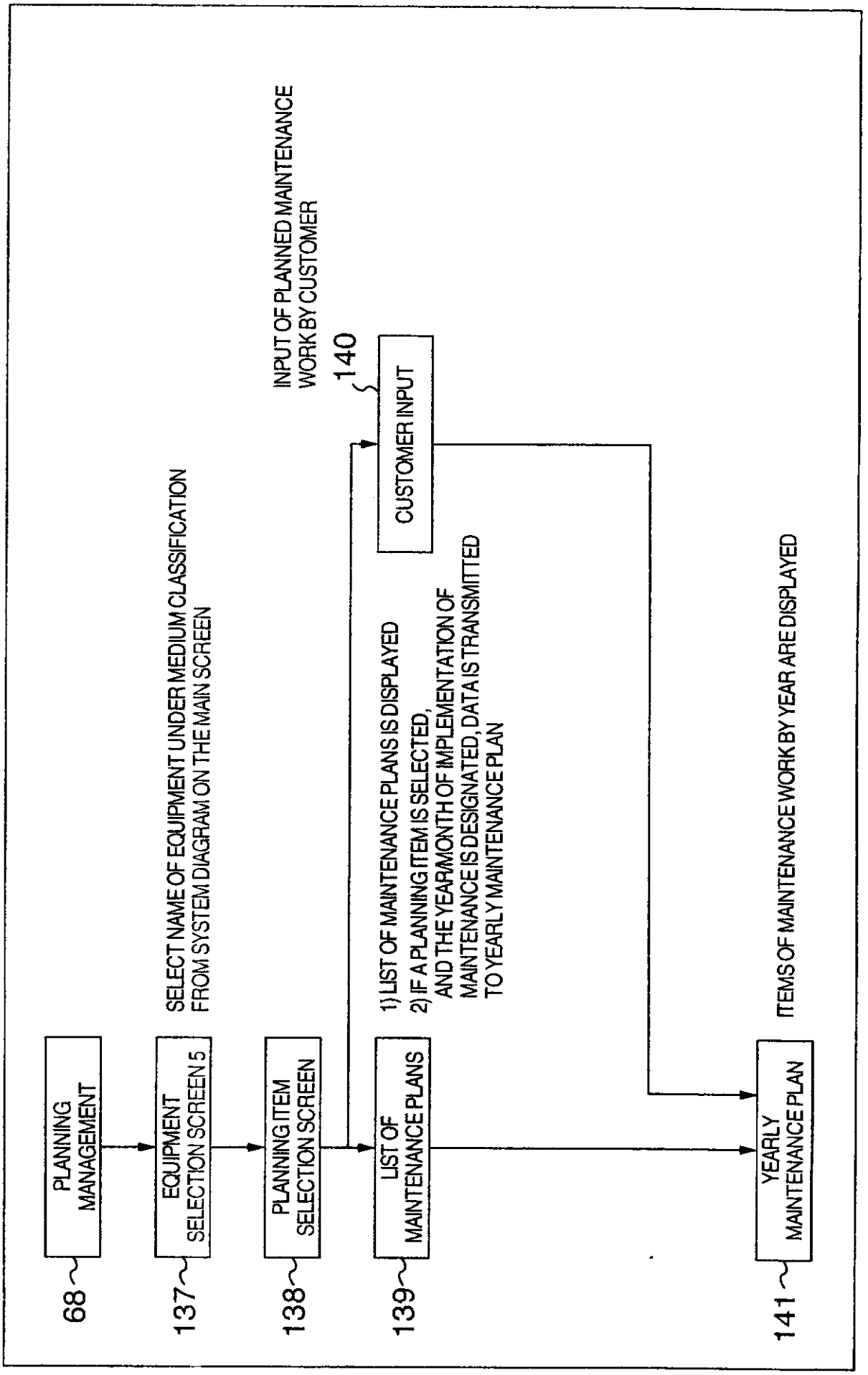

PLANNING MANAGEMENT
68
EQUIPMENT SELECTION SCREEN 5
137
SELECT NAME OF EQUIPMENT UNDER MEDIUM CLASSIFICATION FROM SYSTEM DIAGRAM ON THE MAIN SCREEN
PLANNING ITEM SELECTION SCREEN
138
LIST OF MAINTENANCE PLANS
139
1) LIST OF MAINTENANCE PLANS IS DISPLAYED
2) IF A PLANNING ITEM IS SELECTED, AND THE YEAR/MONTH OF IMPLEMENTATION OF MAINTENANCE IS DESIGNATED, DATA IS TRANSMITTED TO YEARLY MAINTENANCE PLAN
INPUT OF PLANNED MAINTENANCE WORK BY CUSTOMER
140
CUSTOMER INPUT
YEARLY MAINTENANCE PLAN
141
ITEMS OF MAINTENANCE WORK BY YEAR ARE DISPLAYED

FIG. 30

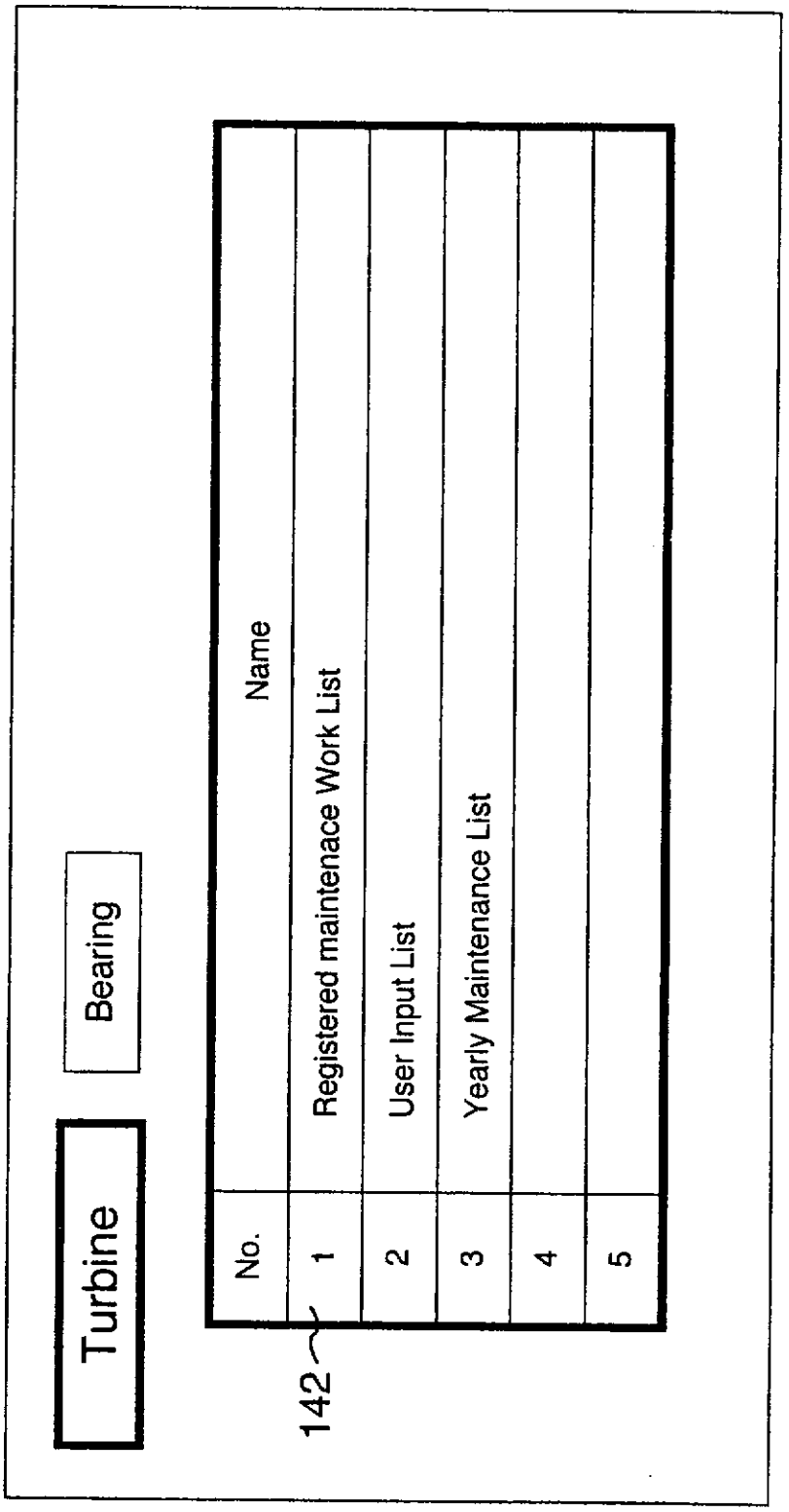
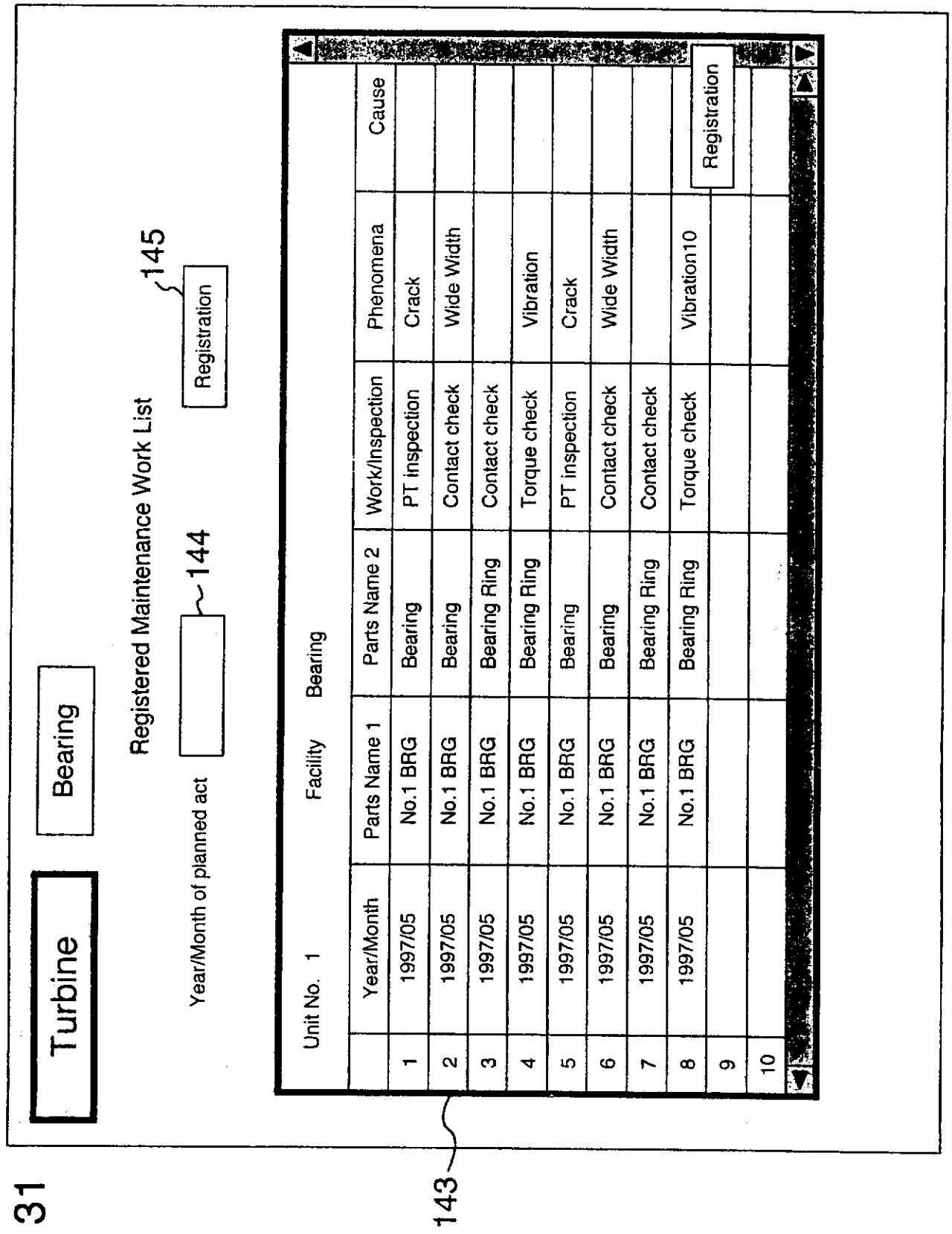

Turbine
Bearing
No.
Name
1
Registered maintenace Work List
2
User Input List
3
Yearly Maintenance List
4
5
142

FIG. 31



	Year/Month	Parts Name 1	Parts Name 2	Work/Inspection	Phenomena	Cause
1	1997/05	No.1 BRG	Bearing	PT inspection	Crack	
2	1997/05	No.1 BRG	Bearing	Contact check	Wide Width	
3	1997/05	No.1 BRG	Bearing Ring	Contact check		
4	1997/05	No.1 BRG	Bearing Ring	Torque check	Vibration	
5	1997/05	No.1 BRG	Bearing	PT inspection	Crack	
6	1997/05	No.1 BRG	Bearing	Contact check	Wide Width	
7	1997/05	No.1 BRG	Bearing Ring	Contact check		
8	1997/05	No.1 BRG	Bearing Ring	Torque check	Vibration10	
9						
10						

FIG. 32

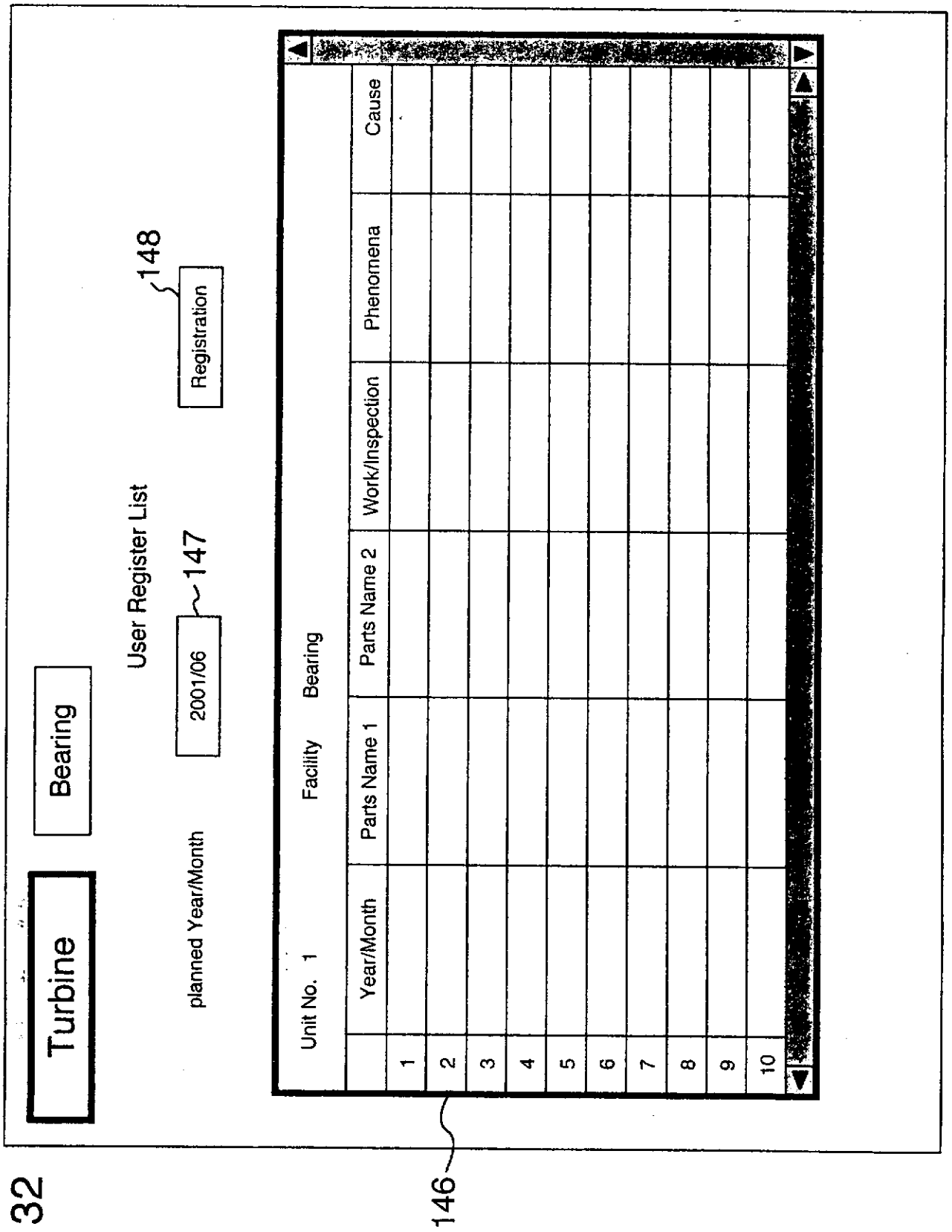
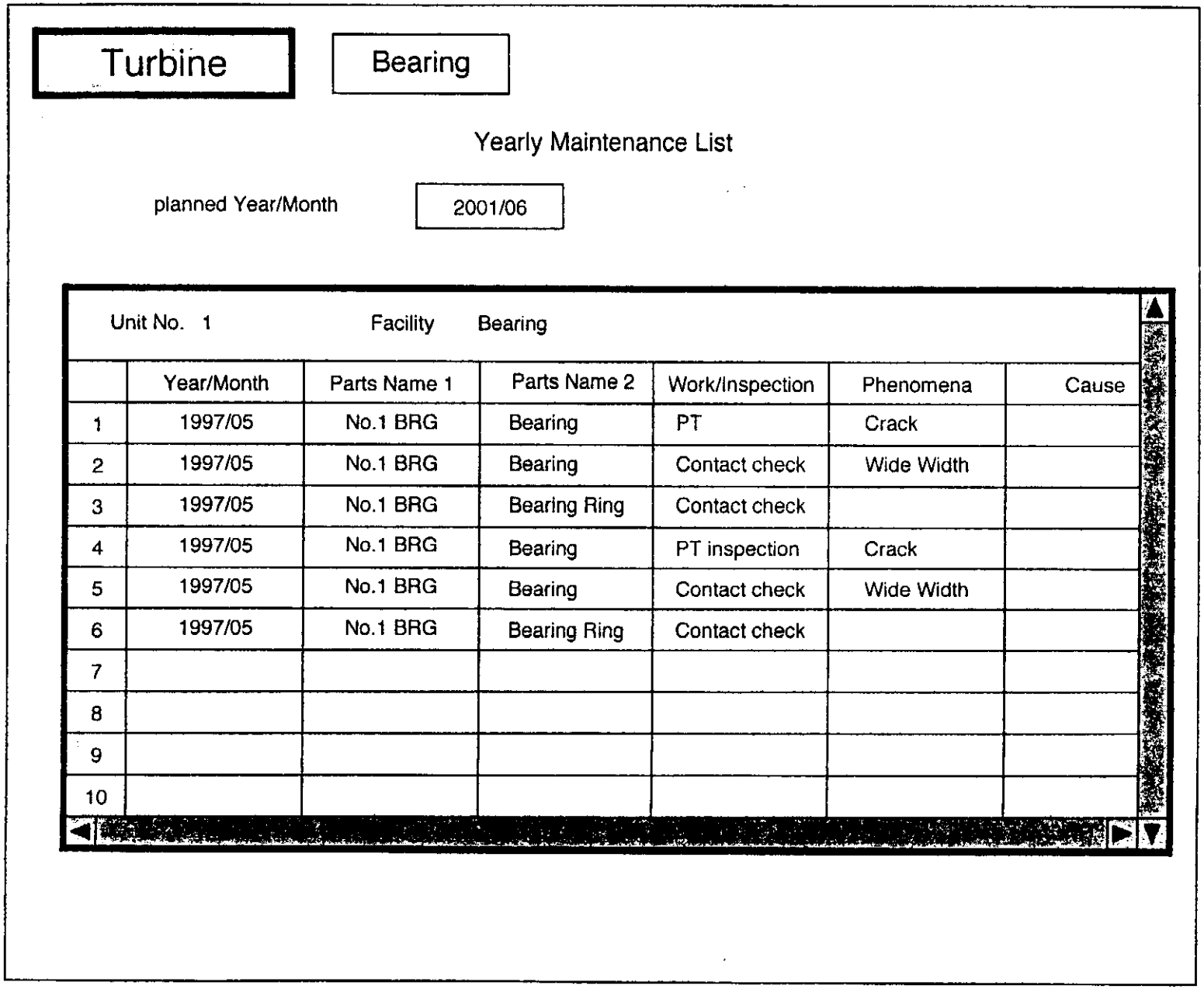

Turbine
Bearing
User Register List
planned Year/Month
2001/06
147
148
Registration
Unit No. 1
Facility
Bearing
Year/Month
Parts Name 1
Parts Name 2
Work/Inspection
Phenomena
Cause
1
2
3
4
5
6
7
8
9
10
146

FIG. 33



	Year/Month	Parts Name 1	Parts Name 2	Work/Inspection	Phenomena	Cause
1	1997/05	No.1 BRG	Bearing	PT	Crack	
2	1997/05	No.1 BRG	Bearing	Contact check	Wide Width	
3	1997/05	No.1 BRG	Bearing Ring	Contact check		
4	1997/05	No.1 BRG	Bearing	PT inspection	Crack	
5	1997/05	No.1 BRG	Bearing	Contact check	Wide Width	
6	1997/05	No.1 BRG	Bearing Ring	Contact check		
7						
8						
9						
10						

29 SEP 2005