FIG. 1

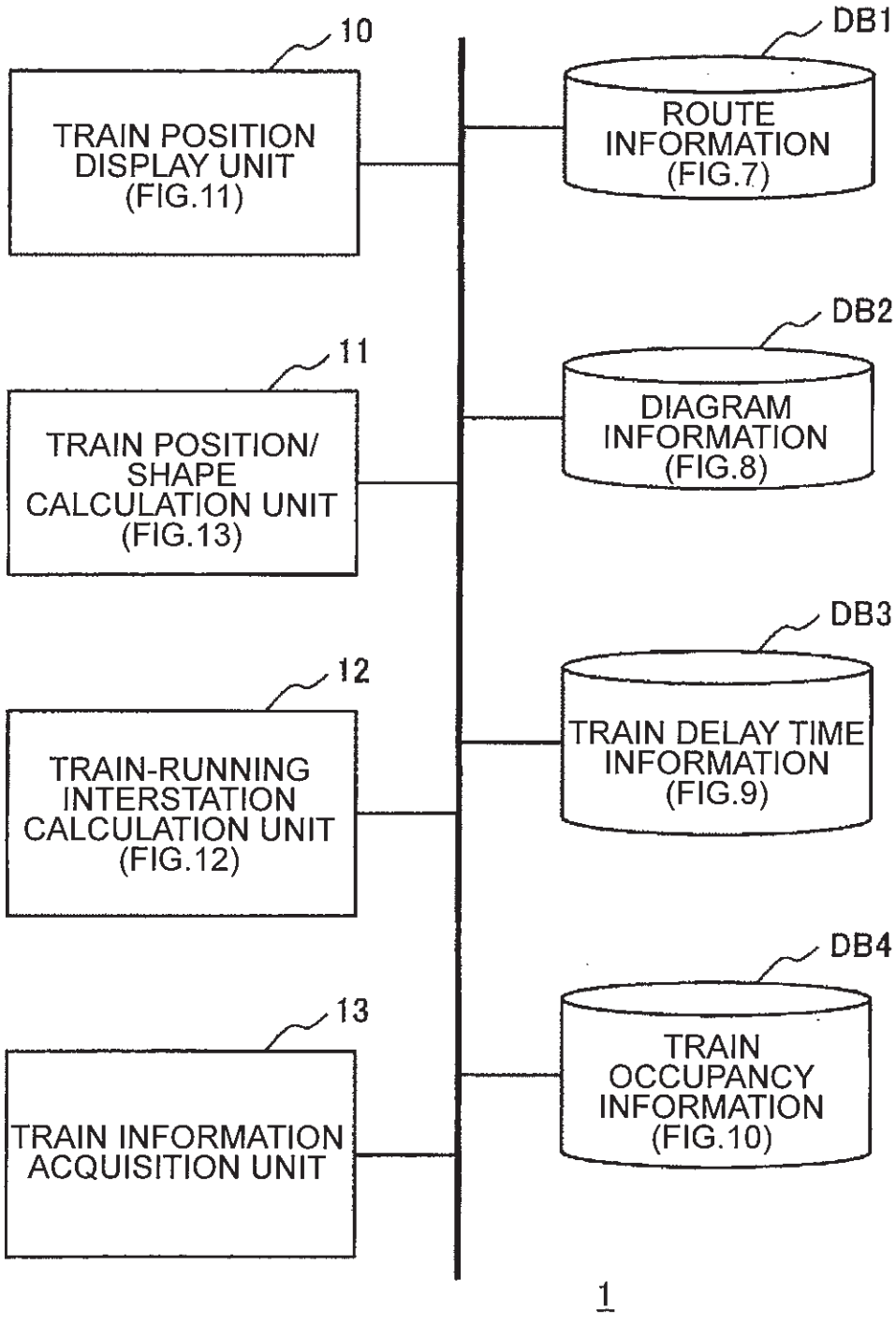

10
TRAIN POSITION DISPLAY UNIT (FIG.11)
11
TRAIN POSITION/ SHAPE CALCULATION UNIT (FIG.13)
12
TRAIN-RUNNING INTERSTATION CALCULATION UNIT (FIG.12)
13
TRAIN INFORMATION ACQUISITION UNIT
DB1
ROUTE INFORMATION (FIG.7)
DB2
DIAGRAM INFORMATION (FIG.8)
DB3
TRAIN DELAY TIME INFORMATION (FIG.9)
DB4
TRAIN OCCUPANCY INFORMATION (FIG.10)
1

FIG. 2

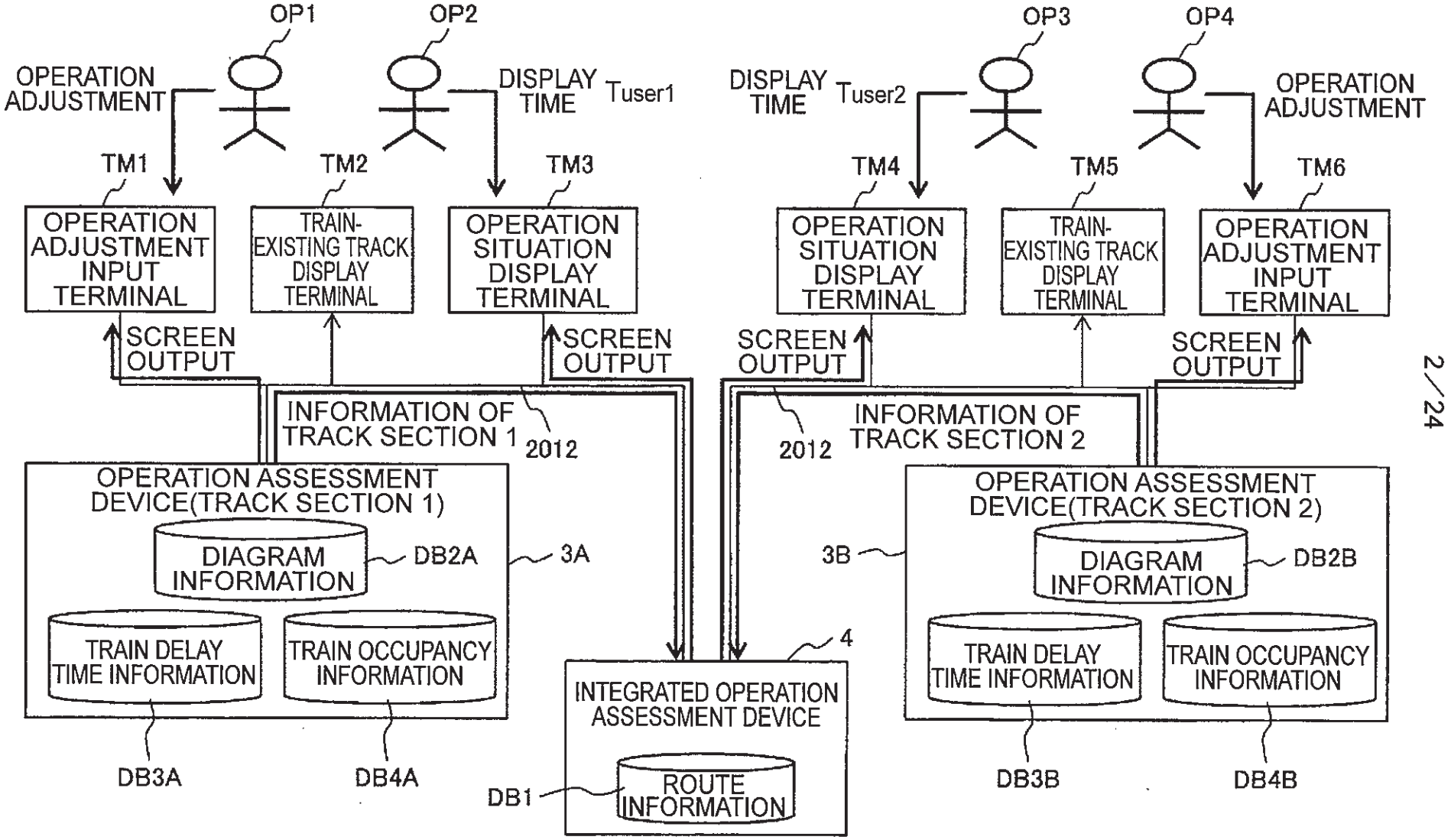

OP1
OP2
OP3
OP4
OPERATION ADJUSTMENT
DISPLAY TIME
Tuser1
DISPLAY TIME
Tuser2
OPERATION ADJUSTMENT
TM1
TM2
TM3
TM4
TM5
TM6
OPERATION ADJUSTMENT INPUT TERMINAL
TRAIN-EXISTING TRACK DISPLAY TERMINAL
OPERATION SITUATION DISPLAY TERMINAL
OPERATION SITUATION DISPLAY TERMINAL
TRAIN-EXISTING TRACK DISPLAY TERMINAL
OPERATION ADJUSTMENT INPUT TERMINAL
SCREEN OUTPUT
SCREEN OUTPUT
SCREEN OUTPUT
SCREEN OUTPUT
INFORMATION OF TRACK SECTION 1
2012
2012
INFORMATION OF TRACK SECTION 2
OPERATION ASSESSMENT DEVICE(TRACK SECTION 1)
OPERATION ASSESSMENT DEVICE(TRACK SECTION 2)
DIAGRAM INFORMATION
DB2A
3A
3B
DIAGRAM INFORMATION
DB2B
TRAIN DELAY TIME INFORMATION
TRAIN OCCUPANCY INFORMATION
4
TRAIN DELAY TIME INFORMATION
TRAIN OCCUPANCY INFORMATION
INTEGRATED OPERATION ASSESSMENT DEVICE
DB3A
DB4A
DB1
ROUTE INFORMATION
DB3B
DB4B
2

FIG. 3

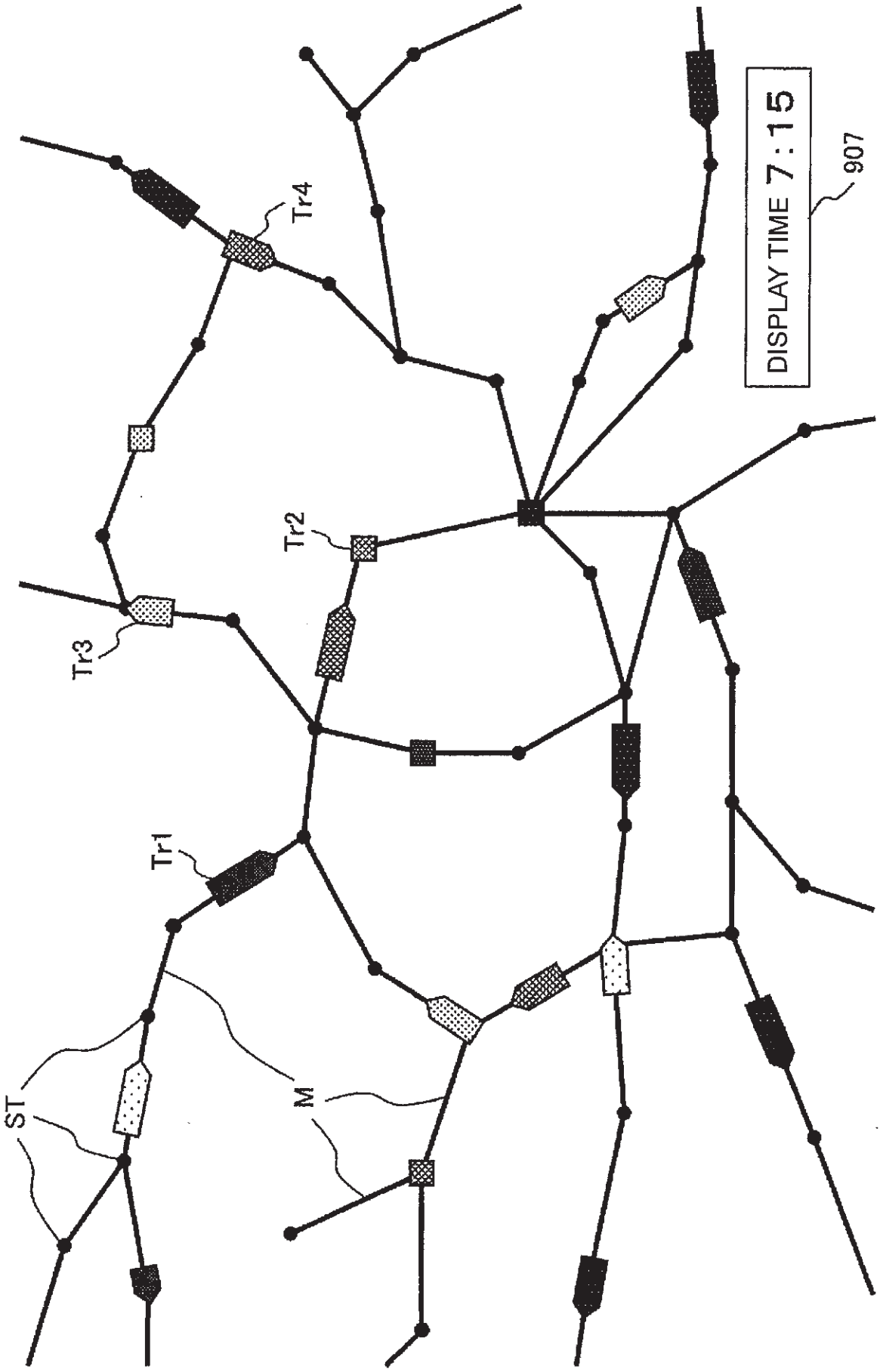


FIG. 4

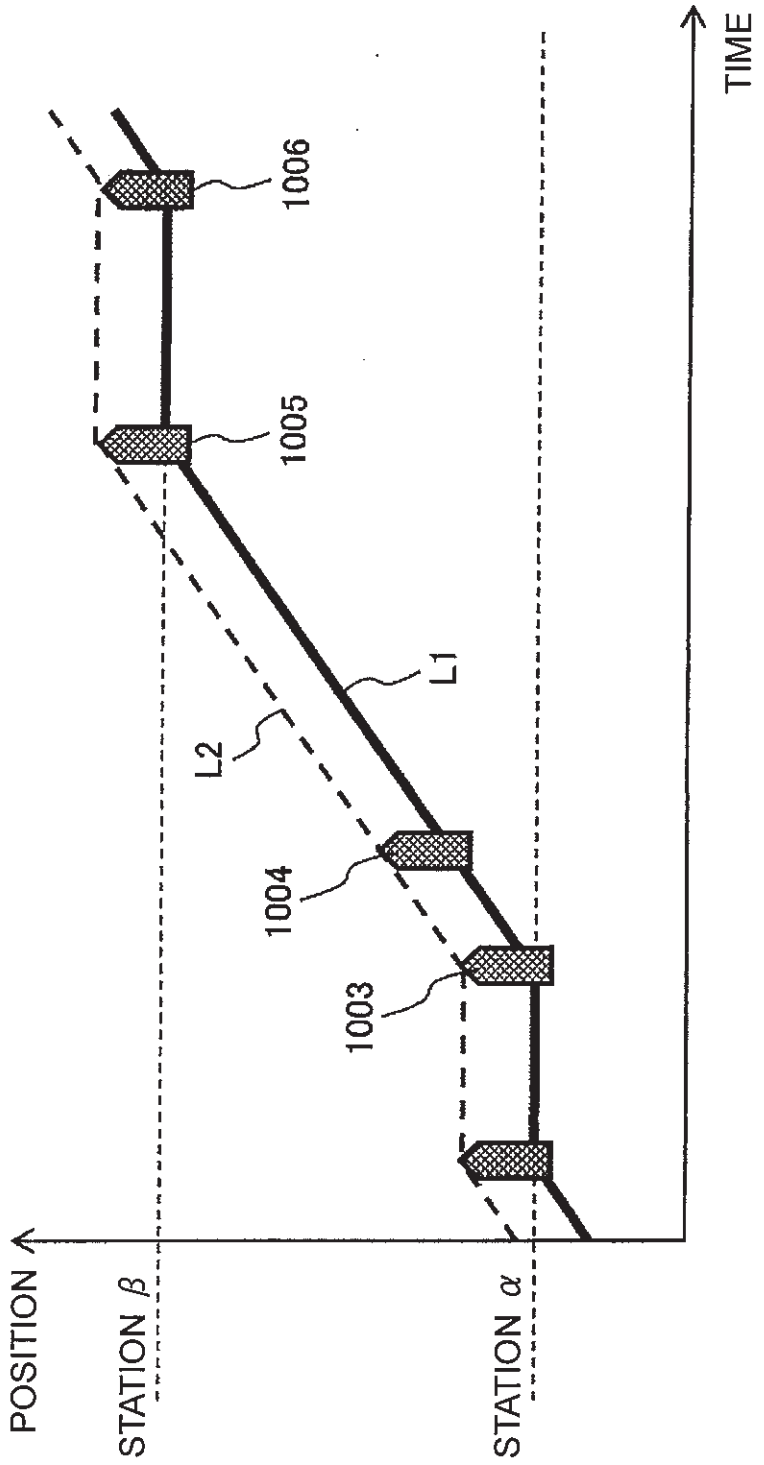


FIG. 5

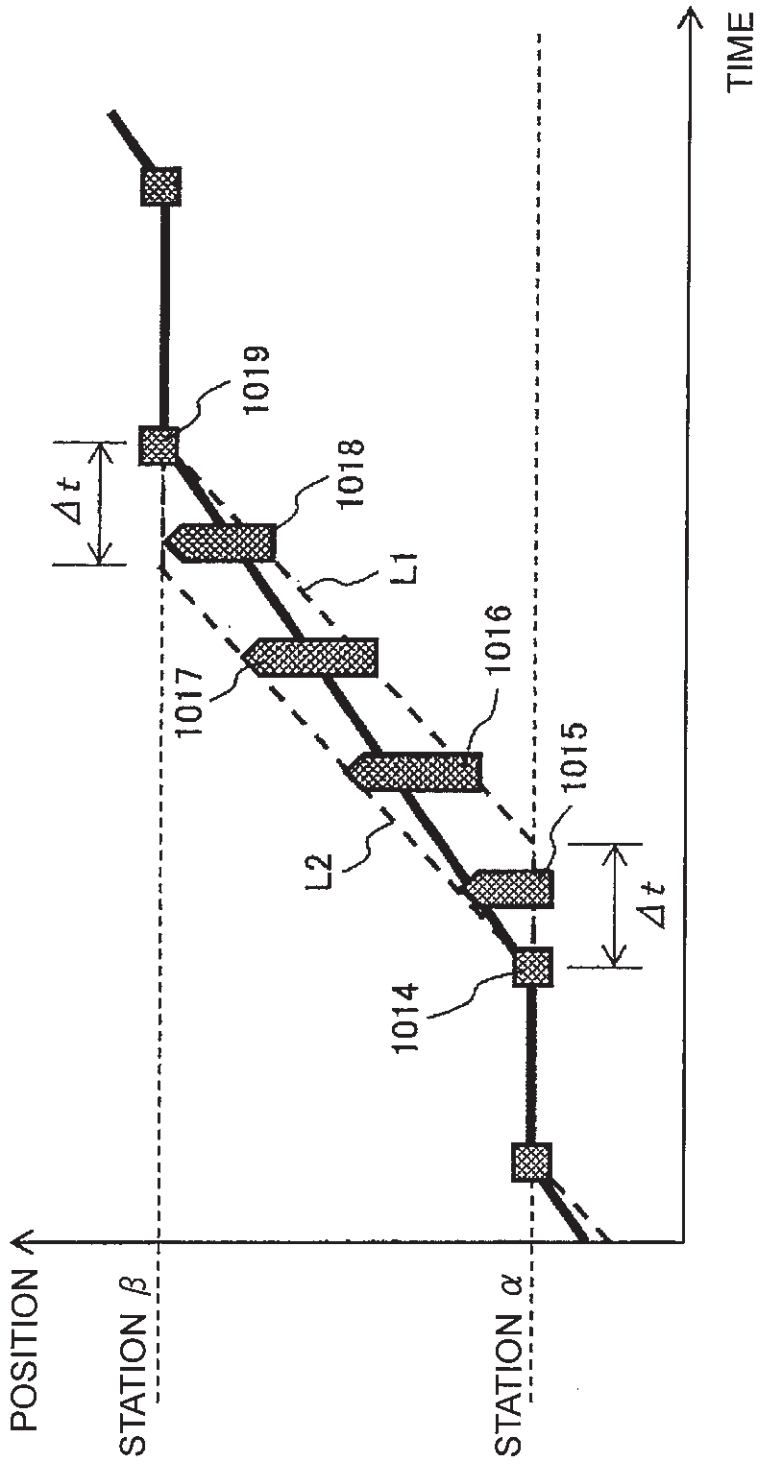

TIME
POSITION
STATION β
STATION α
Δt
Δt
1019
1018
1017
1016
1015
1014
L1
L2

FIG. 6

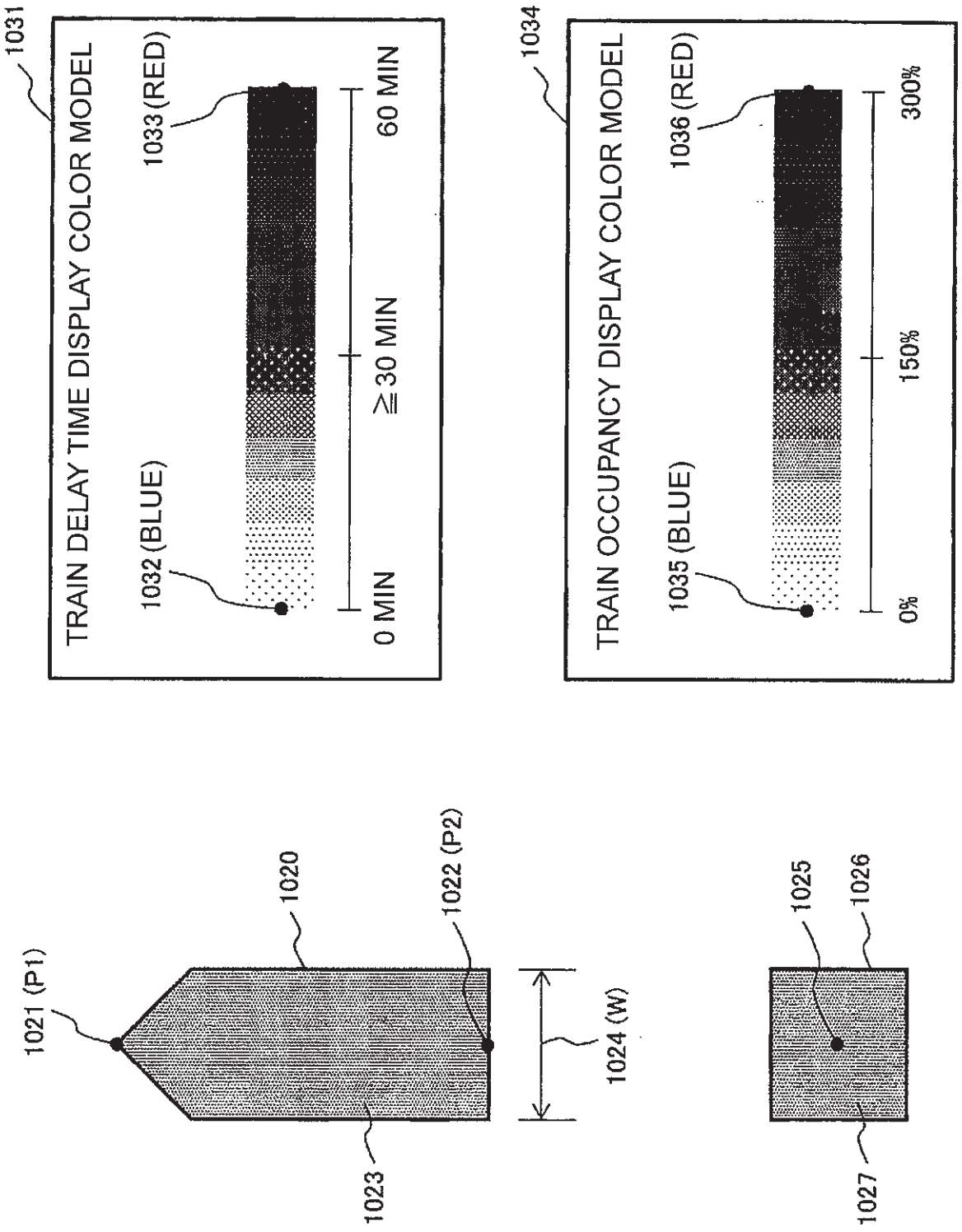

1031
TRAIN DELAY TIME DISPLAY COLOR MODEL
1032 (BLUE)
1033 (RED)
0 MIN
≧30 MIN
60 MIN
1034
TRAIN OCCUPANCY DISPLAY COLOR MODEL
1035 (BLUE)
1036 (RED)
0%
150%
300%
1021 (P1)
1020
1022 (P2)
1023
1024 (W)
1025
1026
1027

FIG. 7

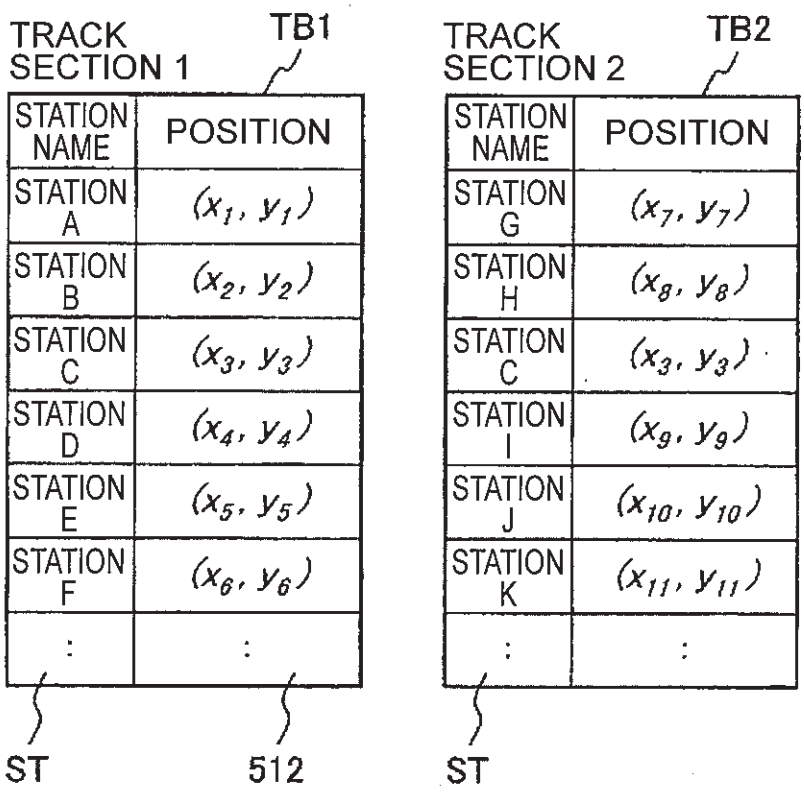

TRACK SECTION 1
TB1
STATION NAME
POSITION
STATION A
(x_1, y_1)
STATION B
(x_2, y_2)
STATION C
(x_3, y_3)
STATION D
(x_4, y_4)
STATION E
(x_5, y_5)
STATION F
(x_6, y_6)
ST
512
TRACK SECTION 2
TB2
STATION NAME
POSITION
STATION G
(x_7, y_7)
STATION H
(x_8, y_8)
STATION C
(x_3, y_3)
STATION I
(x_9, y_9)
STATION J
(x_{10}, y_{10})
STATION K
(x_{11}, y_{11})
ST

FIG. 8

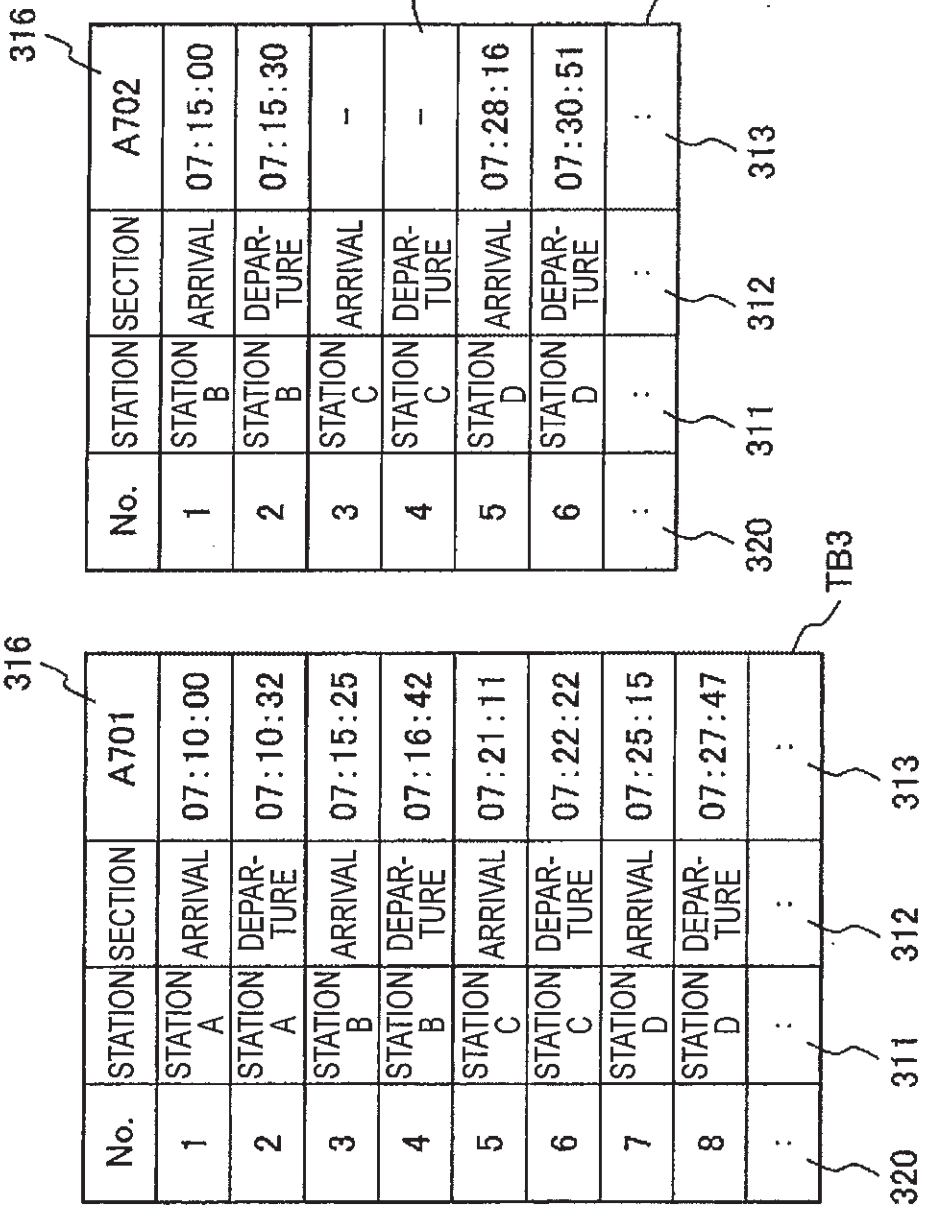
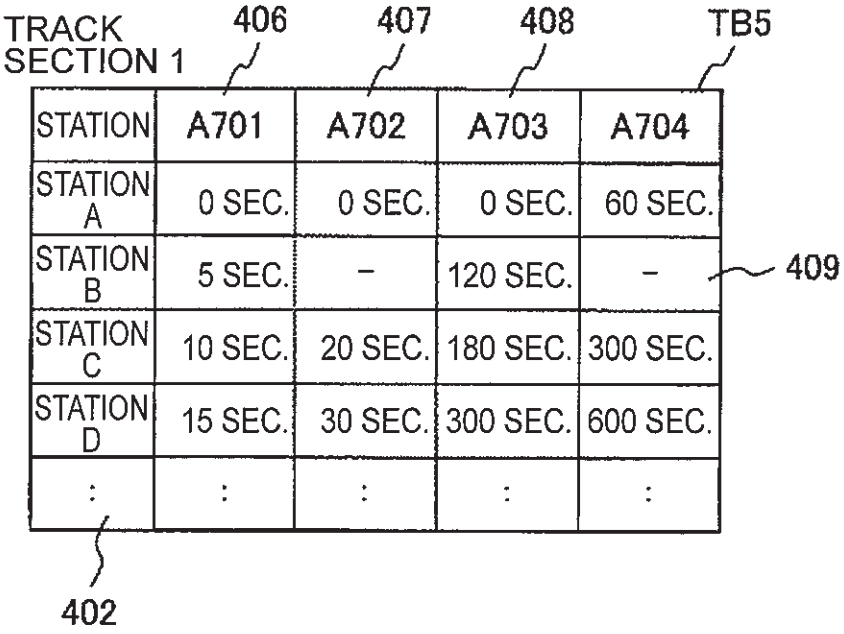
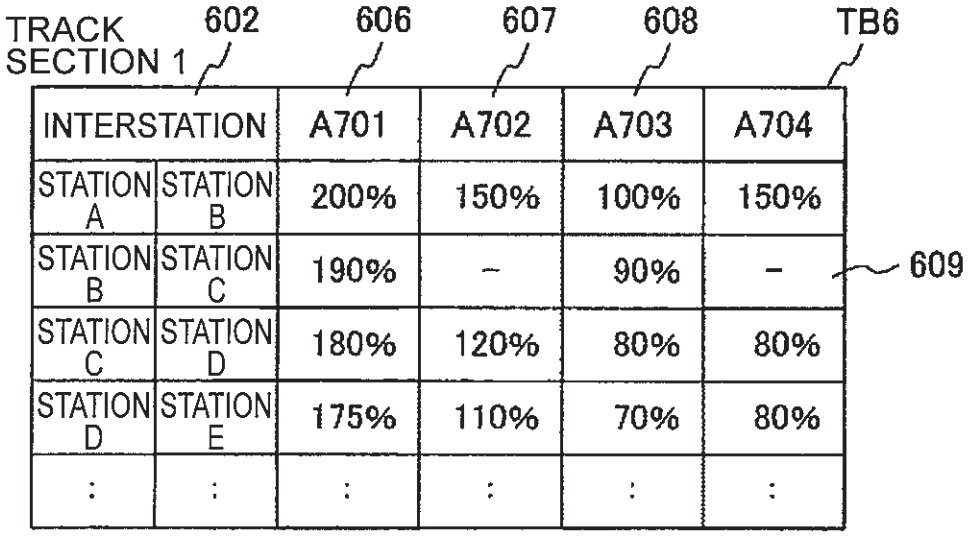

316
A701
No.
STATION
SECTION
1
STATION A
ARRIVAL
07:10:00
2
STATION A
DEPAR-TURE
07:10:32
3
STATION B
ARRIVAL
07:15:25
4
STATION B
DEPAR-TURE
07:16:42
5
STATION C
ARRIVAL
07:21:11
6
STATION C
DEPAR-TURE
07:22:22
7
STATION D
ARRIVAL
07:25:15
8
STATION D
DEPAR-TURE
07:27:47
320
311
312
313
TB3
316
A702
No.
STATION
SECTION
1
STATION B
ARRIVAL
07:15:00
2
STATION B
DEPAR-TURE
07:15:30
3
STATION C
ARRIVAL
–
4
STATION C
DEPAR-TURE
–
5
STATION D
ARRIVAL
07:28:16
6
STATION D
DEPAR-TURE
07:30:51
320
311
312
313
319
TB4

FIG. 9



STATION	A701	A702	A703	A704
STATION A	0 SEC.	0 SEC.	0 SEC.	60 SEC.
STATION B	5 SEC.	–	120 SEC.	–
STATION C	10 SEC.	20 SEC.	180 SEC.	300 SEC.
STATION D	15 SEC.	30 SEC.	300 SEC.	600 SEC.
:	:	:	:	:

FIG. 10



INTERSTATION		A701	A702	A703	A704
STATION A	STATION B	200%	150%	100%	150%
STATION B	STATION C	190%	–	90%	–
STATION C	STATION D	180%	120%	80%	80%
STATION D	STATION E	175%	110%	70%	80%
:	:	:	:	:	:

FIG. 11

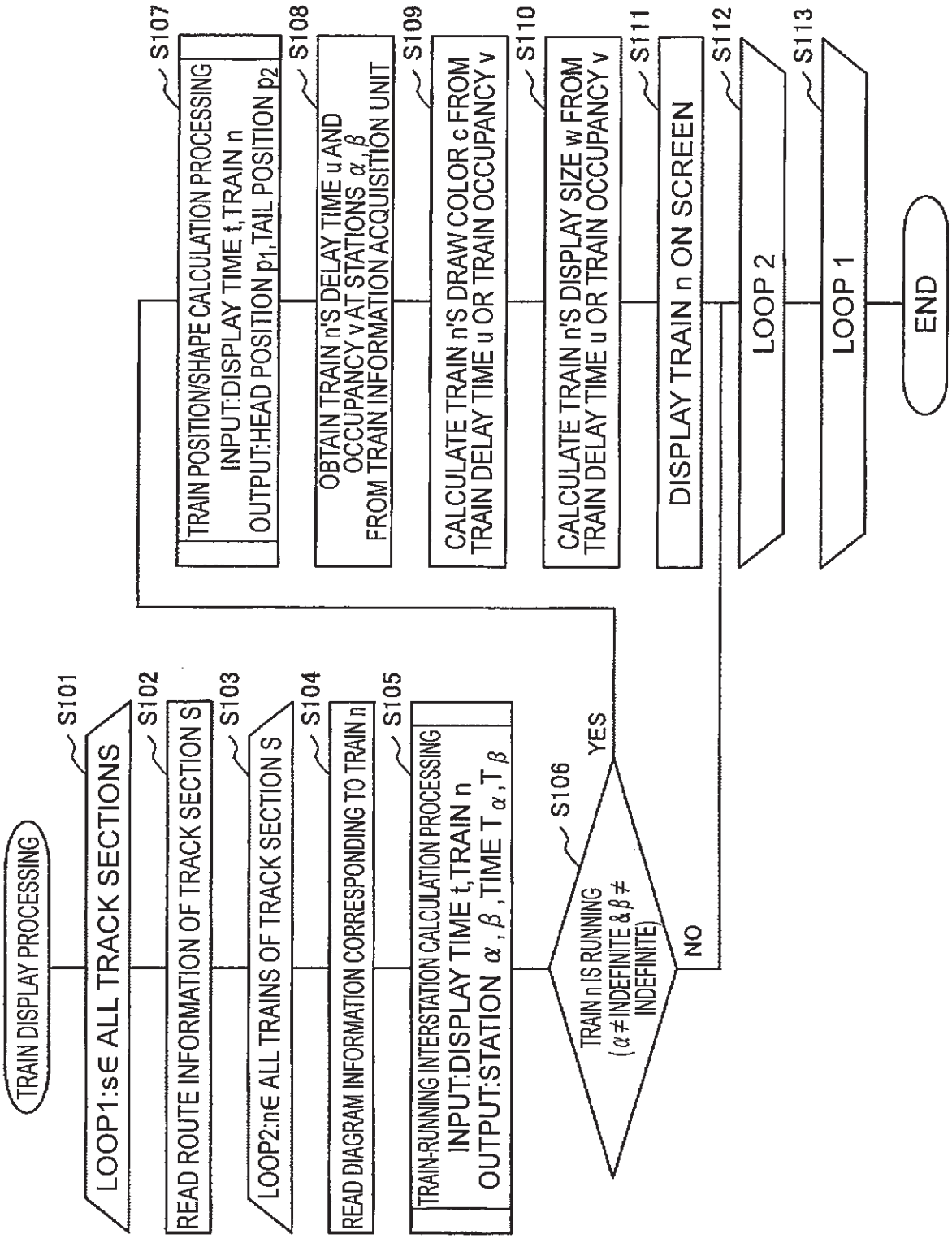

TRAIN DISPLAY PROCESSING
S101
LOOP1:s∈ ALL TRACK SECTIONS
S102
READ ROUTE INFORMATION OF TRACK SECTION S
S103
LOOP2:n∈ ALL TRAINS OF TRACK SECTION S
S104
READ DIAGRAM INFORMATION CORRESPONDING TO TRAIN n
S105
TRAIN-RUNNING INTERSTATION CALCULATION PROCESSING
INPUT:DISPLAY TIME t,TRAIN n
OUTPUT:STATION α, β, TIME Tα, Tβ
S106
TRAIN n IS RUNNING (α≠INDEFINITE & β≠INDEFINITE)
YES
NO
S107
TRAIN POSITION/SHAPE CALCULATION PROCESSING
INPUT:DISPLAY TIME t,TRAIN n
OUTPUT:HEAD POSITION p1,TAIL POSITION p2
S108
OBTAIN TRAIN n'S DELAY TIME u AND OCCUPANCY v AT STATIONS α, β FROM TRAIN INFORMATION ACQUISITION UNIT
S109
CALCULATE TRAIN n'S DRAW COLOR c FROM TRAIN DELAY TIME u OR TRAIN OCCUPANCY v
S110
CALCULATE TRAIN n'S DISPLAY SIZE w FROM TRAIN DELAY TIME u OR TRAIN OCCUPANCY v
S111
DISPLAY TRAIN n ON SCREEN
S112
LOOP 2
S113
LOOP 1
END

FIG. 12

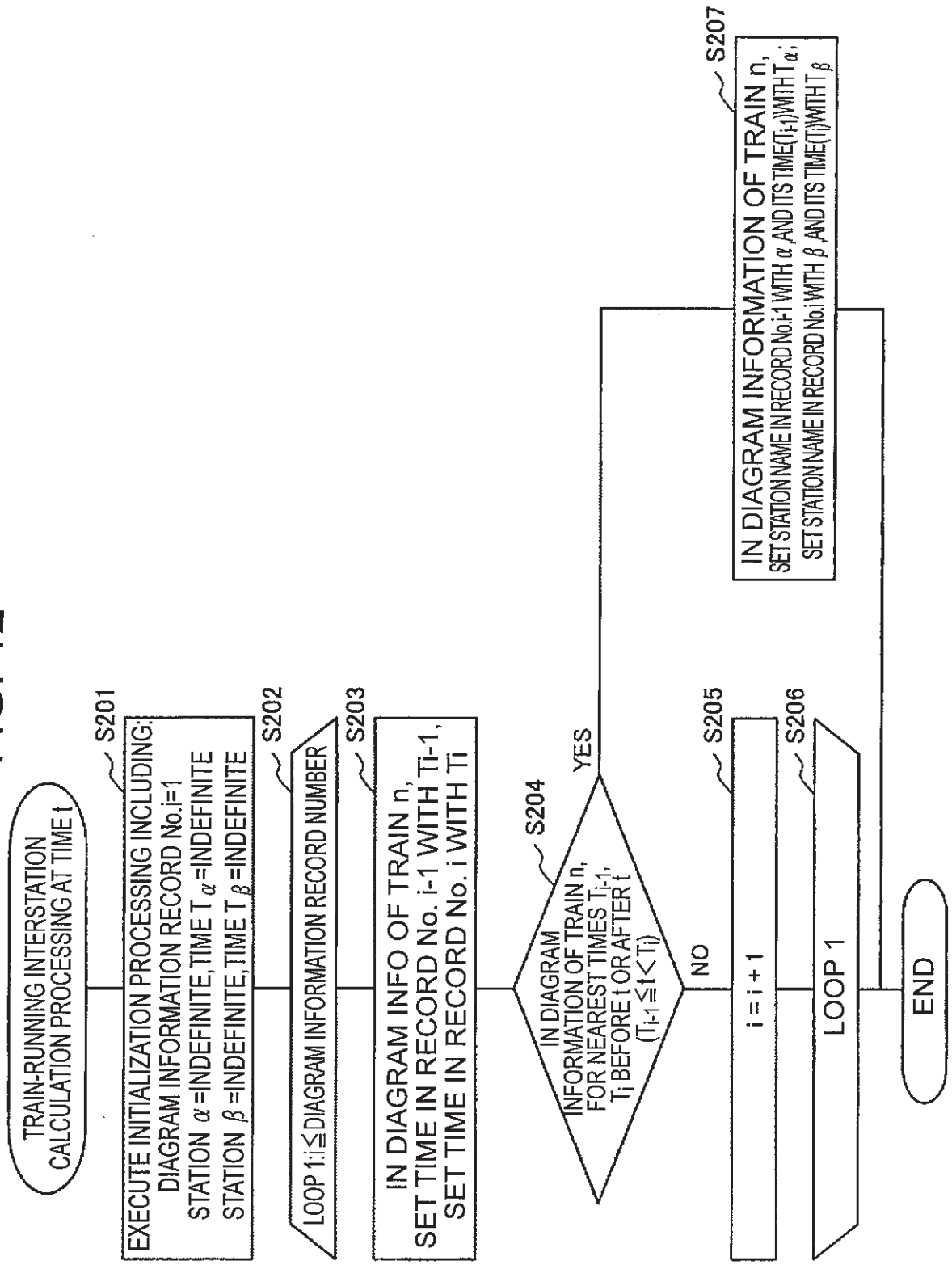

TRAIN-RUNNING INTERSTATION CALCULATION PROCESSING AT TIME t
S201
EXECUTE INITIALIZATION PROCESSING INCLUDING: DIAGRAM INFORMATION RECORD No.i=1 STATION α =INDEFINITE, TIME T α =INDEFINITE STATION β =INDEFINITE, TIME T β =INDEFINITE
S202
LOOP 1:i≦DIAGRAM INFORMATION RECORD NUMBER
S203
IN DIAGRAM INFO OF TRAIN n, SET TIME IN RECORD No. i-1 WITH Ti-1, SET TIME IN RECORD No. i WITH Ti
S204
IN DIAGRAM INFORMATION OF TRAIN n, FOR NEAREST TIMES Ti-1, Ti BEFORE t OR AFTER t (Ti-1≦t<Ti)
YES
NO
S205
i = i + 1
S206
LOOP 1
S207
IN DIAGRAM INFORMATION OF TRAIN n, SET STATION NAME IN RECORD No.i-1 WITH α AND ITS TIME(Ti-1)WITH Tα; SET STATION NAME IN RECORD No.i WITH β AND ITS TIME(Ti)WITH Tβ
END

FIG. 13

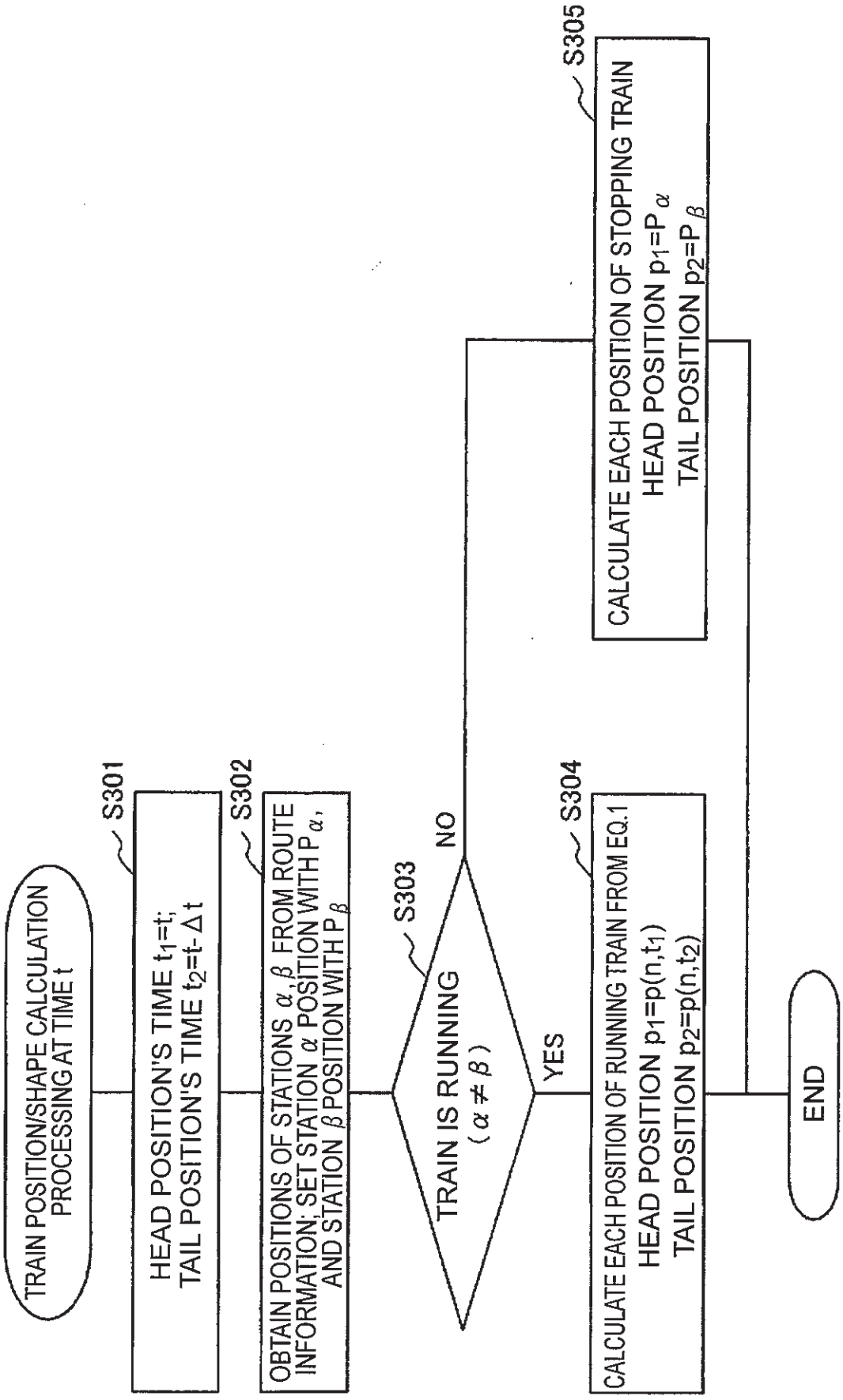

TRAIN POSITION/SHAPE CALCULATION PROCESSING AT TIME t
S301
HEAD POSITION'S TIME t_1=t;
TAIL POSITION'S TIME t_2=t-Δt
S302
OBTAIN POSITIONS OF STATIONS α, β FROM ROUTE INFORMATION; SET STATION α POSITION WITH P_α, AND STATION β POSITION WITH P_β
S303
TRAIN IS RUNNING
(α ≠ β)
NO
YES
S304
CALCULATE EACH POSITION OF RUNNING TRAIN FROM EQ.1
HEAD POSITION p_1=p(n,t_1)
TAIL POSITION p_2=p(n,t_2)
S305
CALCULATE EACH POSITION OF STOPPING TRAIN
HEAD POSITION p_1=P_α
TAIL POSITION p_2=P_β
END

FIG. 14

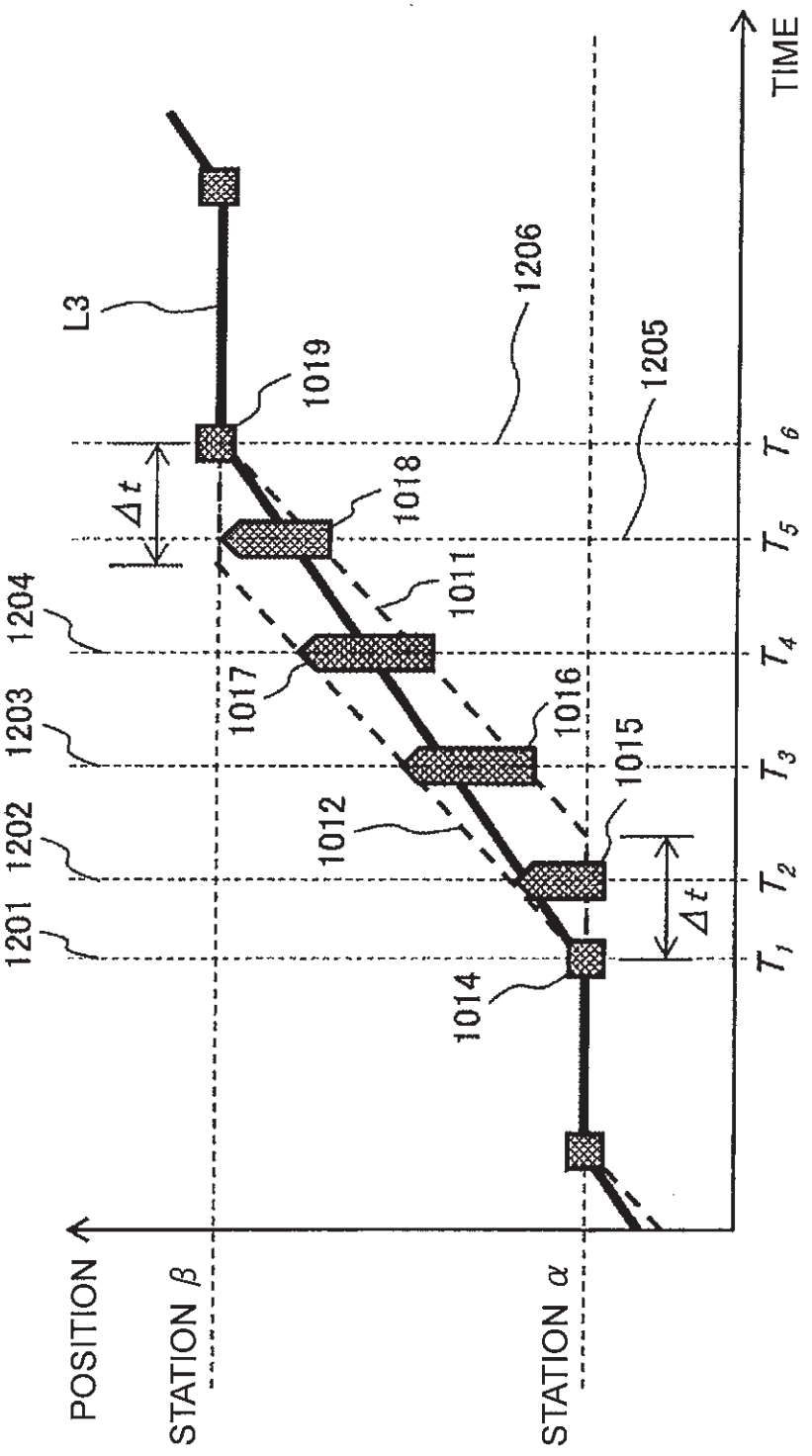

TIME
POSITION
STATION β
STATION α
L3
1019
1018
1011
1017
1016
1015
1012
1014
1206
1205
1204
1203
1202
1201
Δt
Δt
T1
T2
T3
T4
T5
T6

FIG. 15

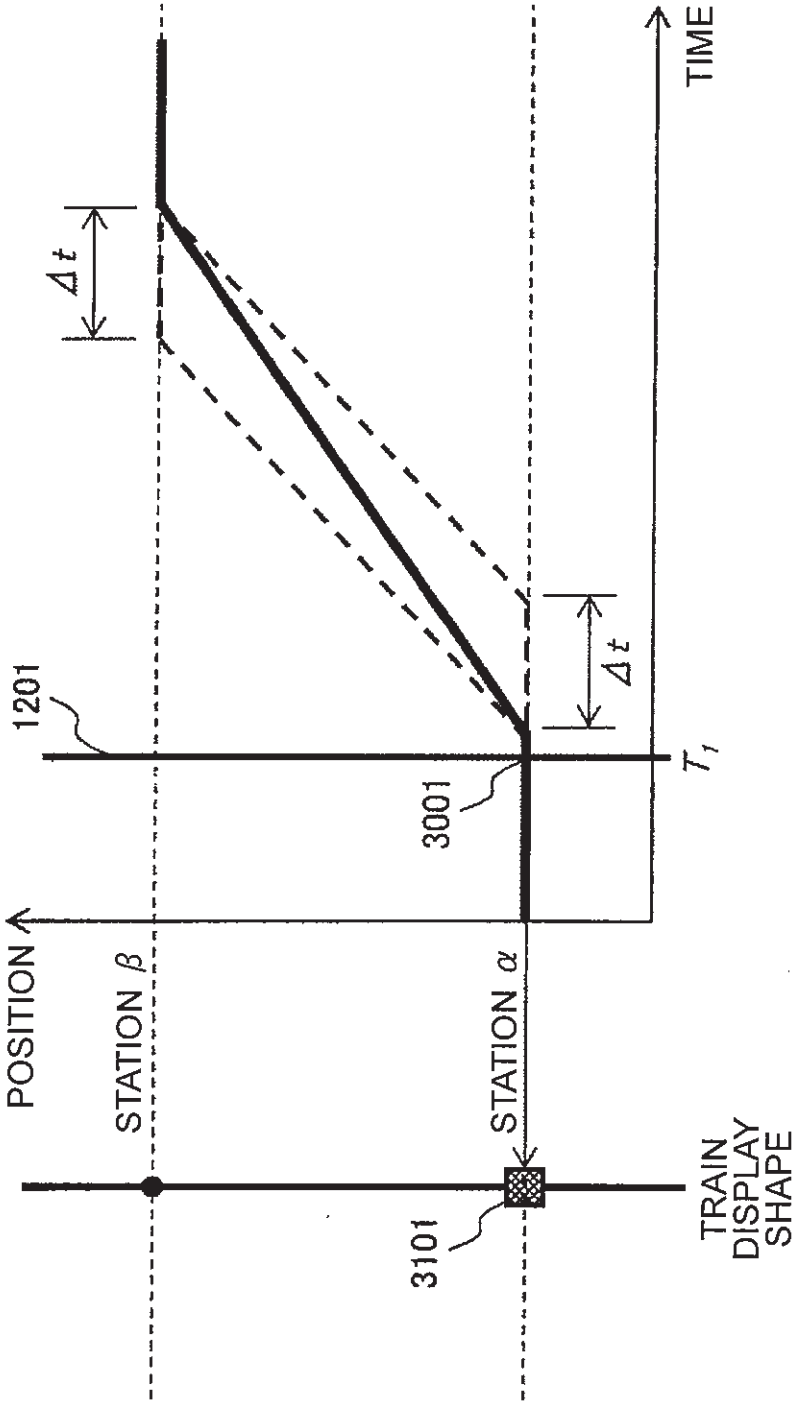

TIME
Δt
Δt
1201
3001
T_1
POSITION
STATION β
STATION α
3101
TRAIN DISPLAY SHAPE

FIG. 16

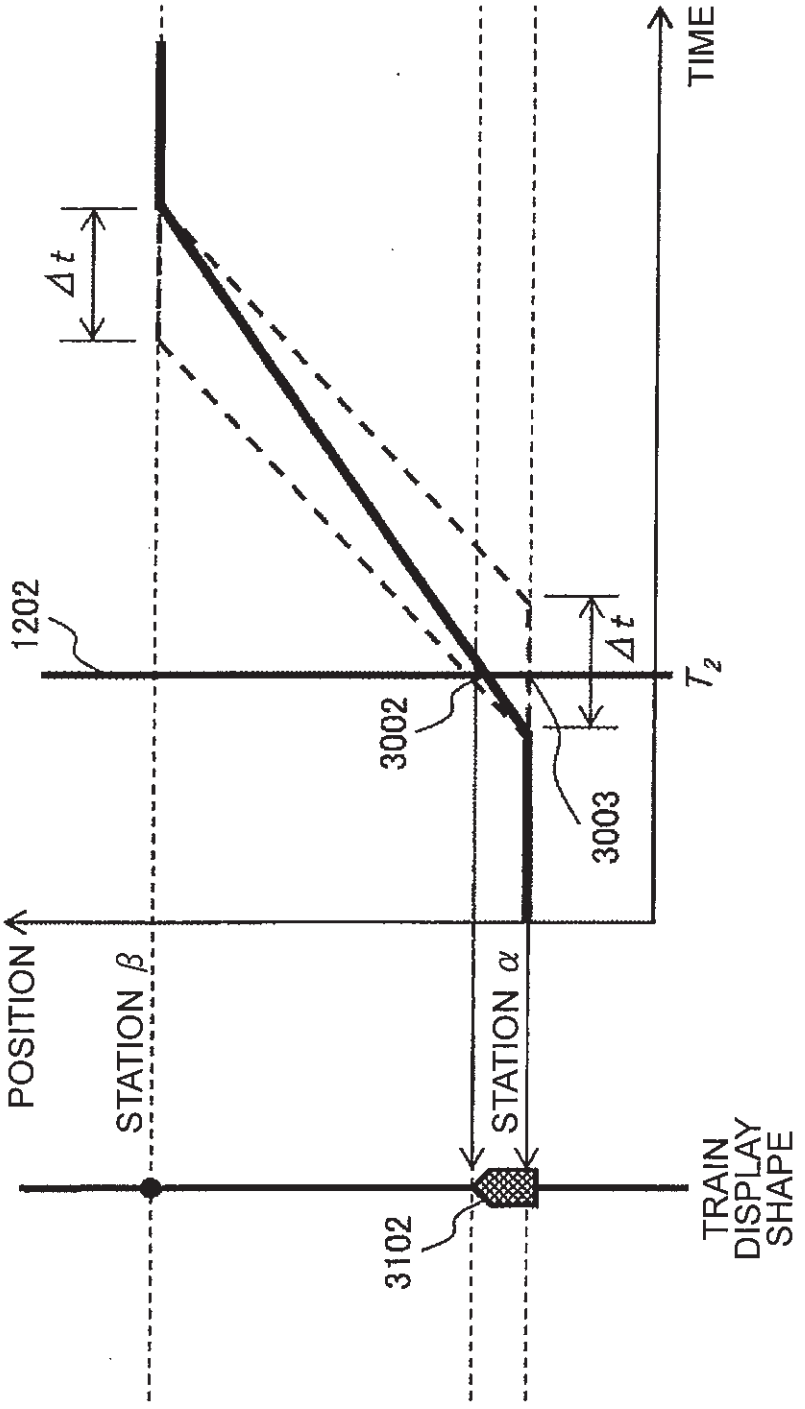

TIME
Δt
1202
3002
3003
Δt
T_2
POSITION
STATION β
STATION α
3102
TRAIN DISPLAY SHAPE

FIG. 17

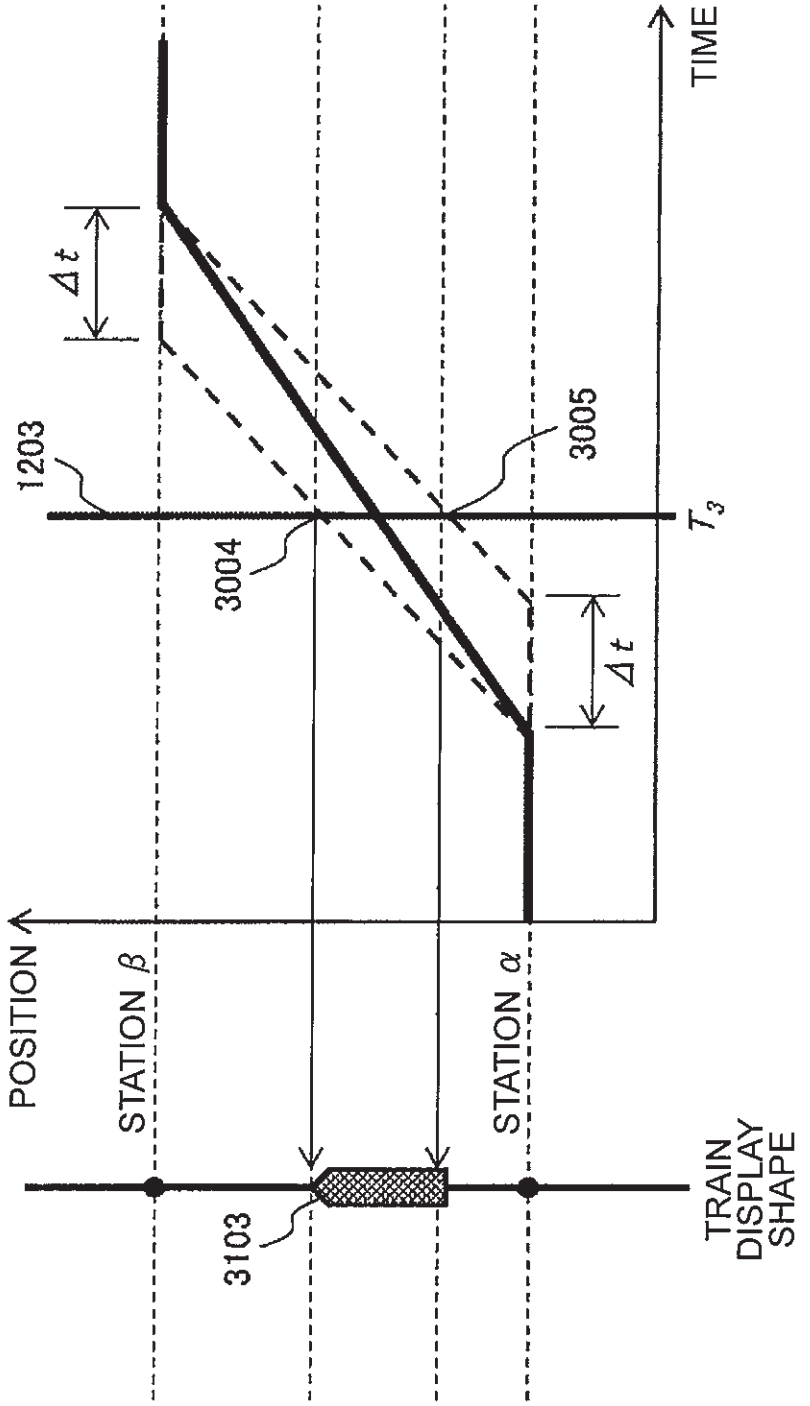

TIME
Δt
1203
3005
3004
T_3
Δt
POSITION
STATION β
STATION α
3103
TRAIN DISPLAY SHAPE

FIG. 18

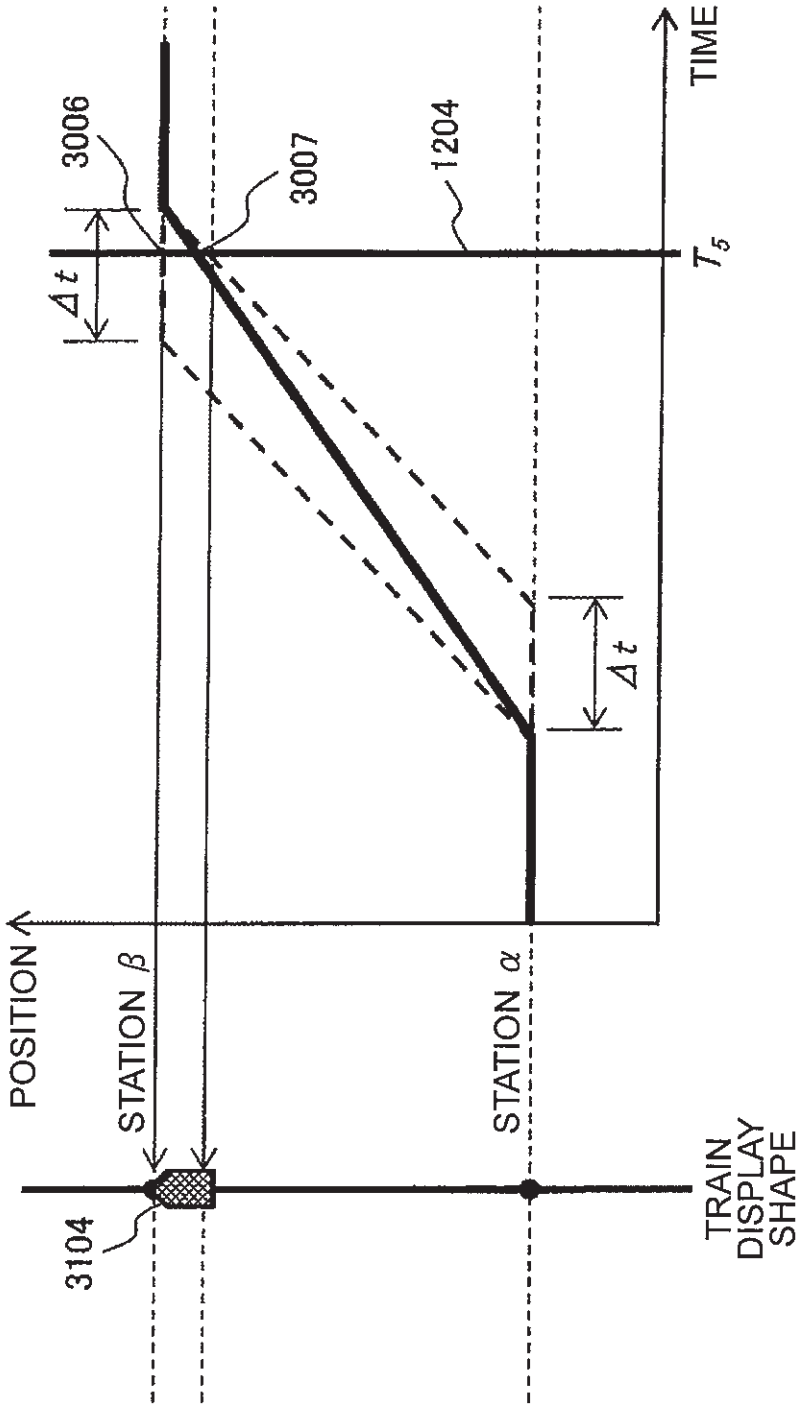

TIME
3006
3007
1204
T_5
Δt
Δt
POSITION
STATION β
STATION α
3104
TRAIN DISPLAY SHAPE

FIG. 19

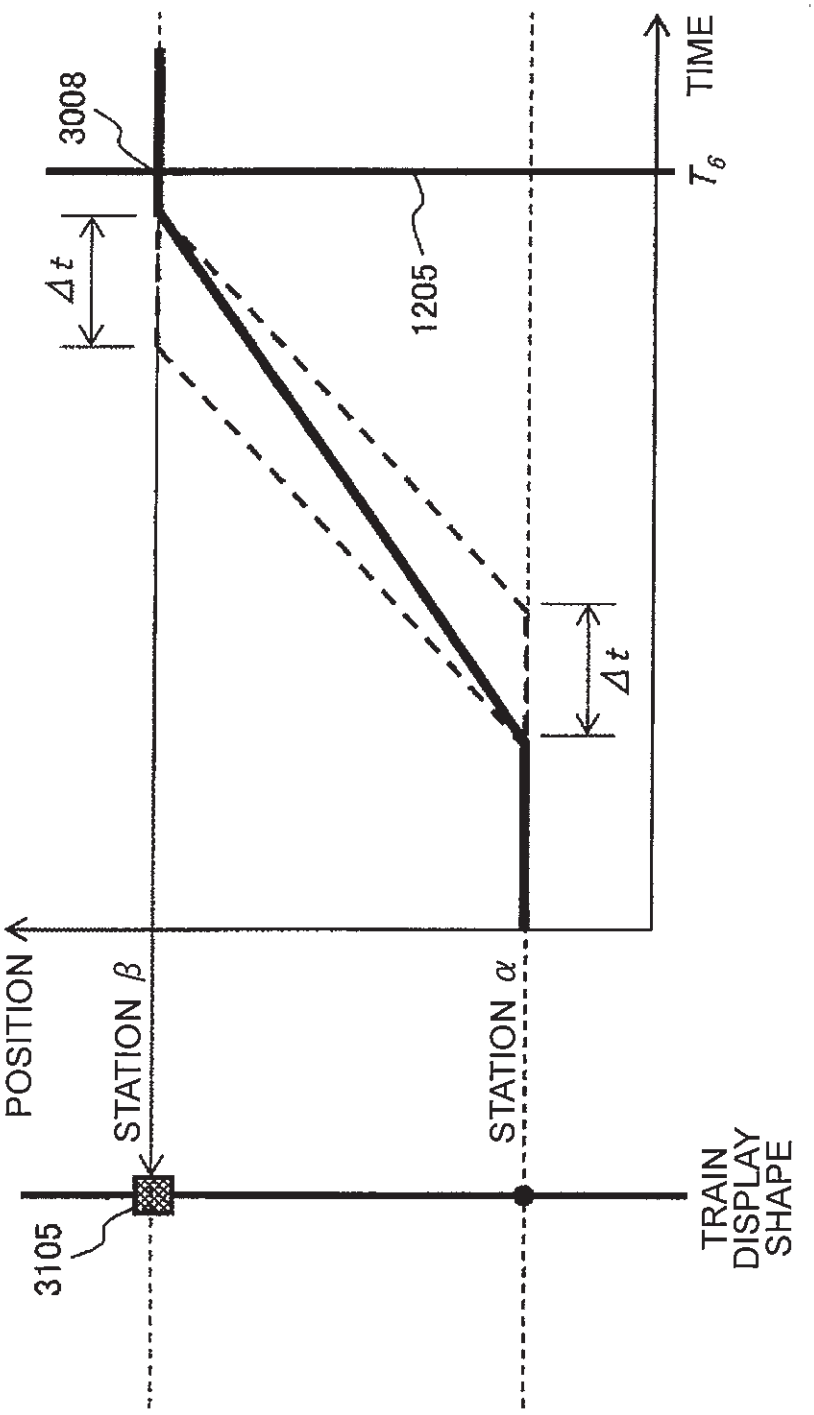

3008
TIME
T_6
Δt
1205
Δt
POSITION
STATION β
STATION α
3105
TRAIN DISPLAY SHAPE

FIG. 20

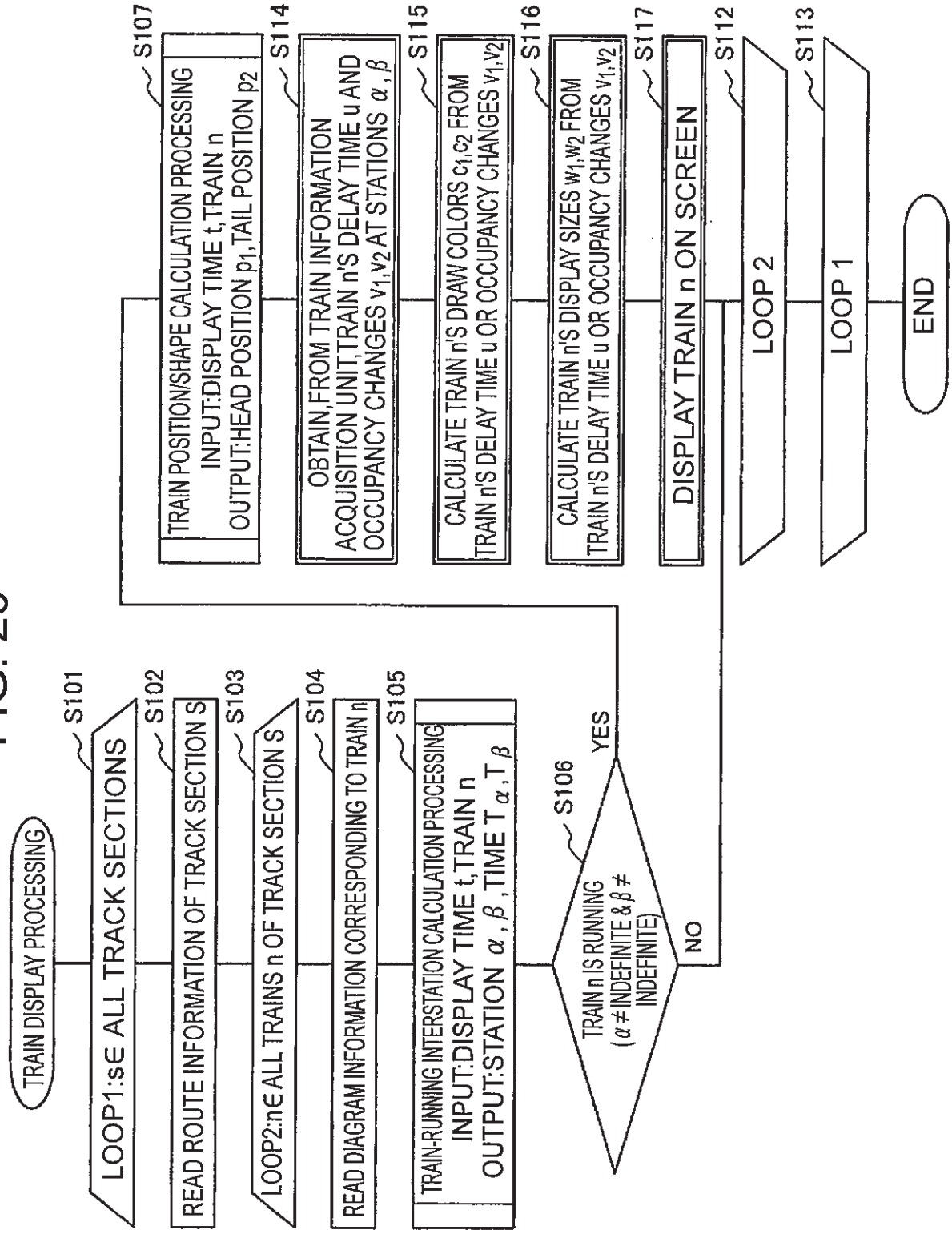

TRAIN DISPLAY PROCESSING
S101
LOOP1:s∈ ALL TRACK SECTIONS
S102
READ ROUTE INFORMATION OF TRACK SECTION S
S103
LOOP2:n∈ ALL TRAINS n OF TRACK SECTION S
S104
READ DIAGRAM INFORMATION CORRESPONDING TO TRAIN n
S105
TRAIN-RUNNING INTERSTATION CALCULATION PROCESSING
INPUT:DISPLAY TIME t,TRAIN n
OUTPUT:STATION α, β, TIME Tα, Tβ
S106
TRAIN n IS RUNNING
(α≠INDEFINITE & β≠INDEFINITE)
YES
NO
S107
TRAIN POSITION/SHAPE CALCULATION PROCESSING
INPUT:DISPLAY TIME t, TRAIN n
OUTPUT:HEAD POSITION p1, TAIL POSITION p2
S114
OBTAIN, FROM TRAIN INFORMATION ACQUISITION UNIT, TRAIN n'S DELAY TIME u AND OCCUPANCY CHANGES v1, v2 AT STATIONS α, β
S115
CALCULATE TRAIN n'S DRAW COLORS c1, c2 FROM TRAIN n'S DELAY TIME u OR OCCUPANCY CHANGES v1, v2
S116
CALCULATE TRAIN n'S DISPLAY SIZES w1, w2 FROM TRAIN n'S DELAY TIME u OR OCCUPANCY CHANGES v1, v2
S117
DISPLAY TRAIN n ON SCREEN
S112
LOOP 2
S113
LOOP 1
END

FIG. 21

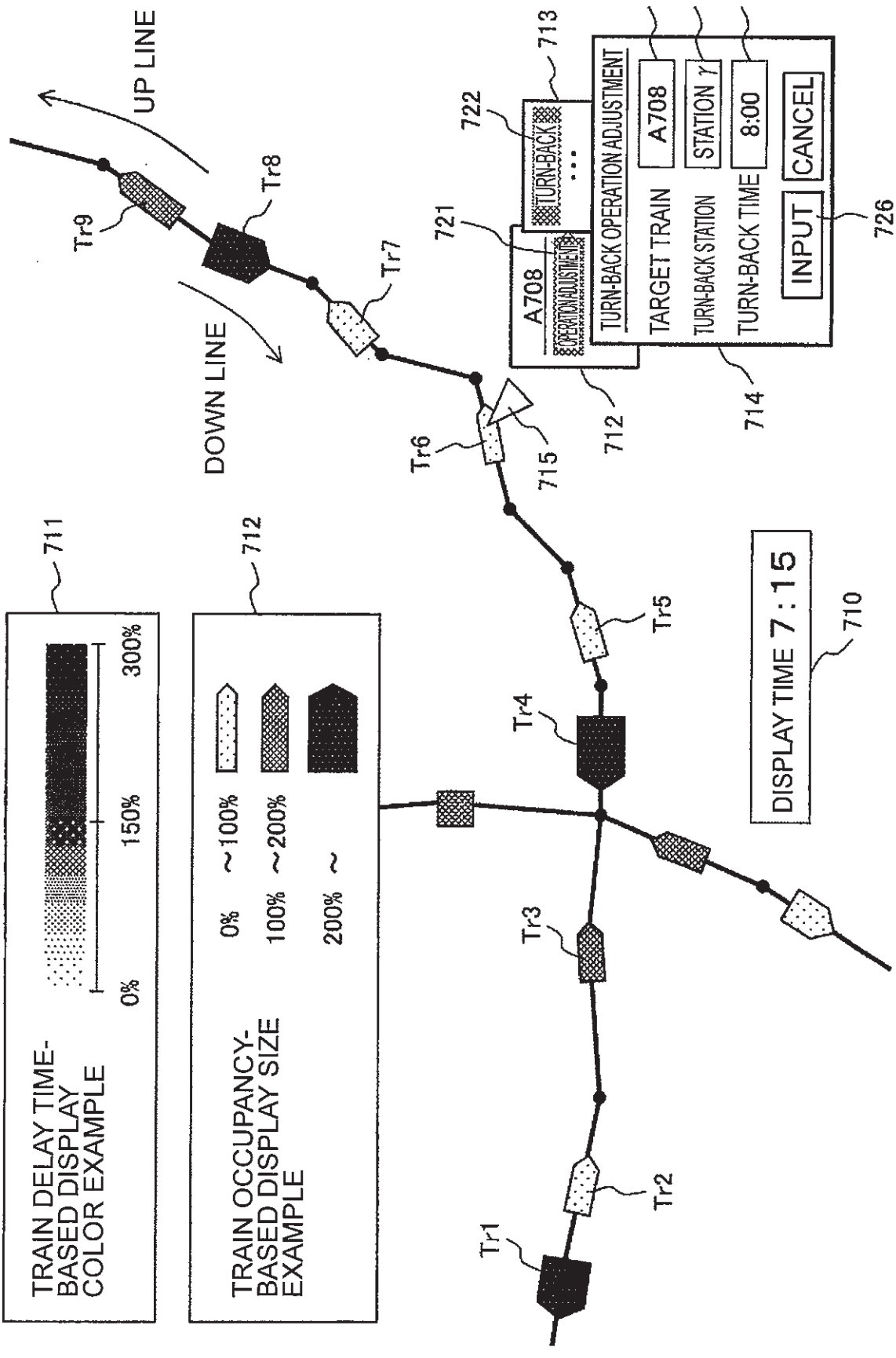

TRAIN DELAY TIME-BASED DISPLAY COLOR EXAMPLE
0%
150%
300%
711
TRAIN OCCUPANCY-BASED DISPLAY SIZE EXAMPLE
0% ~100%
100% ~200%
200% ~
712
UP LINE
DOWN LINE
Tr1
Tr2
Tr3
Tr4
Tr5
Tr6
Tr7
Tr8
Tr9
715
DISPLAY TIME 7 : 15
710
A708
OPERATION ADJUSTMENT
TURN-BACK
721
722
713
712
TURN-BACK OPERATION ADJUSTMENT
TARGET TRAIN
A708
TURN-BACK STATION
STATION γ
TURN-BACK TIME
8:00
INPUT
CANCEL
723
724
725
726
714

FIG. 22

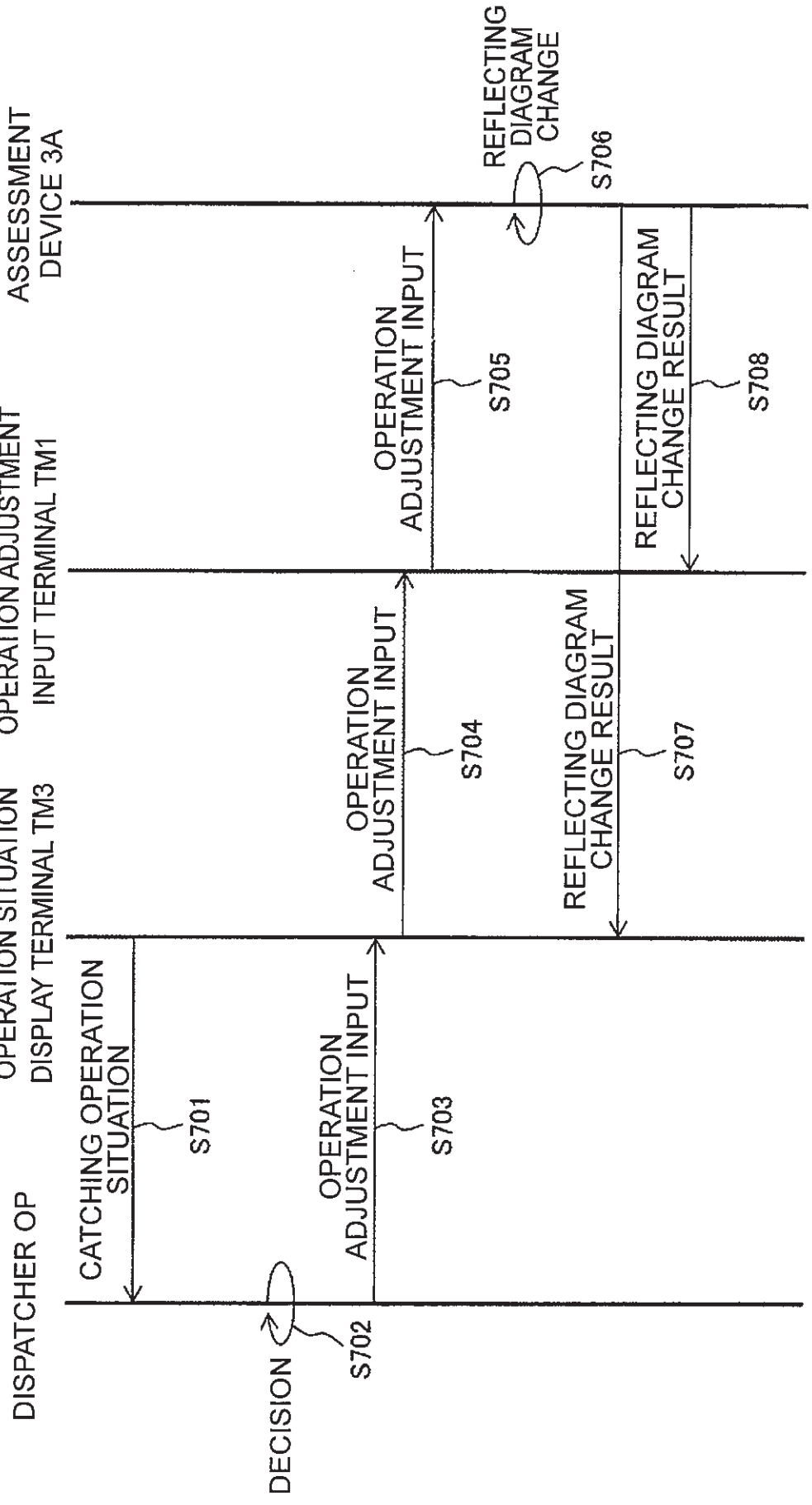

DISPATCHER OP
OPERATION SITUATION DISPLAY TERMINAL TM3
OPERATION ADJUSTMENT INPUT TERMINAL TM1
OPERATION ASSESSMENT DEVICE 3A
CATCHING OPERATION SITUATION
S701
DECISION
S702
OPERATION ADJUSTMENT INPUT
S703
OPERATION ADJUSTMENT INPUT
S704
REFLECTING DIAGRAM CHANGE RESULT
S707
OPERATION ADJUSTMENT INPUT
S705
REFLECTING DIAGRAM CHANGE
S706
REFLECTING DIAGRAM CHANGE RESULT
S708

FIG. 23

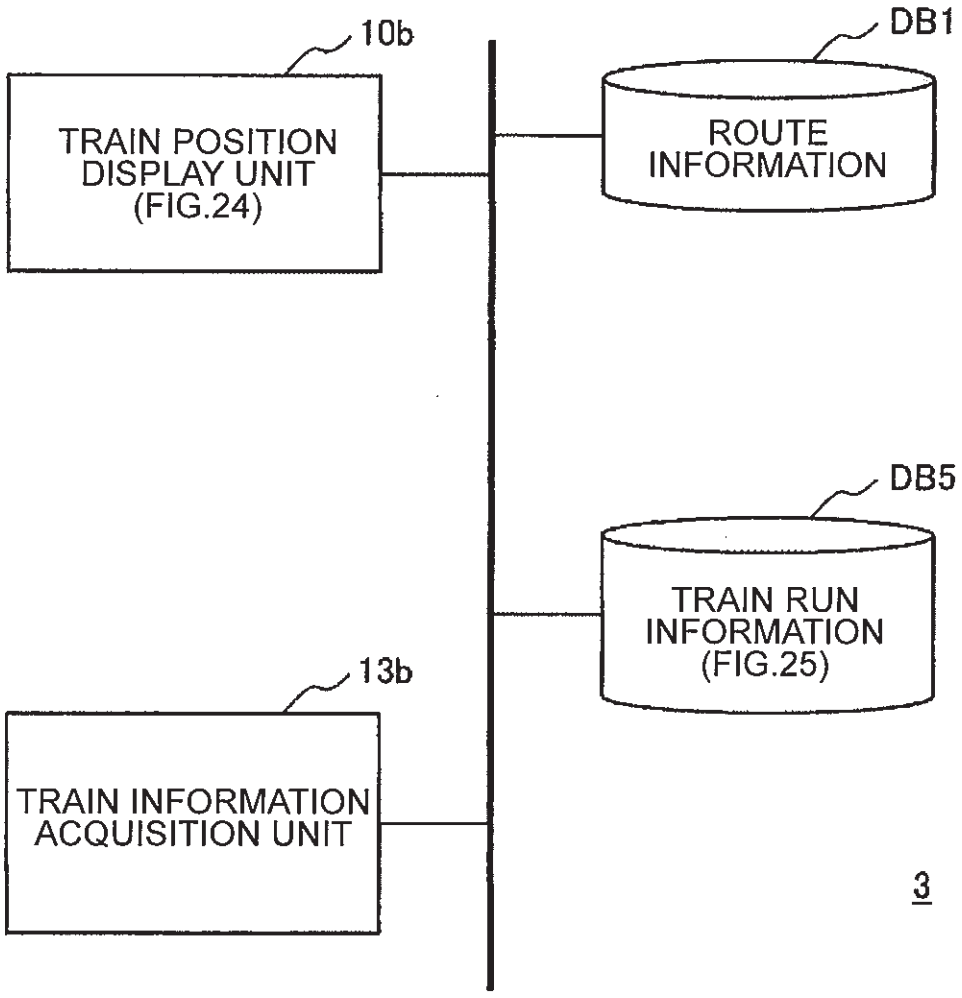

10b
TRAIN POSITION DISPLAY UNIT (FIG.24)
DB1
ROUTE INFORMATION
DB5
TRAIN RUN INFORMATION (FIG.25)
13b
TRAIN INFORMATION ACQUISITION UNIT
3

FIG. 24

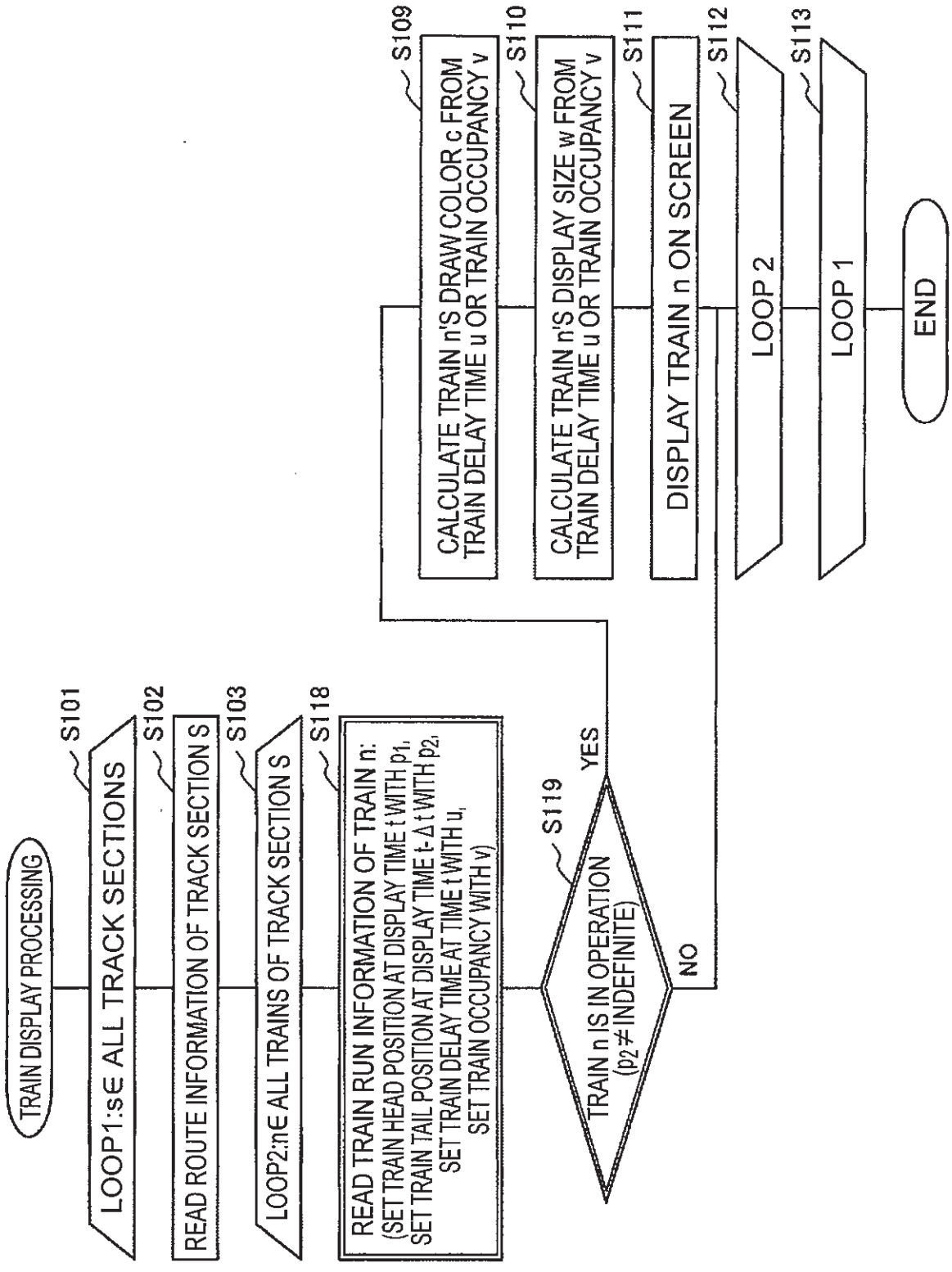

TRAIN DISPLAY PROCESSING
S101
LOOP1:s∈ ALL TRACK SECTIONS
S102
READ ROUTE INFORMATION OF TRACK SECTION S
S103
LOOP2:n∈ ALL TRAINS OF TRACK SECTION S
S118
READ TRAIN RUN INFORMATION OF TRAIN n:
(SET TRAIN HEAD POSITION AT DISPLAY TIME t WITH p1,
SET TRAIN TAIL POSITION AT DISPLAY TIME t-Δt WITH p2,
SET TRAIN DELAY TIME AT TIME t WITH u,
SET TRAIN OCCUPANCY WITH v)
S119
TRAIN n IS IN OPERATION
(p2≠INDEFINITE)
YES
NO
S109
CALCULATE TRAIN n'S DRAW COLOR c FROM
TRAIN DELAY TIME u OR TRAIN OCCUPANCY v
S110
CALCULATE TRAIN n'S DISPLAY SIZE w FROM
TRAIN DELAY TIME u OR TRAIN OCCUPANCY v
S111
DISPLAY TRAIN n ON SCREEN
S112
LOOP 2
S113
LOOP 1
END

FIG. 25

TRAIN n

TB7

TIME	X-COORDINATE	Y-COORDINATE	TRAIN DELAY TIME	TRAIN OCCUPANCY
07:10:10	x_1	y_1	0 SEC.	51%
07:10:20	x_2	y_2	0 SEC.	51%
07:10:30	x_3	y_3	5 SEC.	50%
07:10:40	x_3	y_3	5 SEC.	46%
:	:	:		:

701 702 703 704 705

TRAIN m

TB8

TIME	X-COORDINATE	Y-COORDINATE	TRAIN DELAY TIME	TRAIN OCCUPANCY
07:10:10	x_1	y_1	0 SEC.	51%
07:10:20	x_2	y_2	0 SEC.	51%
07:10:30	x_3	y_3	5 SEC.	50%
07:10:40	x_3	y_3	5 SEC.	46%
:	:	:		: