FIG.1

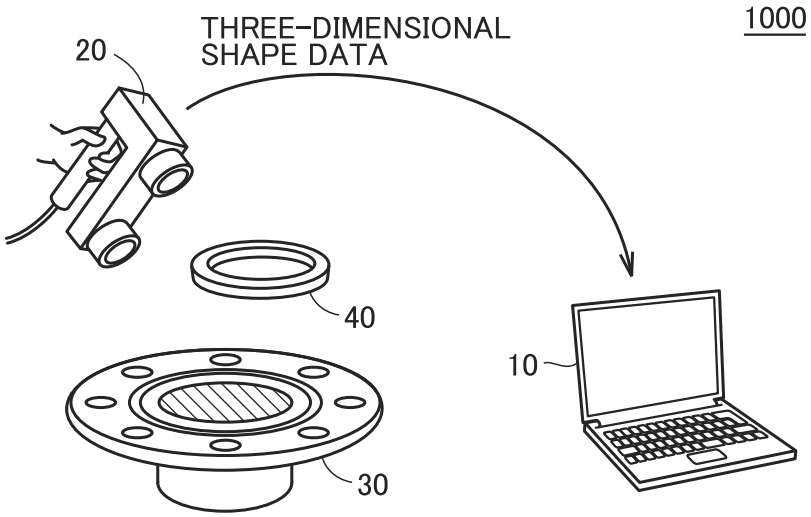


FIG.2

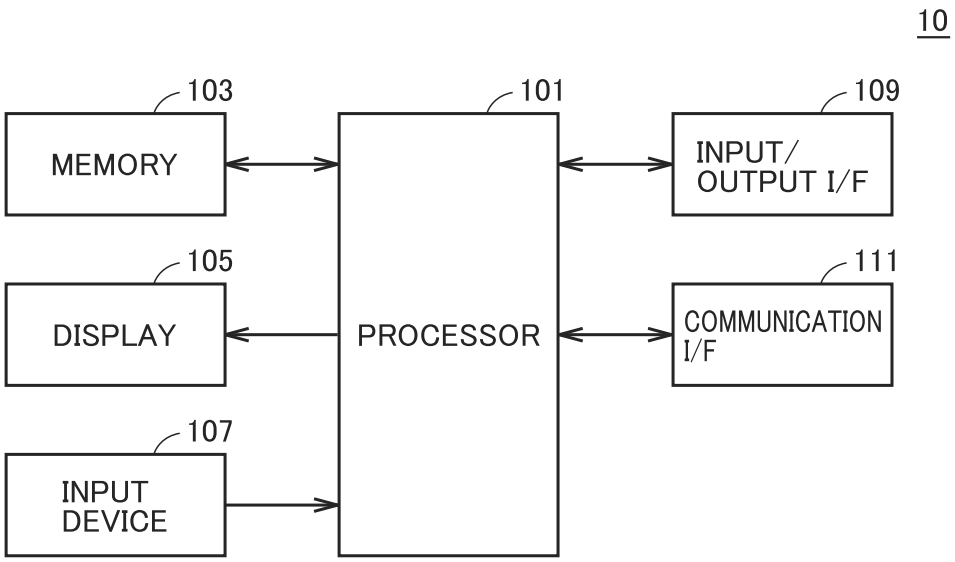

10
103
MEMORY
101
PROCESSOR
109
INPUT/
OUTPUT I/F
105
DISPLAY
111
COMMUNICATION
I/F
107
INPUT
DEVICE

FIG.3

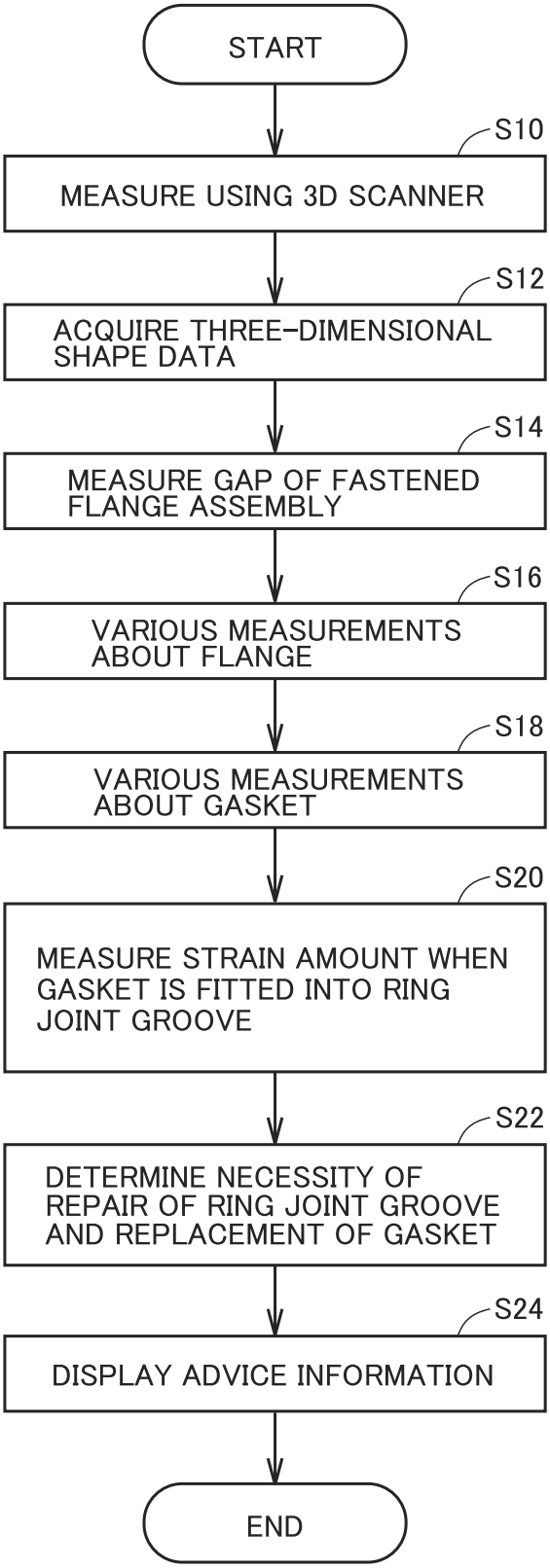
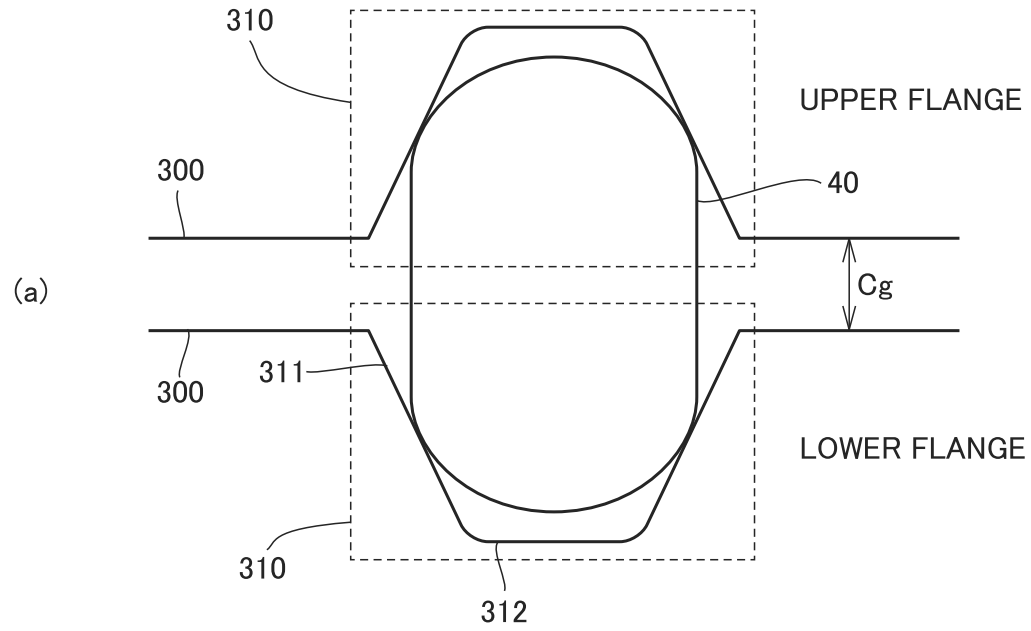

START
S10
MEASURE USING 3D SCANNER
S12
ACQUIRE THREE-DIMENSIONAL SHAPE DATA
S14
MEASURE GAP OF FASTENED FLANGE ASSEMBLY
S16
VARIOUS MEASUREMENTS ABOUT FLANGE
S18
VARIOUS MEASUREMENTS ABOUT GASKET
S20
MEASURE STRAIN AMOUNT WHEN GASKET IS FITTED INTO RING JOINT GROOVE
S22
DETERMINE NECESSITY OF REPAIR OF RING JOINT GROOVE AND REPLACEMENT OF GASKET
S24
DISPLAY ADVICE INFORMATION
END

FIG.4


(a)
310
UPPER FLANGE
300
40
Cg
300
311
LOWER FLANGE
310
312

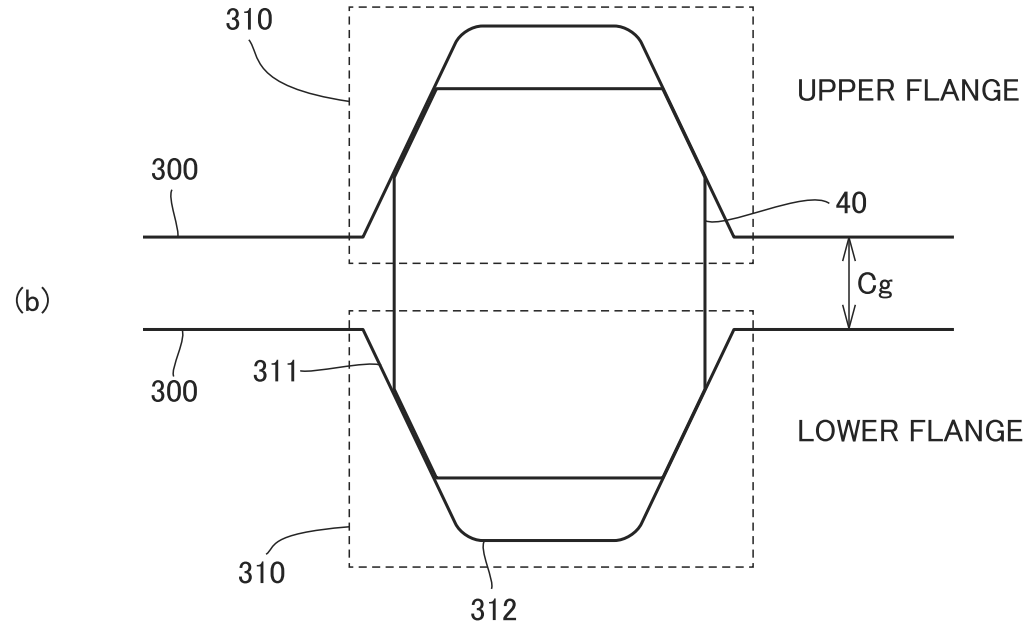

(b)
310
UPPER FLANGE
300
40
Cg
300
311
LOWER FLANGE
310
312

FIG.5

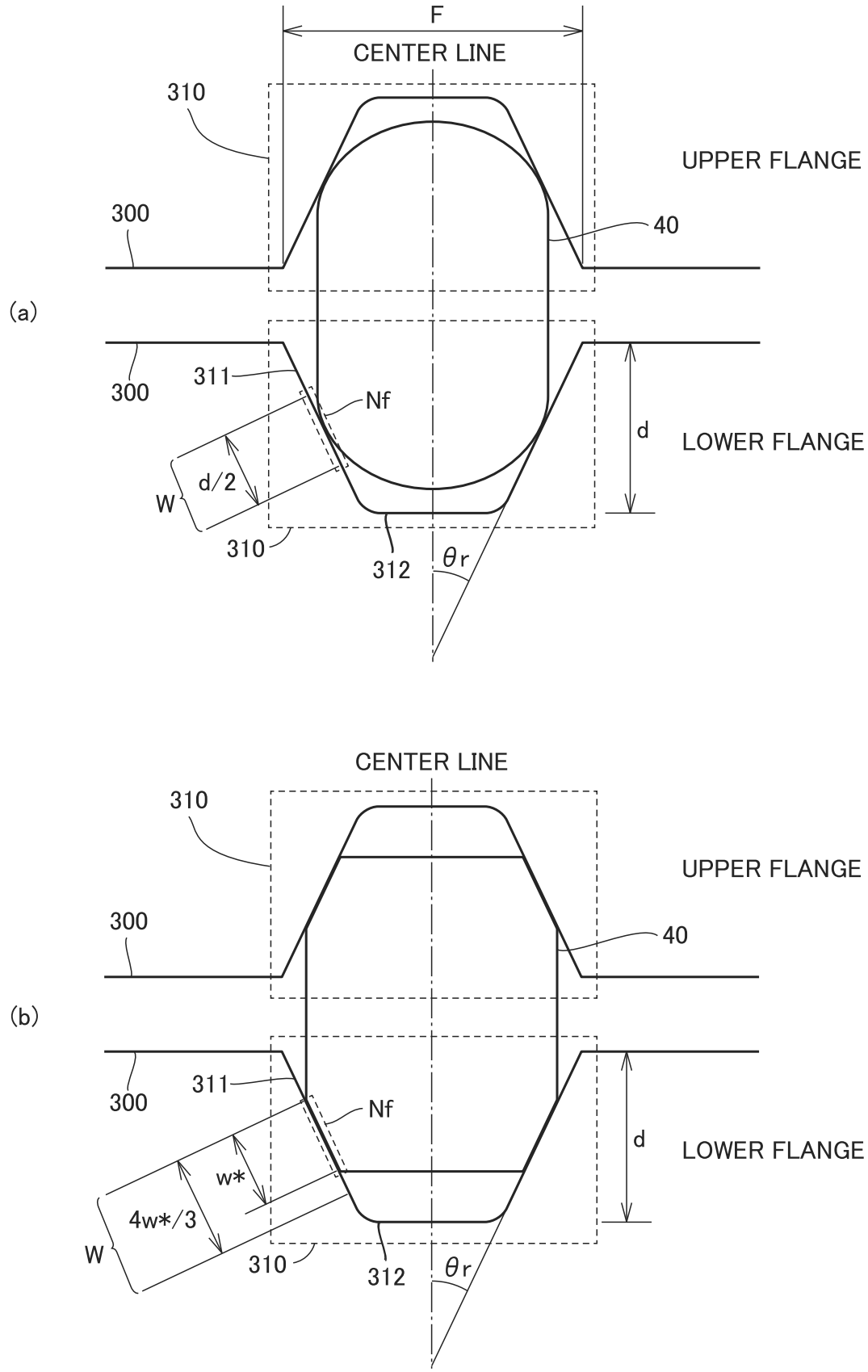
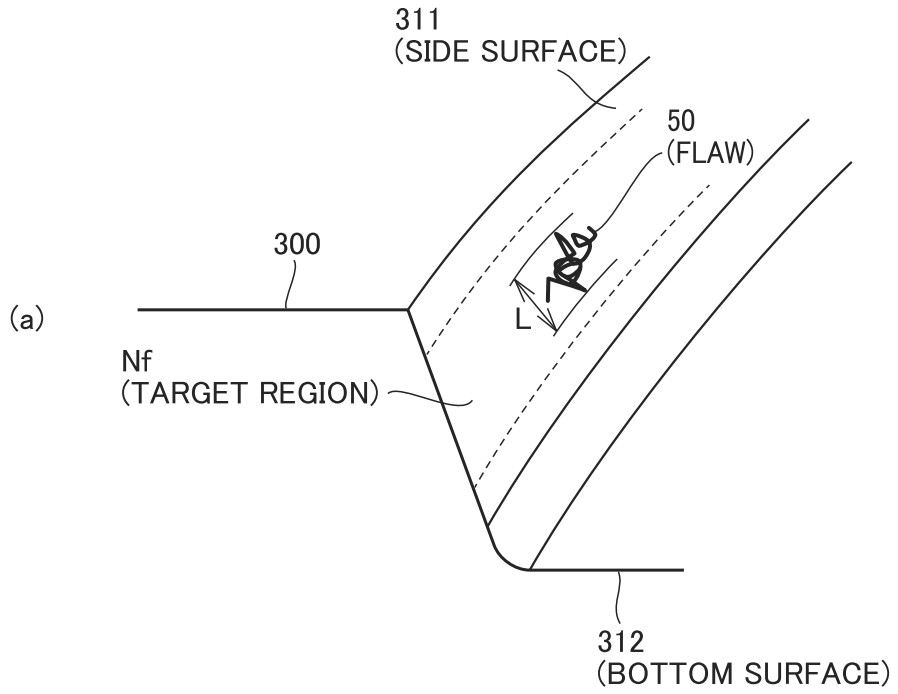

(a)
F
CENTER LINE
310
UPPER FLANGE
300
40
300
311
Nf
d
LOWER FLANGE
d/2
W
310
312
θr
(b)
CENTER LINE
310
UPPER FLANGE
300
40
300
311
Nf
d
LOWER FLANGE
w*
4w*/3
W
310
312
θr

FIG.6


(a)
311
(SIDE SURFACE)
50
(FLAW)
300
L
Nf
(TARGET REGION)
312
(BOTTOM SURFACE)

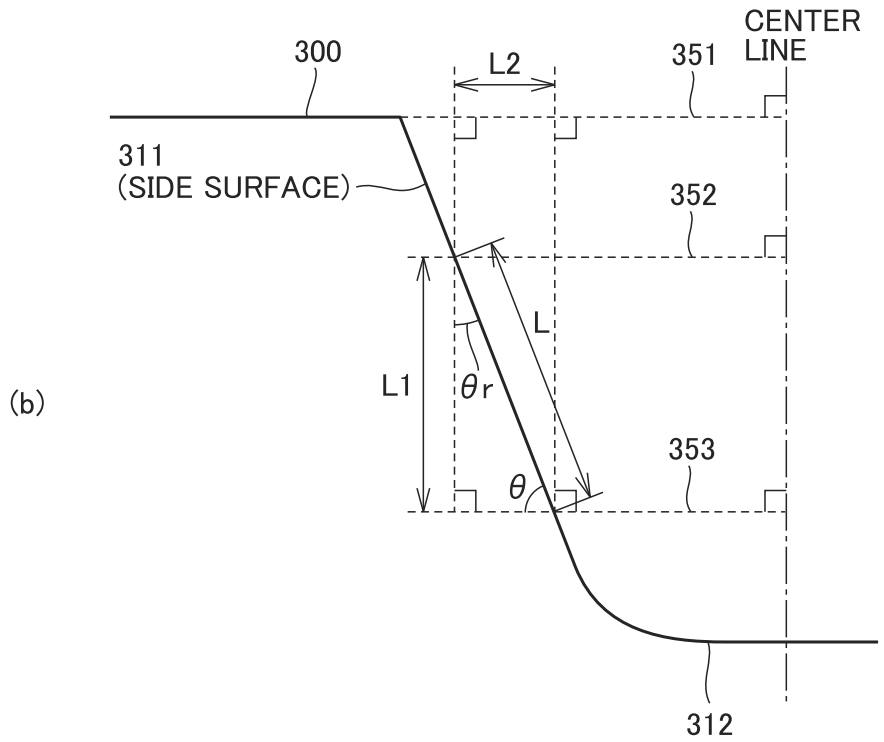

(b)
300
L2
351
CENTER
LINE
311
(SIDE SURFACE)
352
L
L1
θr
353
θ
312

FIG.7

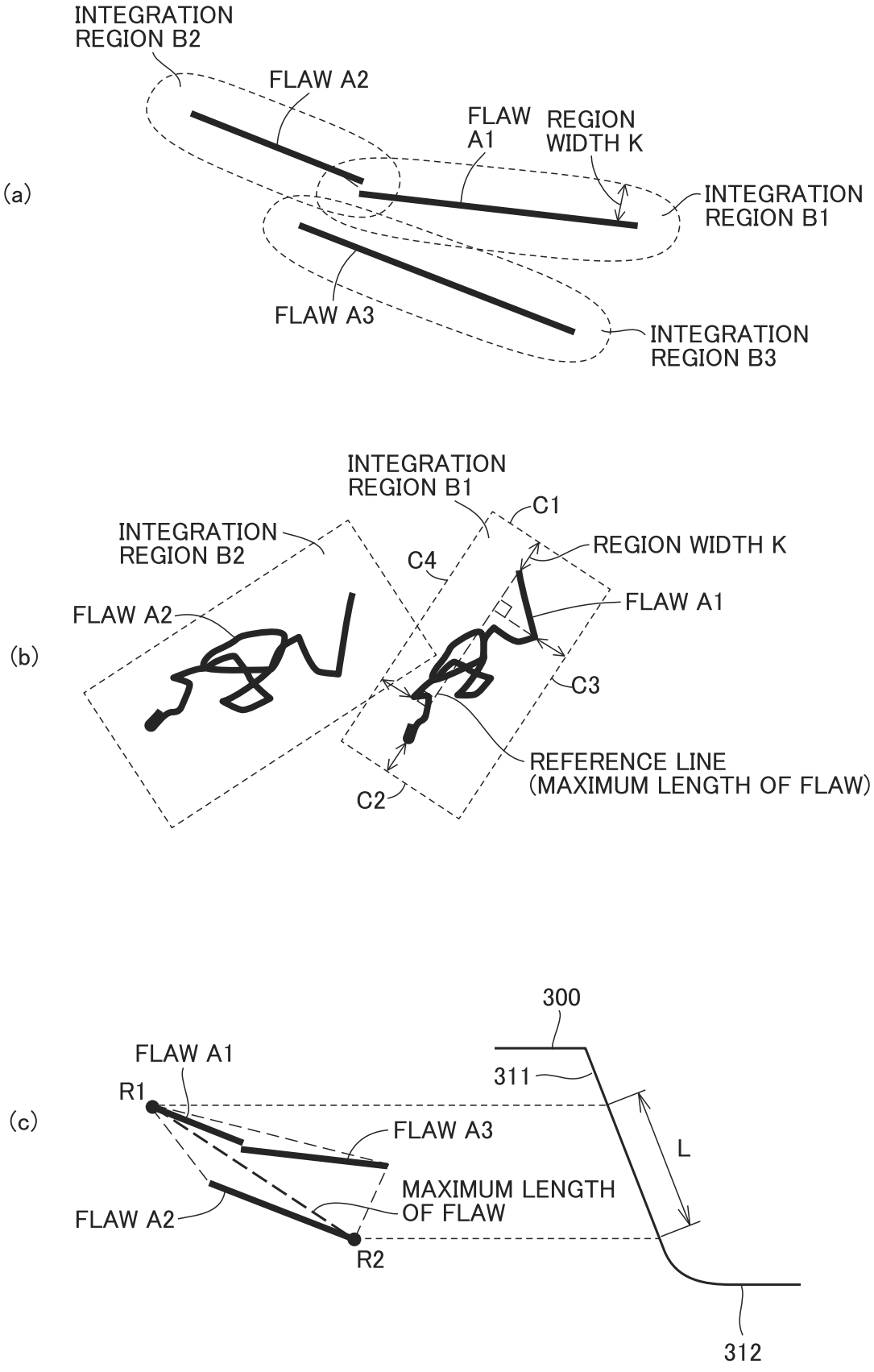

(a)
INTEGRATION REGION B2
FLAW A2
FLAW A1
REGION WIDTH K
INTEGRATION REGION B1
FLAW A3
INTEGRATION REGION B3
(b)
INTEGRATION REGION B1
C1
INTEGRATION REGION B2
C4
REGION WIDTH K
FLAW A2
FLAW A1
C3
REFERENCE LINE (MAXIMUM LENGTH OF FLAW)
C2
(c)
300
FLAW A1
311
R1
FLAW A3
L
MAXIMUM LENGTH OF FLAW
FLAW A2
R2
312

FIG.8

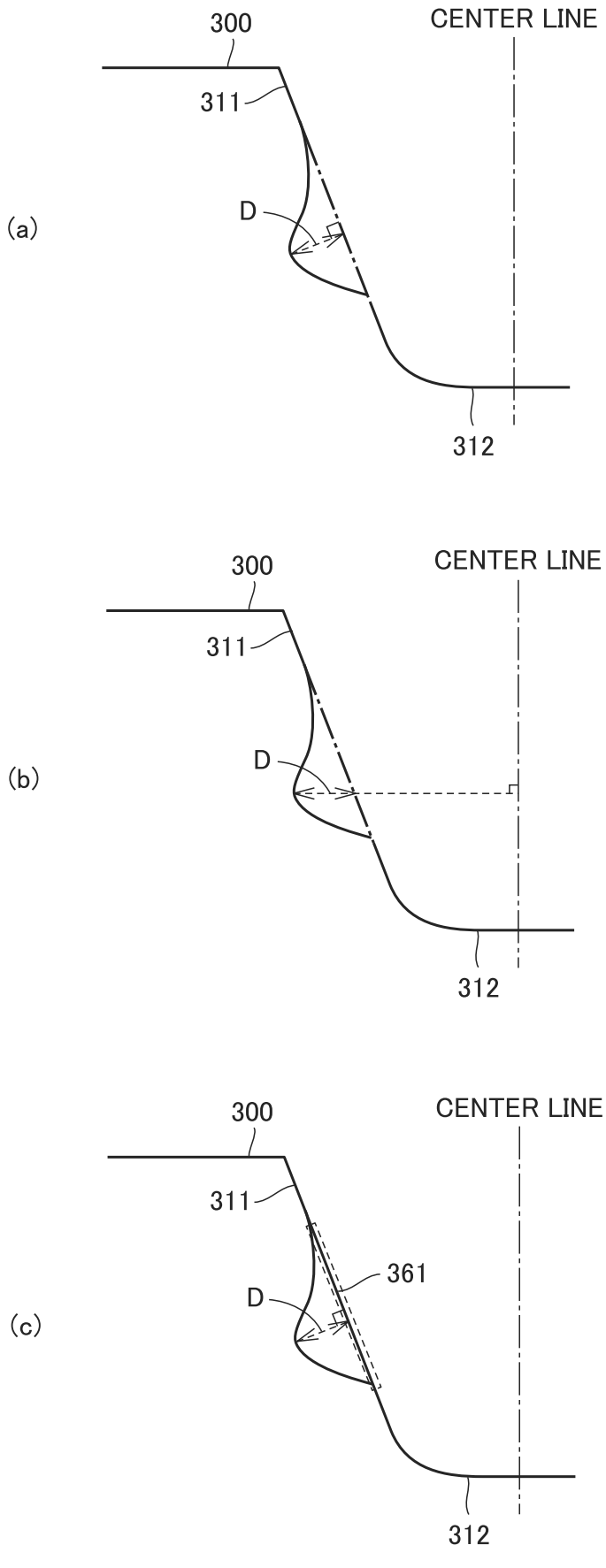

(a)
300
CENTER LINE
311
D
312
(b)
300
CENTER LINE
311
D
312
(c)
300
CENTER LINE
311
361
D
312

FIG.9

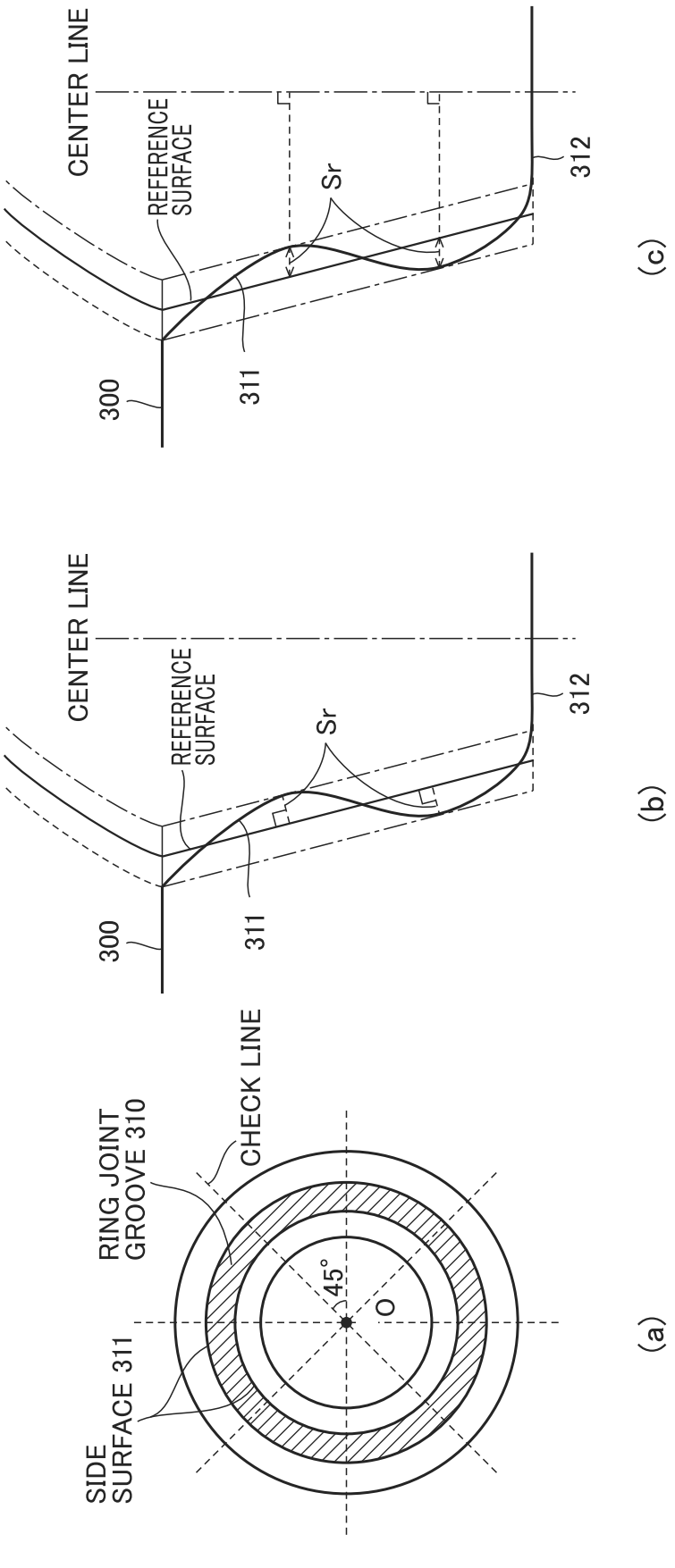

SIDE SURFACE 311
RING JOINT GROOVE 310
CHECK LINE
45°
O
(a)
CENTER LINE
REFERENCE SURFACE
300
311
Sr
312
(b)
CENTER LINE
REFERENCE SURFACE
300
311
Sr
312
(c)

FIG.10

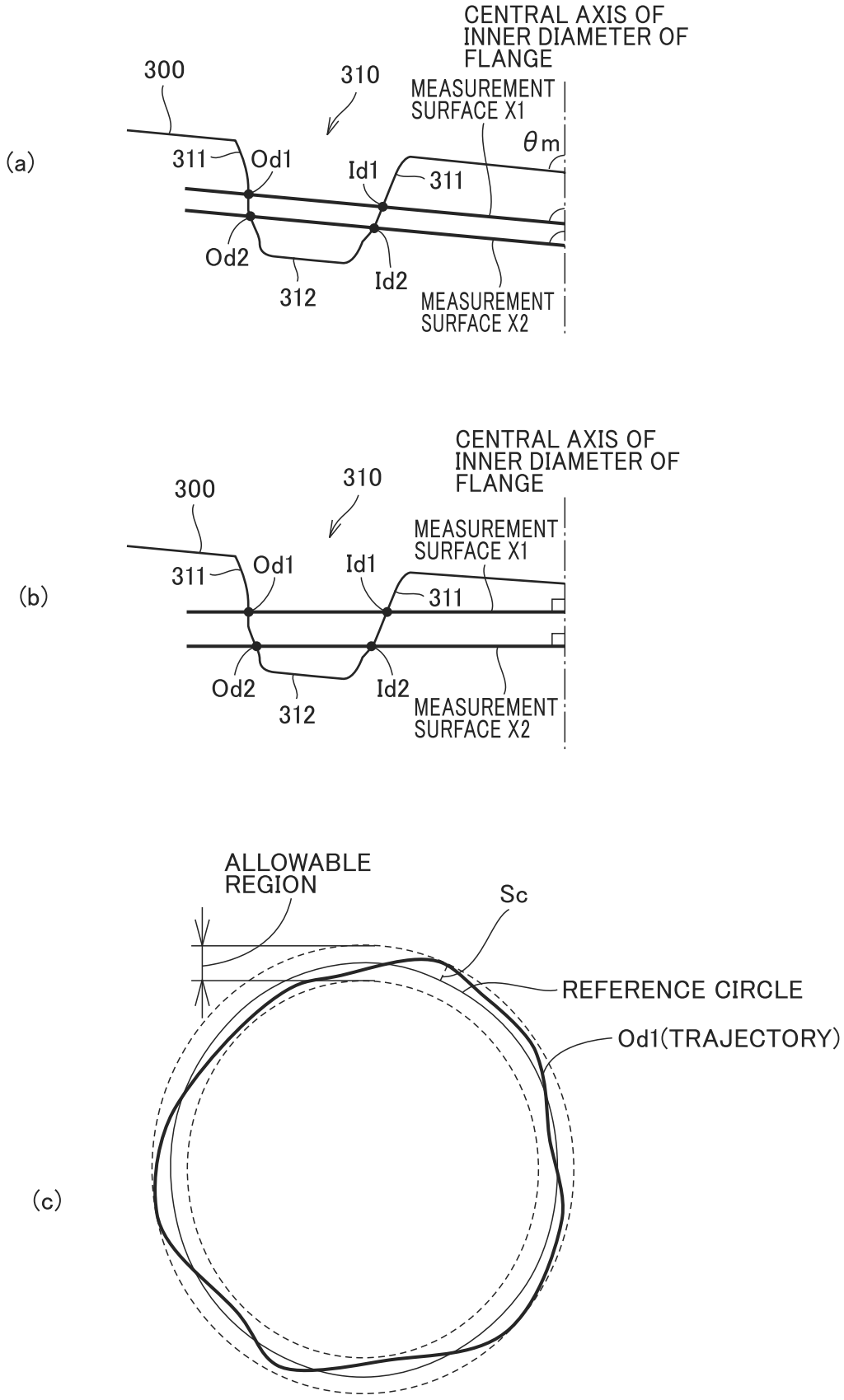
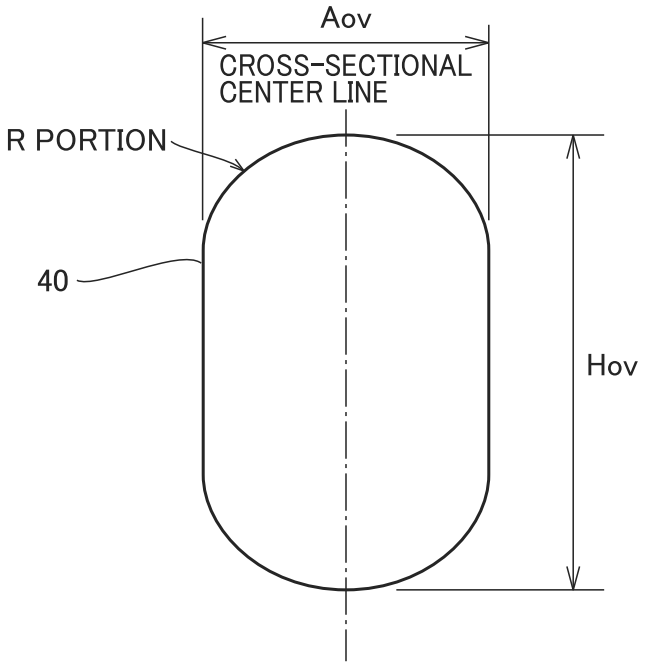

(a)
CENTRAL AXIS OF INNER DIAMETER OF FLANGE
300
310
MEASUREMENT SURFACE X1
θm
311
Od1
Id1
311
Od2
Id2
312
MEASUREMENT SURFACE X2
(b)
CENTRAL AXIS OF INNER DIAMETER OF FLANGE
300
310
MEASUREMENT SURFACE X1
311
Od1
Id1
311
Od2
Id2
312
MEASUREMENT SURFACE X2
(c)
ALLOWABLE REGION
Sc
REFERENCE CIRCLE
Od1(TRAJECTORY)

FIG.11

(a)


Aov
CROSS-SECTIONAL
CENTER LINE
R PORTION
40
Hov

(b)

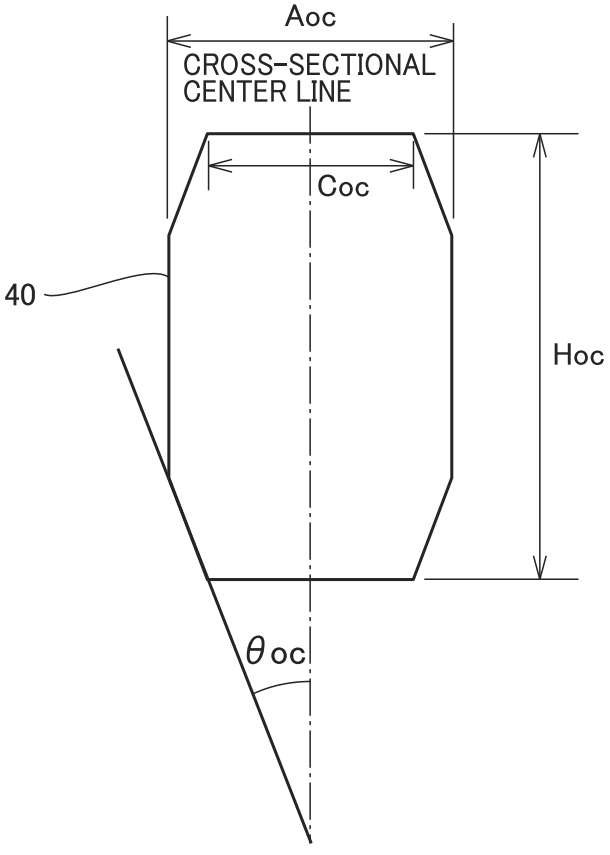
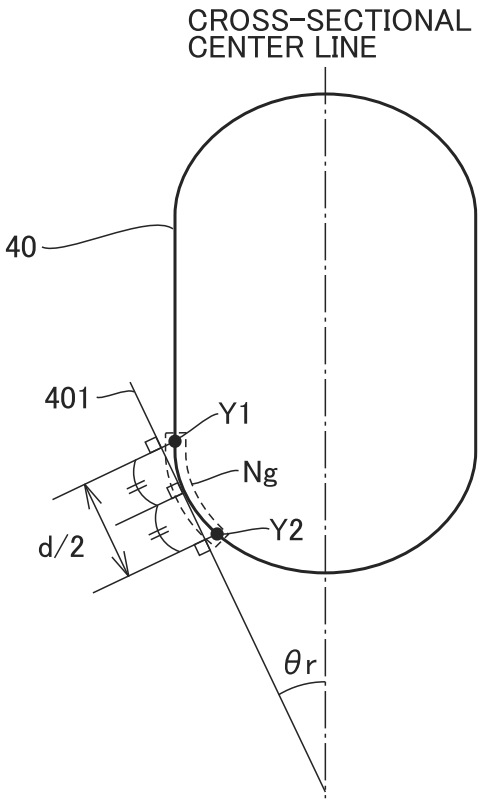

Aoc
CROSS-SECTIONAL
CENTER LINE
Coc
40
Hoc
θoc

FIG.12

(a)


CROSS-SECTIONAL
CENTER LINE
40
401
Y1
Ng
Y2
d/2
θr

(b)

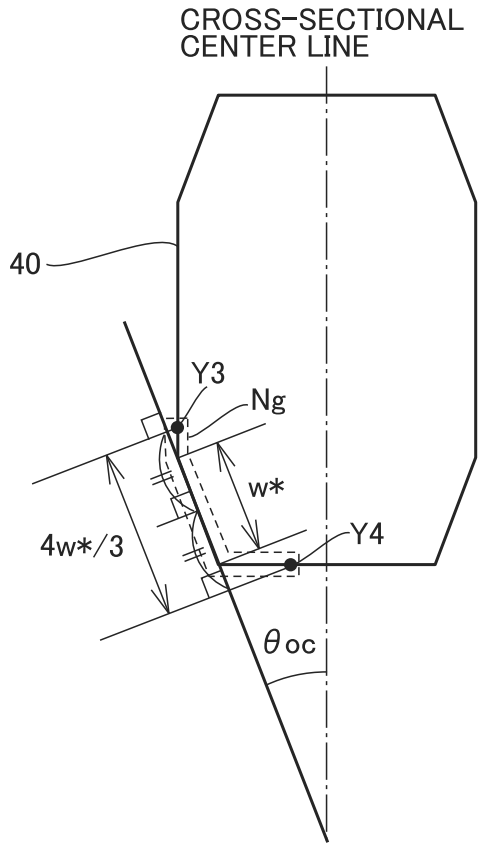

CROSS-SECTIONAL
CENTER LINE
40
Y3
Ng
w*
4w*/3
Y4
θoc

FIG.13

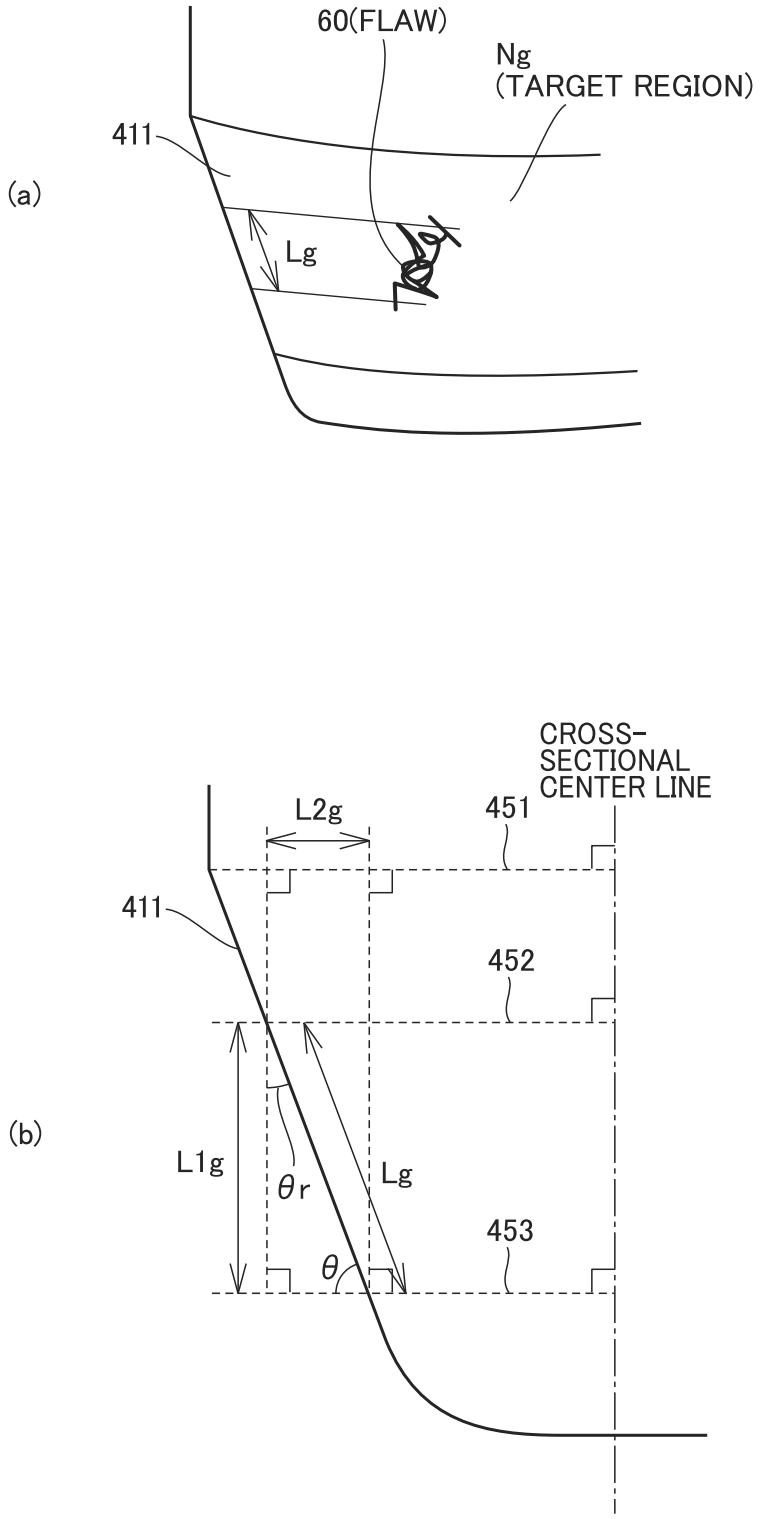

(a)
60(FLAW)
Ng
(TARGET REGION)
411
Lg
(b)
CROSS-
SECTIONAL
CENTER LINE
L2g
451
411
452
L1g
θr
Lg
453
θ

FIG.14

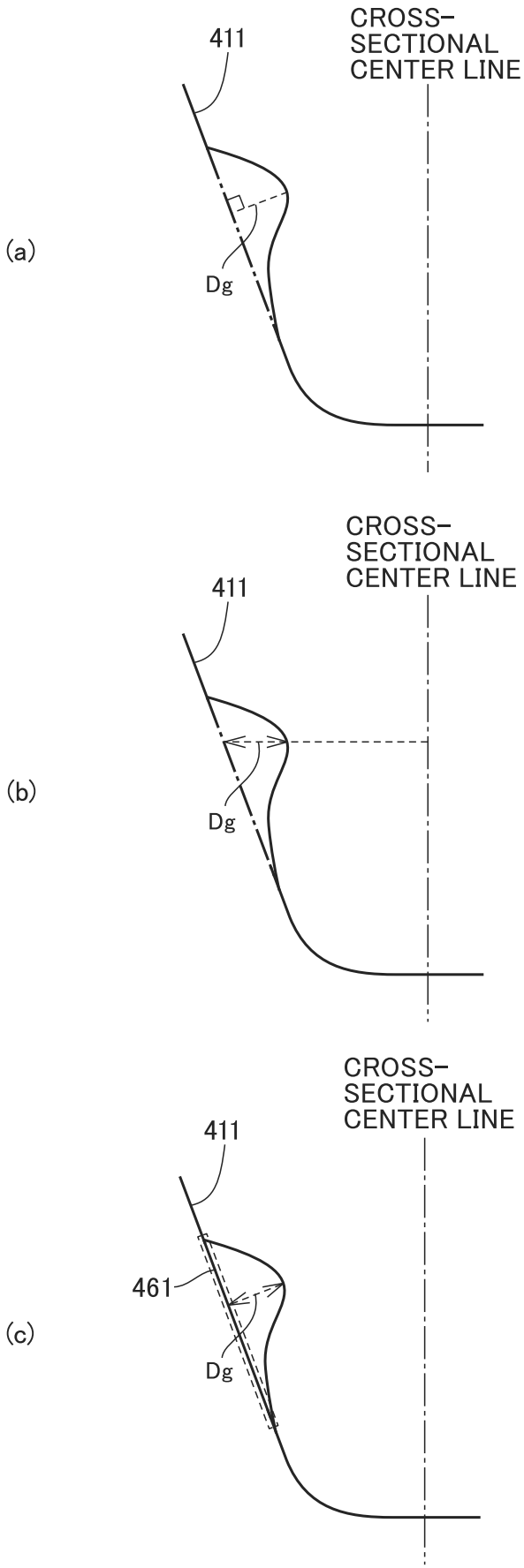

(a)
411
CROSS-
SECTIONAL
CENTER LINE
Dg
(b)
411
CROSS-
SECTIONAL
CENTER LINE
Dg
(c)
411
CROSS-
SECTIONAL
CENTER LINE
461
Dg

FIG.15

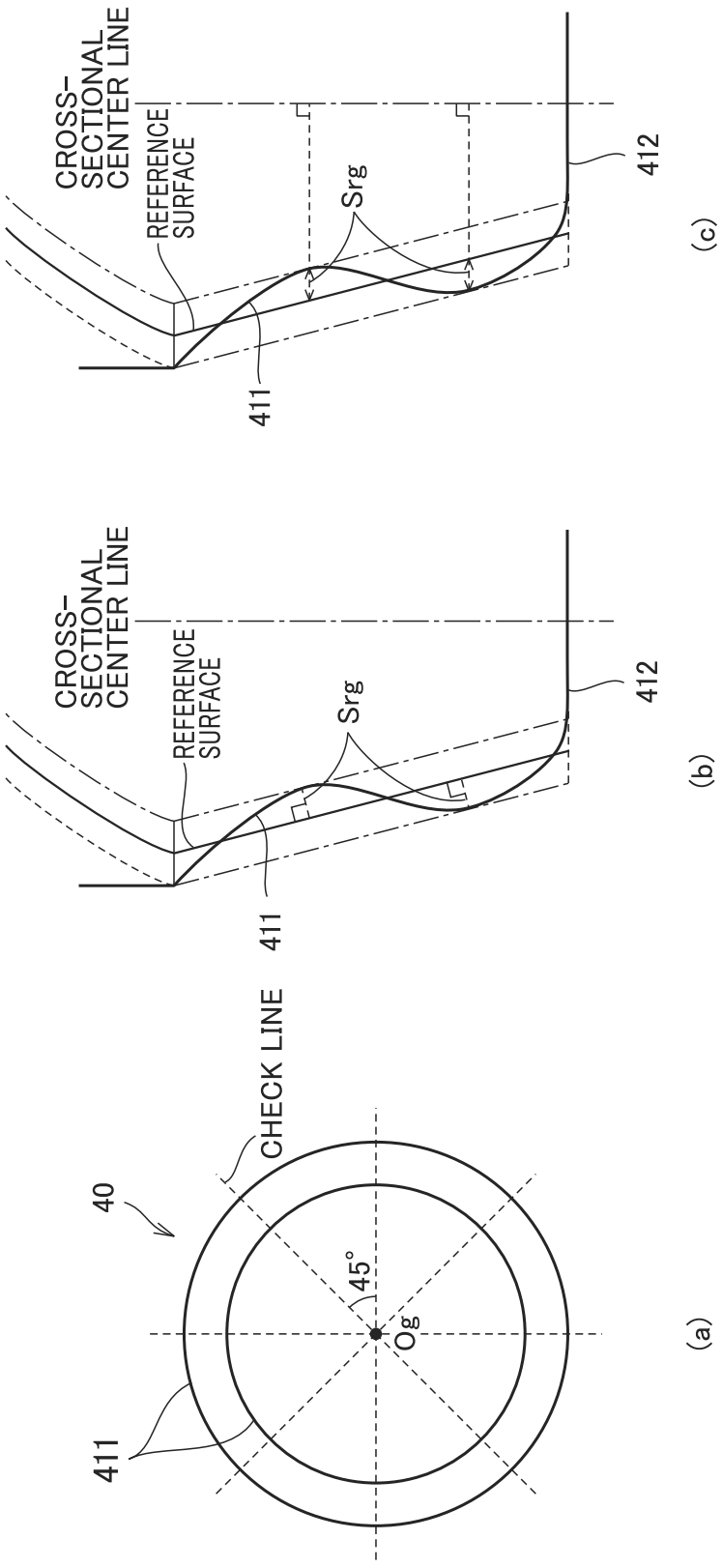
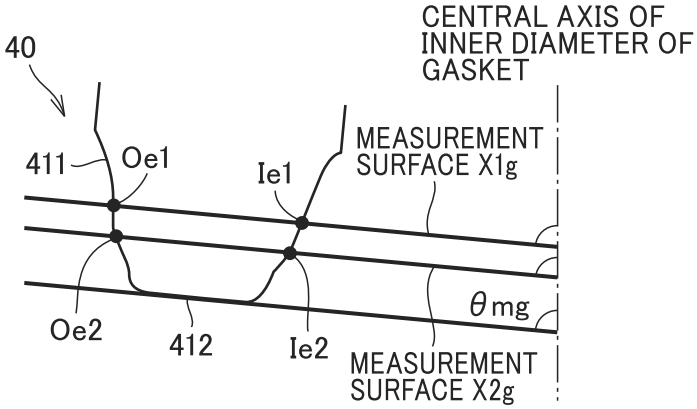
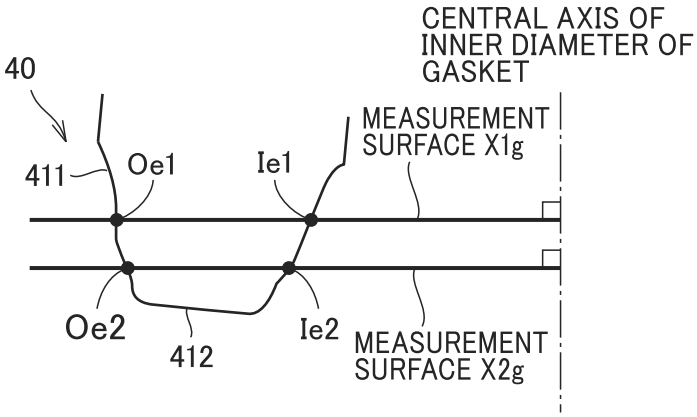

40
CHECK LINE
45°
Og
411
(a)
CROSS-
SECTIONAL
CENTER LINE
REFERENCE
SURFACE
Srg
411
412
(b)
CROSS-
SECTIONAL
CENTER LINE
REFERENCE
SURFACE
Srg
411
412
(c)

FIG.16

(a)


CENTRAL AXIS OF INNER DIAMETER OF GASKET
40
411
Oe1
Ie1
MEASUREMENT SURFACE X1g
θmg
Oe2
412
Ie2
MEASUREMENT SURFACE X2g

(b)


CENTRAL AXIS OF INNER DIAMETER OF GASKET
40
411
Oe1
Ie1
MEASUREMENT SURFACE X1g
Oe2
412
Ie2
MEASUREMENT SURFACE X2g

(c)

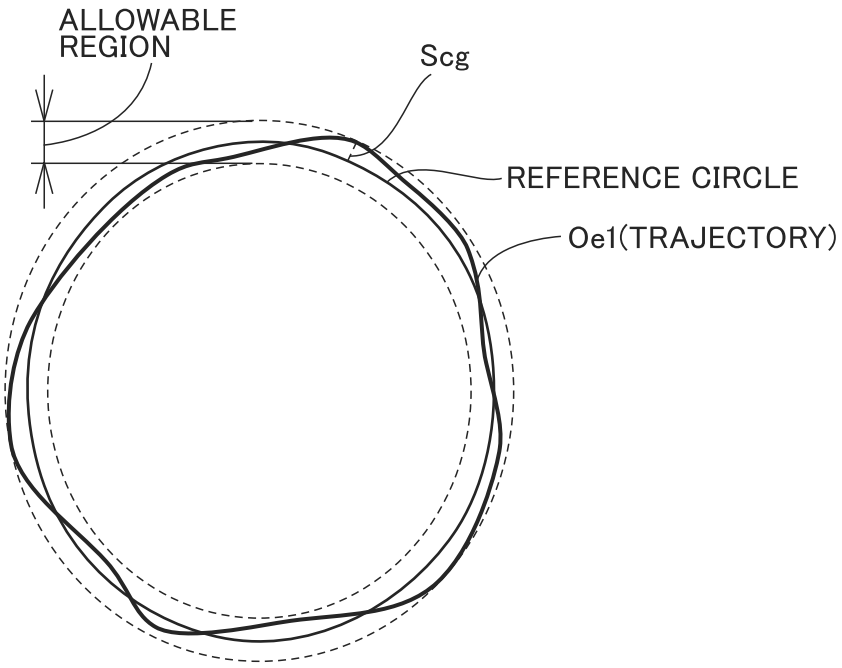

ALLOWABLE REGION
Scg
REFERENCE CIRCLE
Oe1(TRAJECTORY)

FIG.17

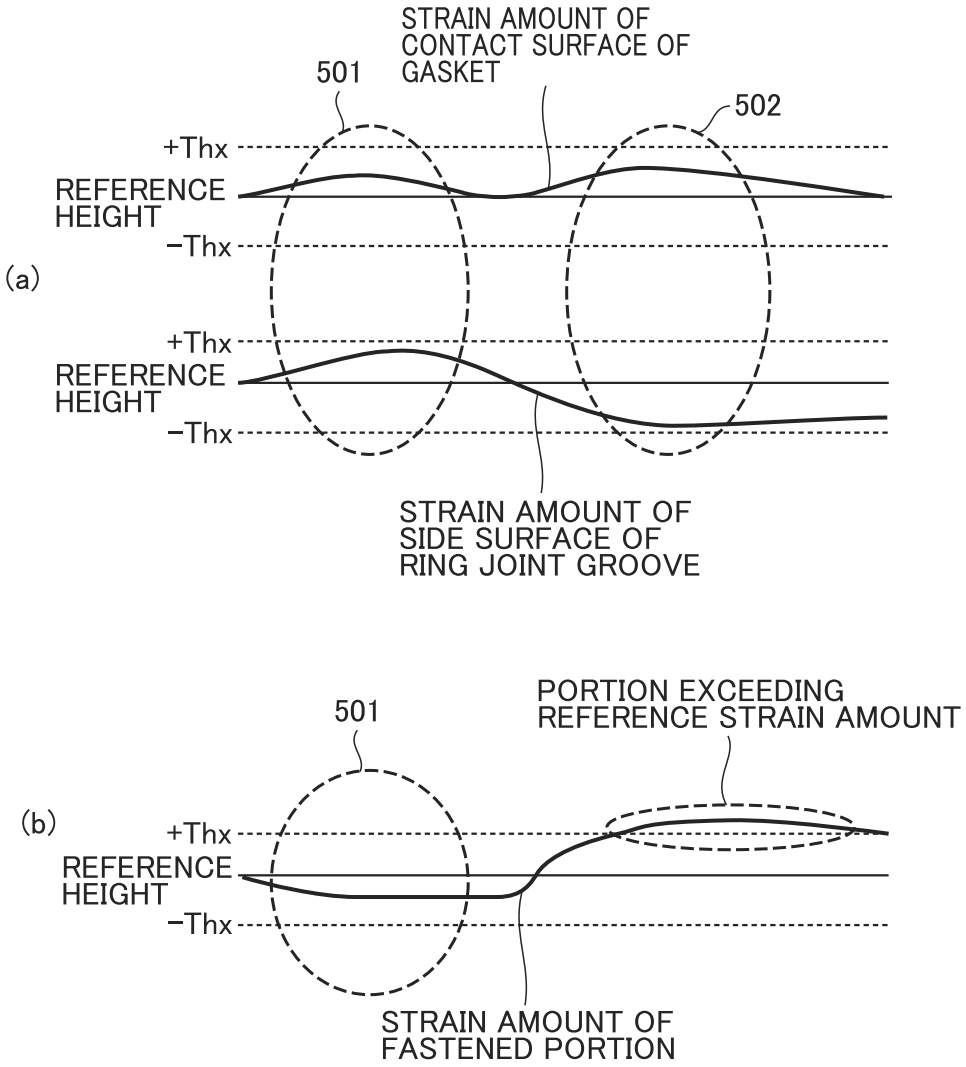
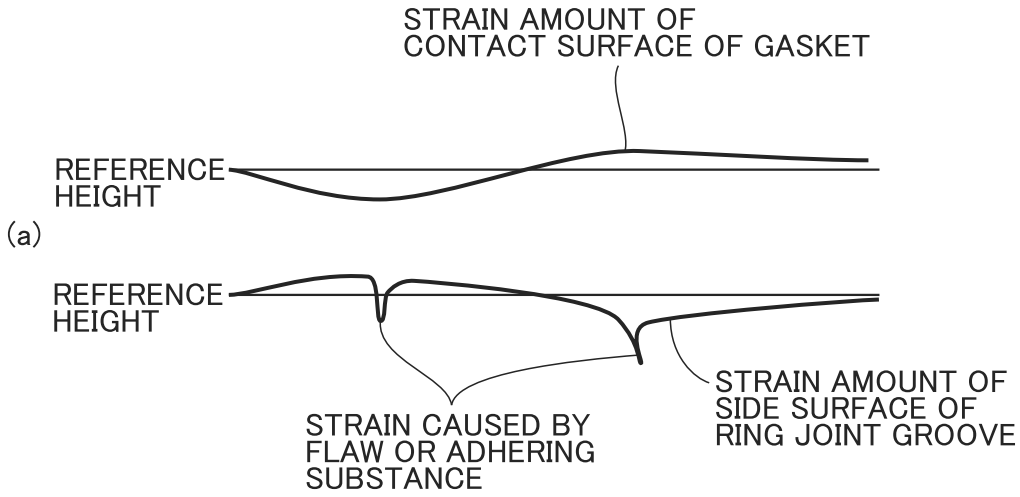

STRAIN AMOUNT OF
CONTACT SURFACE OF
GASKET
501
502
+Thx
REFERENCE
HEIGHT
−Thx
(a)
+Thx
REFERENCE
HEIGHT
−Thx
STRAIN AMOUNT OF
SIDE SURFACE OF
RING JOINT GROOVE
PORTION EXCEEDING
REFERENCE STRAIN AMOUNT
501
(b)
+Thx
REFERENCE
HEIGHT
−Thx
STRAIN AMOUNT OF
FASTENED PORTION

FIG.18


STRAIN AMOUNT OF
CONTACT SURFACE OF GASKET
REFERENCE
HEIGHT
(a)
REFERENCE
HEIGHT
STRAIN AMOUNT OF
SIDE SURFACE OF
RING JOINT GROOVE
STRAIN CAUSED BY
FLAW OR ADHERING
SUBSTANCE

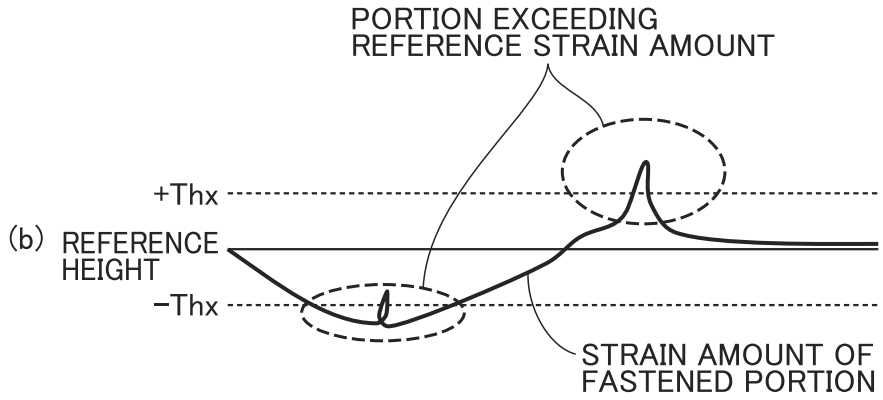
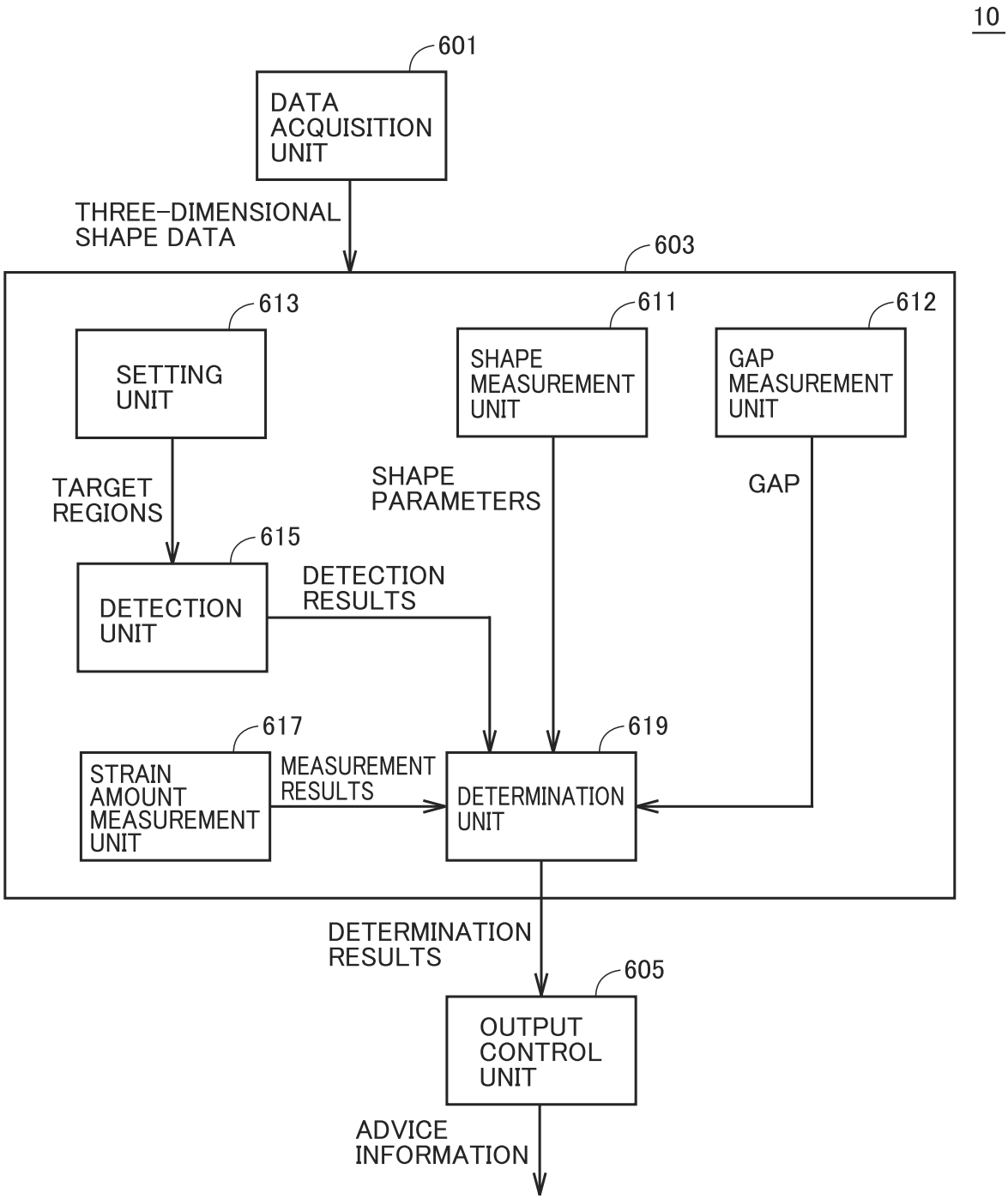

PORTION EXCEEDING
REFERENCE STRAIN AMOUNT
+Thx
(b)
REFERENCE
HEIGHT
−Thx
STRAIN AMOUNT OF
FASTENED PORTION

FIG.19


10
601
DATA ACQUISITION UNIT
THREE-DIMENSIONAL SHAPE DATA
603
613
SETTING UNIT
611
SHAPE MEASUREMENT UNIT
612
GAP MEASUREMENT UNIT
TARGET REGIONS
SHAPE PARAMETERS
GAP
615
DETECTION UNIT
DETECTION RESULTS
617
STRAIN AMOUNT MEASUREMENT UNIT
MEASUREMENT RESULTS
619
DETERMINATION UNIT
DETERMINATION RESULTS
605
OUTPUT CONTROL UNIT
ADVICE INFORMATION