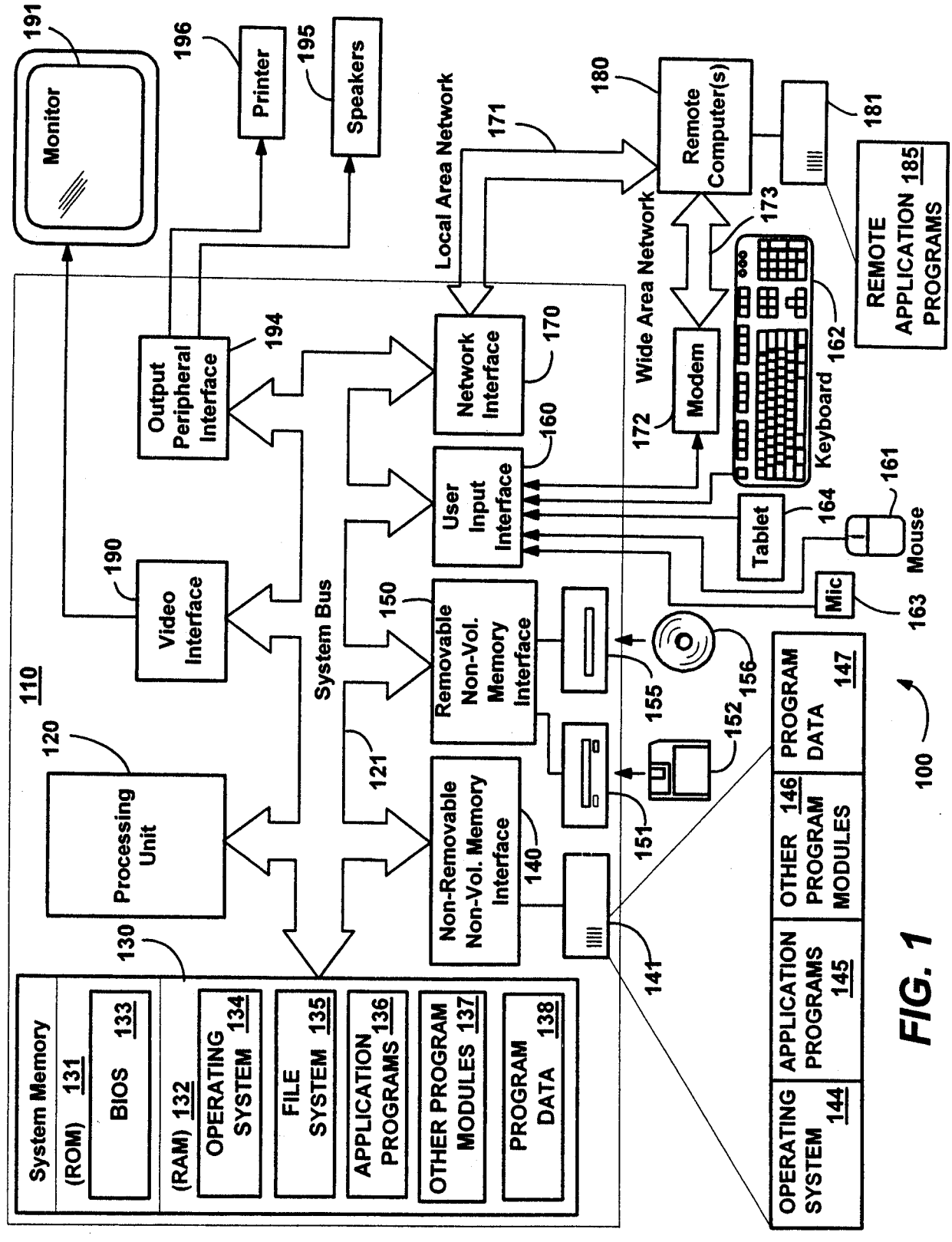

Monitor
191
Printer
196
Speakers
195
Output Peripheral Interface
194
Network Interface
170
Local Area Network
171
Remote Computer(s)
180
Wide Area Network
172
Modem
173
REMOTE APPLICATION PROGRAMS 185
181
Keyboard
162
User Input Interface
160
Tablet
164
Mouse
161
Mic
163
Video Interface
190
System Bus
Removable Non-Vol. Memory Interface
150
Non-Removable Non-Vol. Memory Interface
140
Processing Unit
120
110
121
130
155
156
152
151
141
100
System Memory
(ROM) 131
BIOS 133
(RAM) 132
OPERATING SYSTEM 134
FILE SYSTEM 135
APPLICATION PROGRAMS 136
OTHER PROGRAM MODULES 137
PROGRAM DATA 138
OPERATING SYSTEM 144
APPLICATION PROGRAMS 145
OTHER PROGRAM MODULES 146
PROGRAM DATA 147

FIG. 1

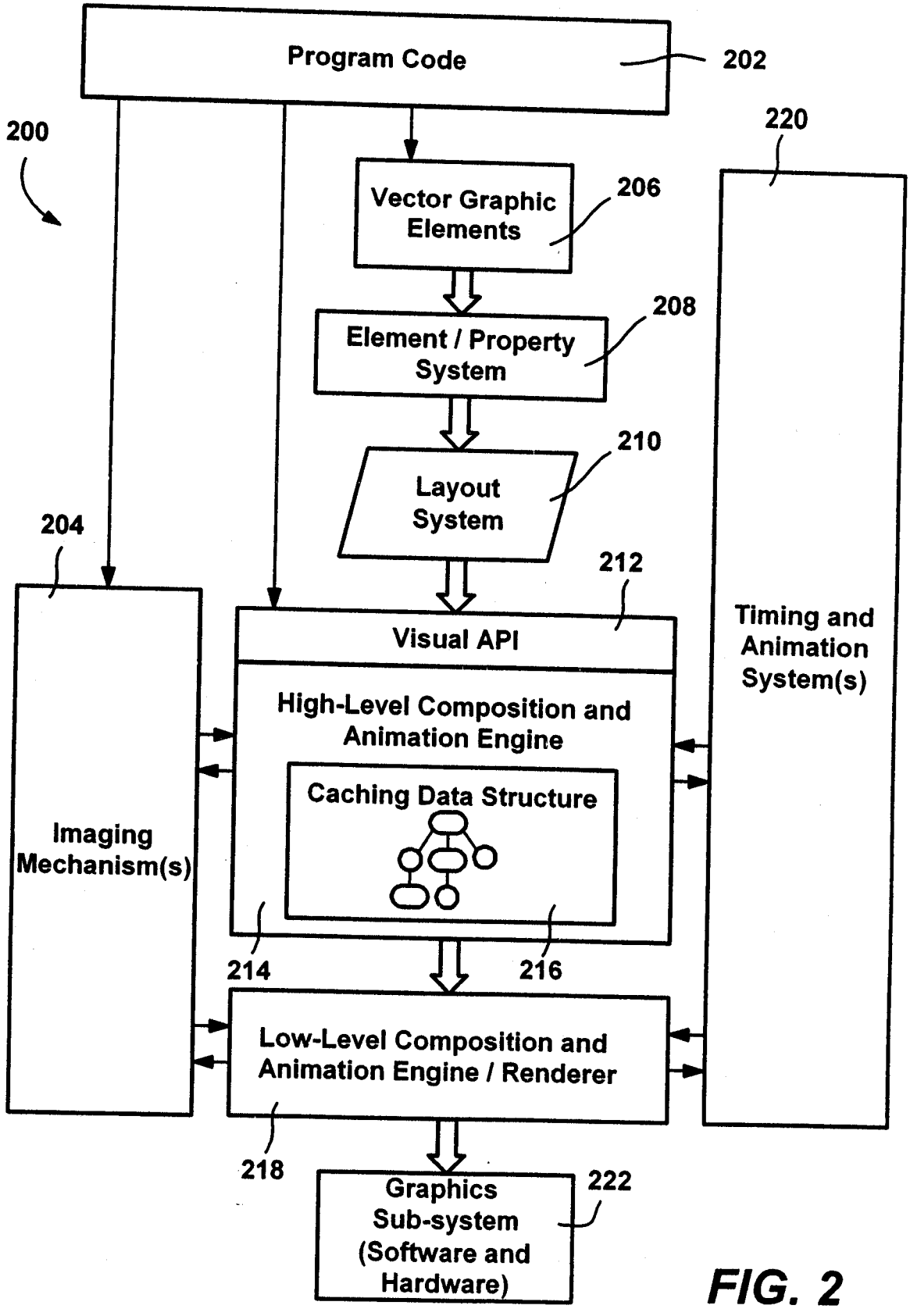

Program Code
202
200
220
Vector Graphic Elements
206
Element / Property System
208
Layout System
210
204
212
Visual API
High-Level Composition and Animation Engine
Caching Data Structure
Imaging Mechanism(s)
Timing and Animation System(s)
214
216
Low-Level Composition and Animation Engine / Renderer
218
Graphics Sub-system (Software and Hardware)
222

FIG. 2

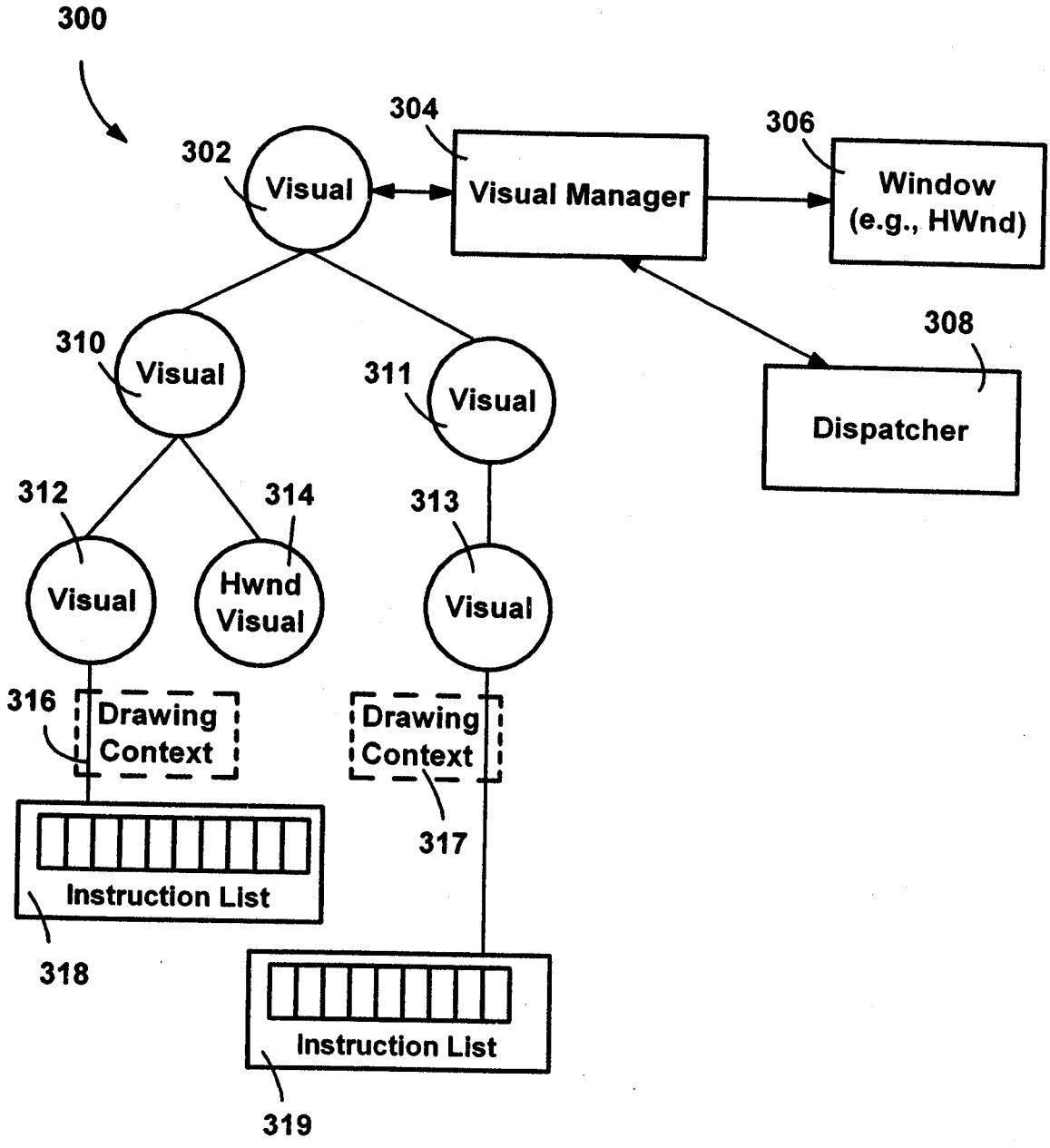

300
302
Visual
304
Visual Manager
306
Window
(e.g., HWnd)
308
Dispatcher
310
Visual
311
Visual
312
Visual
314
Hwnd
Visual
313
Visual
316
Drawing
Context
Drawing
Context
317
Instruction List
318
Instruction List
319

FIG. 3

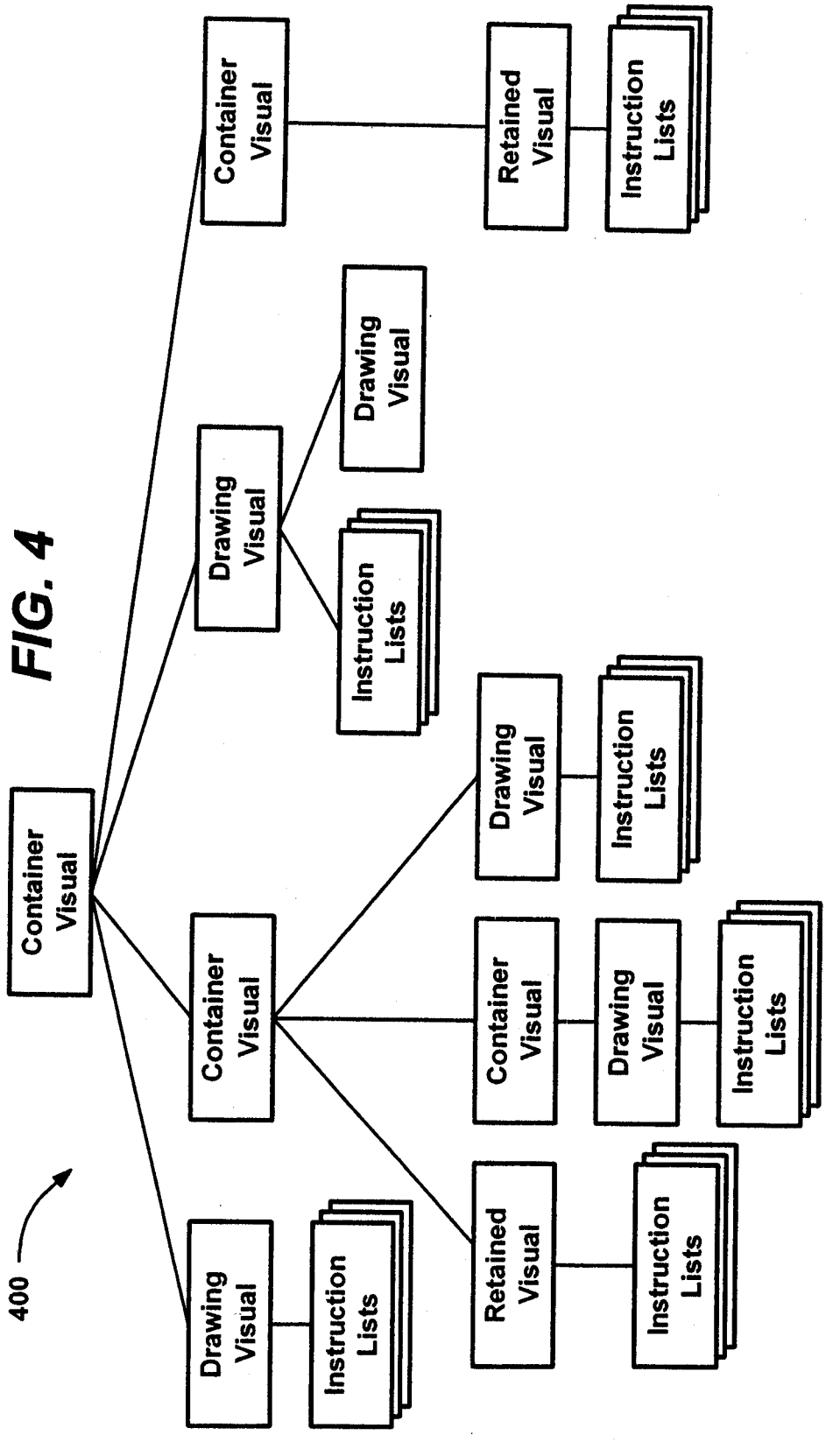
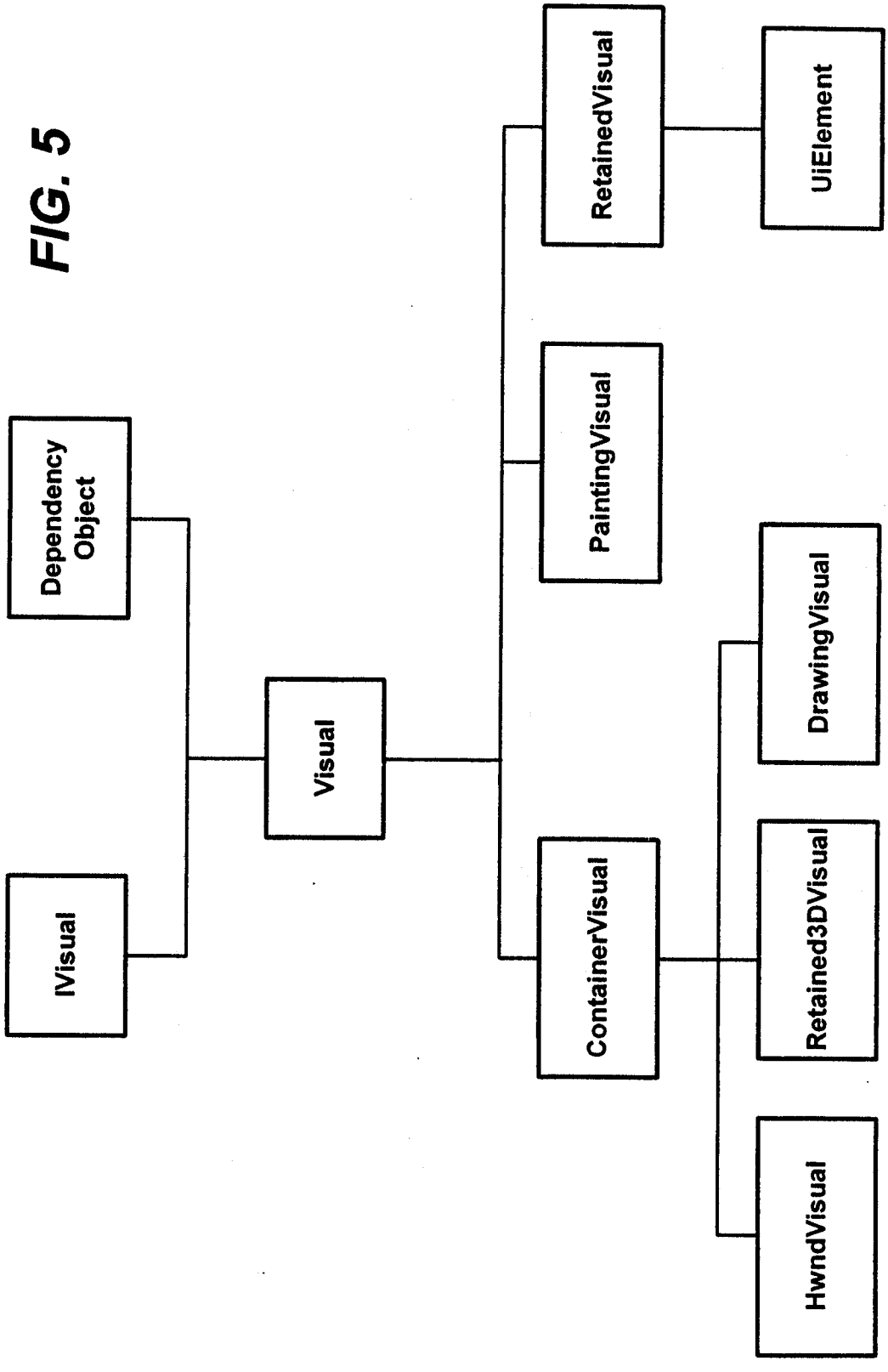

400
Container Visual
Drawing Visual
Instruction Lists
Container Visual
Drawing Visual
Instruction Lists
Container Visual
Retained Visual
Instruction Lists
Drawing Visual
Instruction Lists
Container Visual
Drawing Visual
Instruction Lists
Retained Visual
Instruction Lists

FIG. 4

FIG. 5


IVisual
Dependency Object
Visual
RetainedVisual
UiElement
PaintingVisual
ContainerVisual
DrawingVisual
Retained3DVisual
HwndVisual

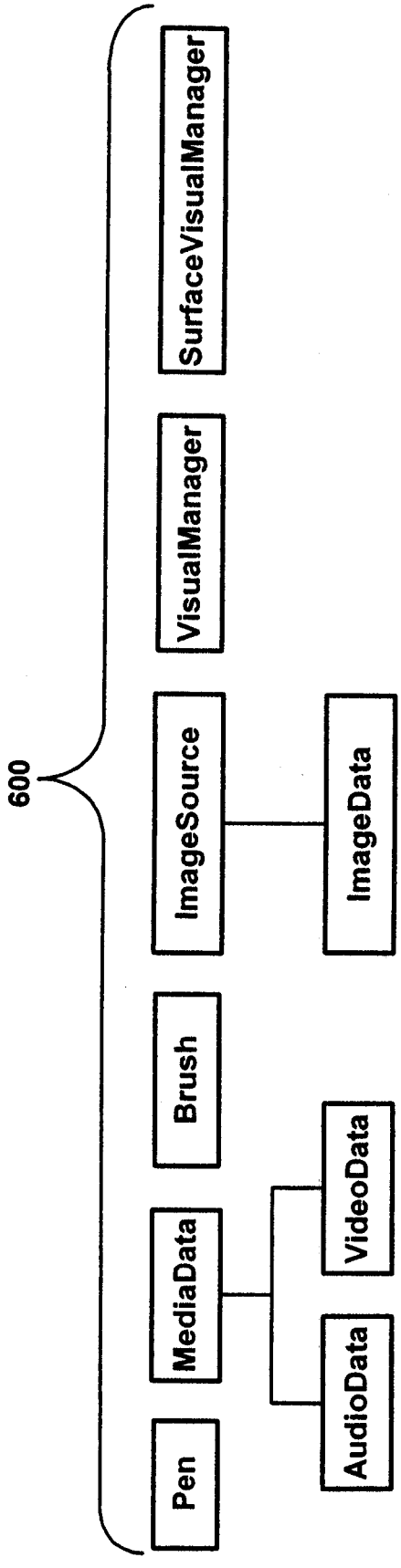

600
Pen
MediaData
AudioData
VideoData
Brush
ImageSource
ImageData
VisualManager
SurfaceVisualManager

FIG. 6

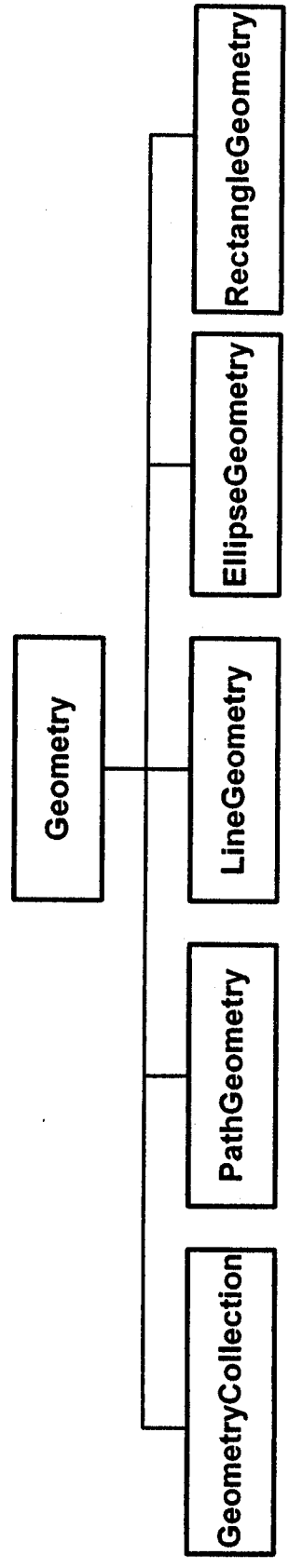

Geometry
GeometryCollection
PathGeometry
LineGeometry
EllipseGeometry
RectangleGeometry

FIG. 10

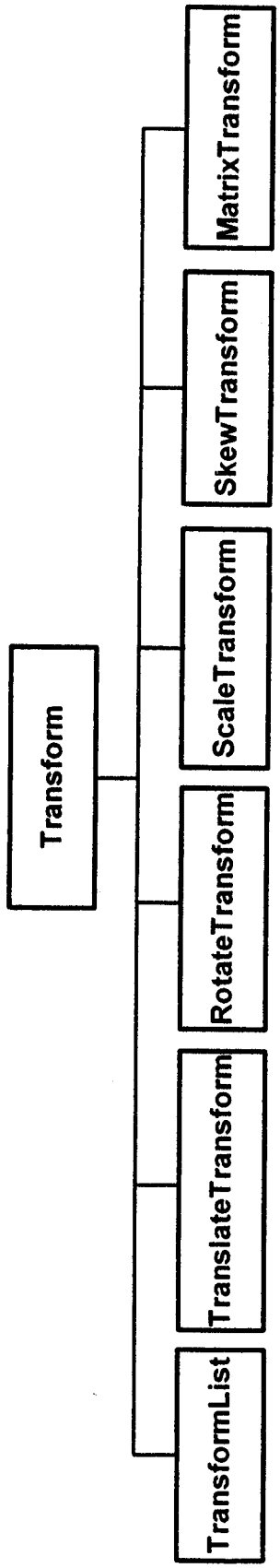

Transform
TransformList
TranslateTransform
RotateTransform
ScaleTransform
SkewTransform
MatrixTransform

FIG. 7

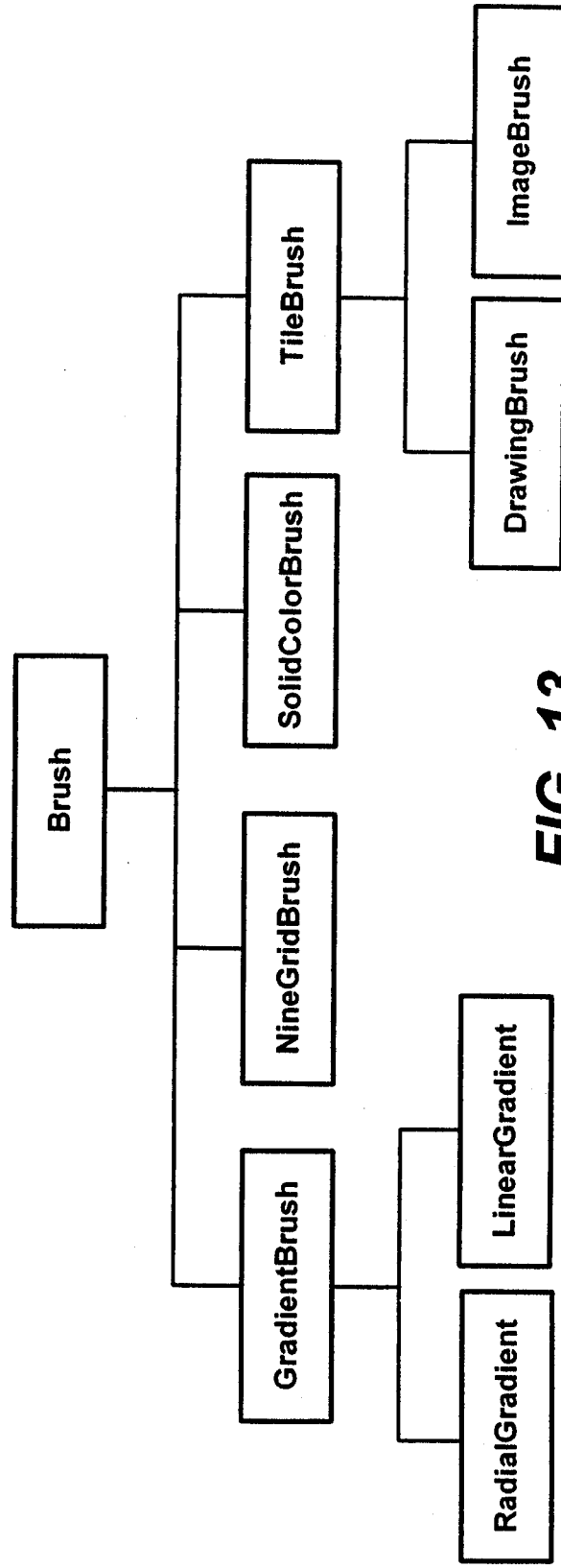

Brush
GradientBrush
RadialGradient
LinearGradient
NineGridBrush
SolidColorBrush
TileBrush
DrawingBrush
ImageBrush

FIG. 13

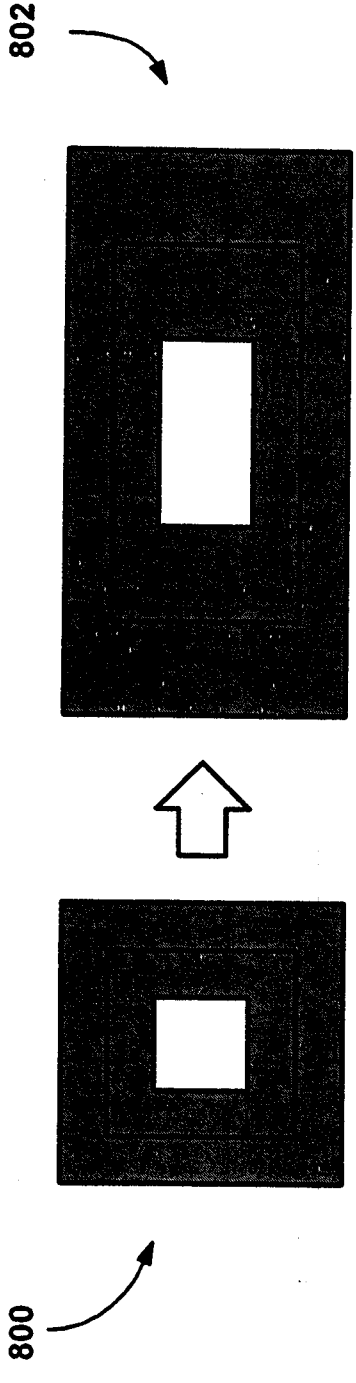


FIG. 8

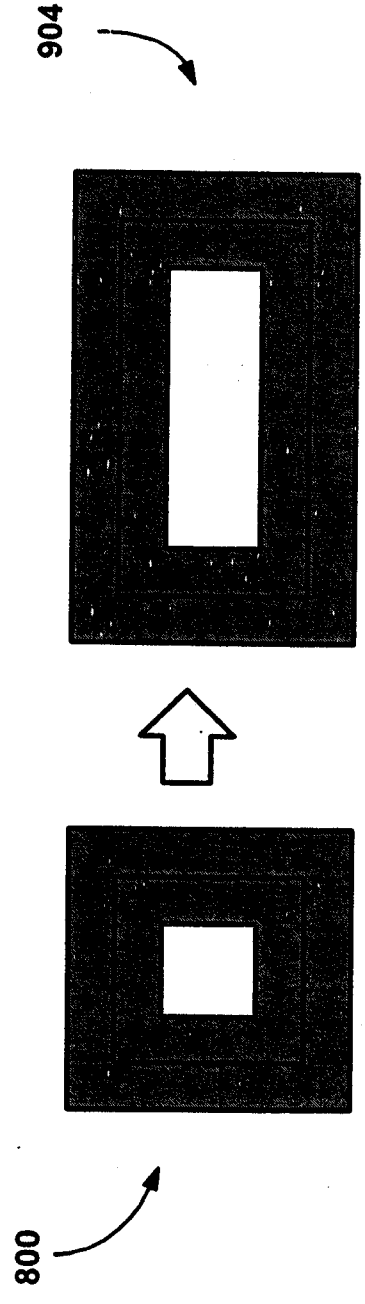


FIG. 9

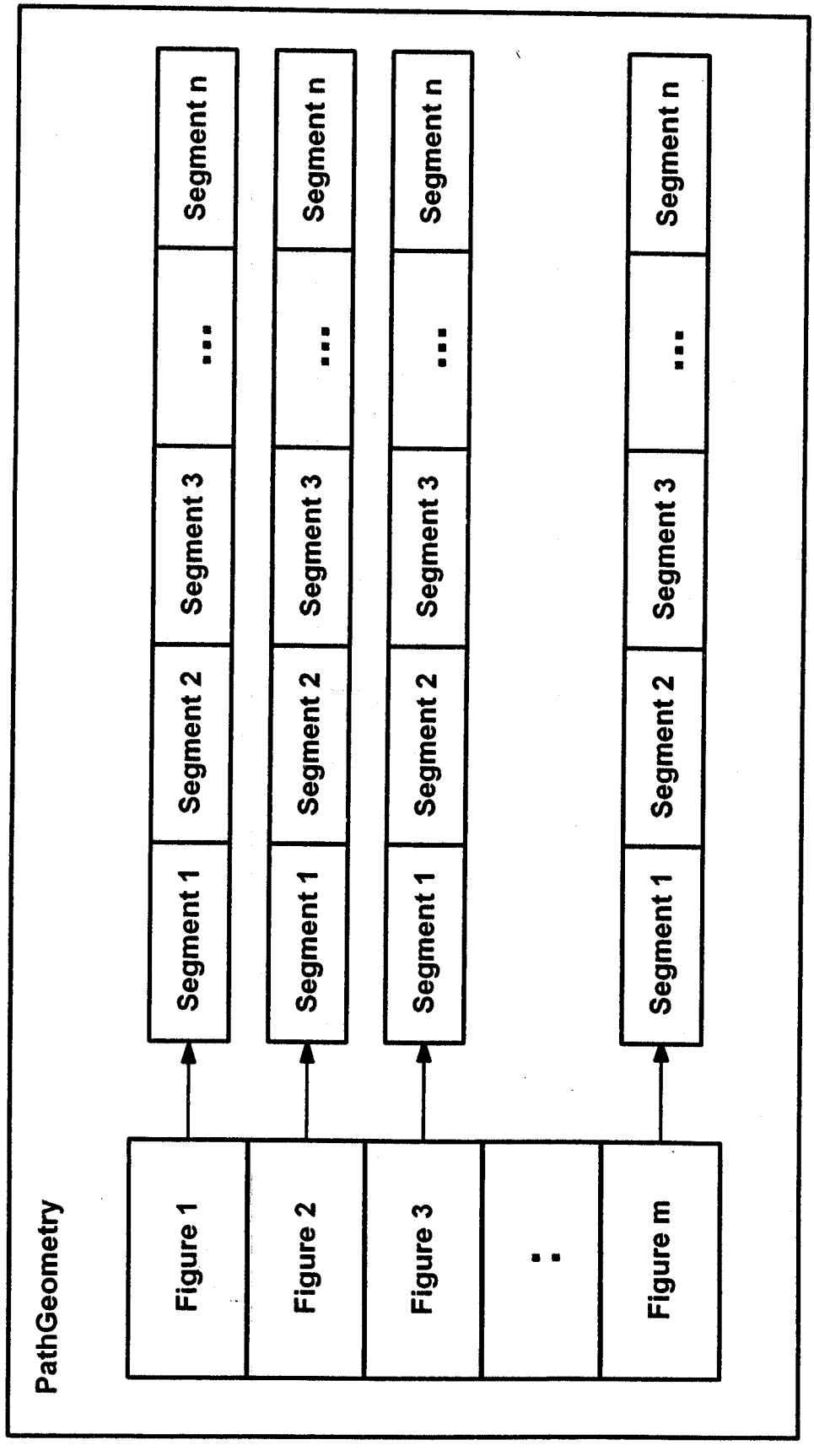

PathGeometry
Figure 1
Figure 2
Figure 3
:
Figure m
Segment 1
Segment 2
Segment 3
...
Segment n

FIG. 11

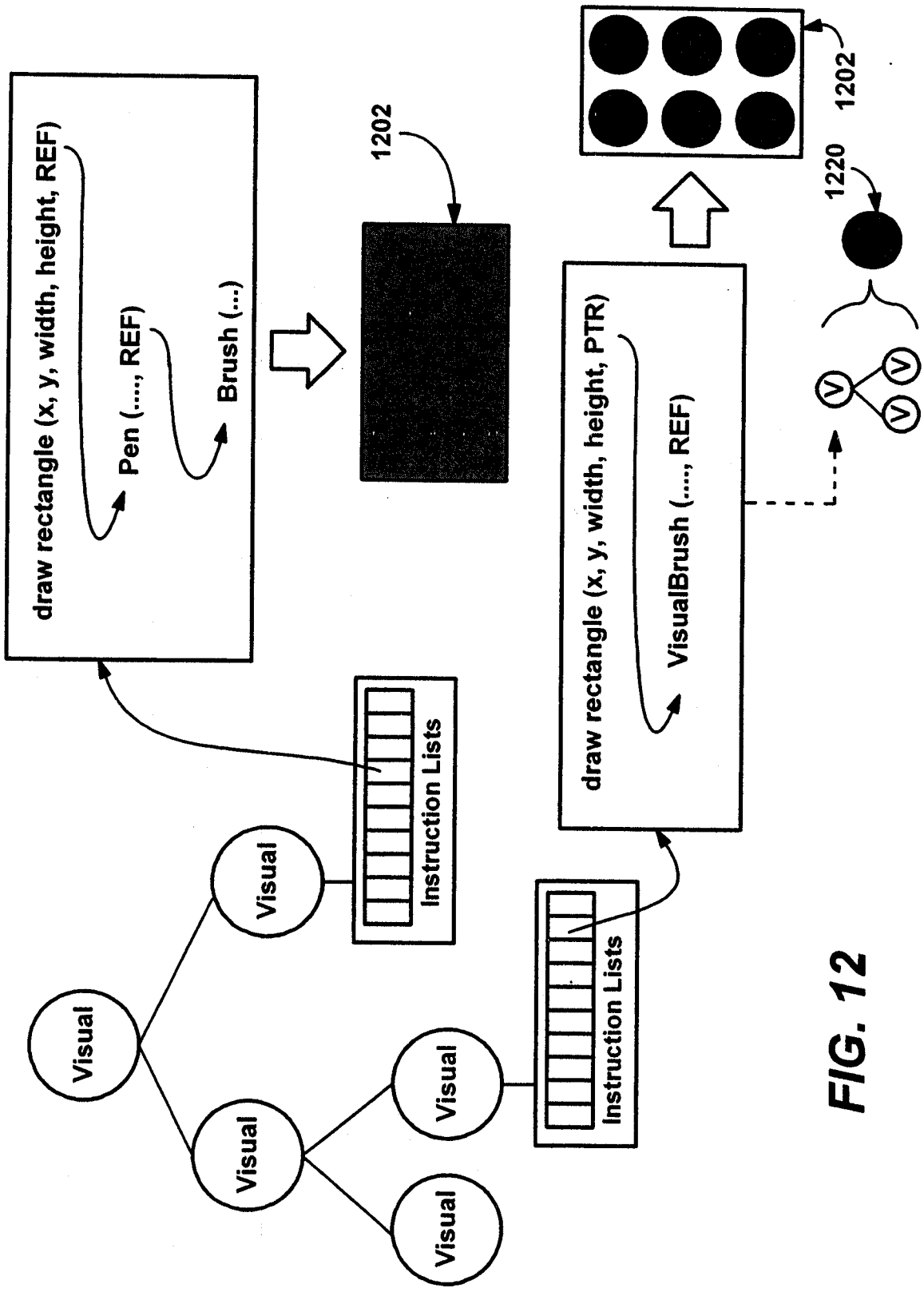

draw rectangle (x, y, width, height, REF)
Pen (...., REF)
Brush (...)
1202
1202
1220
Instruction Lists
Visual
Visual
Visual
Visual
Instruction Lists
draw rectangle (x, y, width, height, PTR)
VisualBrush (...., REF)

FIG. 12

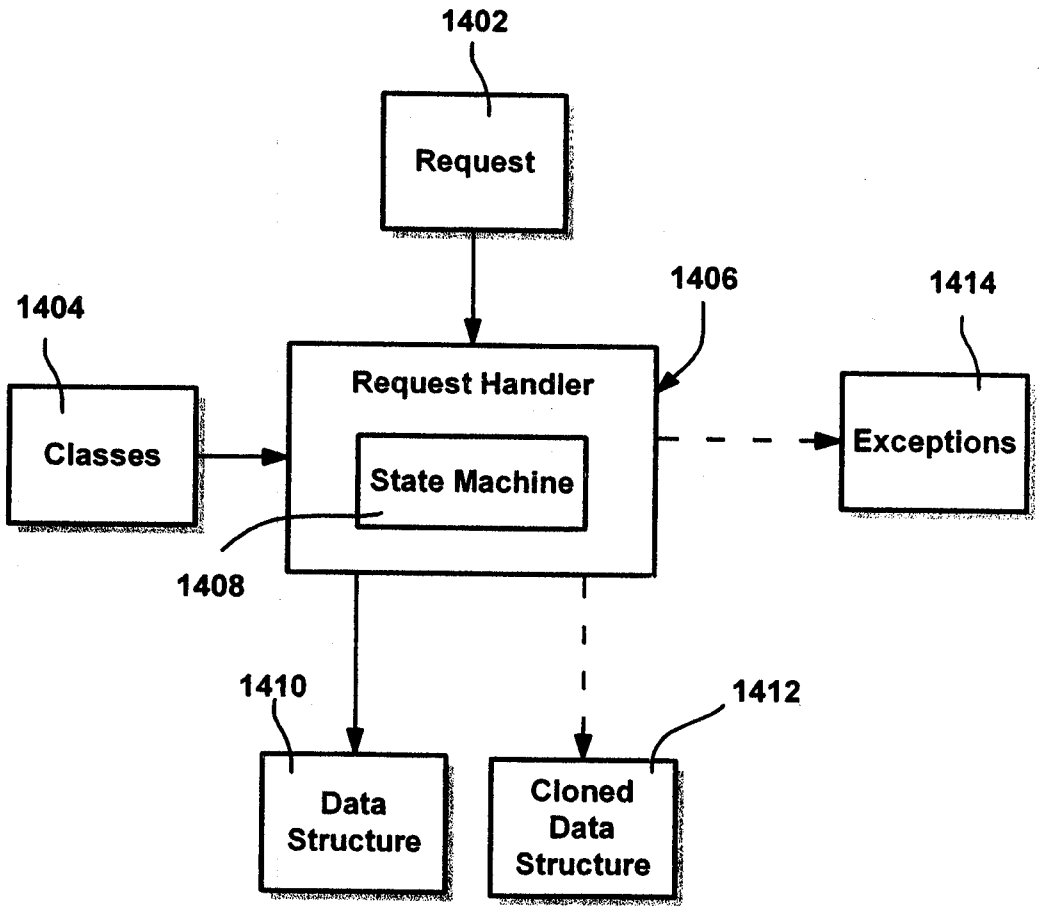

1402
Request
1404
Classes
1406
Request Handler
State Machine
1408
1414
Exceptions
1410
Data Structure
1412
Cloned Data Structure

FIG. 14

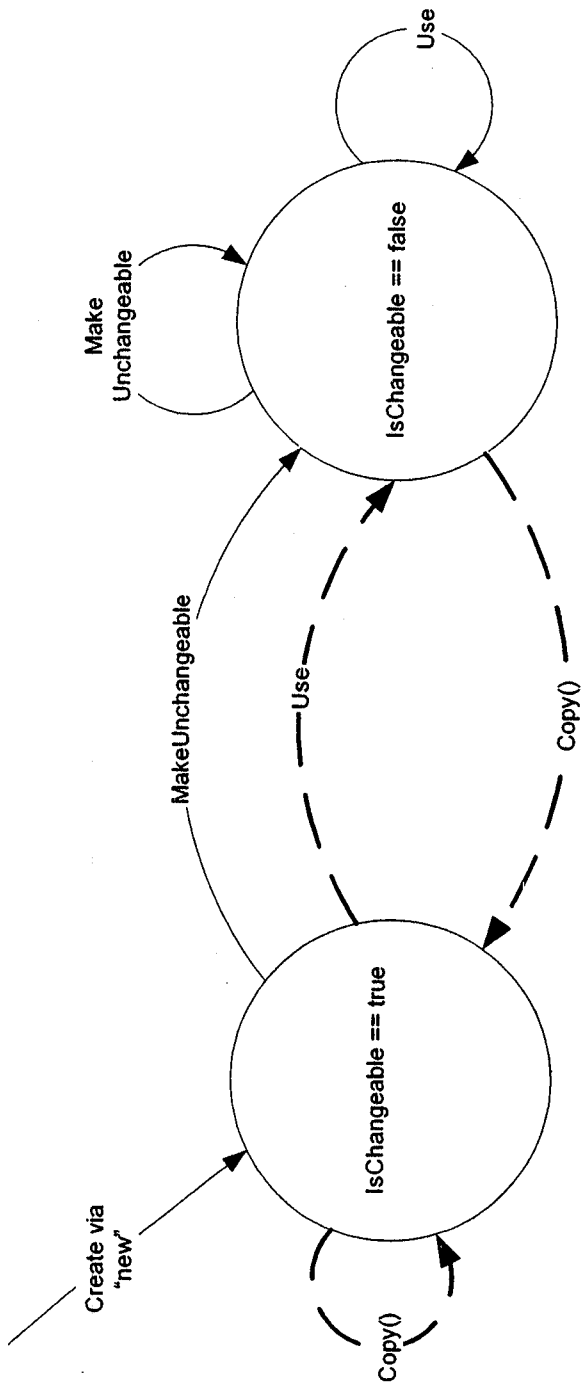

Use
IsChangeable == false
Make
Unchangeable
MakeUnchangeable
Use
Copy()
IsChangeable == true
Create via
"new"
Copy()

FIG. 15

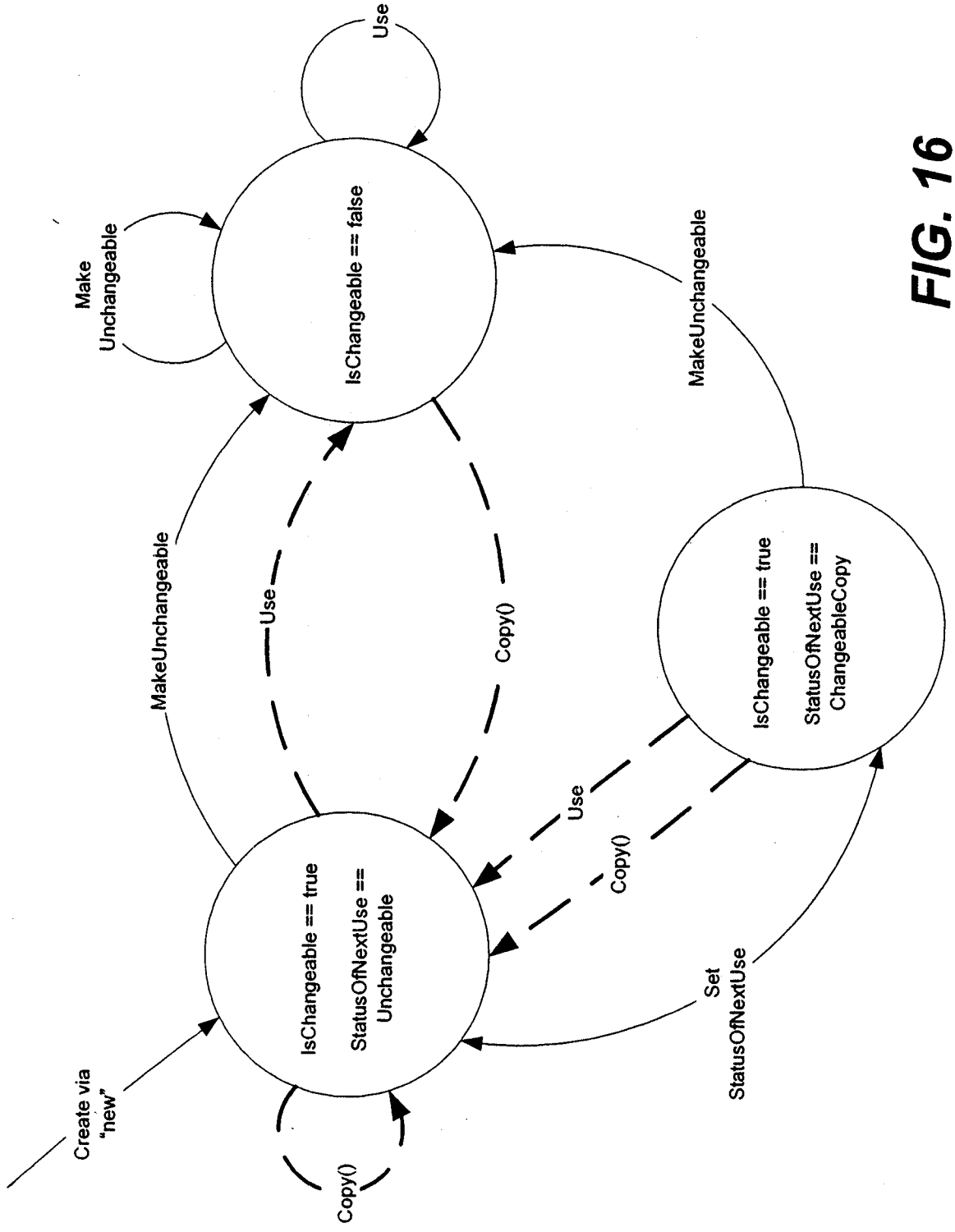

Use
Make
Unchangeable
IsChangeable == false
MakeUnchangeable
MakeUnchangeable
Use
Copy()
IsChangeable == true
StatusOfNextUse ==
Unchangeable
IsChangeable == true
StatusOfNextUse ==
ChangeableCopy
Use
Copy()
Create via
"new"
Copy()
Set
StatusOfNextUse

FIG. 16

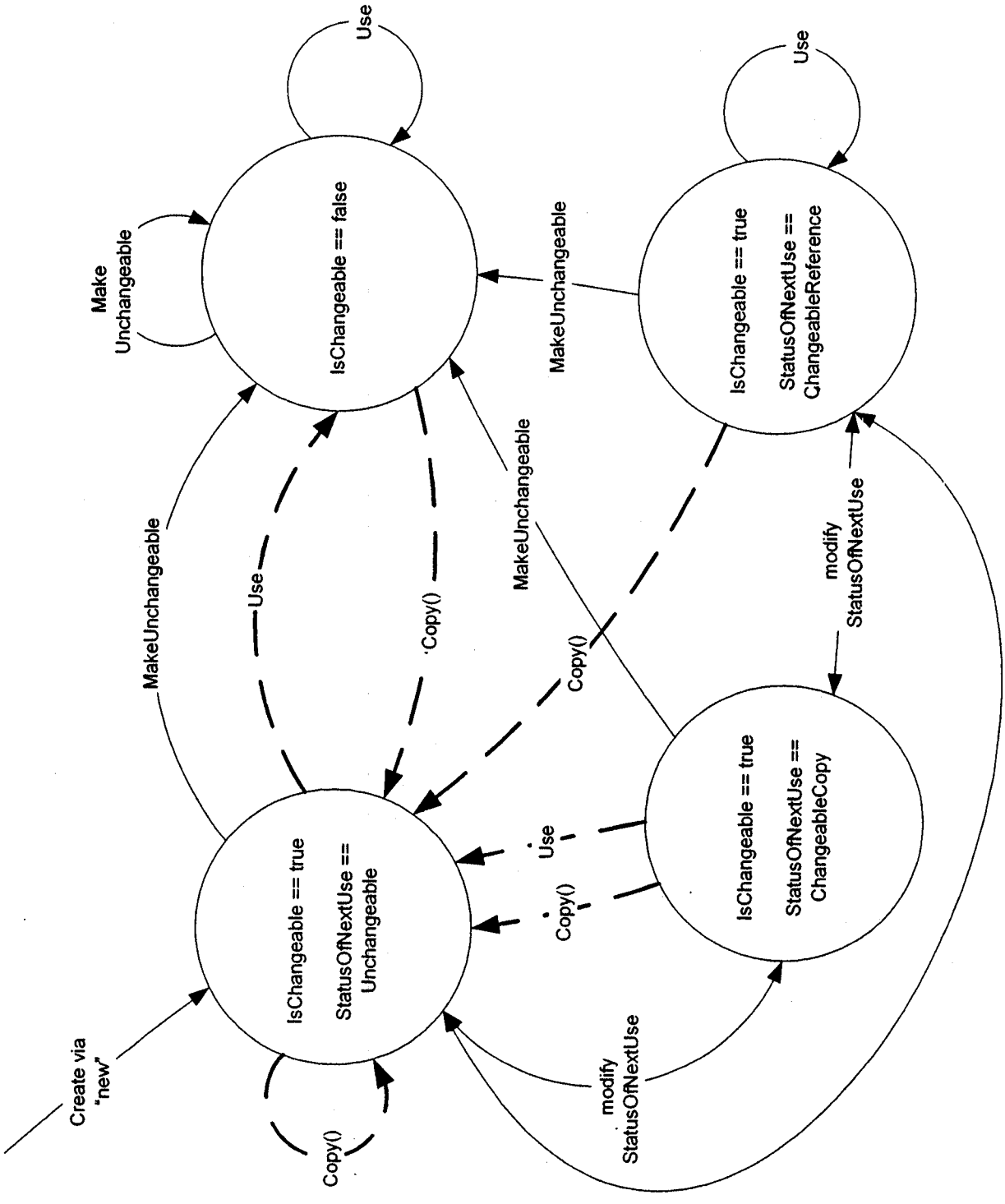

Create via "new"
IsChangeable == true
StatusOfNextUse == Unchangeable
IsChangeable == false
IsChangeable == true
StatusOfNextUse == ChangeableCopy
IsChangeable == true
StatusOfNextUse == ChangeableReference
Use
Copy()
Make Unchangeable
MakeUnchangeable
modify StatusOfNextUse

FIG. 17

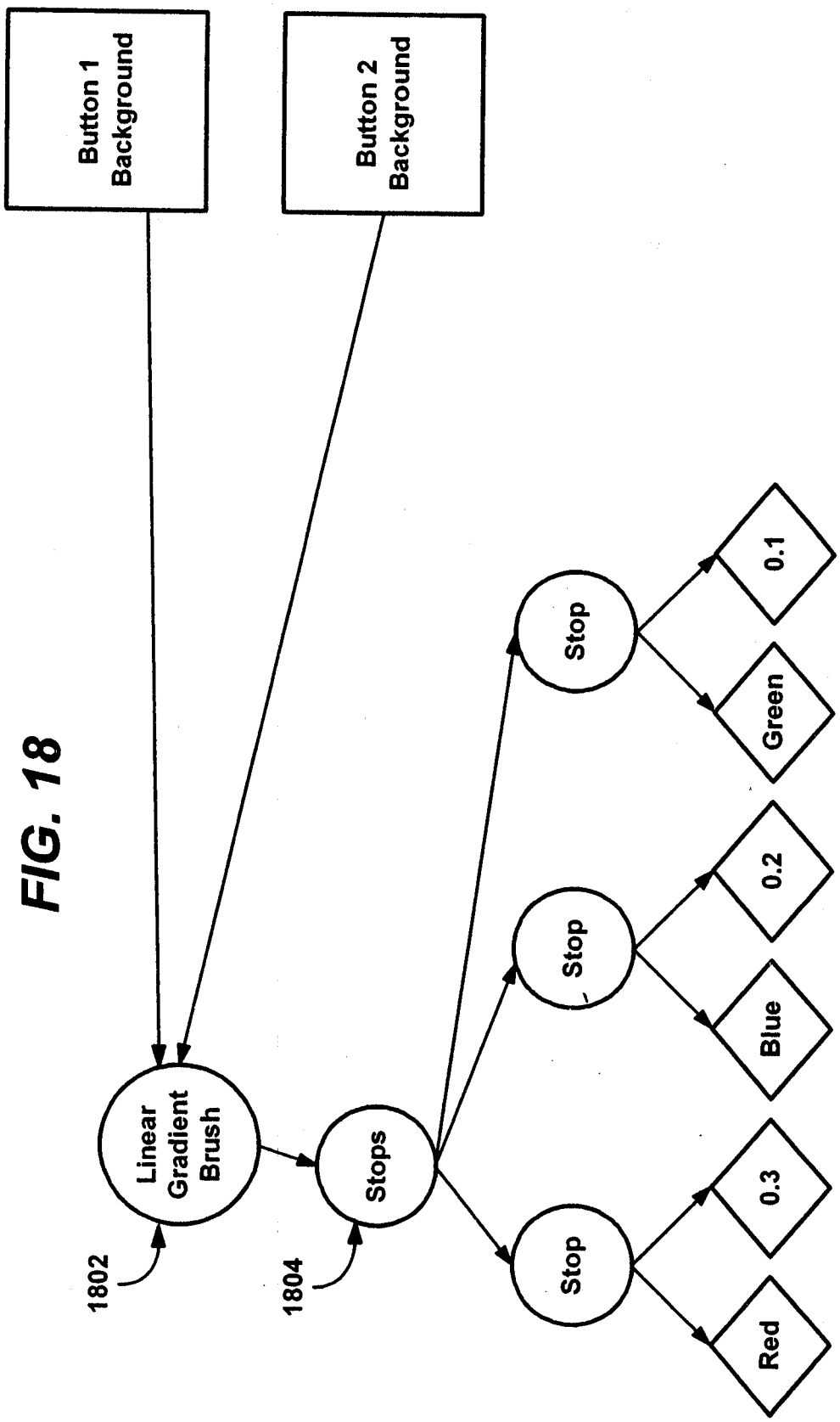

Button 1 Background
Button 2 Background
Linear Gradient Brush
Stops
Stop
Stop
Stop
0.1
Green
0.2
Blue
0.3
Red
1802
1804

FIG. 18

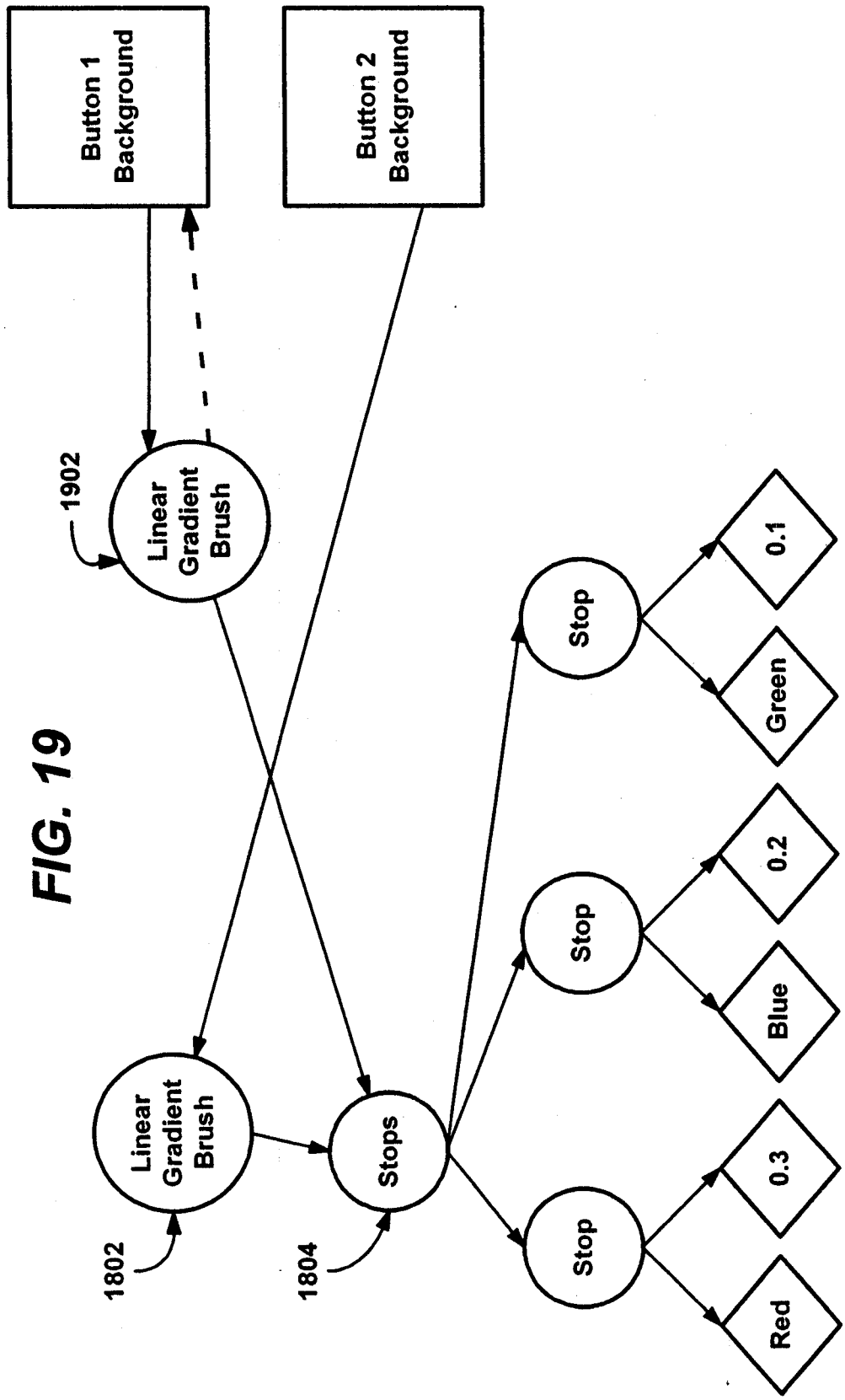

Button 1 Background
Button 2 Background
1902
Linear Gradient Brush
Linear Gradient Brush
1802
Stops
1804
Stop
Stop
Stop
0.1
Green
0.2
Blue
0.3
Red

FIG. 19

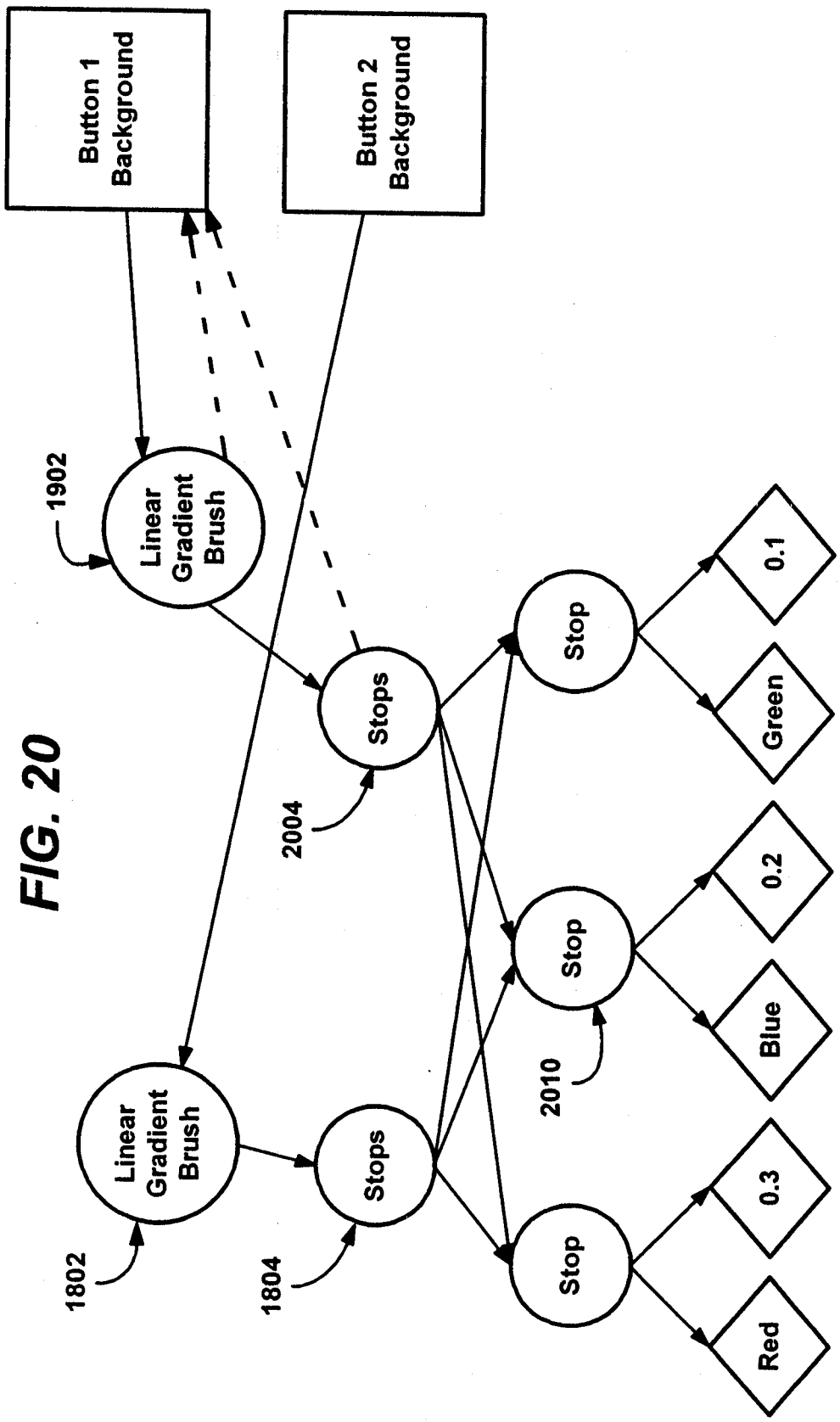

Button 1 Background
Button 2 Background
1902
Linear Gradient Brush
Linear Gradient Brush
1802
1804
Stops
2004
Stops
Stop
Stop
Stop
2010
0.1
Green
0.2
Blue
0.3
Red

FIG. 20

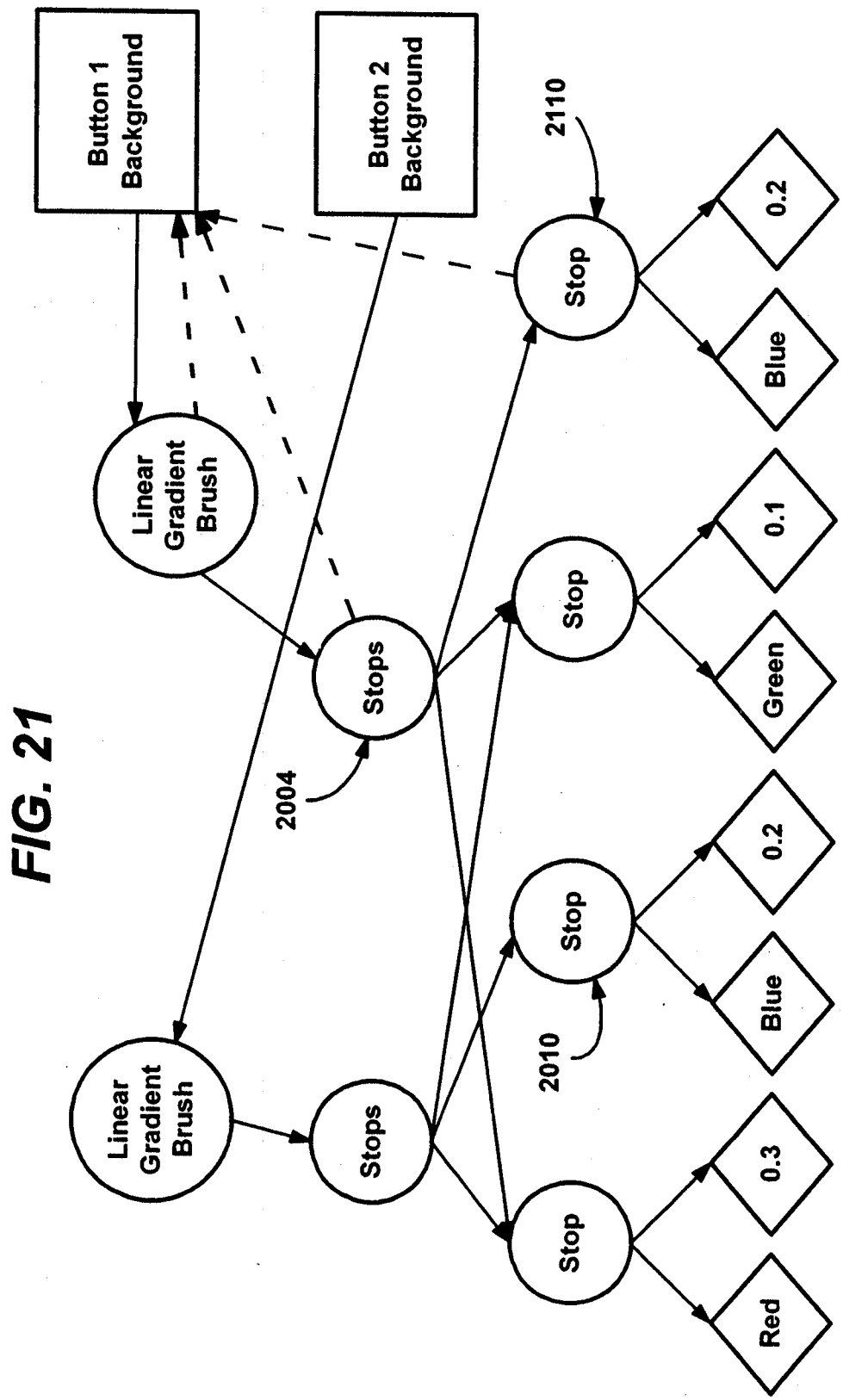

Button 1 Background
Button 2 Background
2110
Linear Gradient Brush
Stops
2004
Stop
0.2
Blue
Stop
0.1
Green
Linear Gradient Brush
Stops
Stop
0.2
Blue
2010
Stop
0.3
Red

FIG. 21

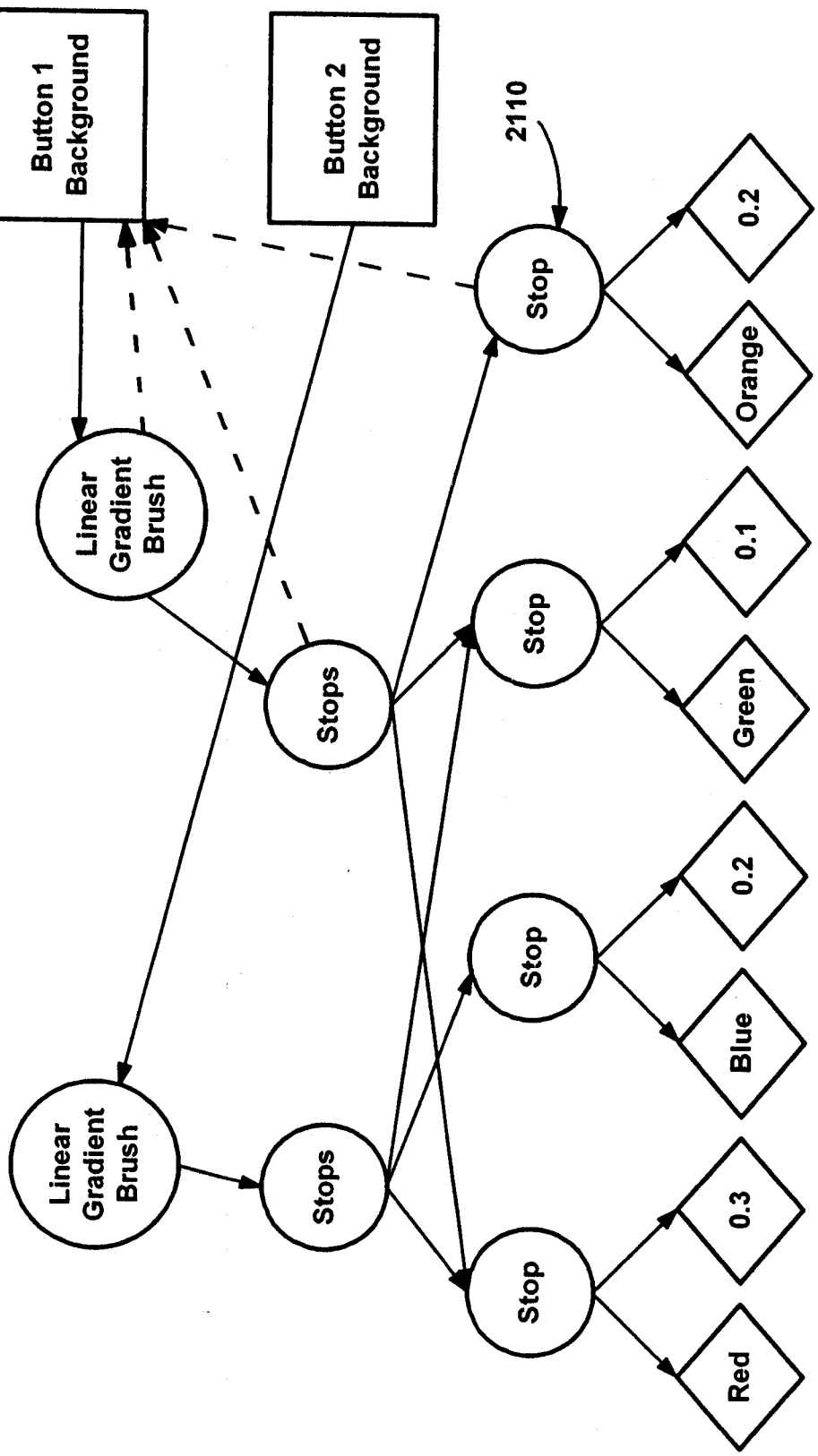

Button 1 Background
Button 2 Background
2110
Linear Gradient Brush
Stops
Stop
0.2
Orange
Linear Gradient Brush
Stops
Stop
0.1
Green
Stop
0.2
Blue
Stop
0.3
Red

FIG. 22

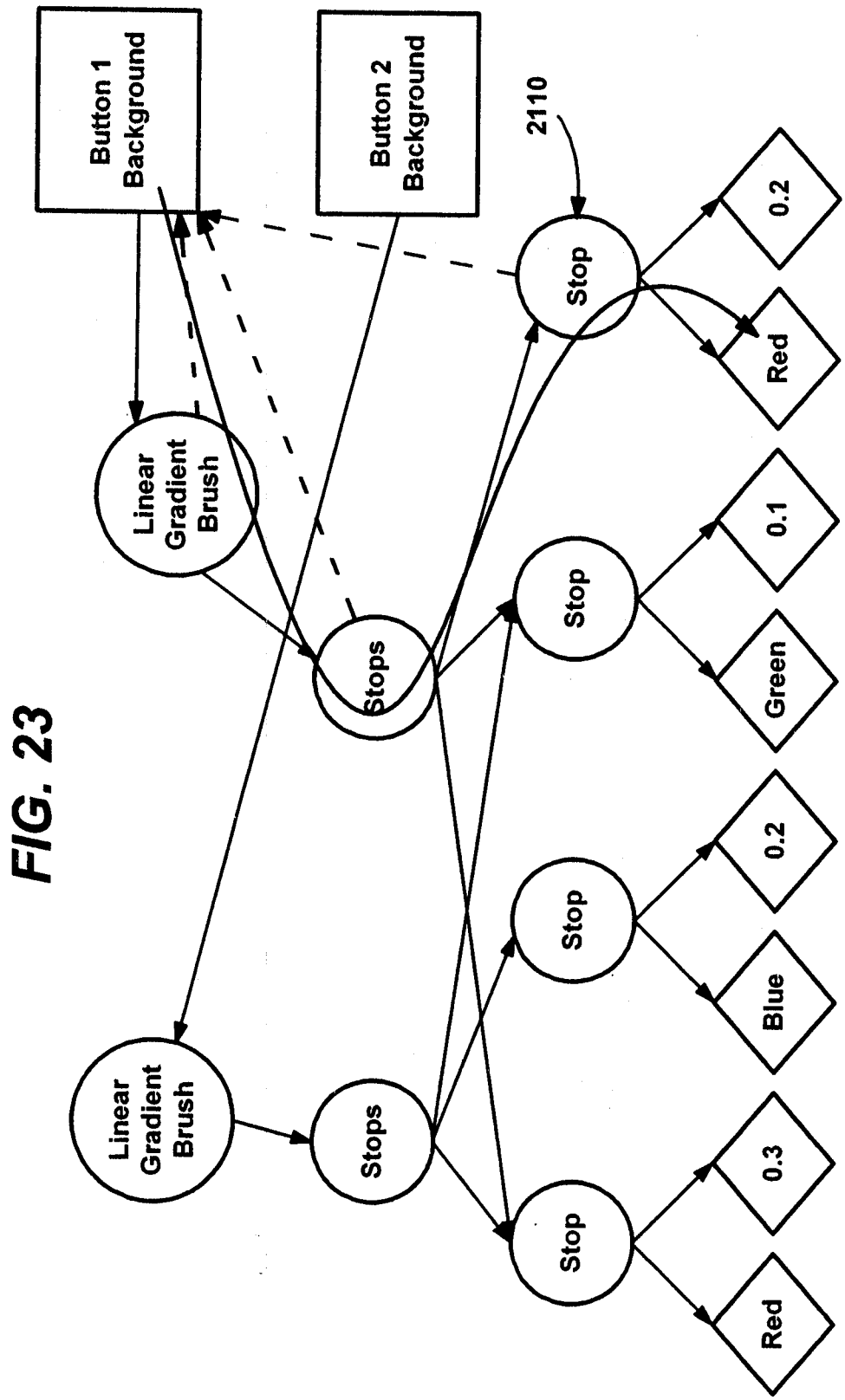

Button 1 Background
Button 2 Background
2110
Linear Gradient Brush
Stops
Stop
0.2
Red
Stop
0.1
Green
Linear Gradient Brush
Stops
Stop
0.2
Blue
Stop
0.3
Red

FIG. 23

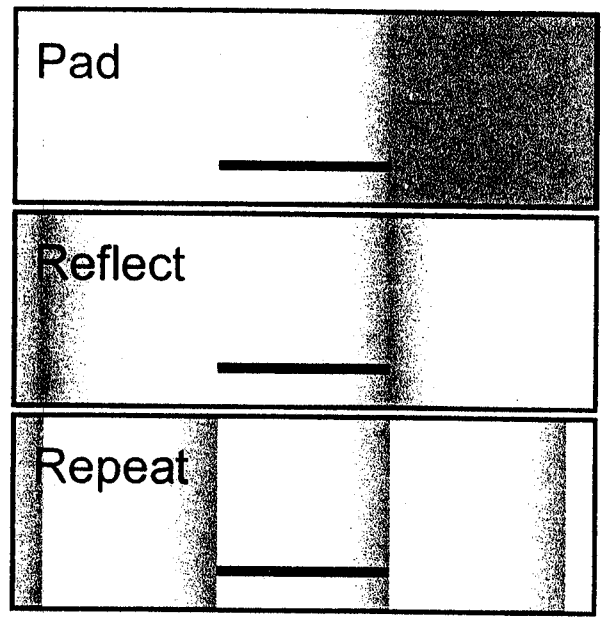


FIG. 24

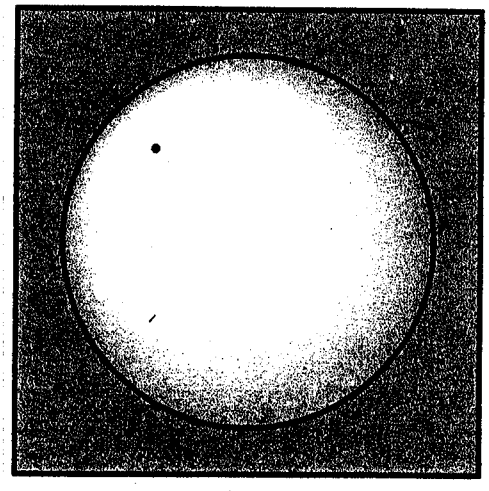


FIG. 25

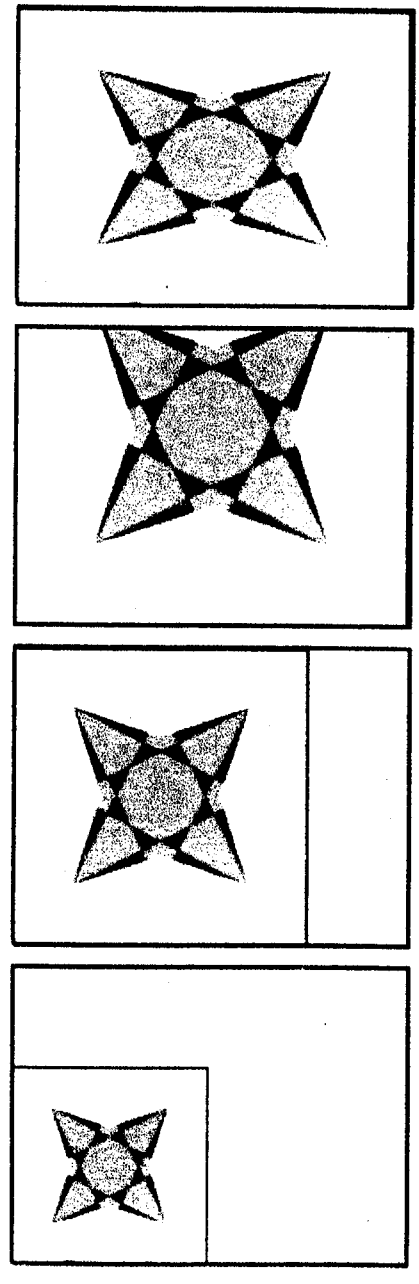


FIG. 26

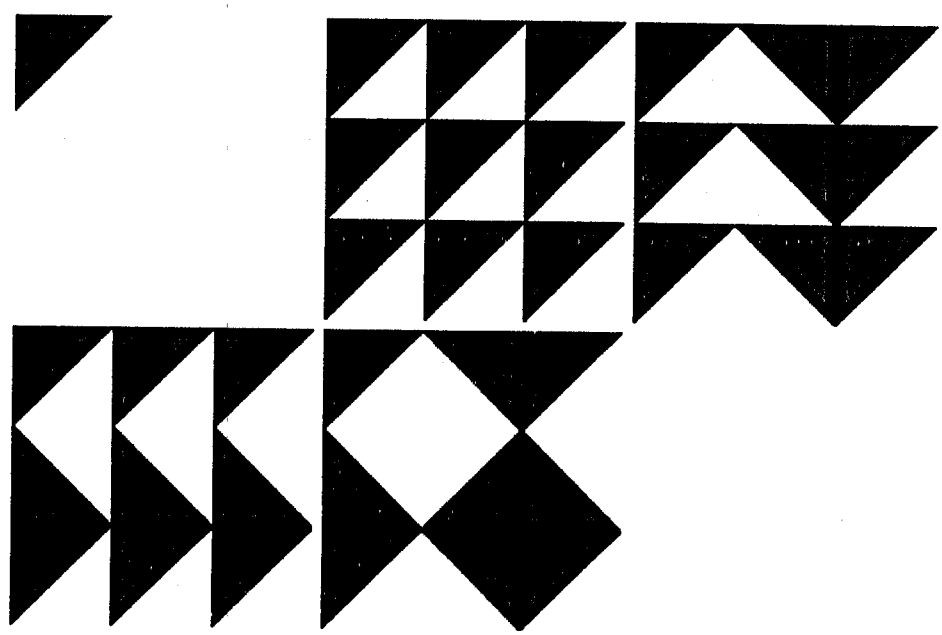


FIG. 27

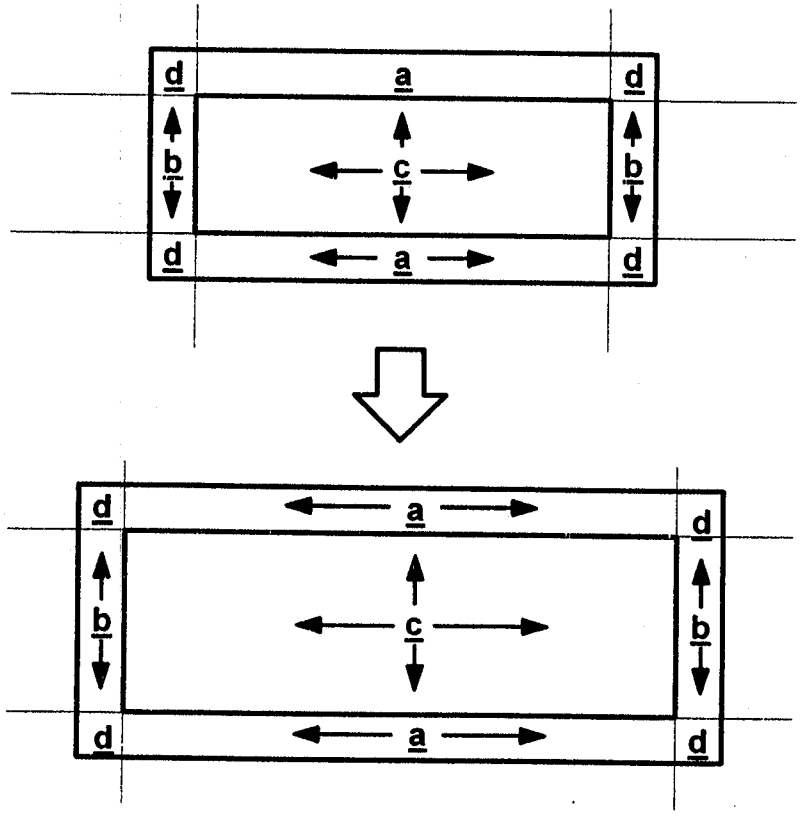


FIG. 28

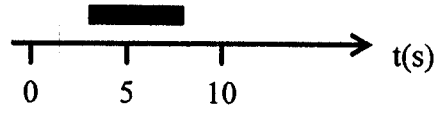


FIG. 29

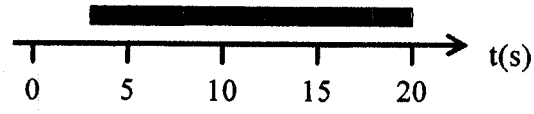


FIG. 30

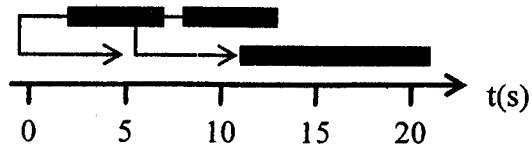


FIG. 31

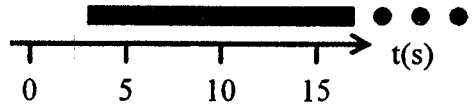


FIG. 32

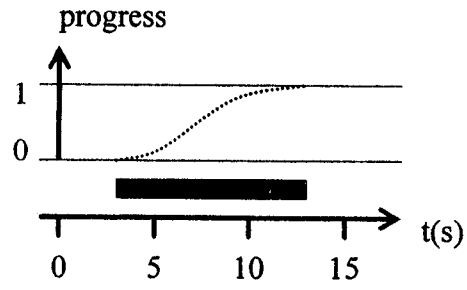


FIG. 33

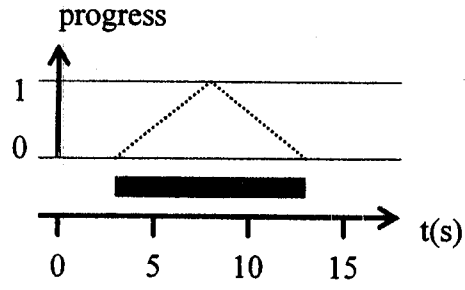


FIG. 34

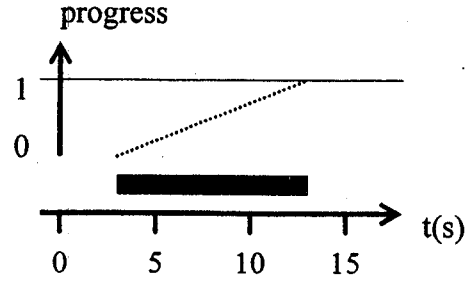


FIG. 35

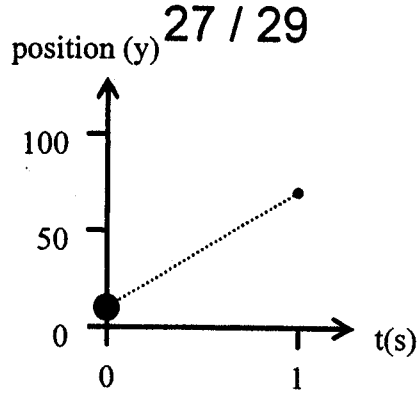


FIG. 36

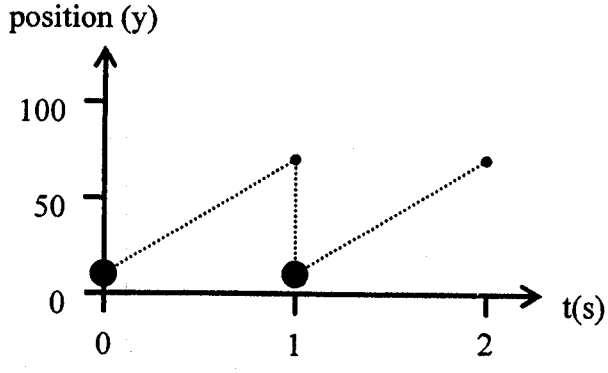


FIG. 37

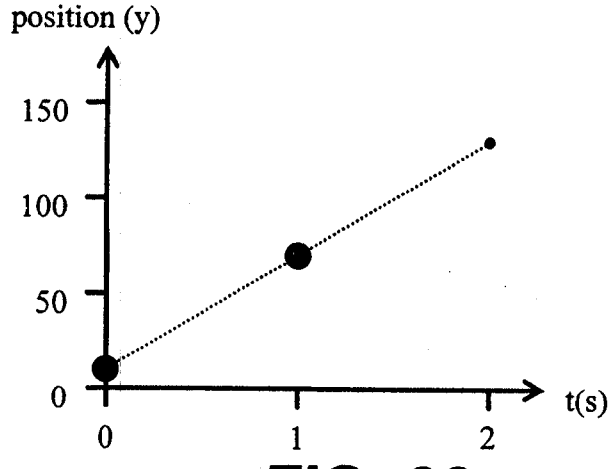


FIG. 38

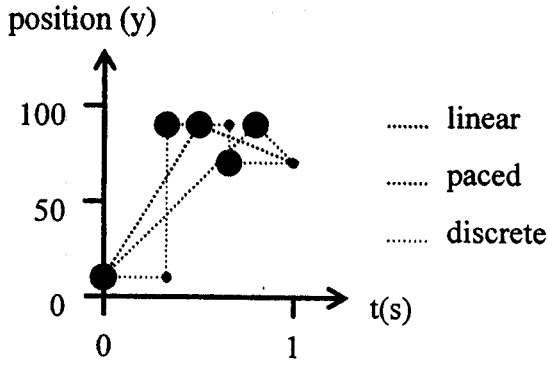

position (y)
100
50
0
0
1
t(s)
linear
paced
discrete

FIG. 39

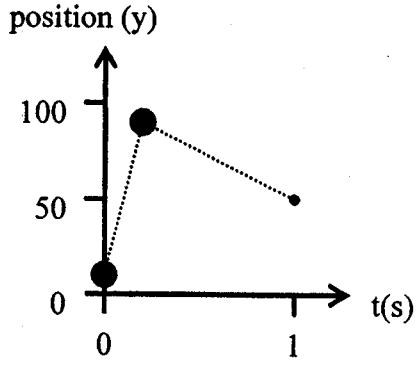

position (y)
100
50
0
0
1
t(s)

FIG. 40

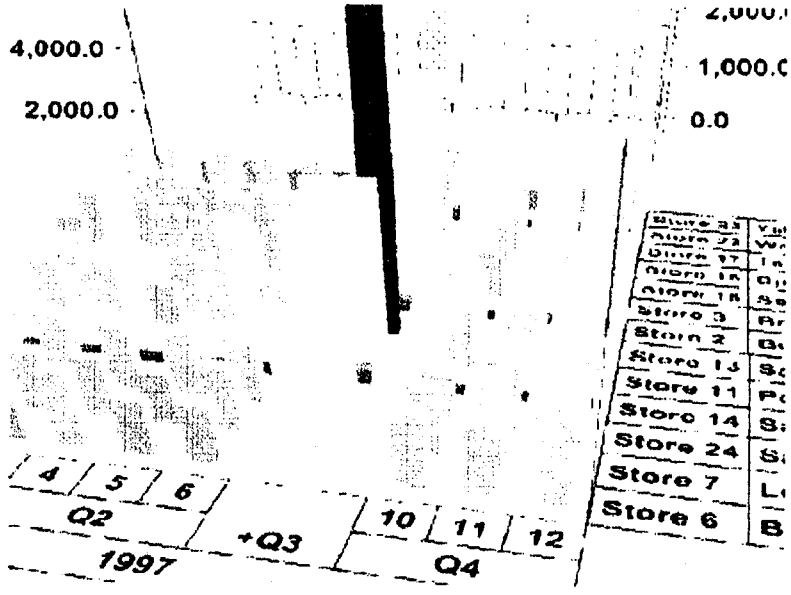

4,000.0
2,000.0
1,000.0
0.0
Store 3
Store 2
Store 14
Store 11
Store 14
Store 24
Store 7
Store 6
4
5
6
Q2
1997
Q3
10
11
12
Q4

FIG. 41

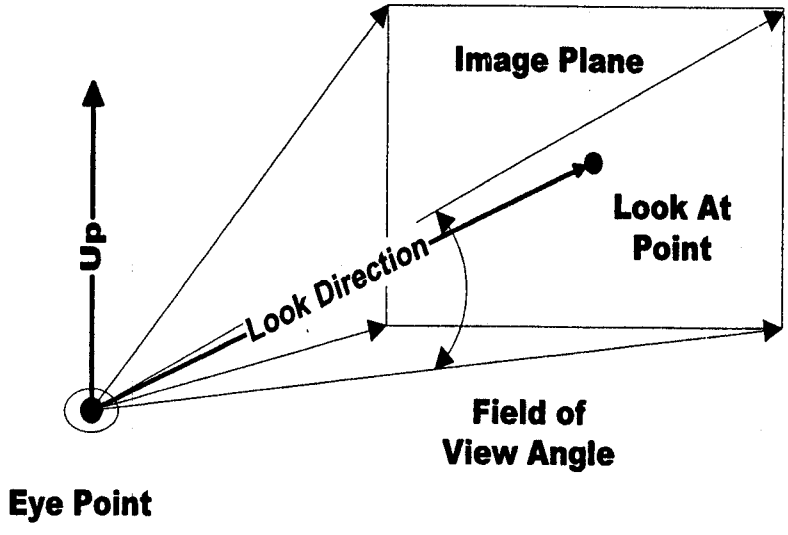

Image Plane
Look At Point
Look Direction
UP
Field of View Angle
Eye Point

FIG. 42