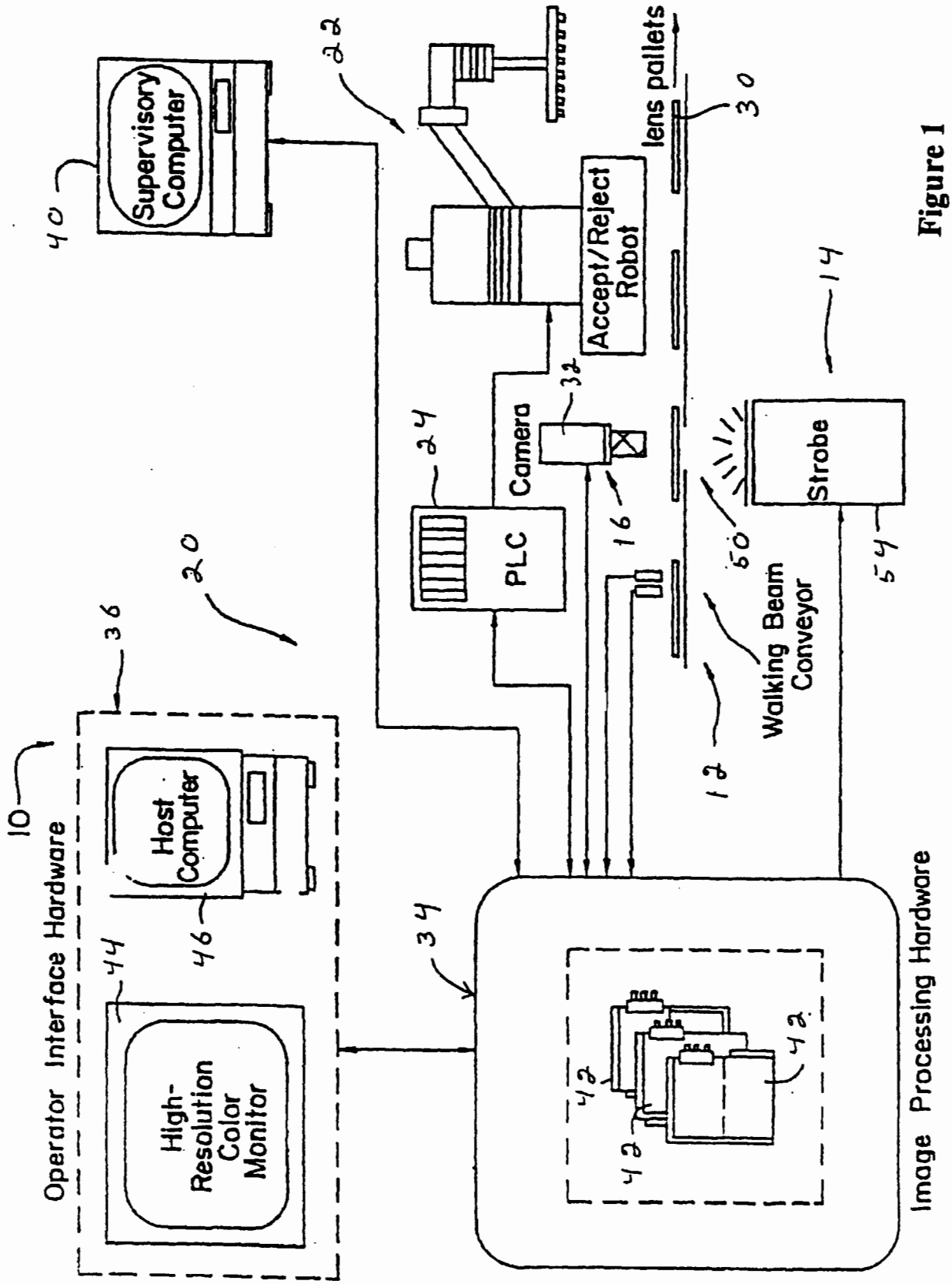

Supervisory Computer
40
22
lens pallets
30
Accept/Reject Robot
14
Camera
32
24
PLC
16
Strobe
60
54
Walking Beam Conveyor
12
20
36
10
Host Computer
46
Operator Interface Hardware
44
High-Resolution Color Monitor
34
42
42
42
Image Processing Hardware

Figure 1

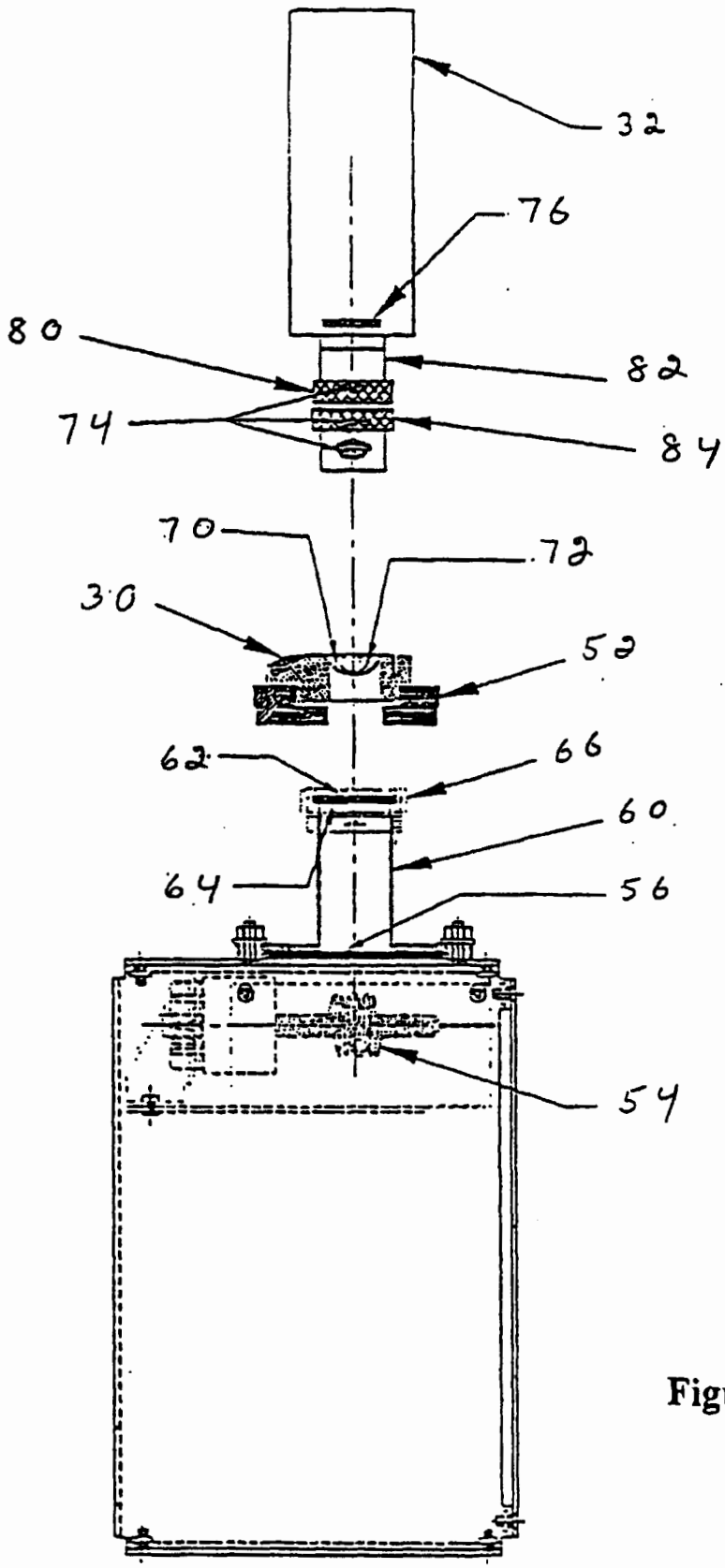
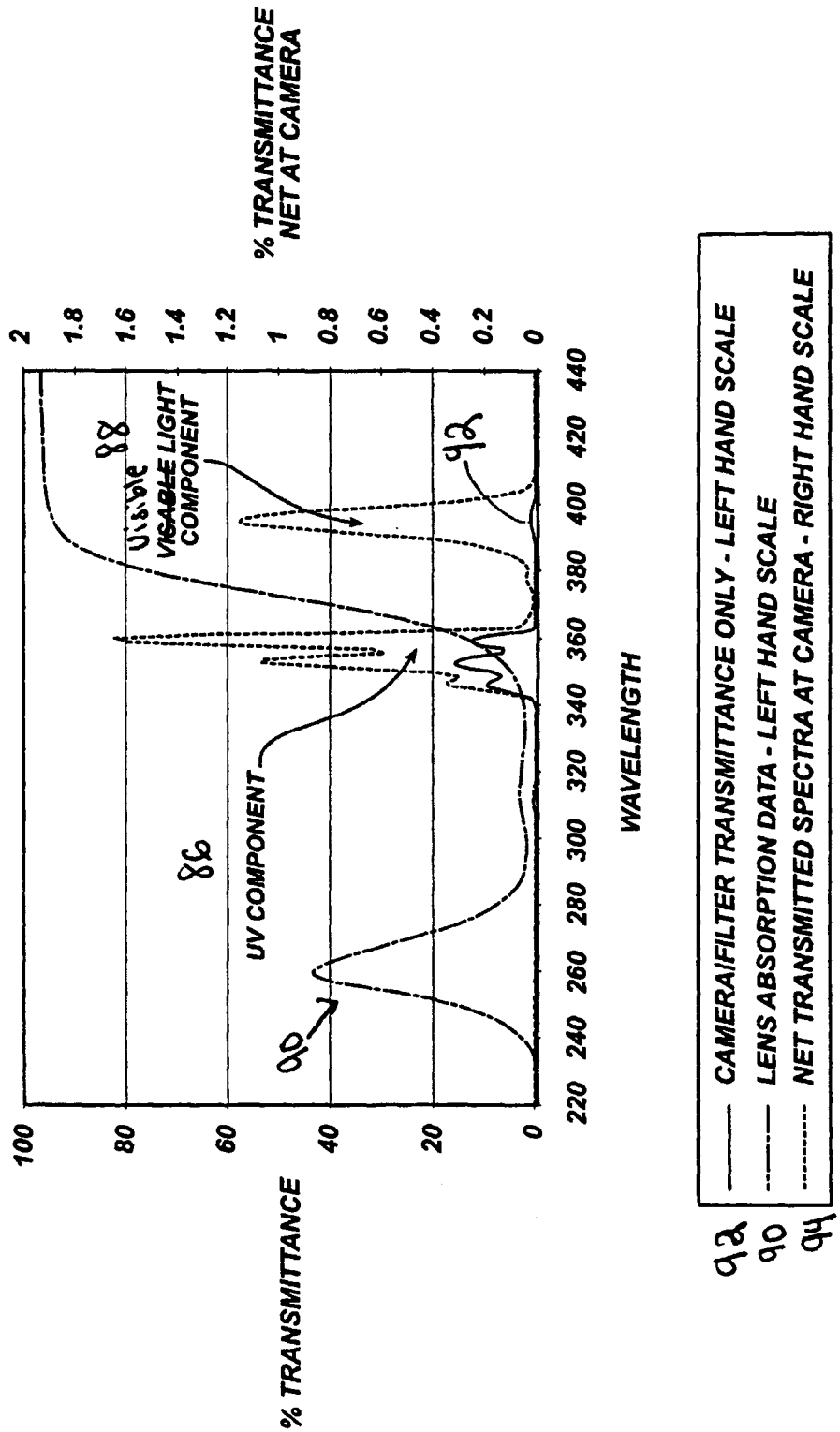


Figure 2

FIG. 3


% TRANSMITTANCE NET AT CAMERA
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
88
Visible LIGHT COMPONENT
86
UV COMPONENT
90
92
% TRANSMITTANCE
100
80
60
40
20
0
220 240 260 280 300 320 340 360 380 400 420 440
WAVELENGTH
CAMERA/FILTER TRANSMITTANCE ONLY - LEFT HAND SCALE
LENS ABSORPTION DATA - LEFT HAND SCALE
NET TRANSMITTED SPECTRA AT CAMERA - RIGHT HAND SCALE
92
90
94

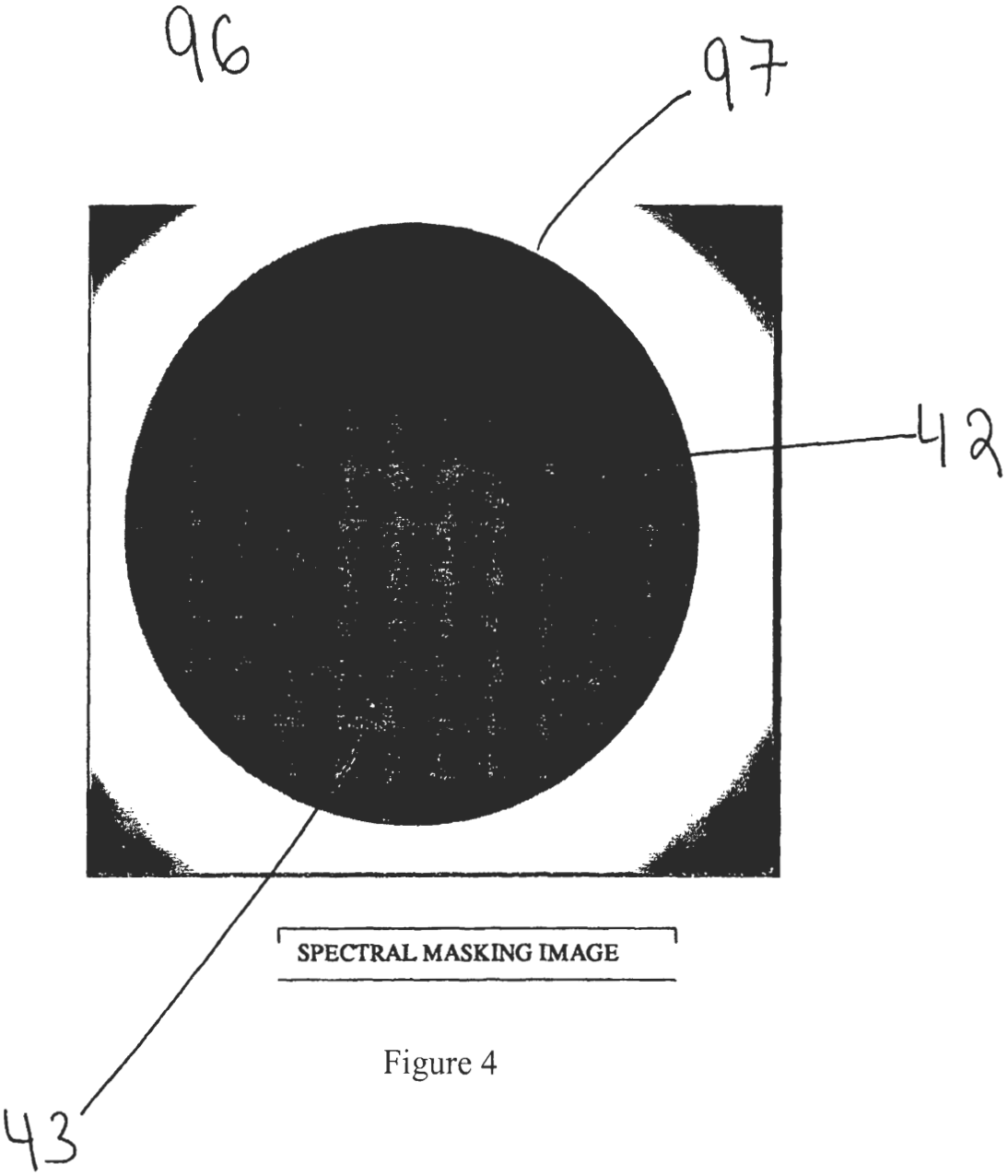


Figure 4

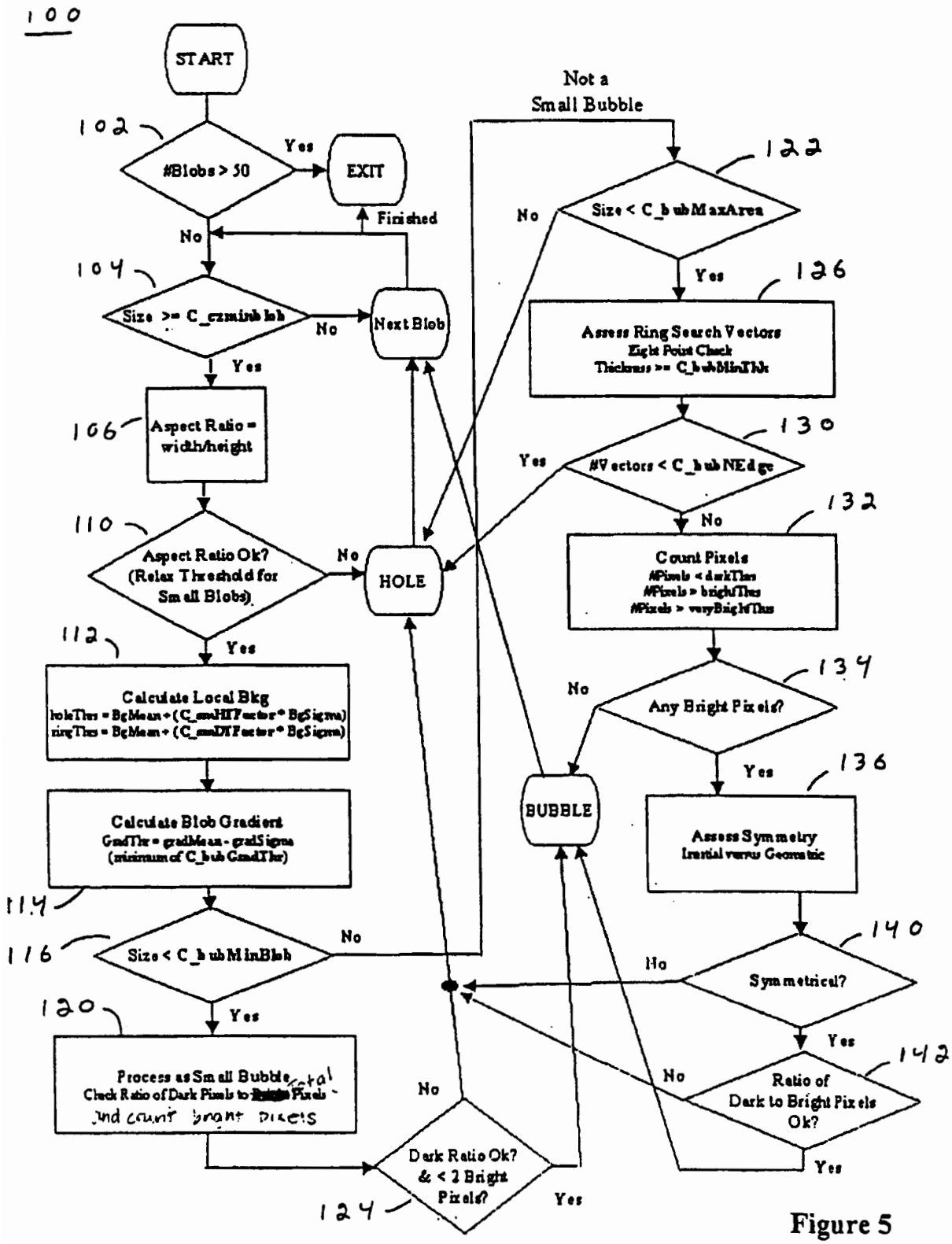

100
START
102
#Blobs > 50
Yes
EXIT
Finished
No
104
Size >= C_cxminblob
No
Next Blob
Yes
106
Aspect Ratio = width/height
110
Aspect Ratio Ok? (Relax Threshold for Small Blobs)
No
HOLE
Yes
112
Calculate Local Bkg
holeThr = BgMean + (C_smHITFactor * BgSigma)
ringThr = BgMean + (C_smDTFactor * BgSigma)
Calculate Blob Gradient
GradThr = gradMean - gradSigma
(minimum of C_bubGradThr)
114
116
Size < C_bubMinBlob
No
Yes
120
Process as Small Bubble
Check Ratio of Dark Pixels to Bright Pixels
and count bright pixels
Dark Ratio Ok? & < 2 Bright Pixels?
124
No
Yes
Not a Small Bubble
122
Size < C_bubMaxArea
No
Yes
126
Assess Ring Search Vectors
Eight Point Check
Thickness >= C_bubMinThk
130
#Vectors < C_bubNEdge
Yes
No
132
Count Pixels
#Pixels < darkThr
#Pixels > brightThr
#Pixels > veryBrightThr
134
Any Bright Pixels?
No
Yes
BUBBLE
136
Assess Symmetry
Inertial versus Geometric
140
Symmetrical?
No
Yes
142
Ratio of Dark to Bright Pixels Ok?
No
Yes

Figure 5

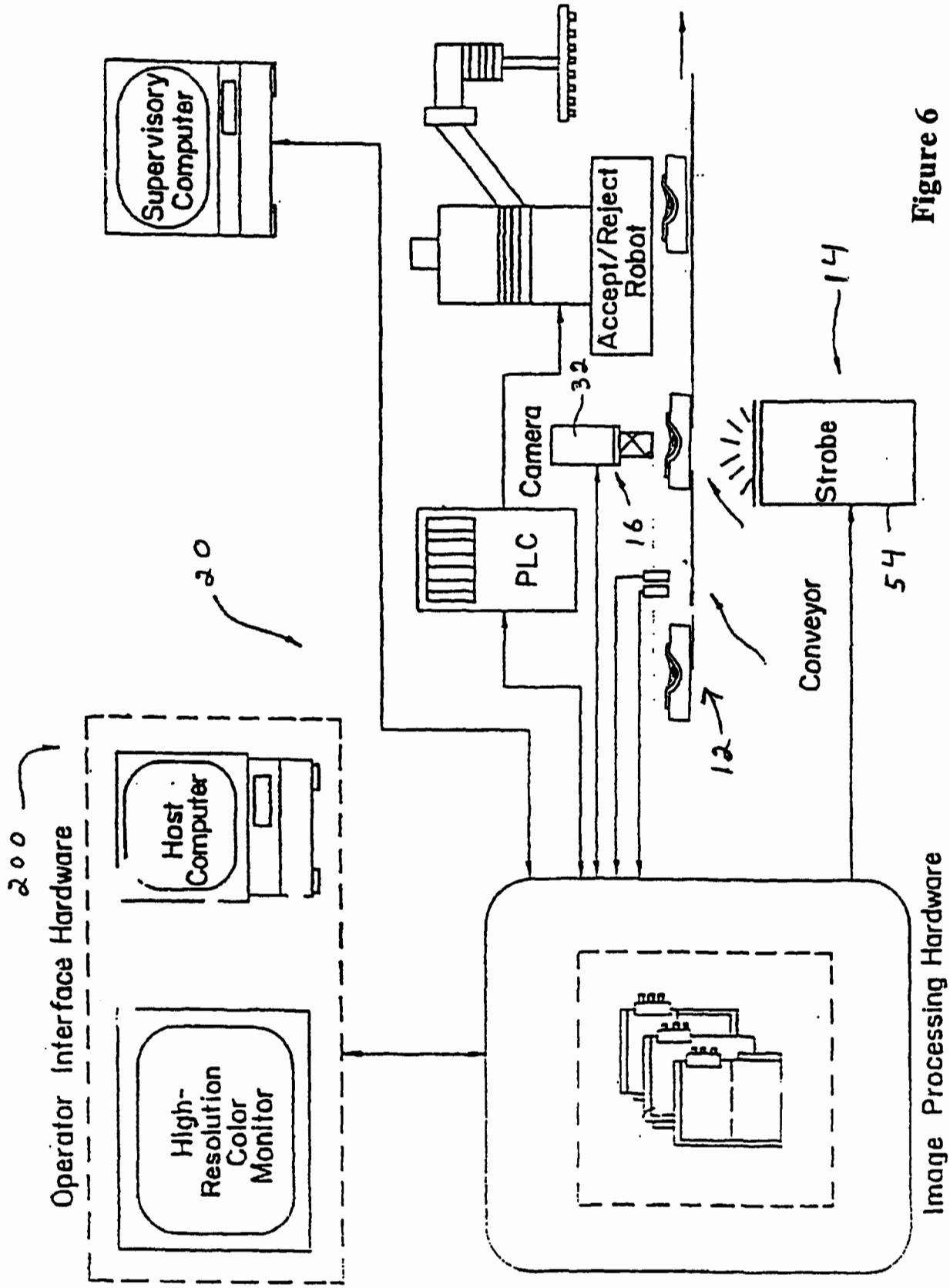
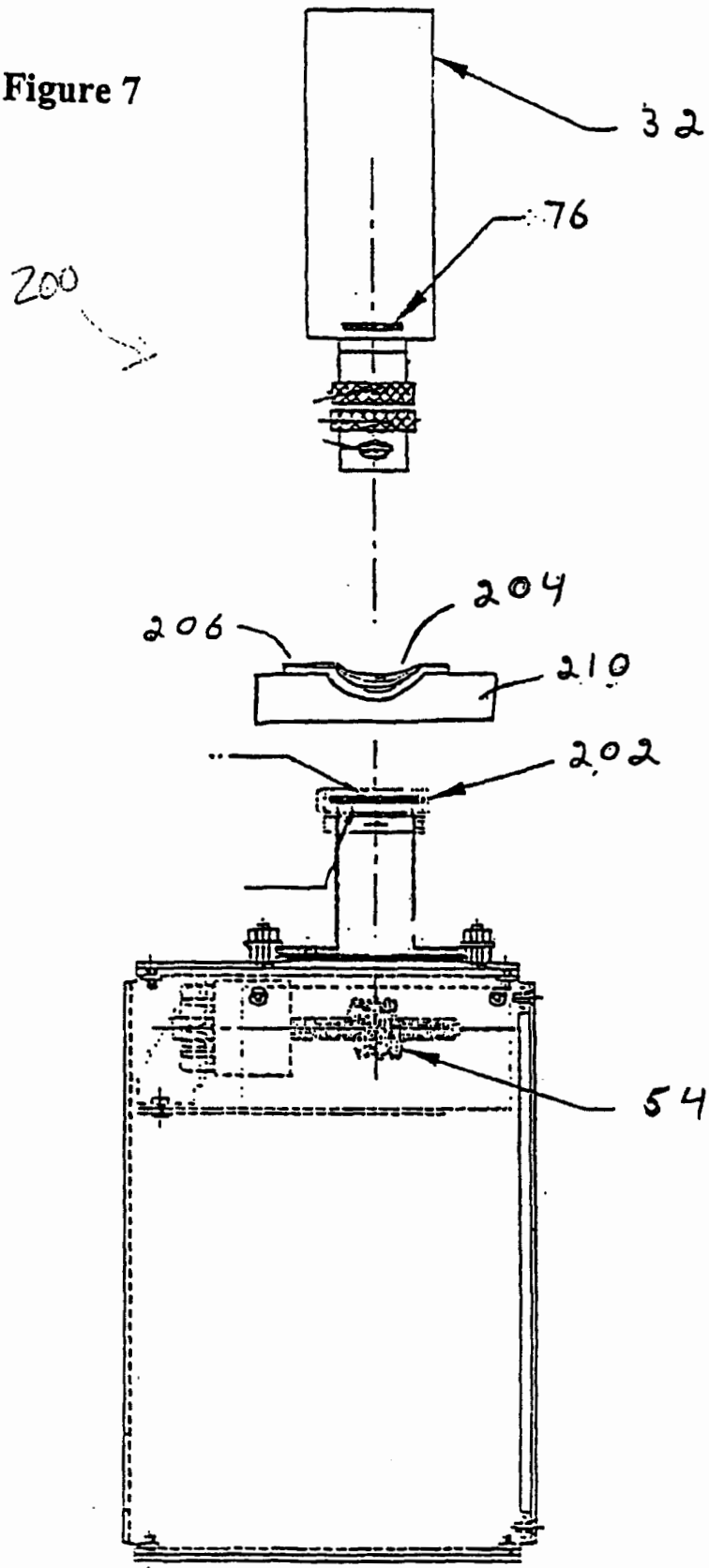

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Conveyor
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200
Operator Interface Hardware
Host Computer
High-Resolution Color Monitor
Image Processing Hardware

Figure 6

Figure 7



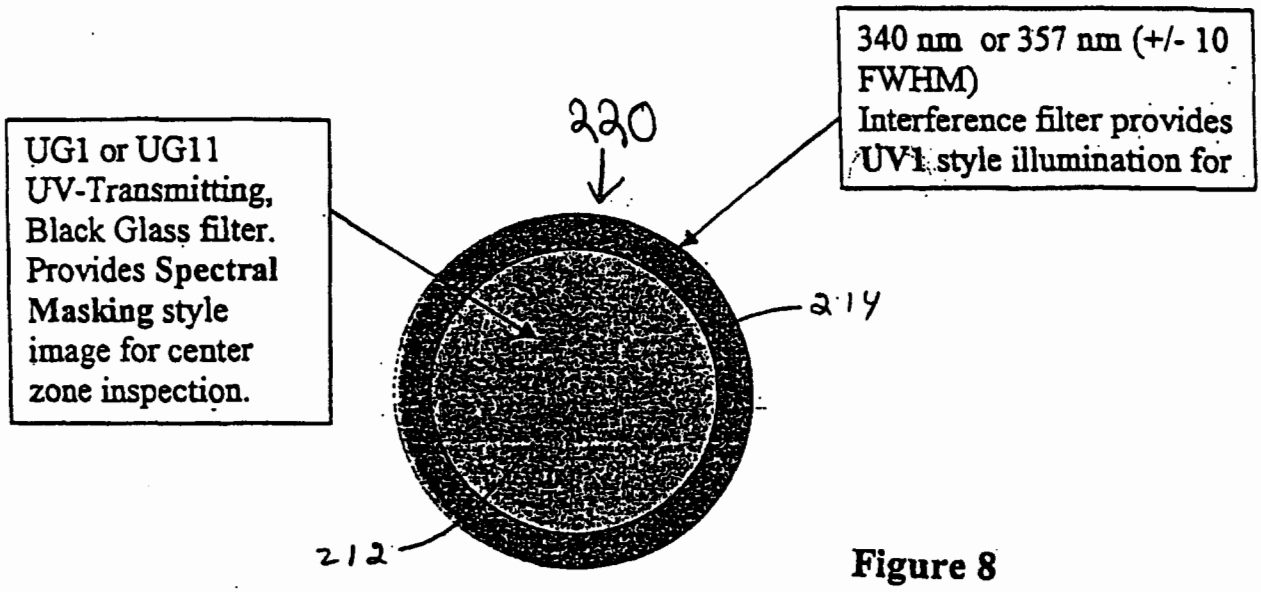


Figure 8

Figure 9

