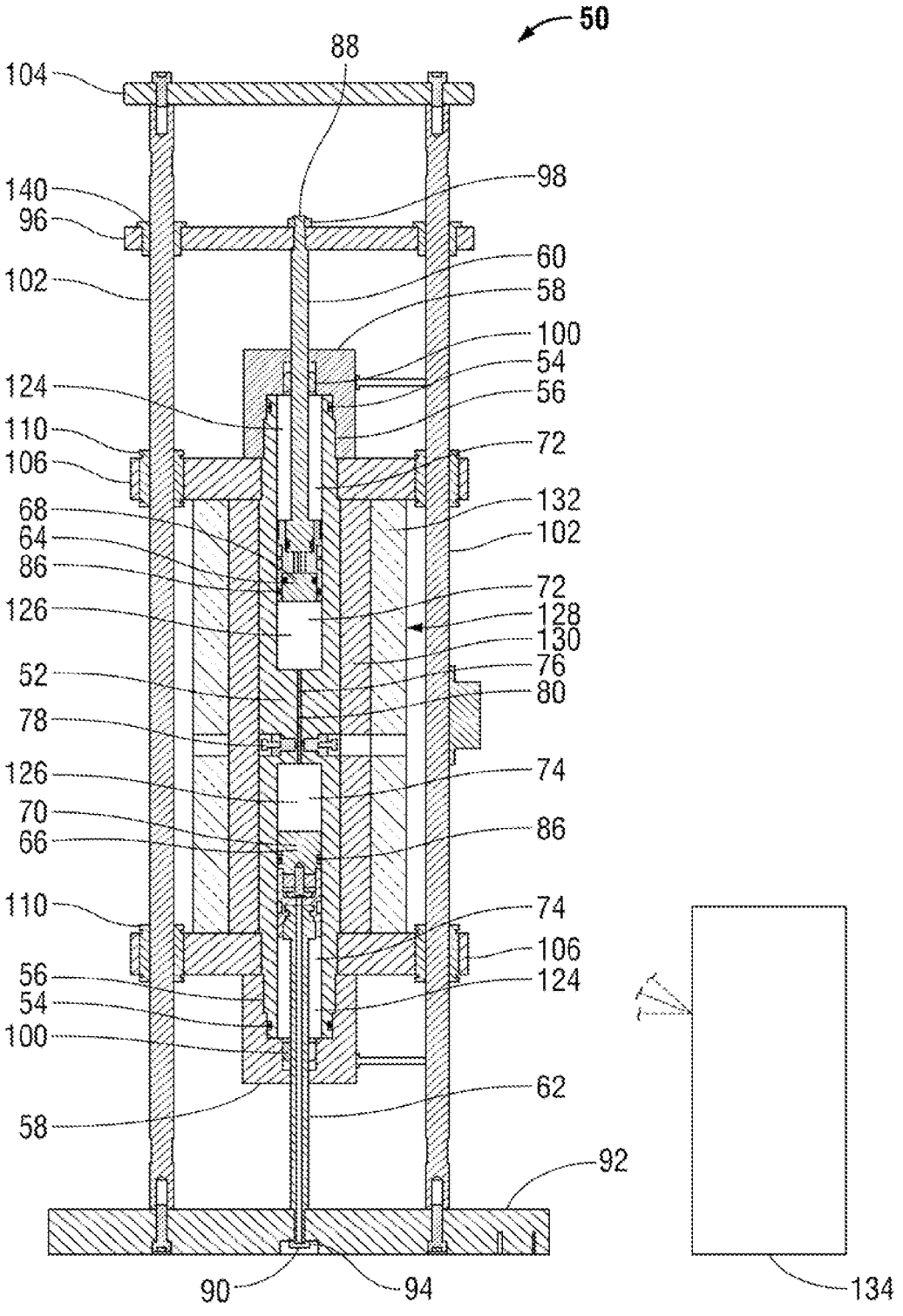

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62
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134

FIG. 1

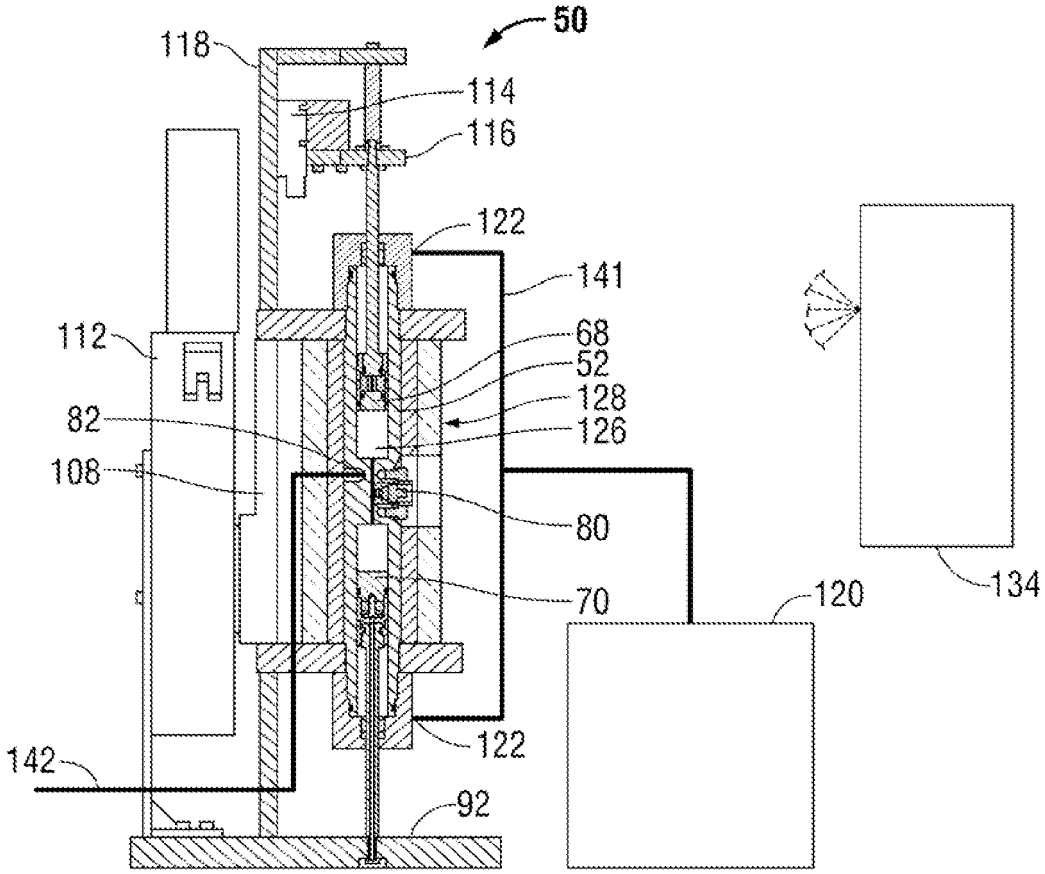

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FIG. 2

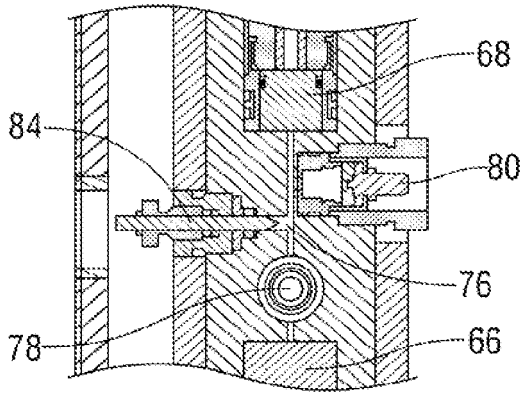

68
84
80
76
78
66

FIG. 3

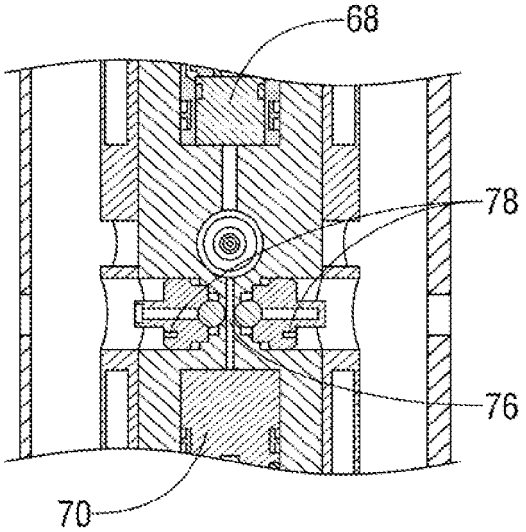

68
78
76
70

FIG. 4

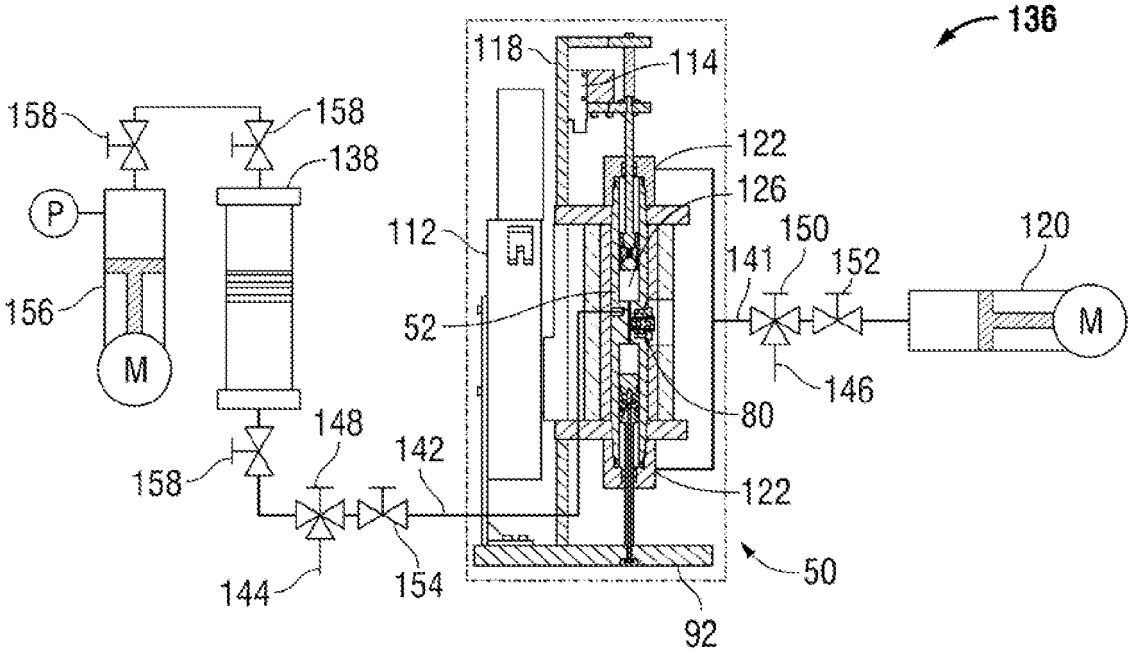

136
118
114
158
158
138
122
126
112
150
120
141
152
P
156
52
M
M
146
80
148
142
158
122
144
154
50
92

FIG. 5

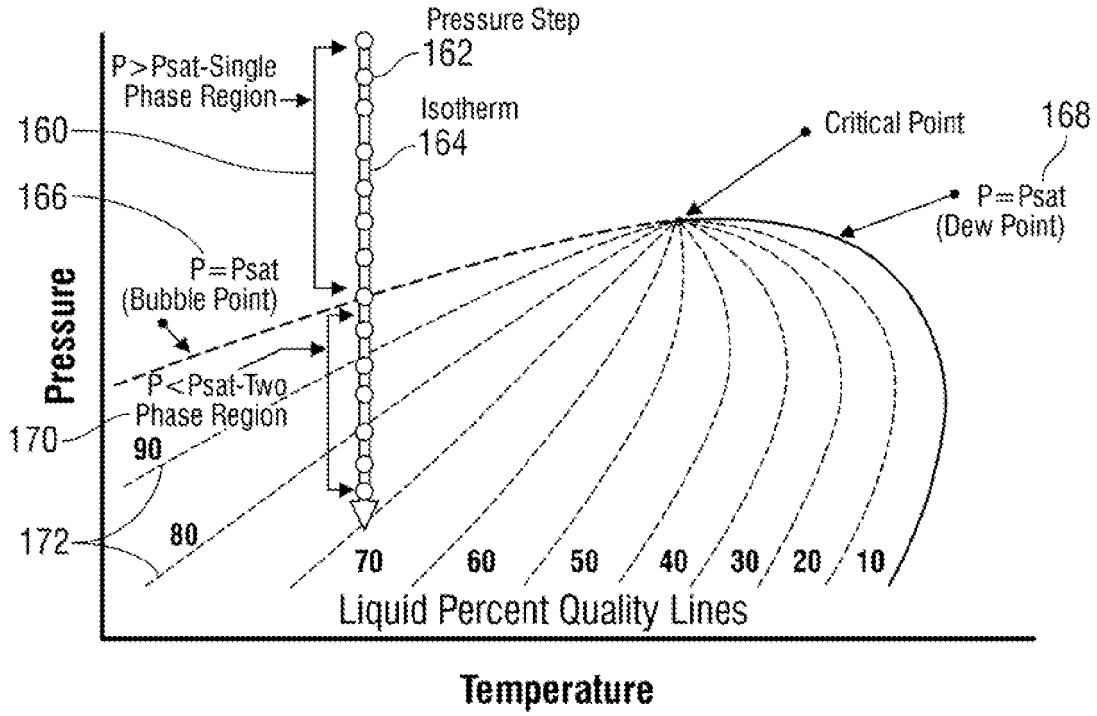

Pressure Step
162
P>Psat-Single Phase Region
Isotherm
164
160
Critical Point
168
166
P=Psat (Dew Point)
P=Psat (Bubble Point)
Pressure
P<Psat-Two Phase Region
170
90
172
80
70
60
50
40
30
20
10
Liquid Percent Quality Lines
Temperature

FIG. 6

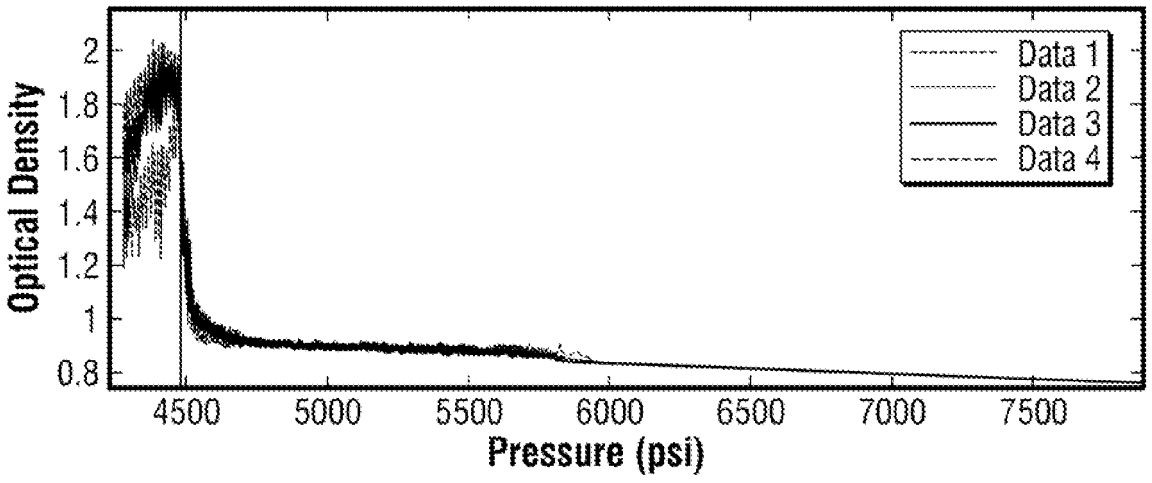

Optical Density
2
1.8
1.6
1.4
1.2
1
0.8
4500
5000
5500
6000
6500
7000
7500
Pressure (psi)
Data 1
Data 2
Data 3
Data 4

FIG. 7

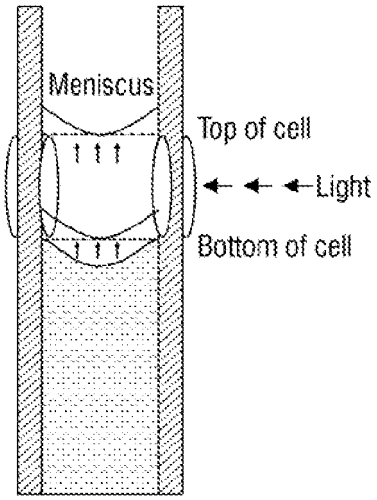

Meniscus
Top of cell
Light
Bottom of cell

FIG. 8

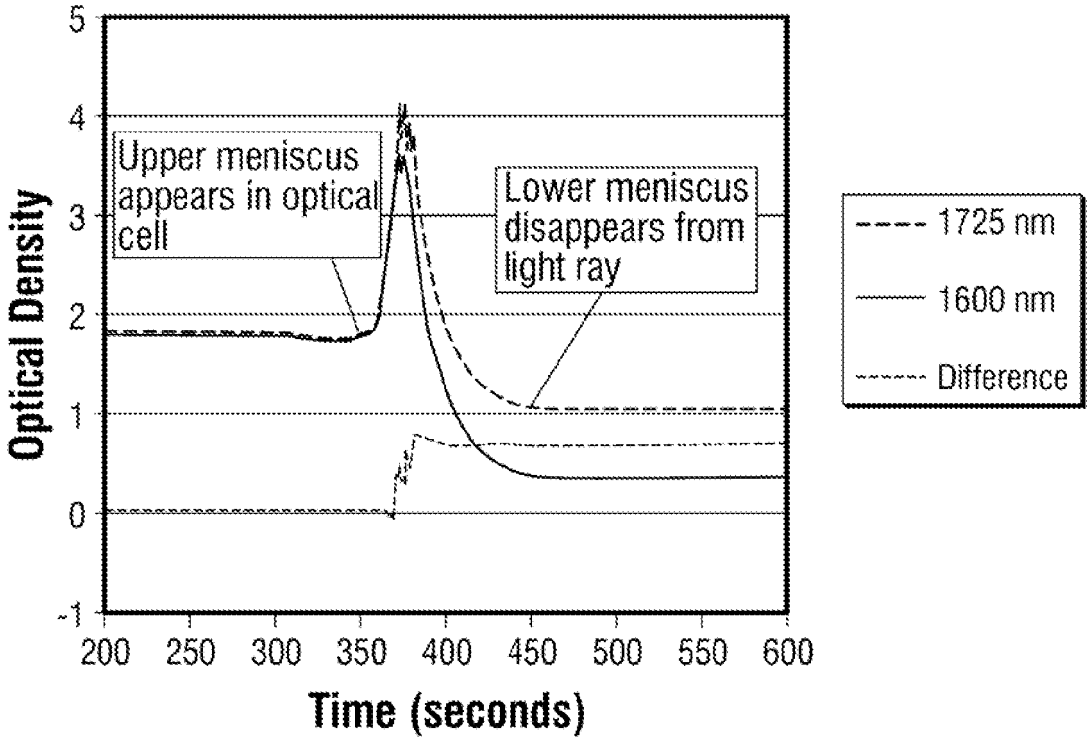

Optical Density
Time (seconds)
Upper meniscus appears in optical cell
Lower meniscus disappears from light ray
1725 nm
1600 nm
Difference
5
4
3
2
1
0
-1
200
250
300
350
400
450
500
550
600

FIG. 9

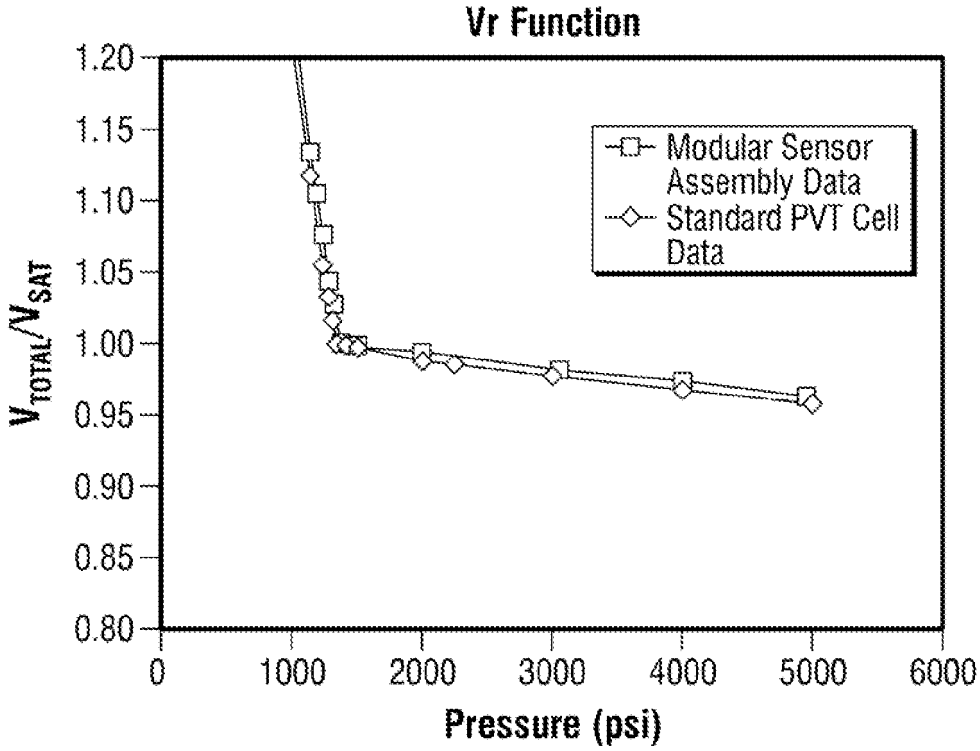

Vr Function
1.20
1.15
1.10
1.05
1.00
0.95
0.90
0.85
0.80
V_{TOTAL}/V_{SAT}
Modular Sensor Assembly Data
Standard PVT Cell Data
0
1000
2000
3000
4000
5000
6000
Pressure (psi)

FIG. 10

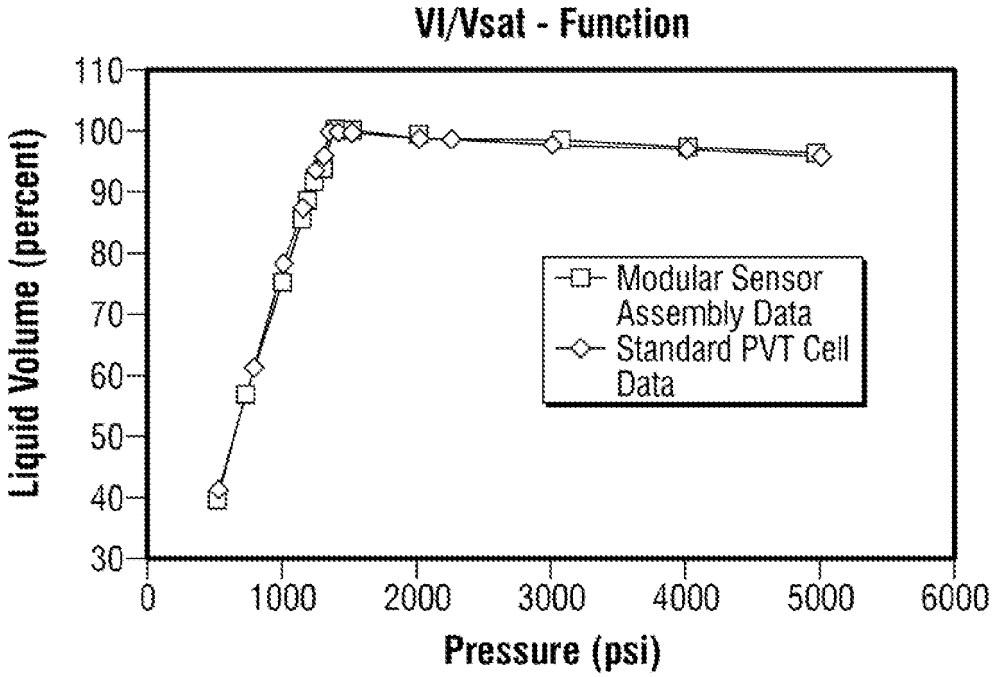

Vl/Vsat - Function
110
100
90
80
70
60
50
40
30
Liquid Volume (percent)
Modular Sensor Assembly Data
Standard PVT Cell Data
0
1000
2000
3000
4000
5000
6000
Pressure (psi)

FIG. 11

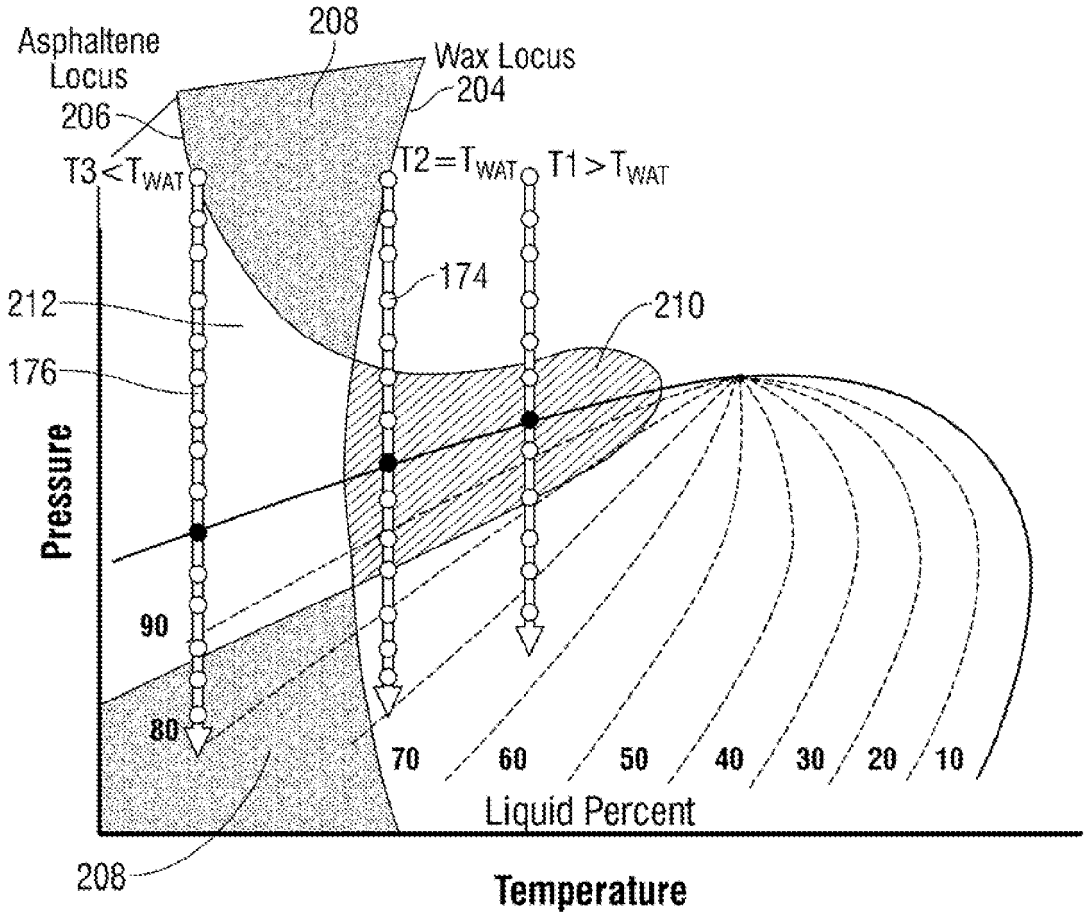

Asphaltene Locus
206
208
Wax Locus
204
T3 < T_WAT
T2 = T_WAT
T1 > T_WAT
174
210
212
176
Pressure
90
80
70
60
50
40
30
20
10
Liquid Percent
208
Temperature

FIG. 12

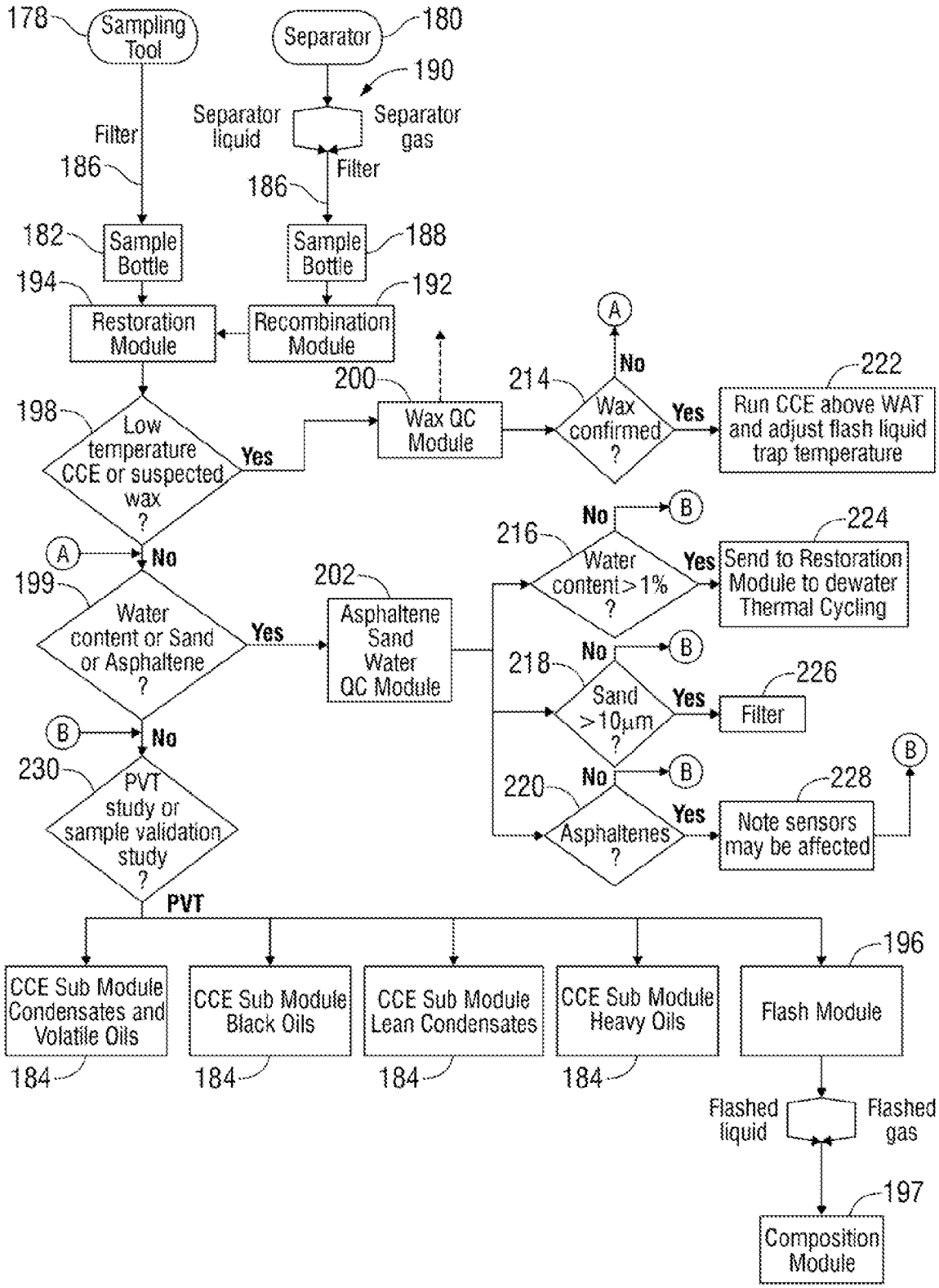

178
Sampling Tool
Separator
180
190
Separator liquid
Separator gas
Filter
186
Filter
186
182
Sample Bottle
Sample Bottle
188
194
192
Restoration Module
Recombination Module
A
No
200
214
222
198
Low temperature CCE or suspected wax ?
Yes
Wax QC Module
Wax confirmed ?
Yes
Run CCE above WAT and adjust flash liquid trap temperature
No
B
216
224
A
No
Water content > 1% ?
Yes
Send to Restoration Module to dewater Thermal Cycling
199
202
Water content or Sand or Asphaltene ?
Yes
Asphaltene Sand Water QC Module
No
B
218
226
Sand >10μm ?
Yes
Filter
B
No
No
B
230
220
228
PVT study or sample validation study ?
Asphaltenes ?
Yes
Note sensors may be affected
B
PVT
196
CCE Sub Module Condensates and Volatile Oils
CCE Sub Module Black Oils
CCE Sub Module Lean Condensates
CCE Sub Module Heavy Oils
Flash Module
184
184
184
184
Flashed liquid
Flashed gas
197
Composition Module

FIG. 13

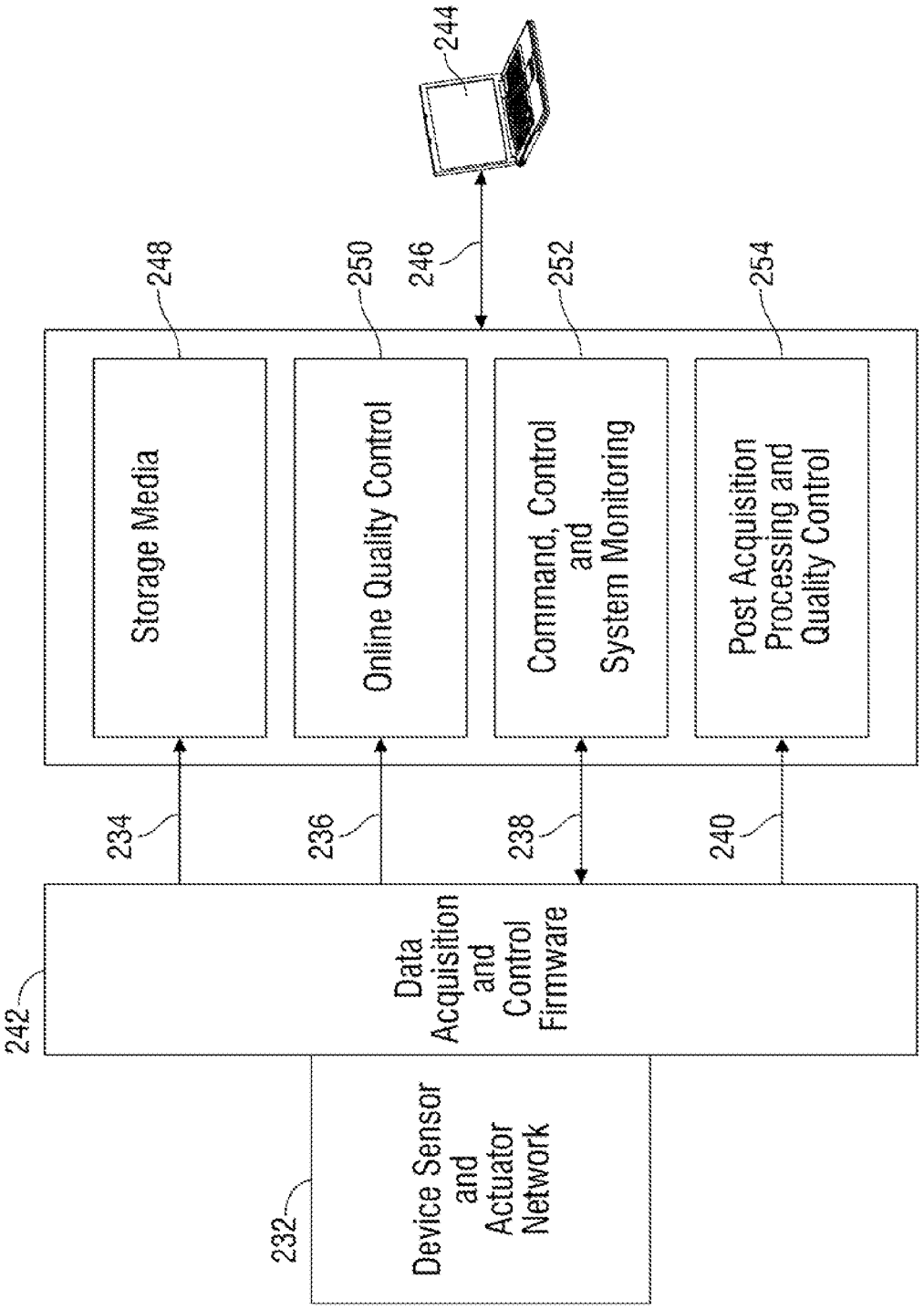

244
246
248
250
252
254
Storage Media
Online Quality Control
Command, Control and System Monitoring
Post Acquisition Processing and Quality Control
234
236
238
240
242
Data Acquisition and Control Firmware
232
Device Sensor and Actuator Network

FIG. 14

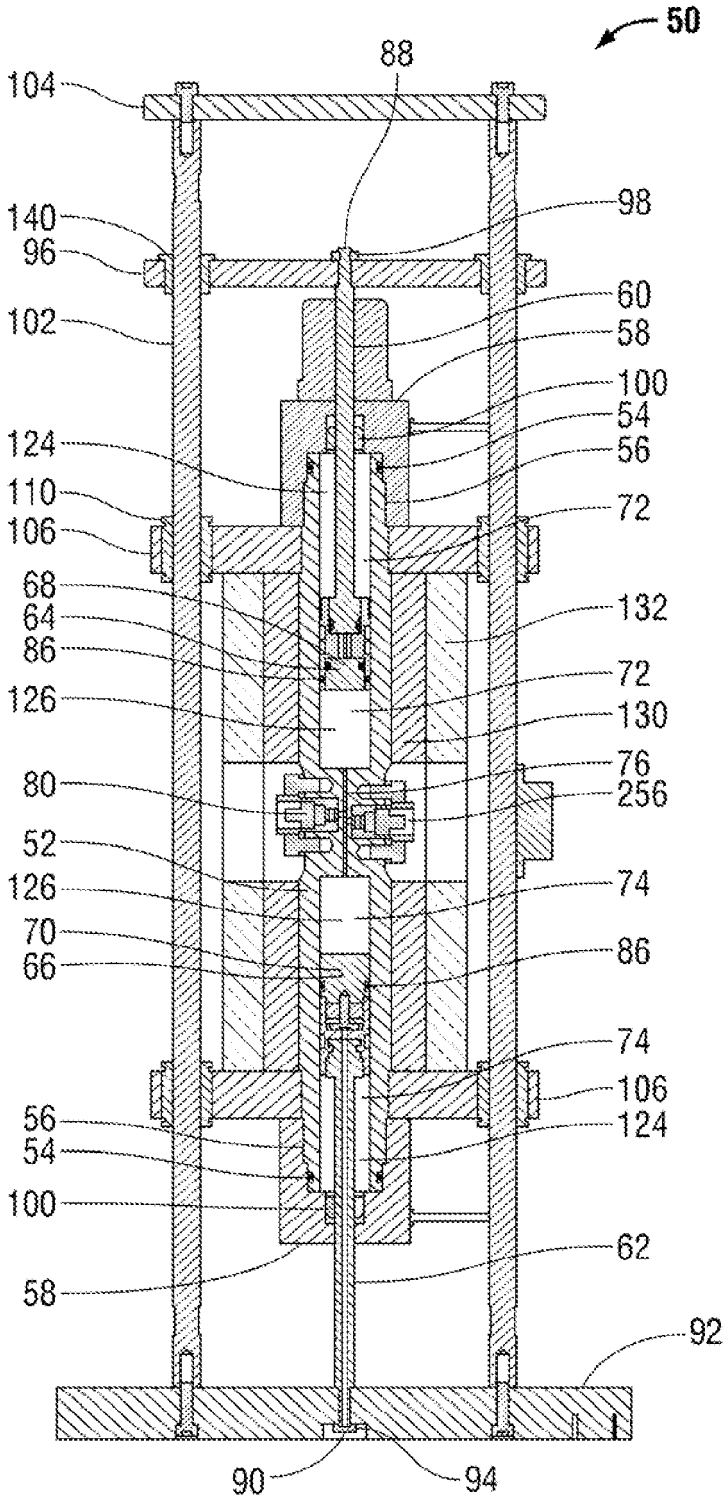

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FIG. 15

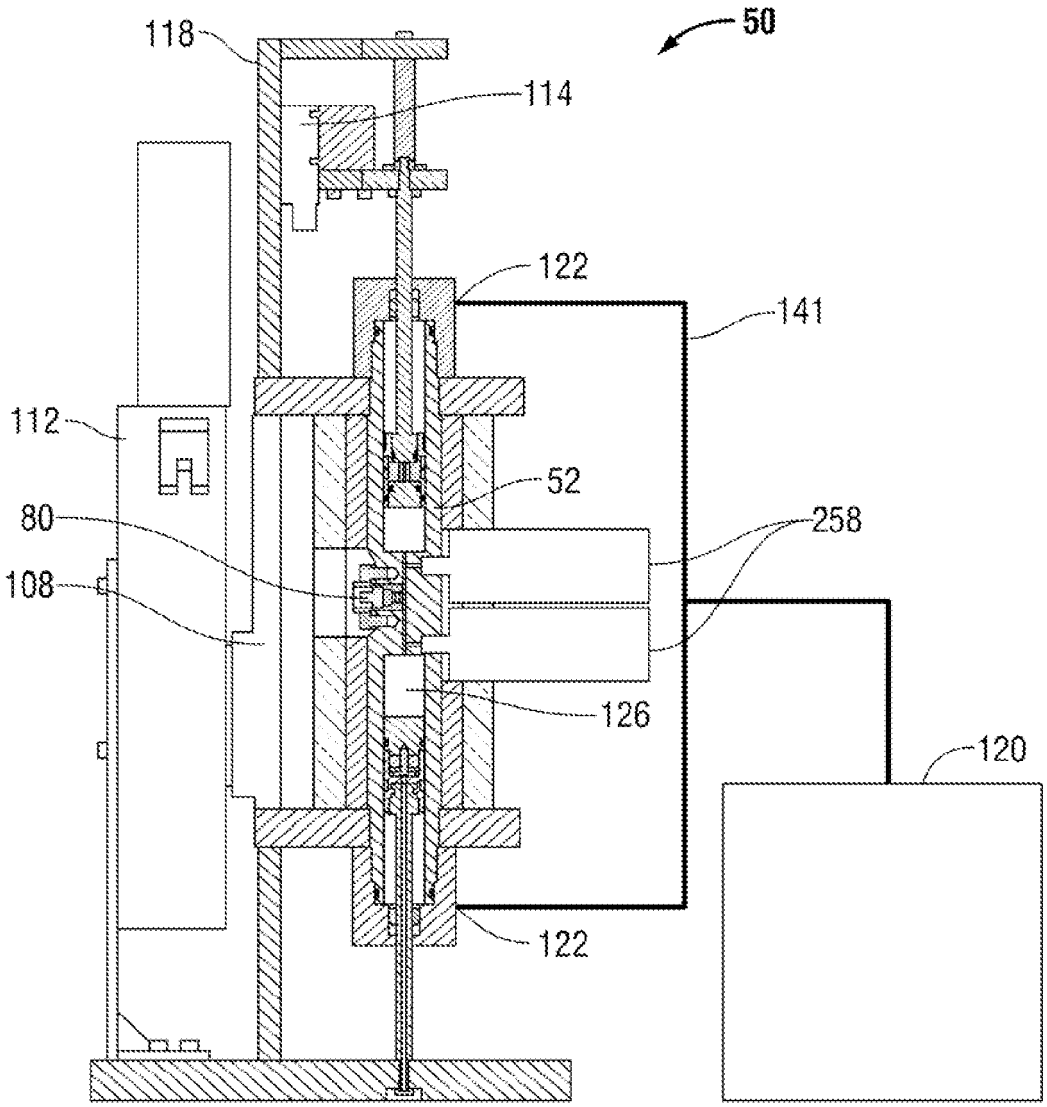


FIG. 16

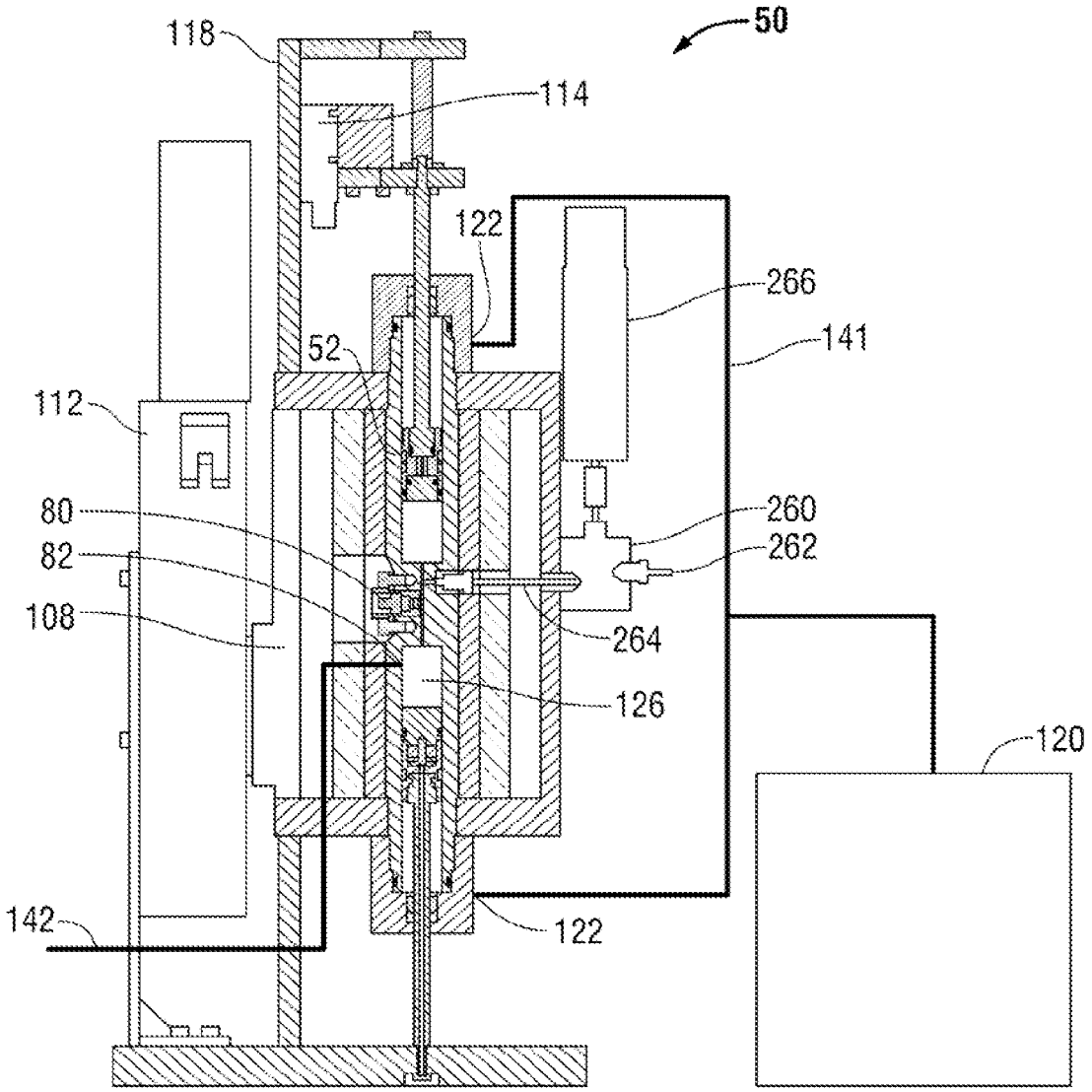

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FIG. 17

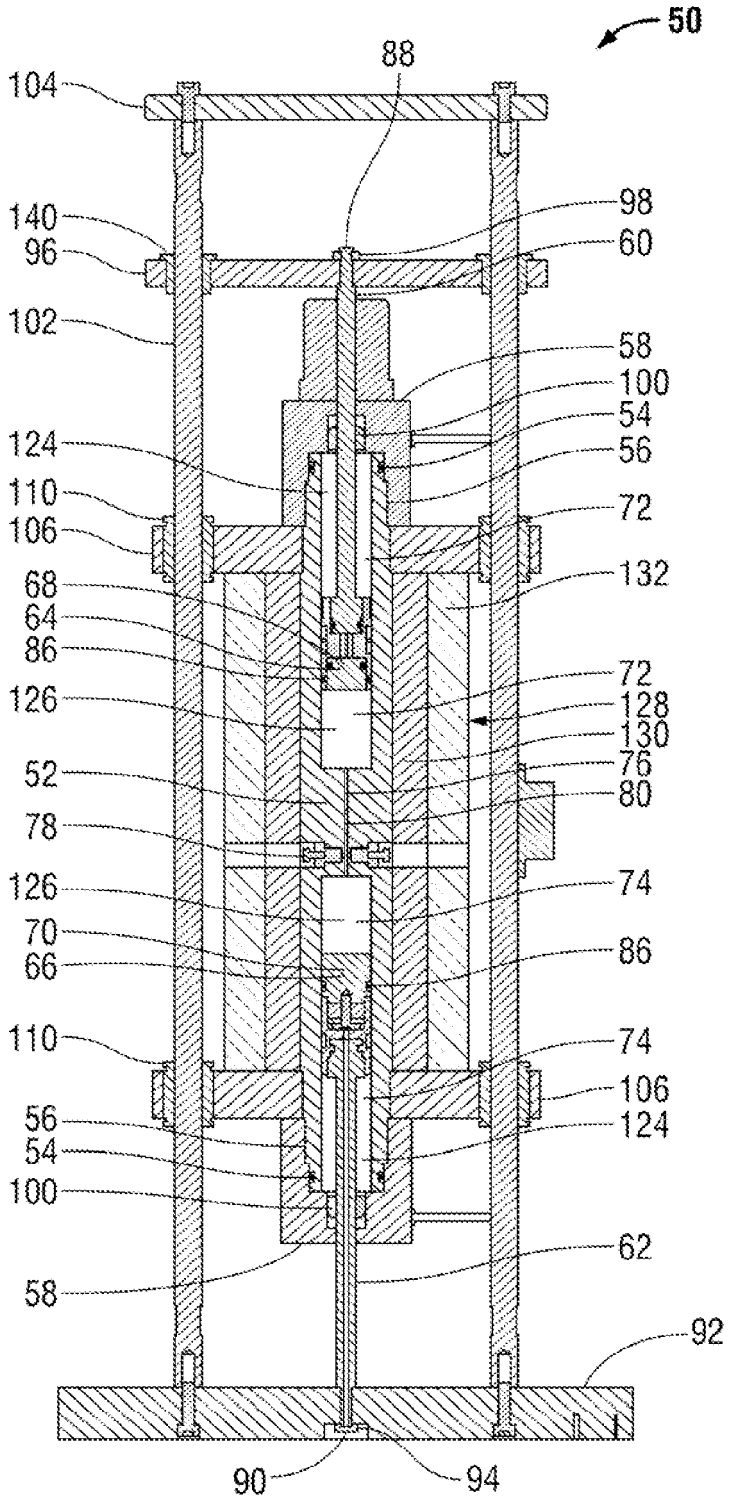

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FIG. 18

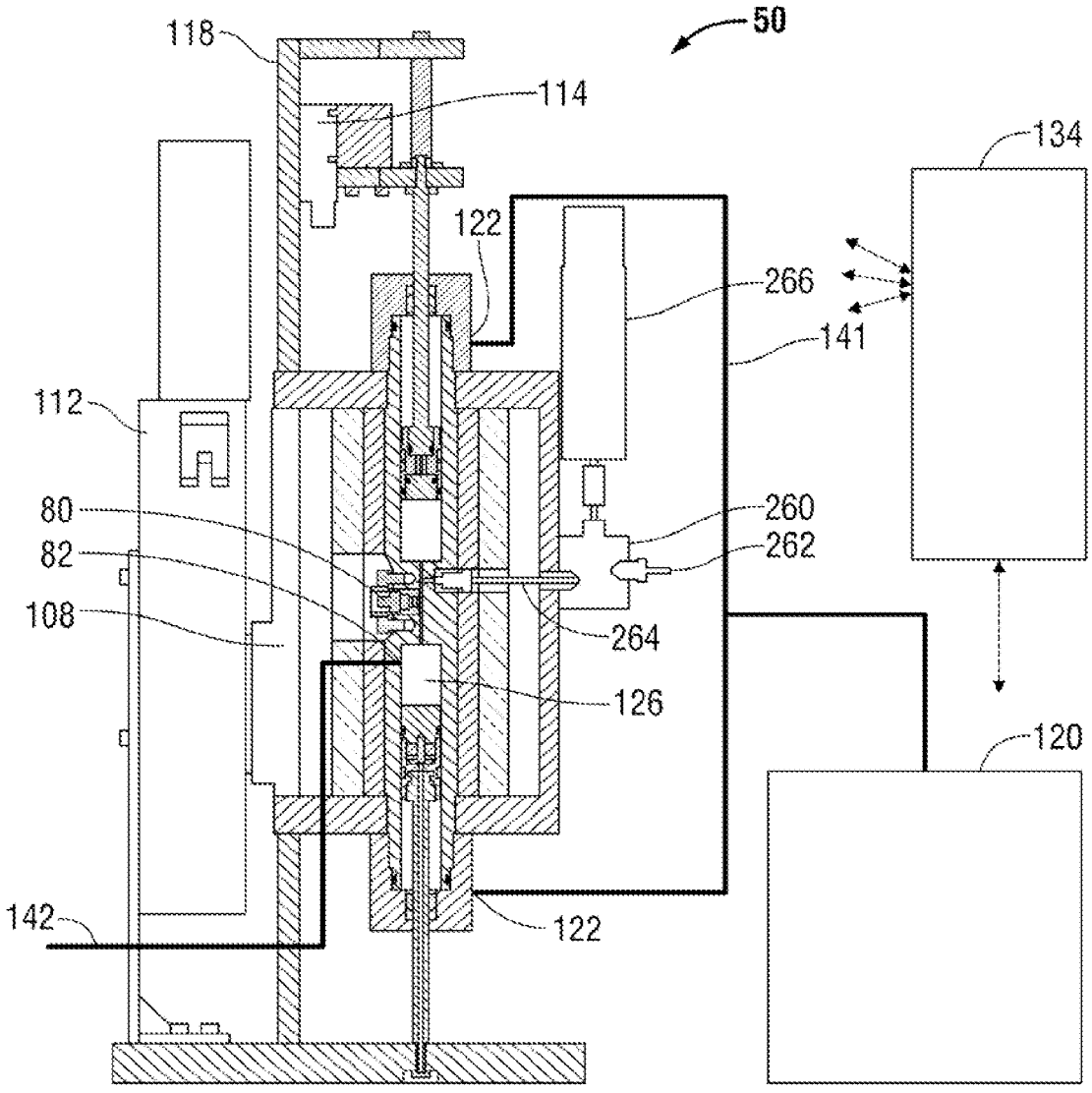

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FIG. 19

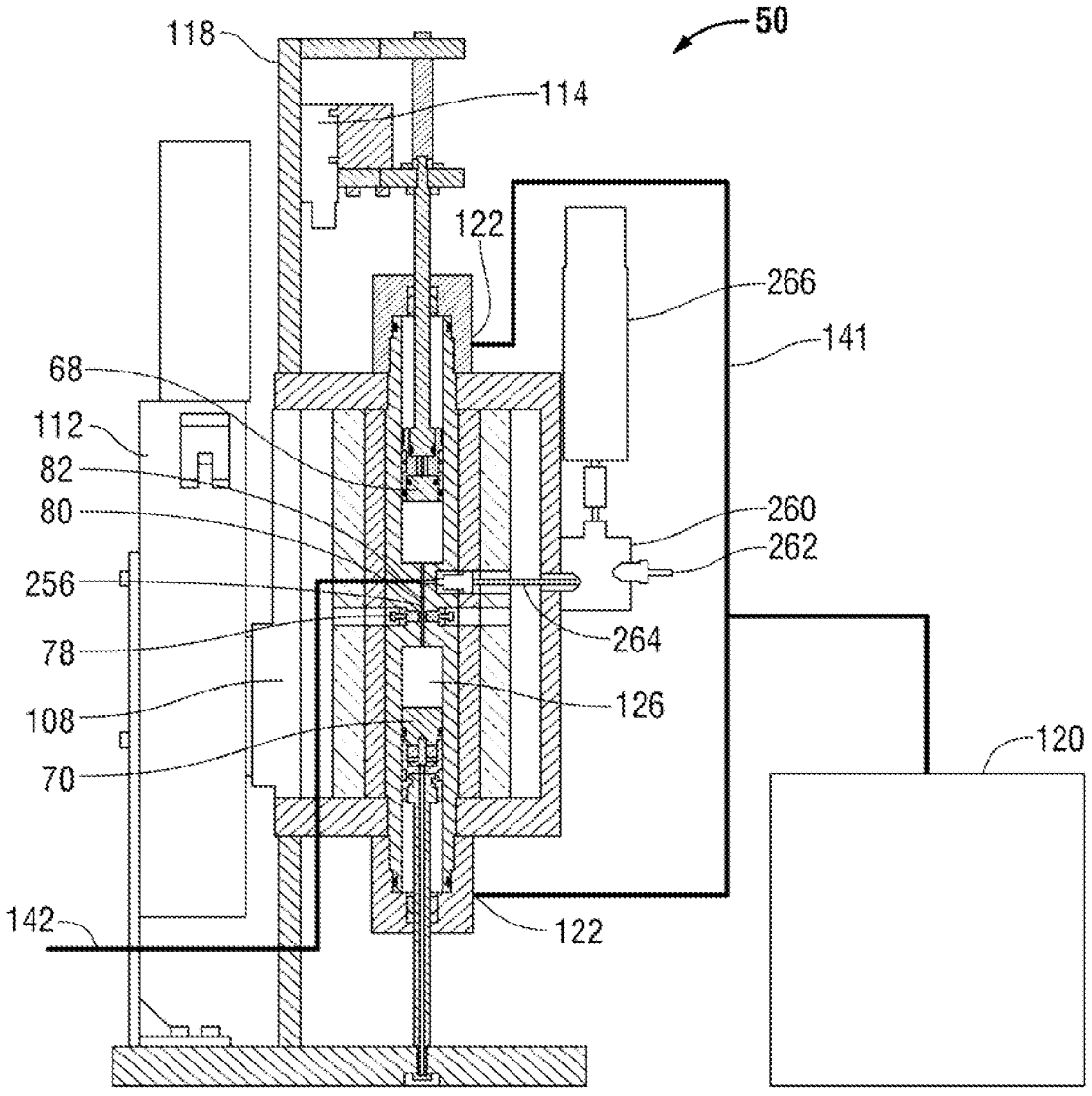

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FIG. 20

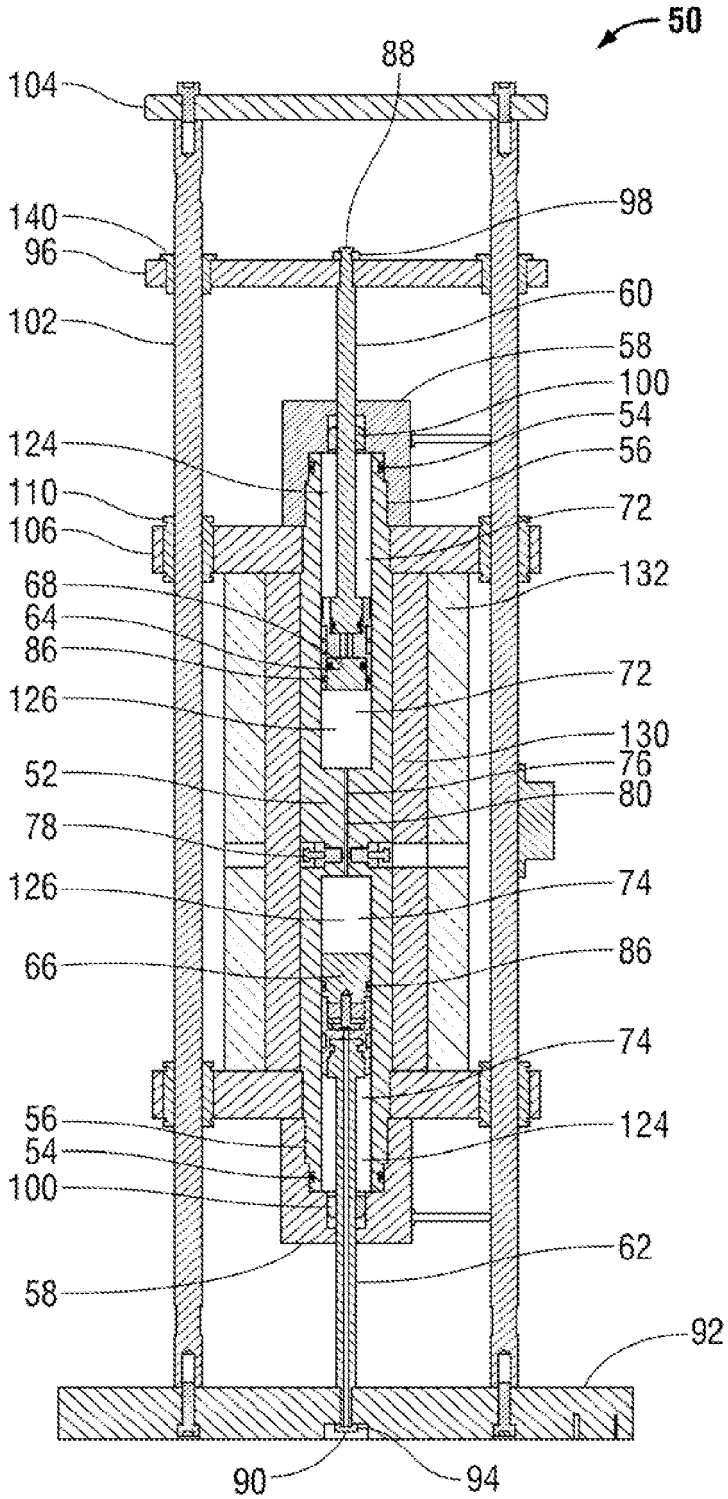

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FIG. 21

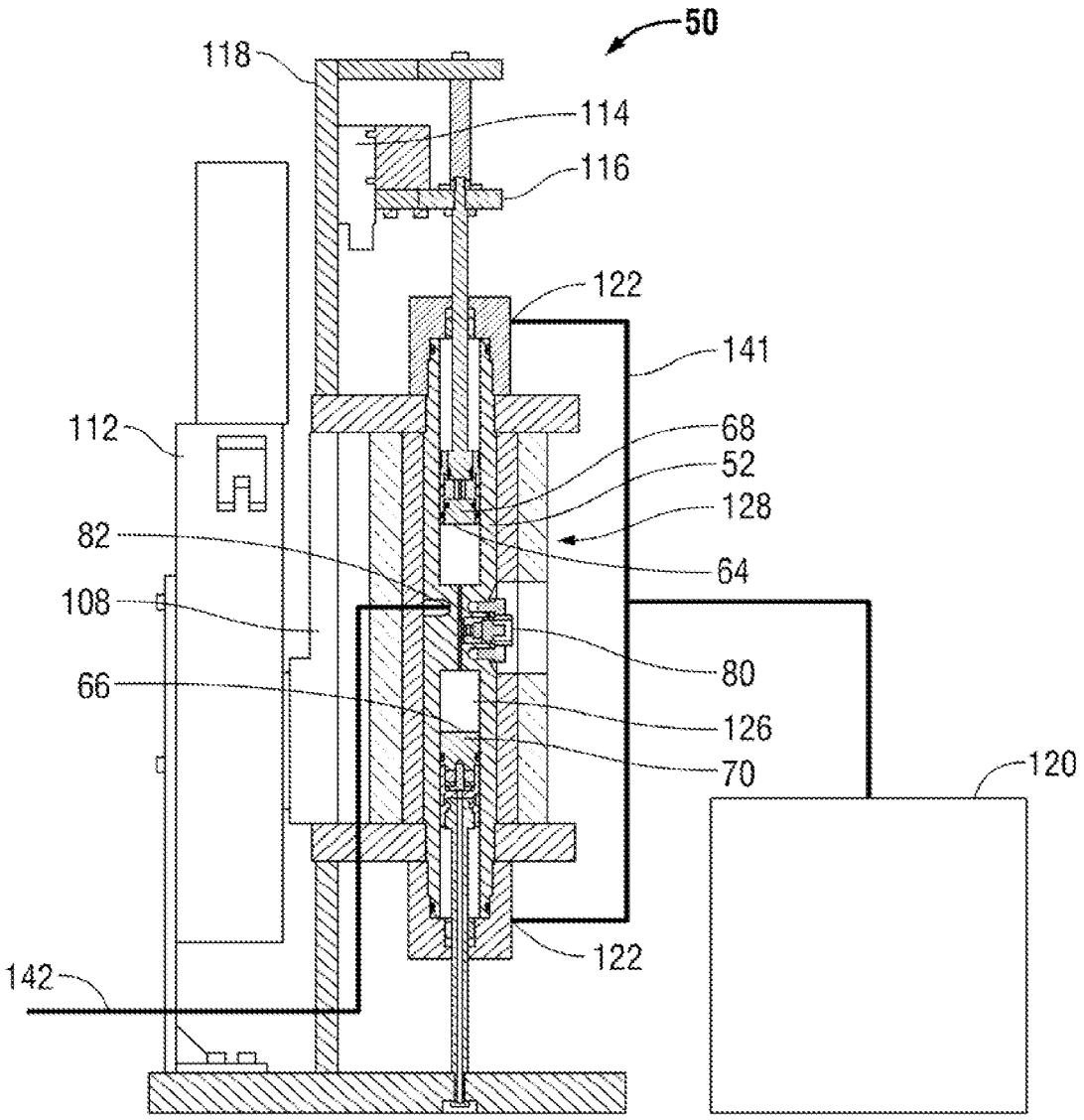

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FIG. 22

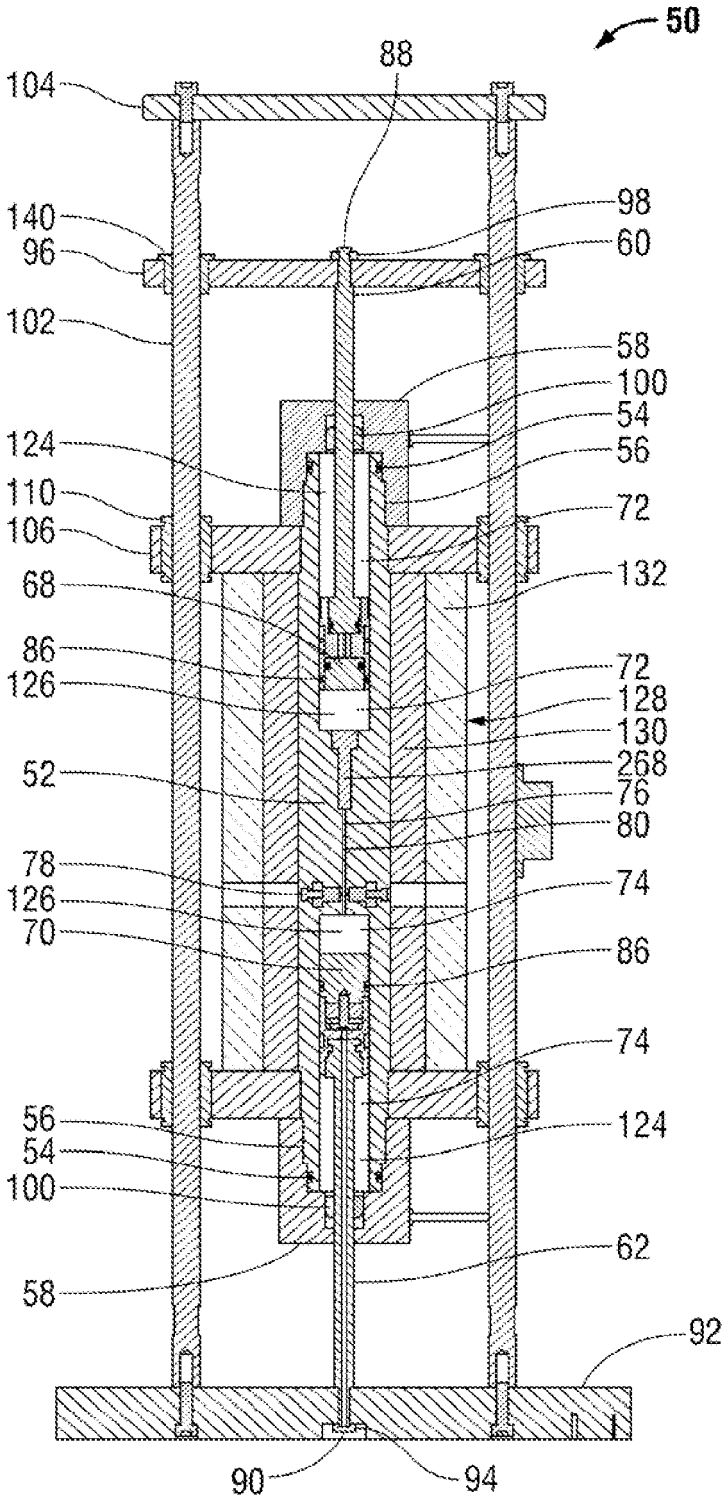

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FIG. 23

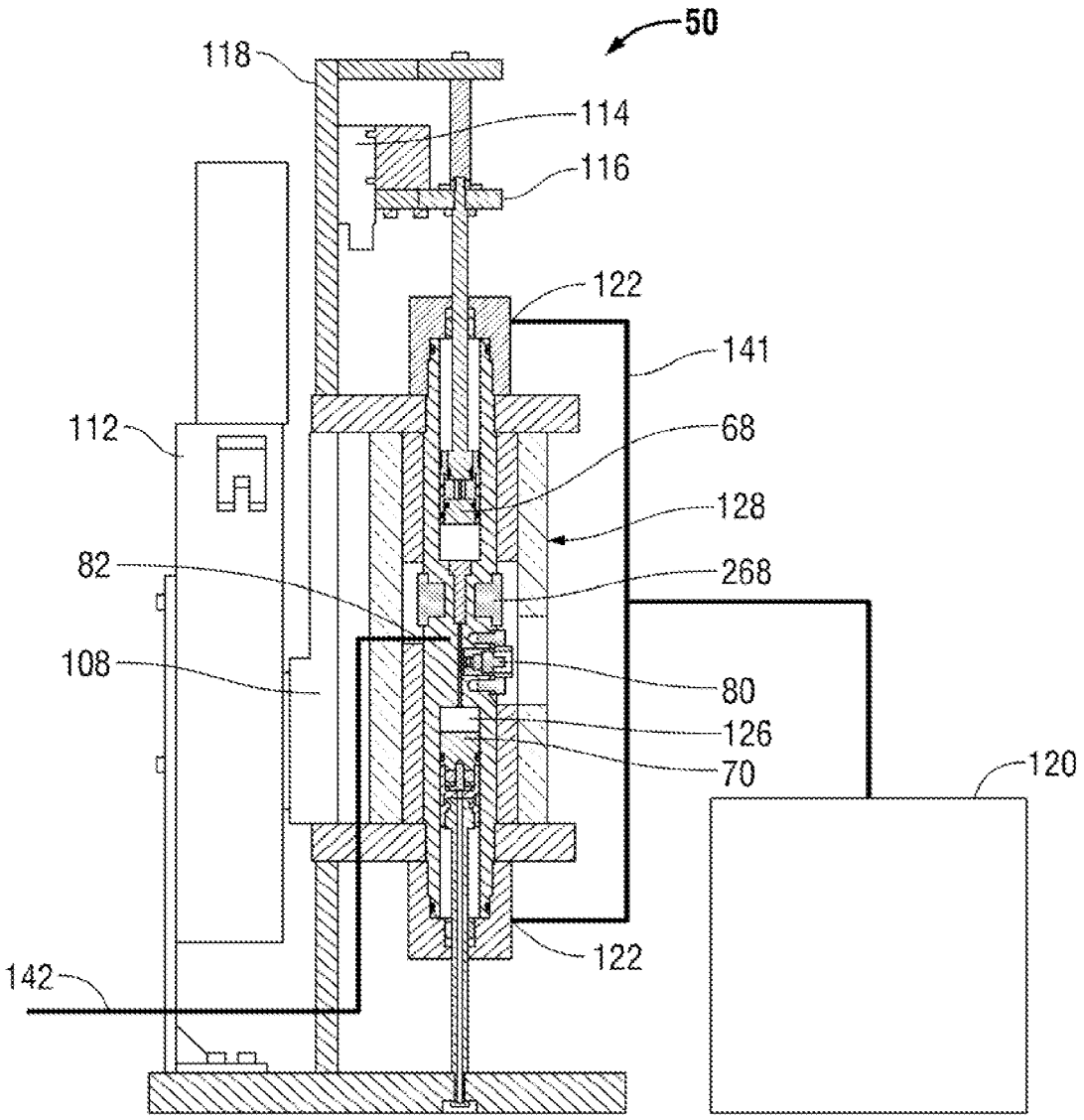


FIG. 24

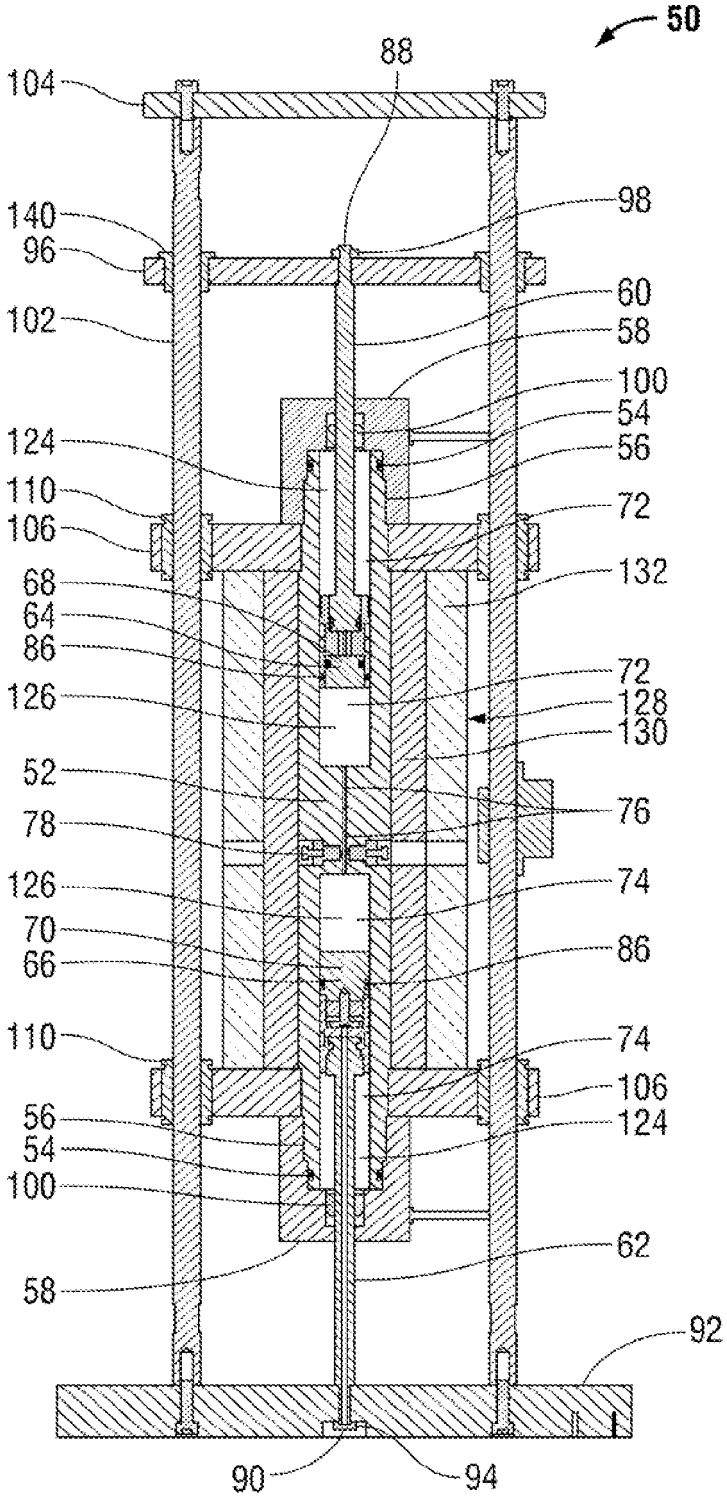

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FIG. 25

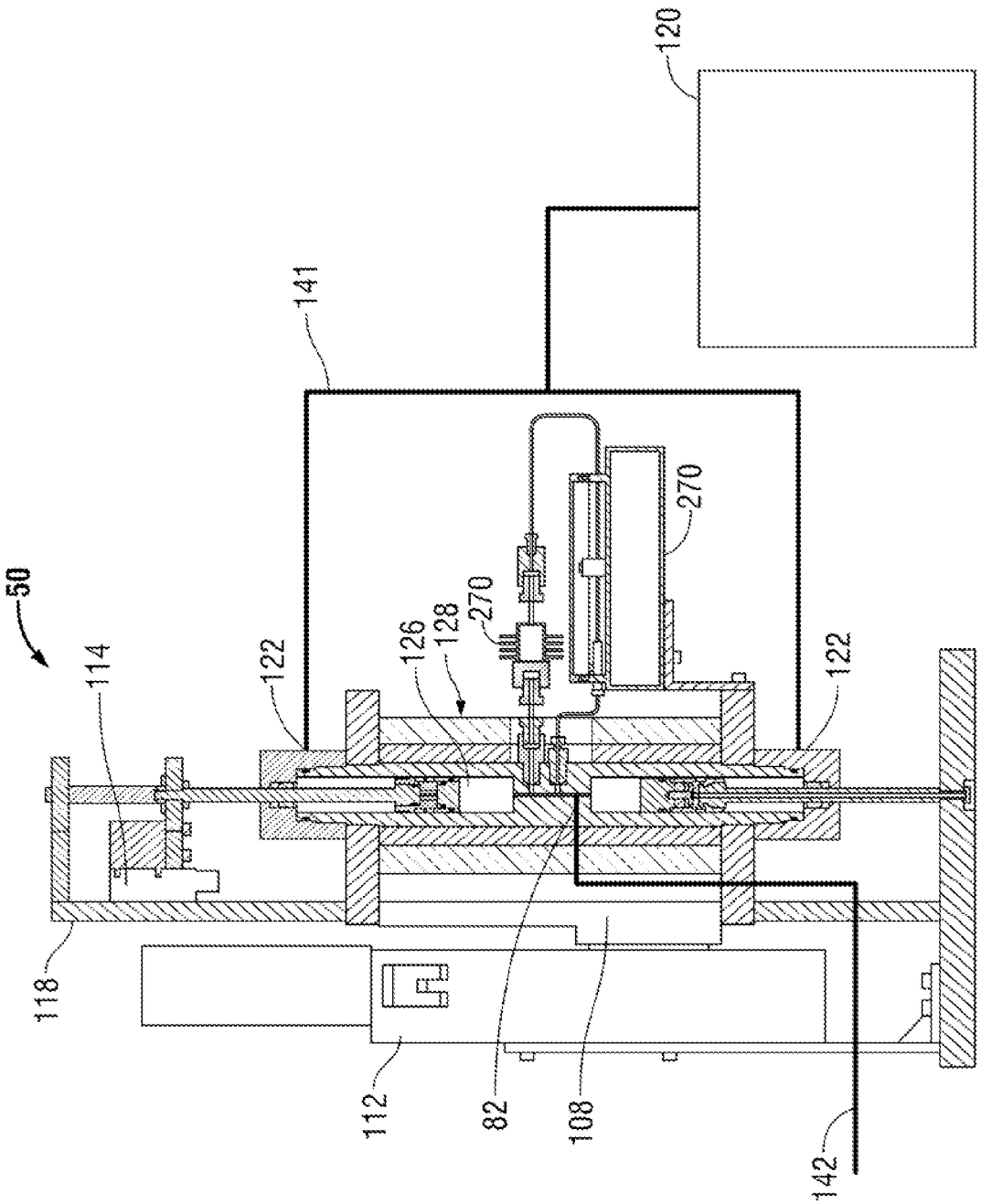


FIG. 26

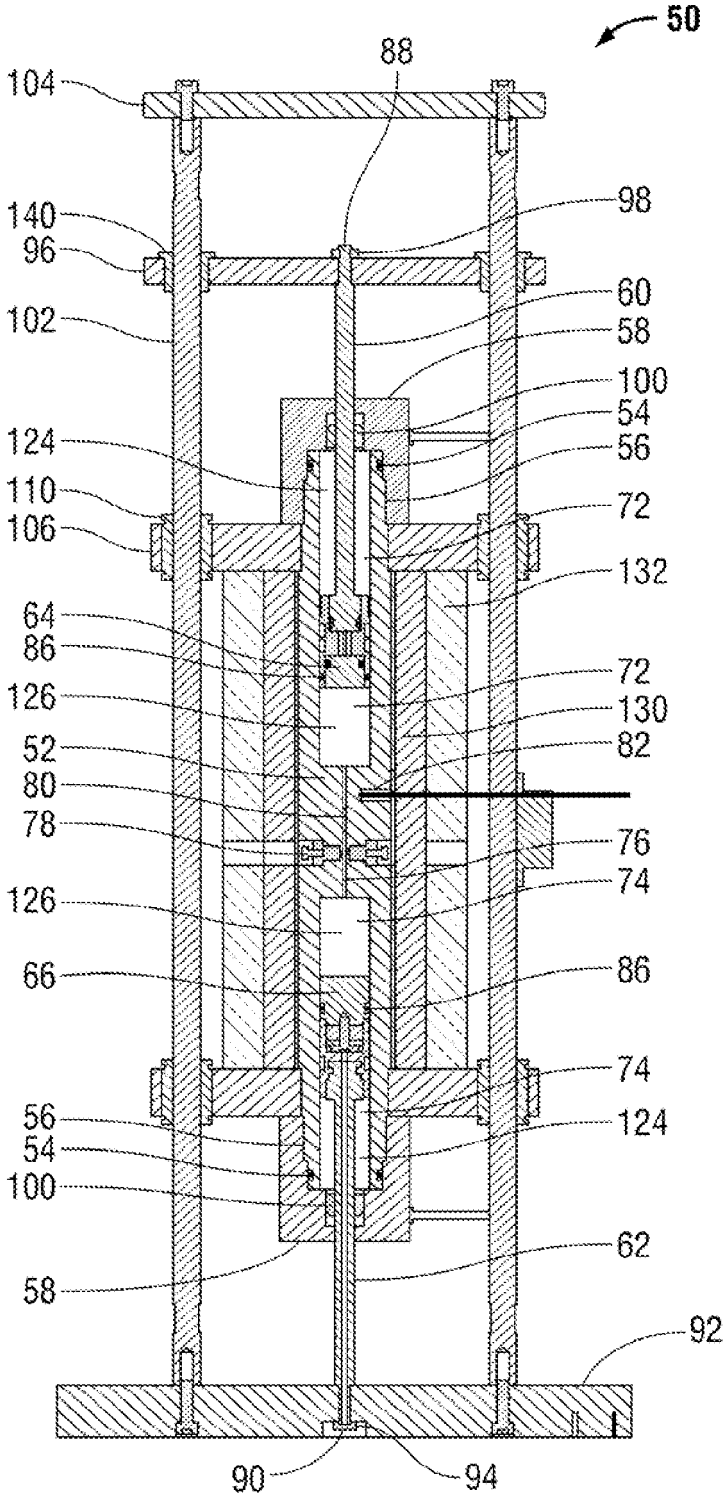

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FIG. 27

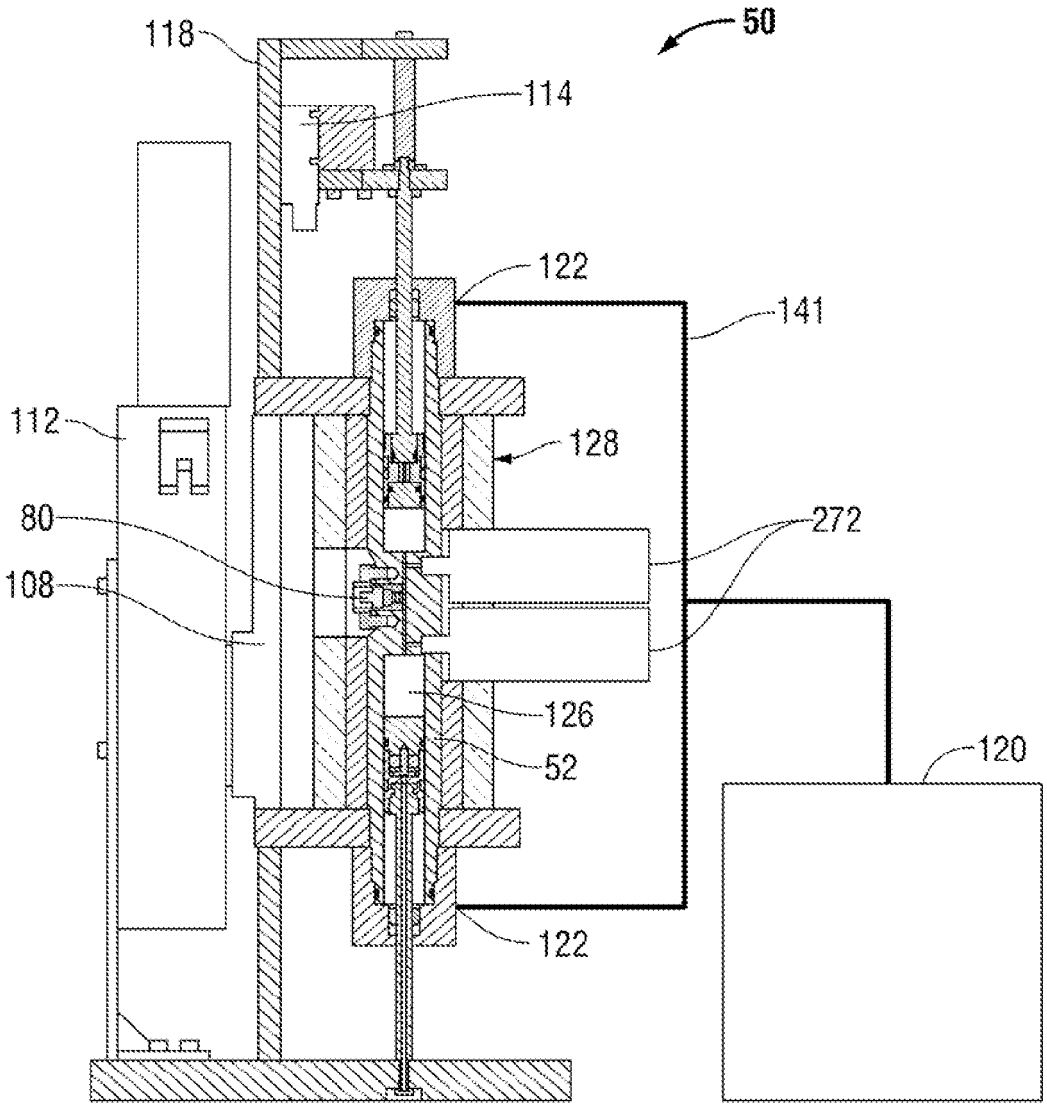


FIG. 28

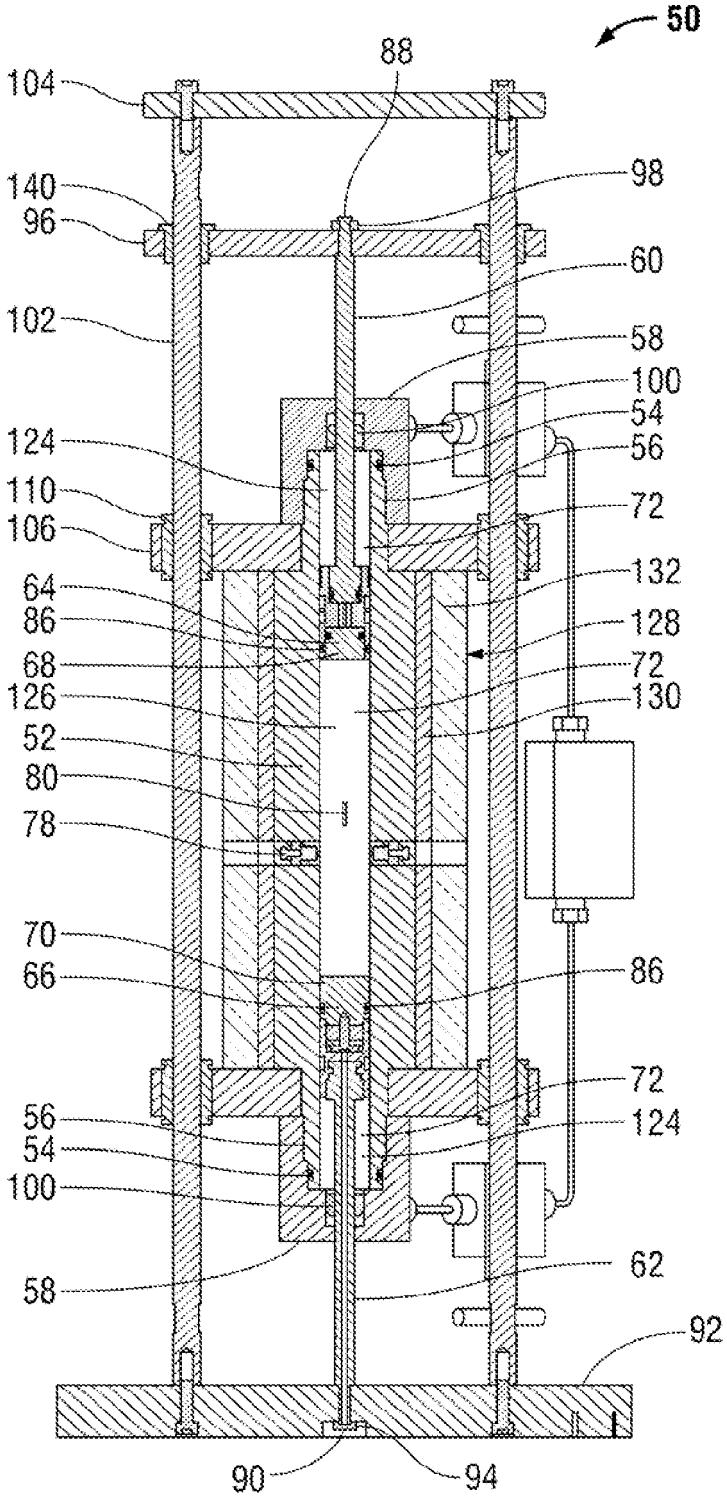

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FIG. 29

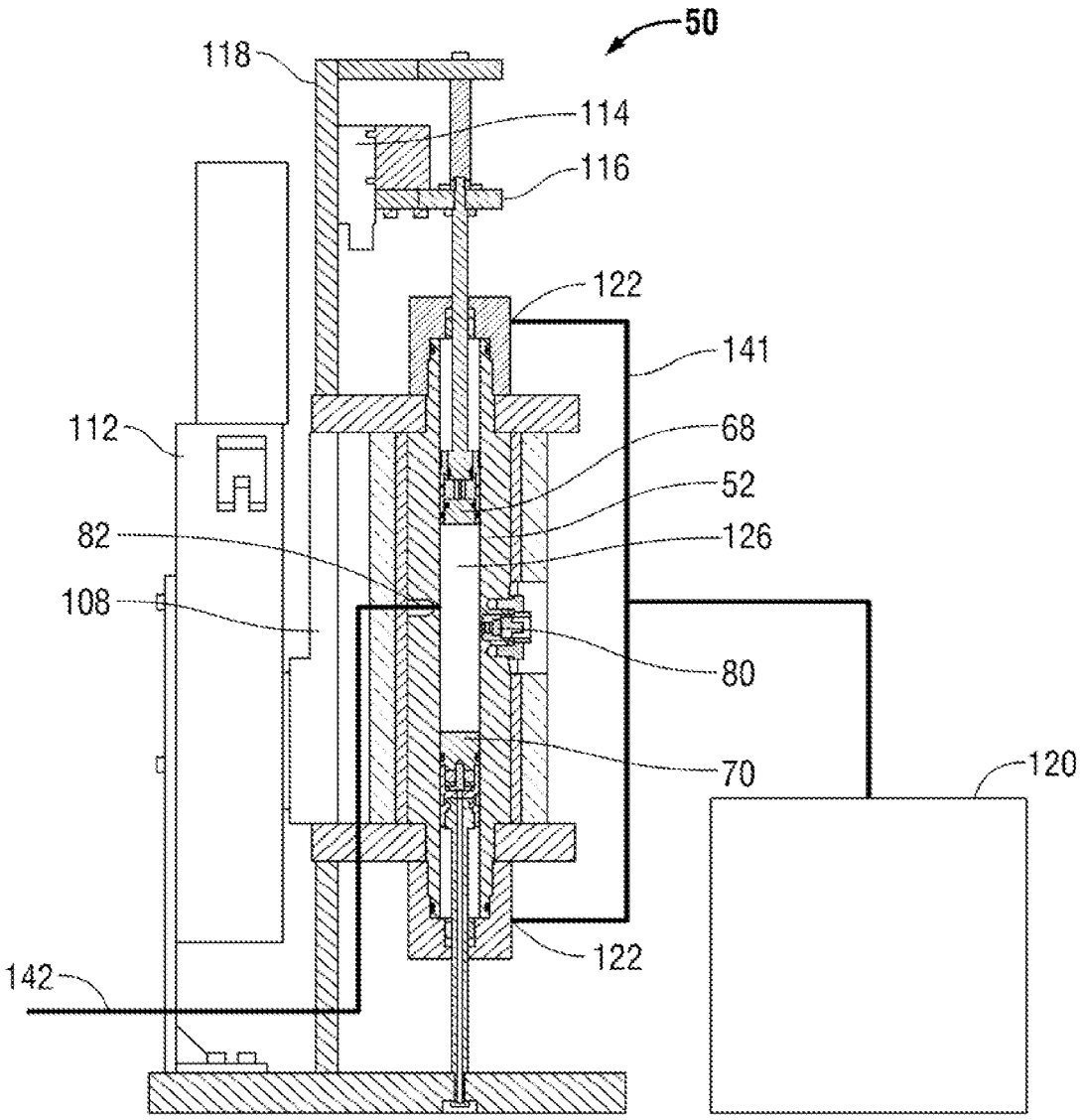


FIG. 30