

FIG. 1

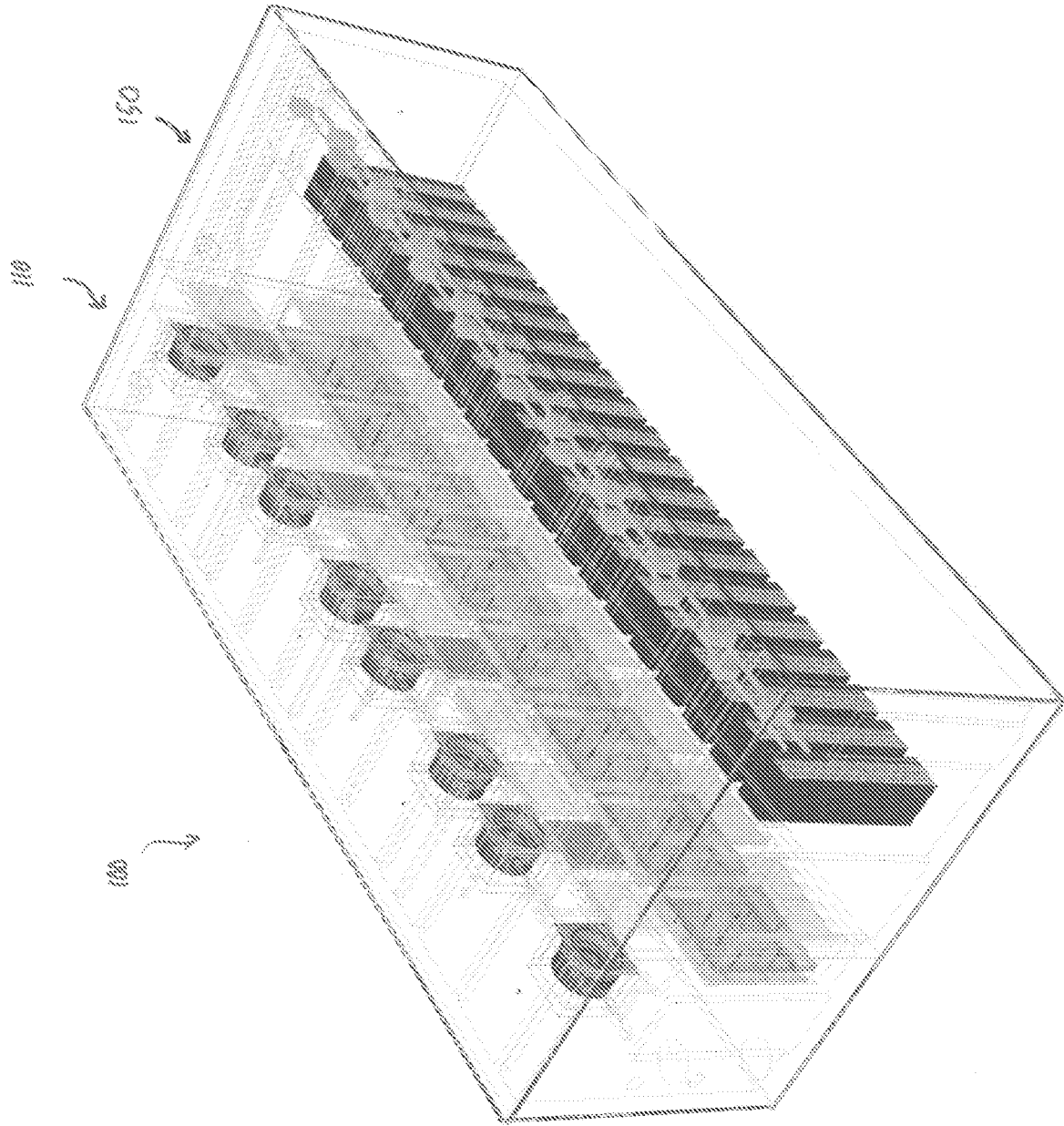


FIG. 2

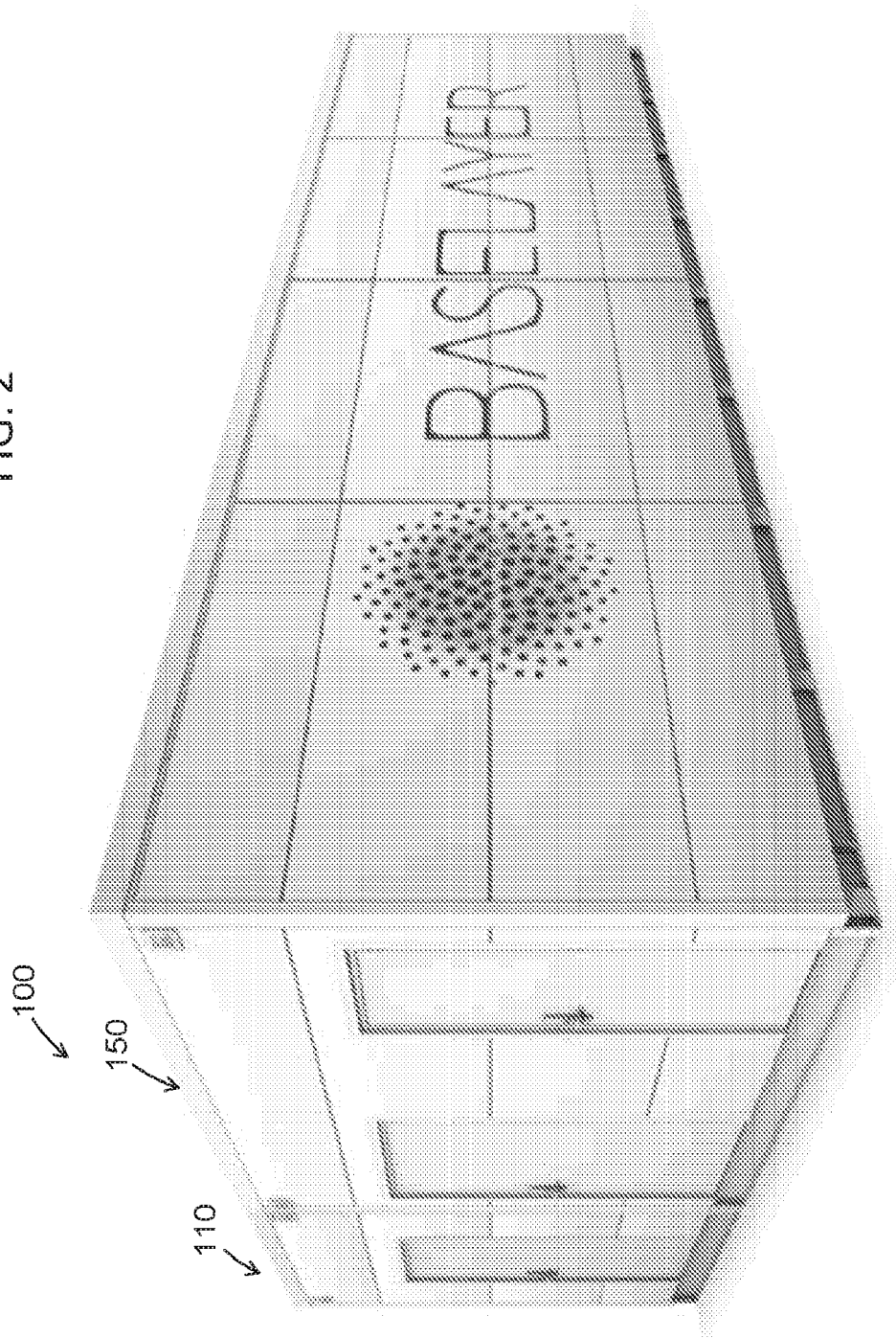
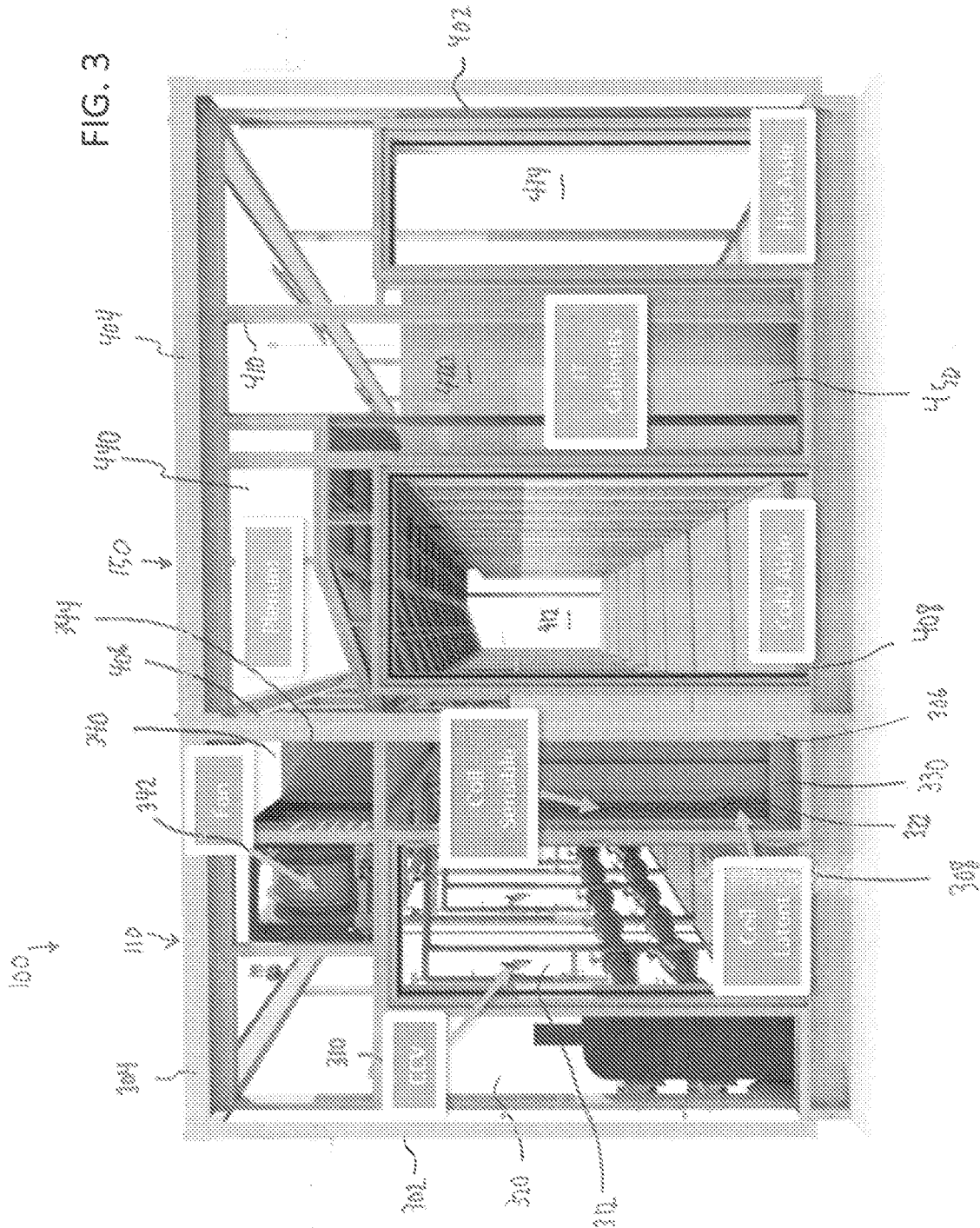


FIG. 3



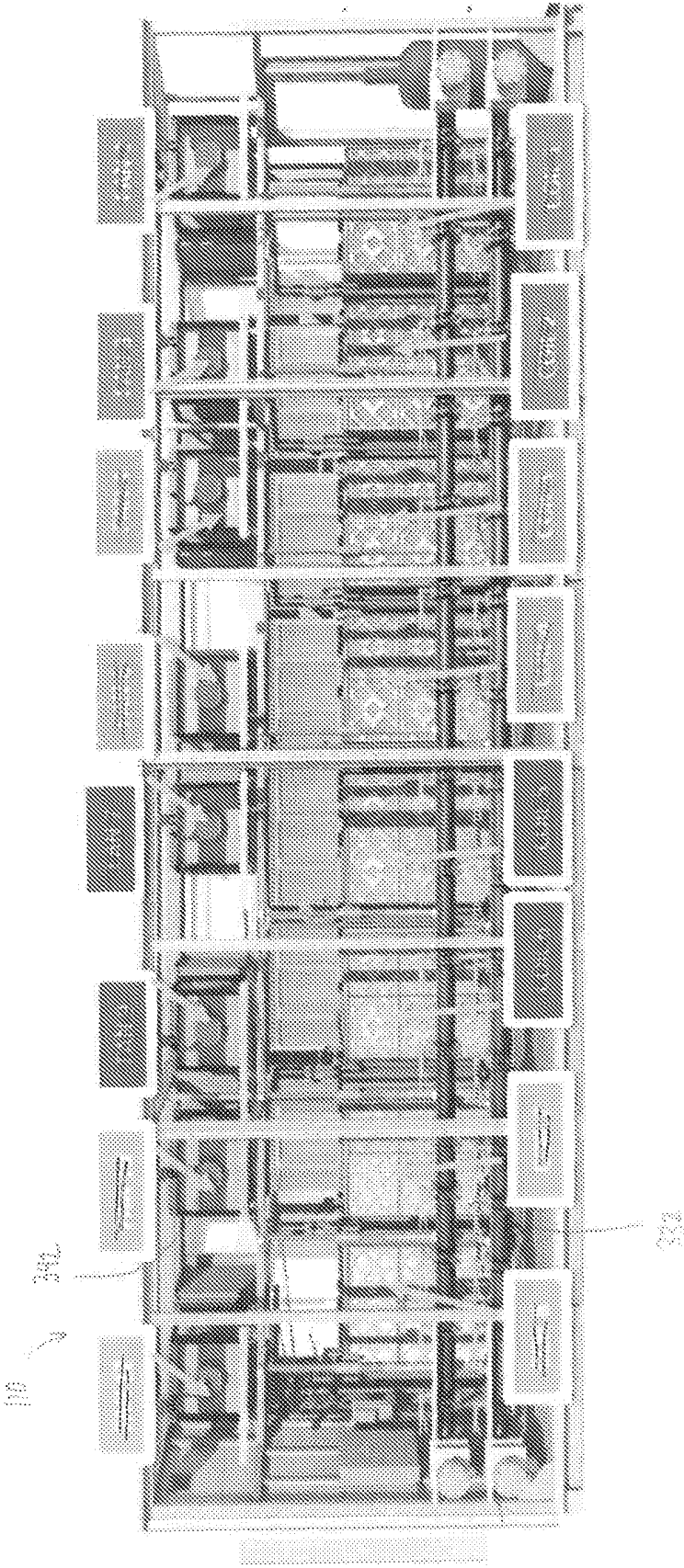


FIG. 5

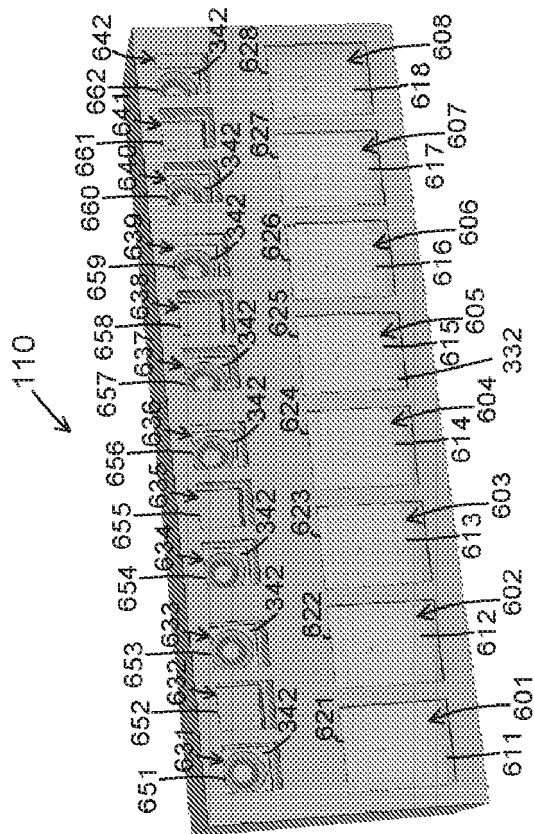


FIG. 6

FIG. 7

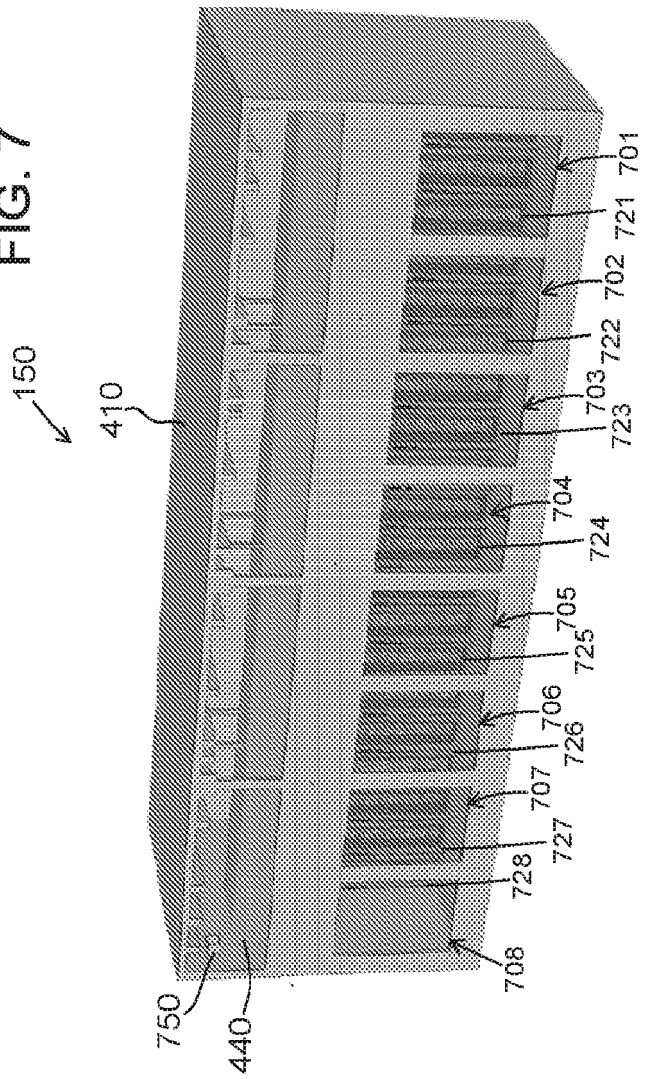




FIG. 10

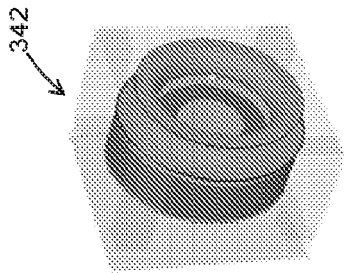


FIG. 8

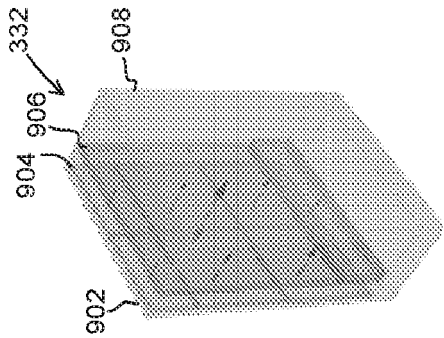
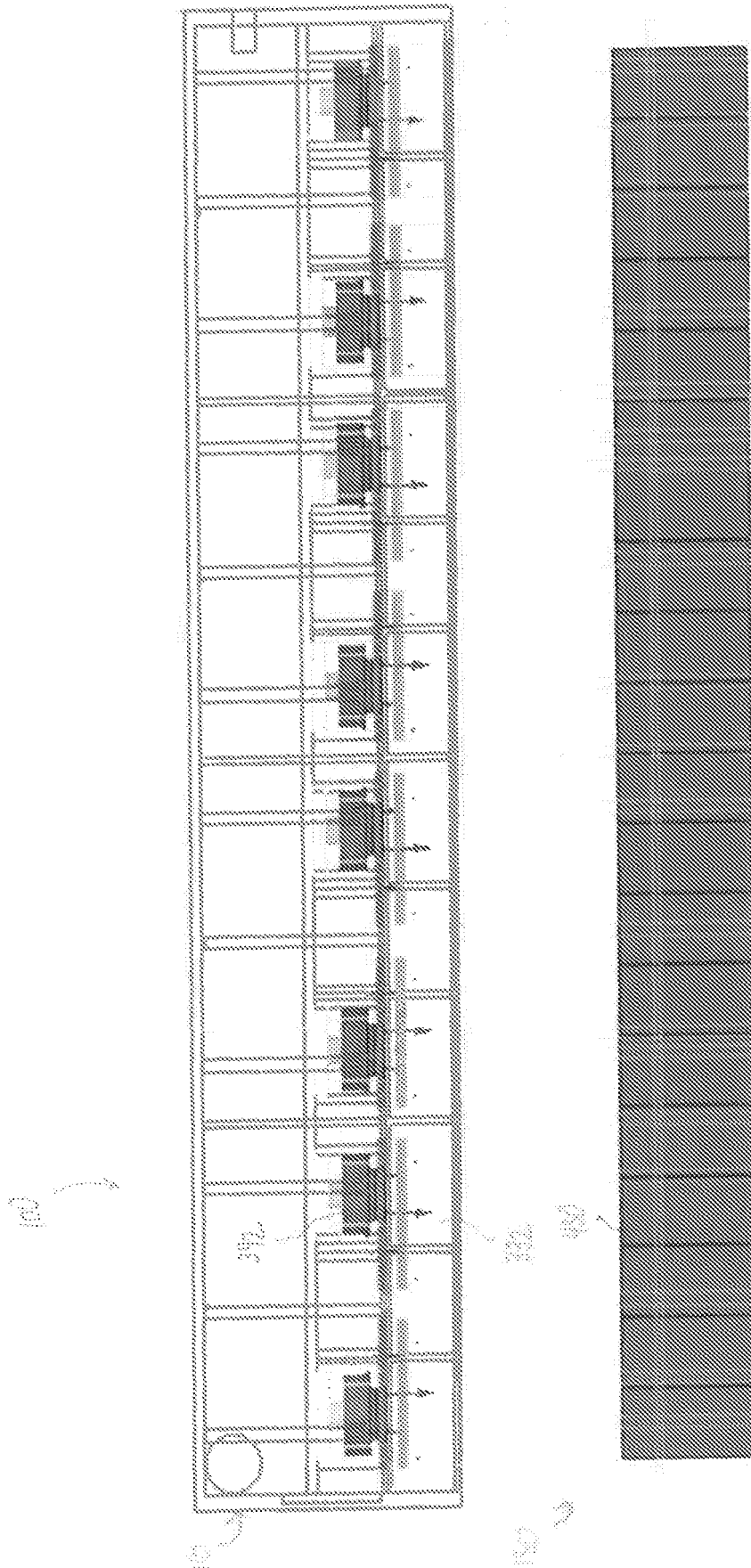


FIG. 9

Fig. 11



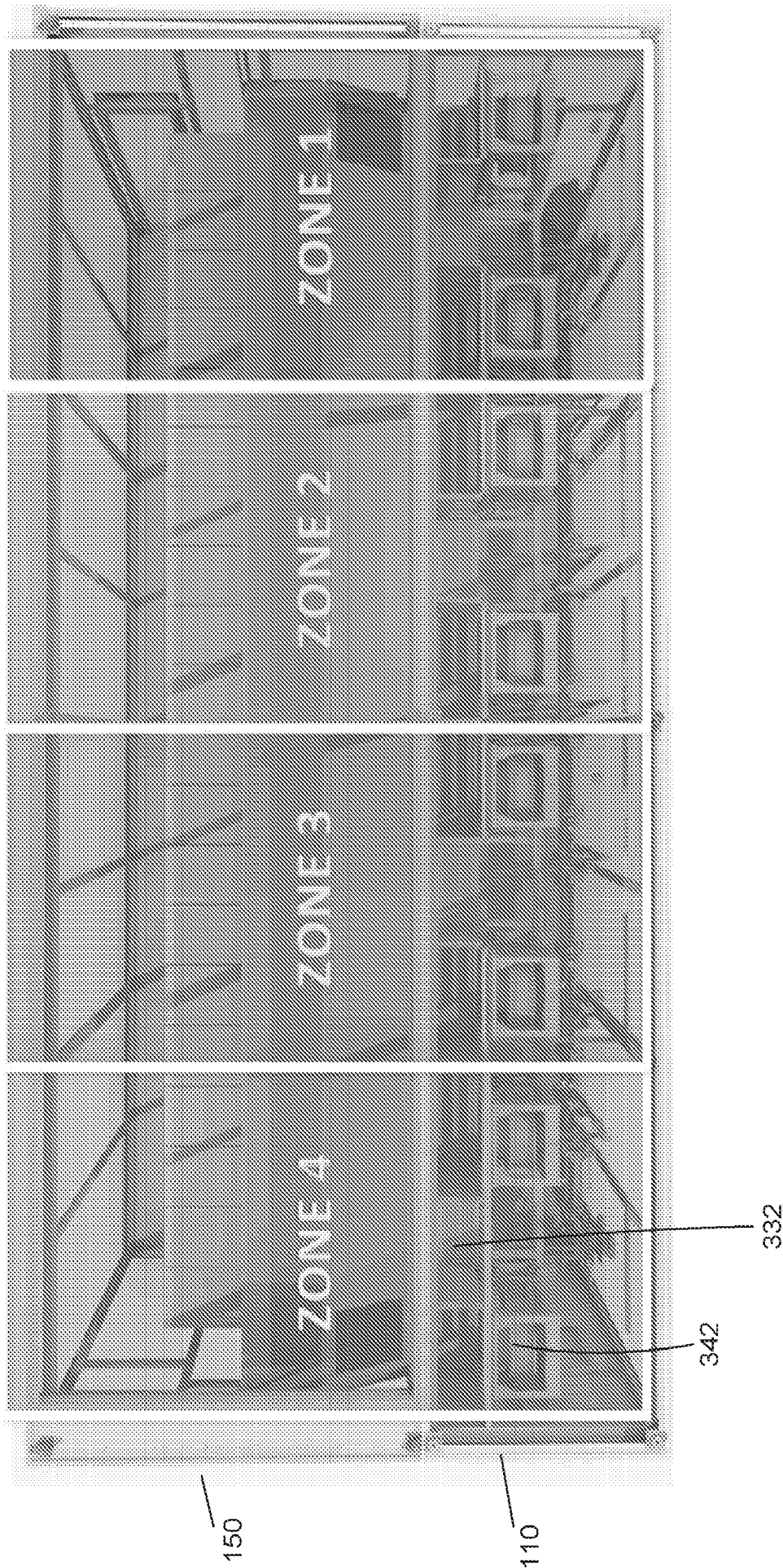


FIG. 12

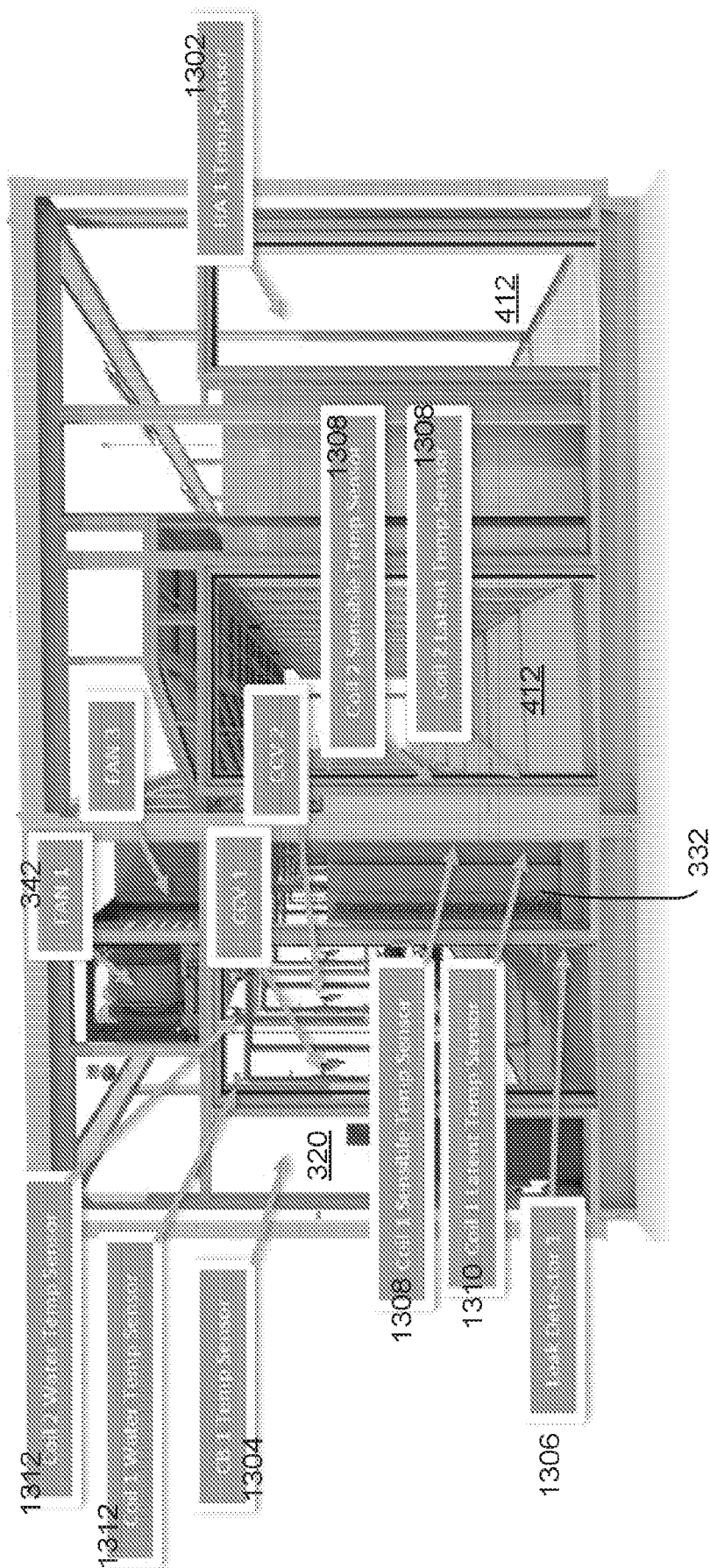
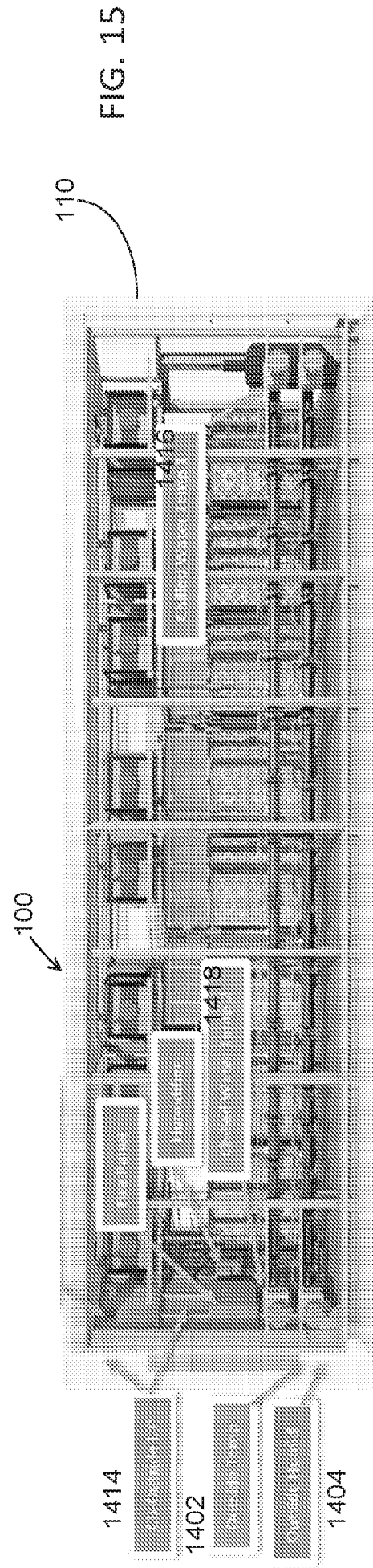
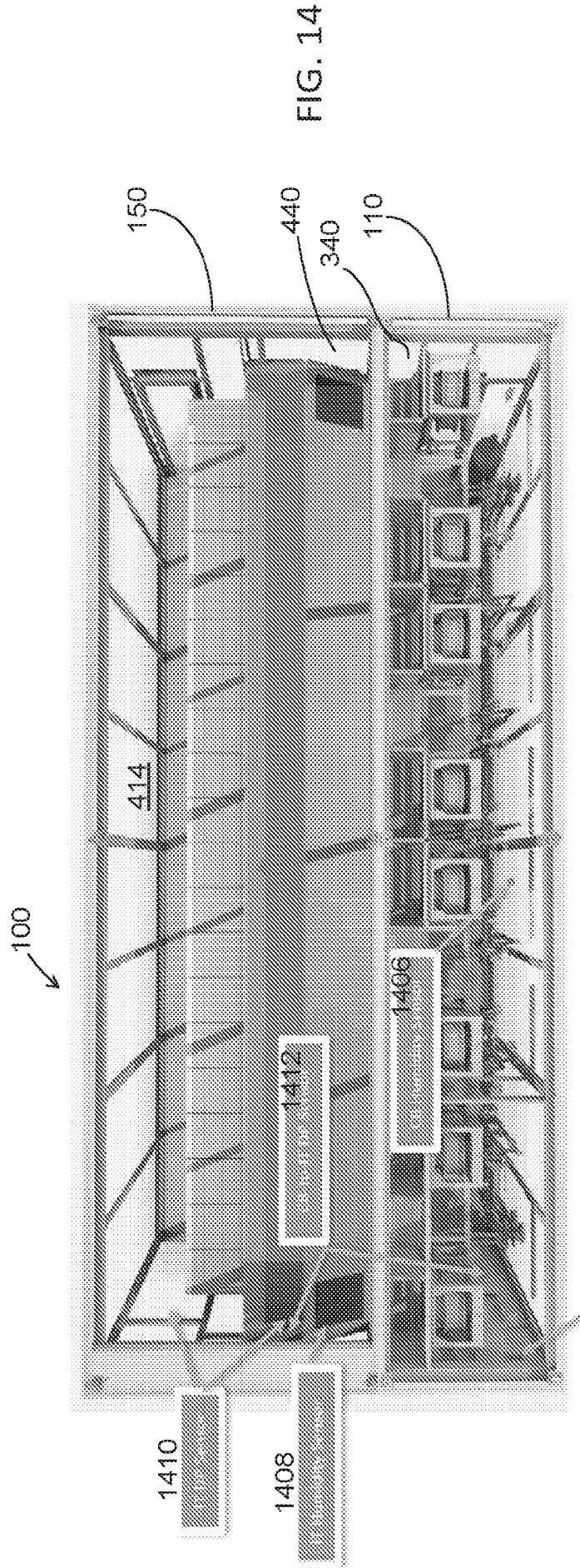


FIG. 13



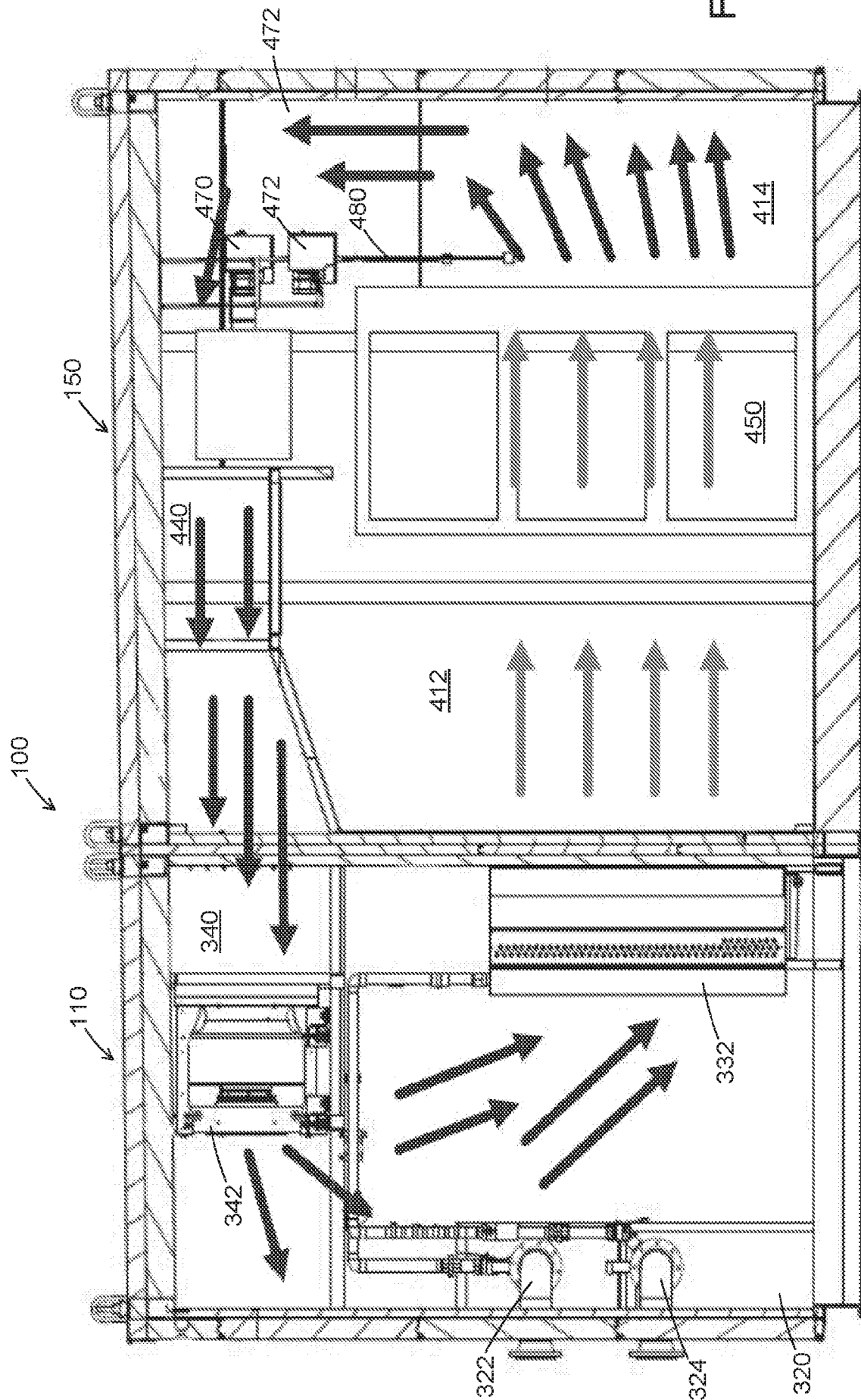


FIG. 16

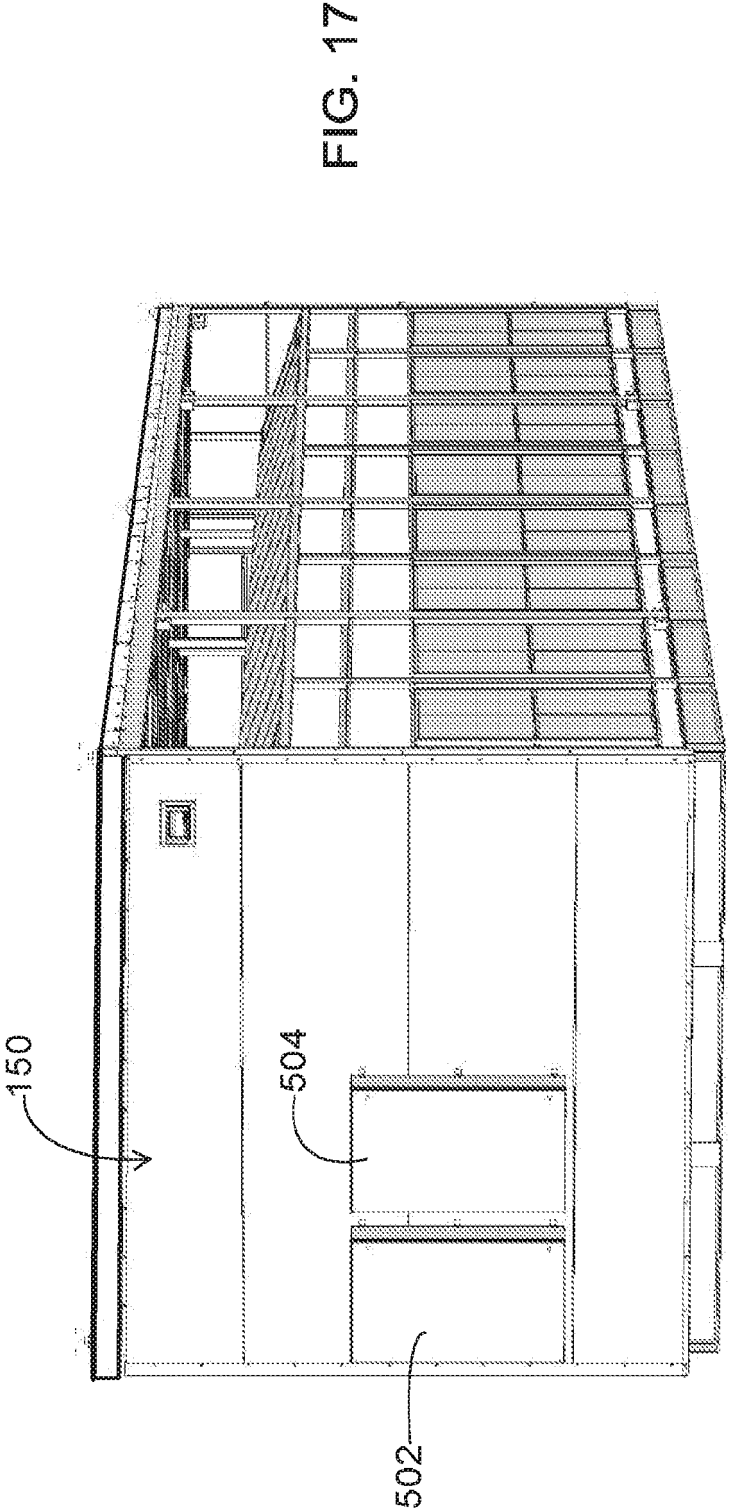


FIG. 18

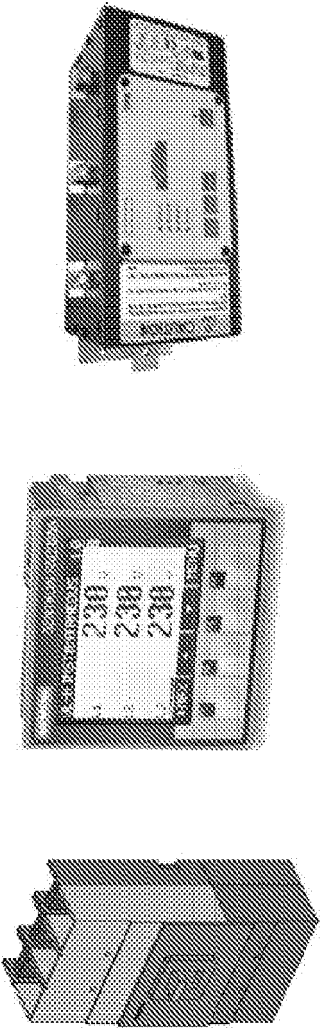


FIG. 19

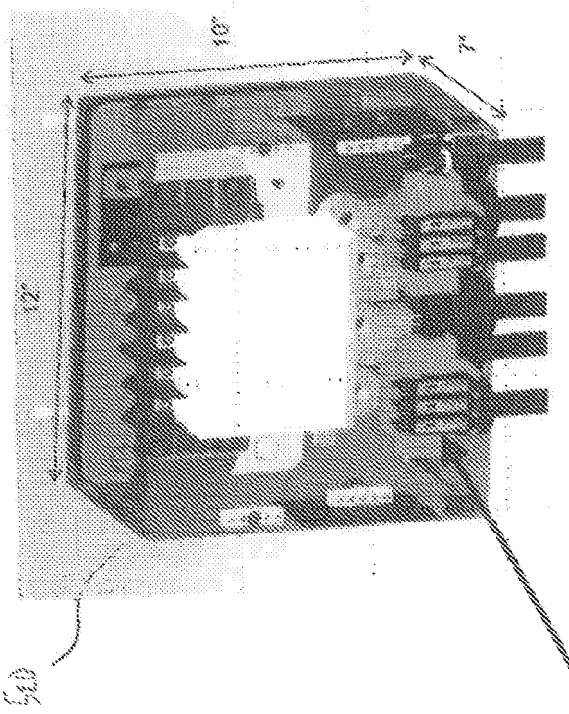
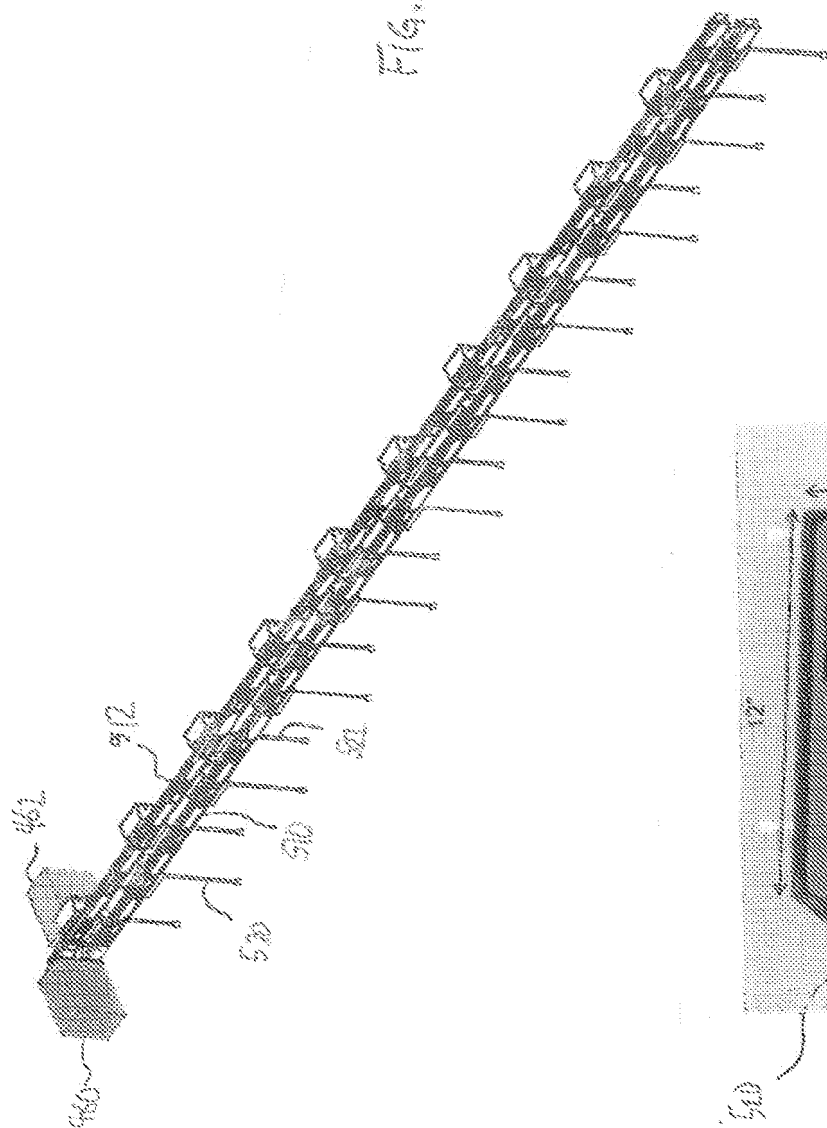


FIG. 20

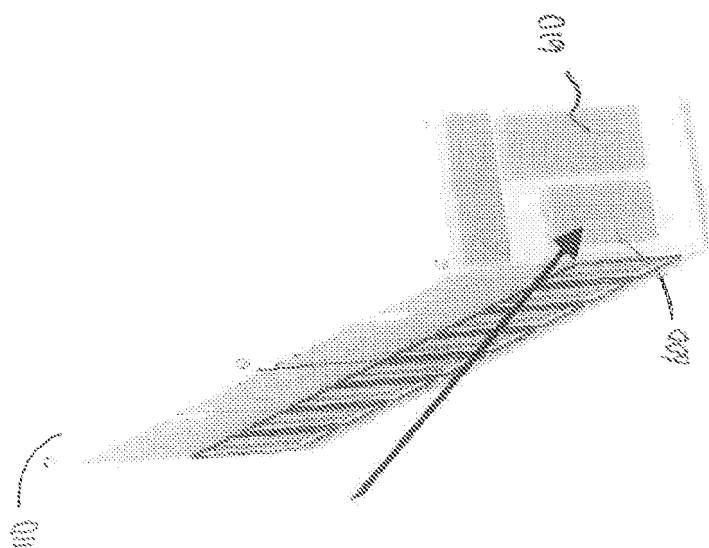


FIG. 21

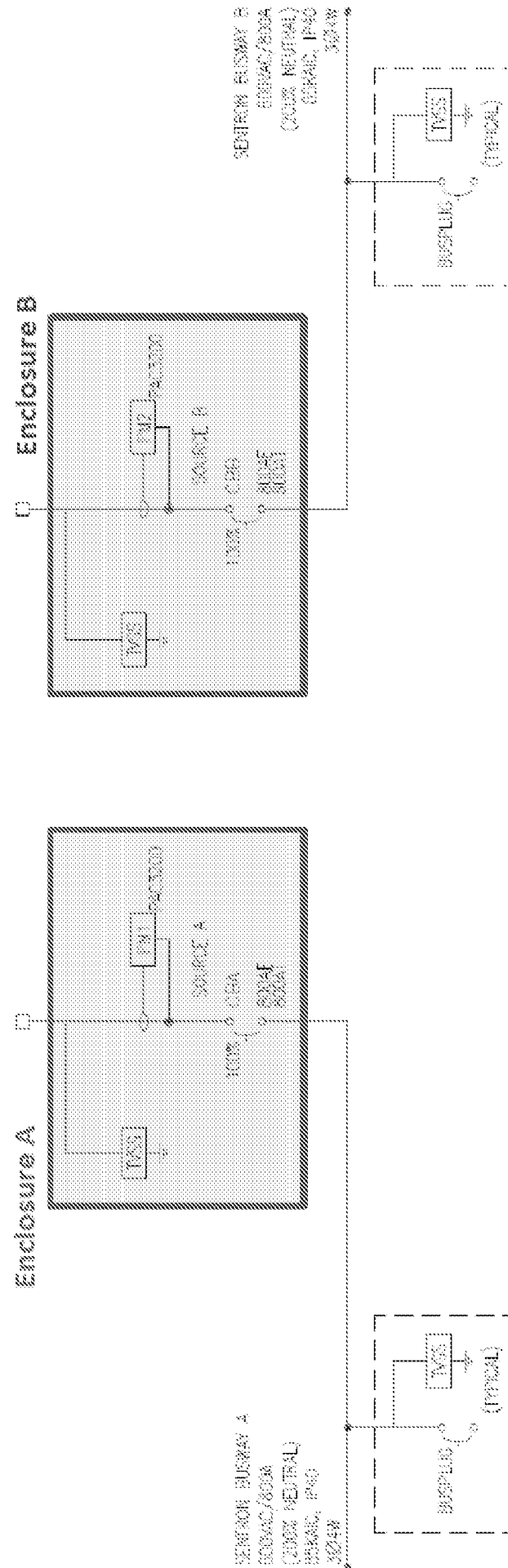
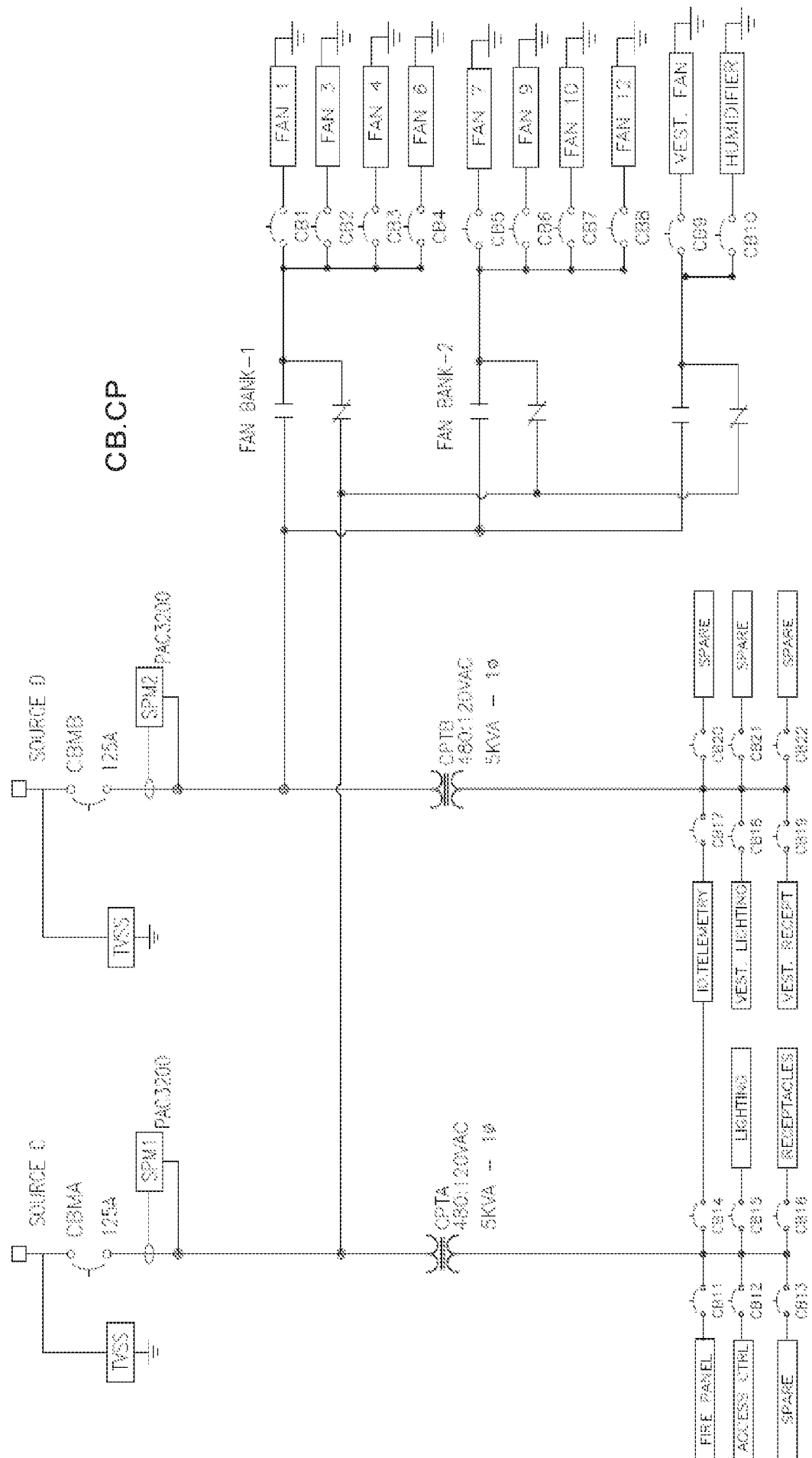


Fig. 22

Fig. 23



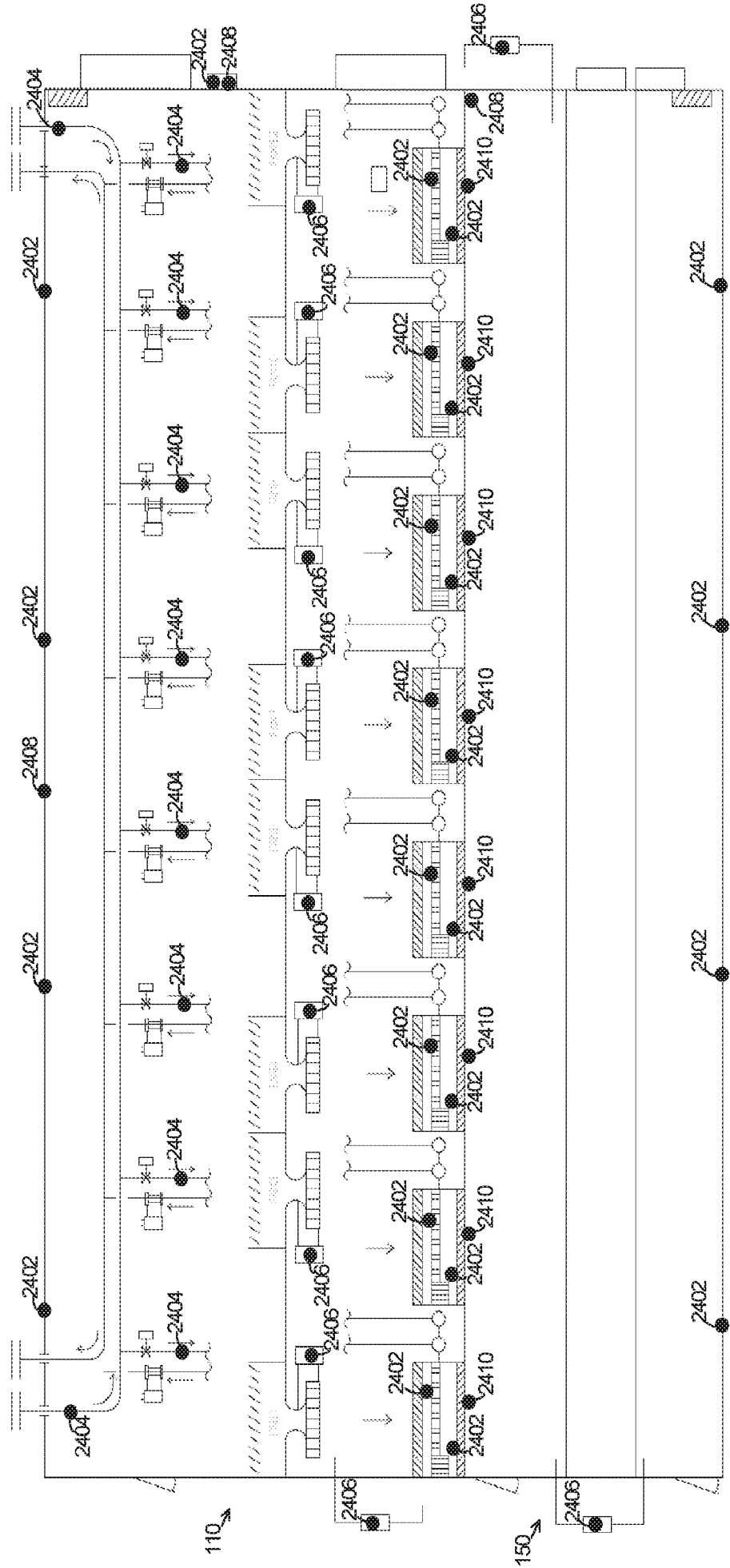


FIG. 24

System Startup		
Item	Description	Range if Adjustable
1. Hardware Pre-Startup Settings		
a.	Fan Back Switch is set to Auto	Auto or Manual
b.	CBMA Breaker is closed	
c.	Control Panel Source A is Available	
d.	CBMB Breaker is closed	
e.	Control Panel Source B is Available	
f.	CB1-CB22 are closed	
g.	Telemetry Power A is Available	
h.	Telemetry Power B is Available	
i.	CBA Breaker is closed	
j.	CBB Breaker is closed	
2. OS Pre-Startup Settings		
a.	Coil Sensible Temperature Setpoint is set for Cold Aisle (Default 75F)	64-81
b.	RA Temperature Setpoint is set for Hot Aisle (Default 102F)	80-104
c.	Humidifier OFF Dew point Setpoint is set (Default 45F)	0-100
d.	Humidifier ON Dew point Setpoint is set (Default 59F)	0-100
e.	Cooling Fan Mode Auto is set to Auto	Auto or Override
f.	If Cooling Fan Mode is in Auto, then, FAN CFM Demand is from the PLC	
g.	Makeup Air Damper Status is set to Open	Open or Closed
h.	Chilled Water Valves All Auto is set to Open	Auto or Manual
i.	Fan CFM Low Limit is set (Default 2000 CFM)	0 - 12500
j.	Fan CFM Manual Mode Setpoint (Default 2000 CFM)	0 - 12500
k.	Makeup Air Damper Deviation Timer	0 - 100
l.	Air Density is set (Default 0.07)	0.00 - 0.10
m.	Zone 1 Cooling is set to Enabled	Enabled or Disabled
n.	Zone 2 Cooling is set to Enabled	Enabled or Disabled
o.	Zone 3 Cooling is set to Enabled	Enabled or Disabled
p.	Zone 4 Cooling is set to Enabled	Enabled or Disabled
3. Startup		
a.	In OS, set Module Start/Stop to "Start"	Start or Stop
b.	All 8 fans ramp up to "Fan CFM Low Limit"	
c.	Make-Up Air Damper IT Block Opens	
d.	Make-Up Air Damper CB Opens	
e.	All 8 CCVs open up to maintain "Coil Sensible Temperature Setpoint"	
f.	Humidified turns ON based on "Humidifier ON Dew Point Setpoint"	

FIG. 25

FIG. 25
(cont)

Normal Operating Conditions (Auto)		
Item	Description	Setting
1.	Fan Operation	
a.	Fan Status 1 shows OK if Fan 1 is energized	
b.	Fan Status 3 shows OK if Fan 3 is energized	
c.	Fan Status 4 shows OK if Fan 4 is energized	
d.	Fan Status 6 shows OK if Fan 6 is energized	
e.	Fan Status 7 shows OK if Fan 7 is energized	
f.	Fan Status 9 shows OK if Fan 9 is energized	
g.	Fan Status 10 shows OK if Fan 10 is energized	
h.	Fan Status 12 shows OK if Fan 12 is energized	
i.	All (8) fans calculate Air Flow (ACFM) utilizing the DP sensors $ACFM = 1114.064 \times (DP / \rho \Delta h)^{1/2}$	$\rho \Delta h$ = altitude of location in lb./cu.Ft. $\Delta P = 346G$
j.	All (8) fans calculate Air Flow (SCFM) utilizing the DP sensors $SCFM = 4087.385 \times (AP)^{1/2}$	$\Delta P = 346G$
k.	All (8) fans ramp up to "Fan CFM Low Limit" as the minimum speed	2000
l.	HA Temperature Setpoint is set controlling all (4) HA Temperature Sensors if any of the (4) HA Zone temperatures exceed "HA Temperature Setpoint", all (8) fans modulate to decrease the temperature of all (4) HA Temperature Sensors to "HA Temperature Setpoint"	102
m.	Temperature Setpoint	
n.	All (8) Fans always display "Fan CFM Feedback"	
o.	All (8) Fans always display "Fan CFM Demand"	
p.	All (8) Fans always display "Fan Runtime"	
q.	All (8) Fans have "Fan Runtime" that is resettable from the OS	Yes or No
r.	All (8) Fans always display "Fan Mode"	Auto or Override
2.	Coil Operation	
a.	All (8) CCVs modulate to Master "Coil Sensible Temperature Setpoint"	75F
b.	CCV1 modules to maintain Coil 1 Sensible Temperature	
c.	CCV2 modules to maintain Coil 2 Sensible Temperature	
d.	CCV3 modules to maintain Coil 3 Sensible Temperature	
e.	CCV4 modules to maintain Coil 4 Sensible Temperature	
f.	CCV5 modules to maintain Coil 5 Sensible Temperature	
g.	CCV6 modules to maintain Coil 6 Sensible Temperature	
h.	CCV7 modules to maintain Coil 7 Sensible Temperature	
i.	CCV8 modules to maintain Coil 8 Sensible Temperature	
j.	Failure of a CCV, CCV stays at last known state	
k.	CCV Feedback reports an alarm to the OS if it does NOT match within 5% of CCV Demand signal for a period of 150 seconds.	
l.	Failure of CCV Coil Sensible Temperature Sensor, CCV for the designated coil stays at last known state	
m.	Water Flow DP Sensor is used to calculate CCV Coil Flow [in GPM] for the designated coil. 2" Circuit Setter (CS) is set 10 orifice for the calculation $GMP = 28.0365 \times (\Delta P_{cs} / \rho \Delta h)^{1/2} \times 0.2$	

Zone Control #	Room	Description	Setting
1.	a.	Zone 1 Enabled	
	b.	Zone 1 is Disabled	
	c.	Zone 1 is Enabled	
	d.	Zone 2 is Disabled	
	e.	Zone 2 is Enabled	
	f.	Zone 3 is Disabled	
	g.	Zone 3 is Enabled	
	h.	Zone 4 is Disabled	
	i.	Zone 4 is Enabled	
	j.	Fan 1 Demand is set based off of "Fan CFM Demand" from PLC	
	k.	Fan 2 Demand is set based off of "Fan CFM Demand" from PLC	
	l.	Fan 3 Demand is set to 0 from the PLC	
	m.	Fan 4 Demand is set to 0 from the PLC	
	n.	Fan 5 Demand is set to 0 from the PLC	
	o.	Fan 6 Demand is set to 0 from the PLC	
	p.	Fan 7 Demand is set to 0 from the PLC	
	q.	Fan 8 Demand is set to 0 from the PLC	
	r.	Fan 9 Demand is set to 0 from the PLC	
	s.	Fan 10 Demand is set to 0 from the PLC	
	t.	Fan 11 Demand is set to 0 from the PLC	
	u.	Fan 12 Demand is set to 0 from the PLC	
	v.	Fan 13 Demand is set to 0 from the PLC	
	w.	Fan 14 Demand is set to 0 from the PLC	
	x.	Fan 15 Demand is set to 0 from the PLC	
	y.	Fan 16 Demand is set to 0 from the PLC	
	z.	Fan 17 Demand is set to 0 from the PLC	
	aa.	Fan 18 Demand is set to 0 from the PLC	
	ab.	Fan 19 Demand is set to 0 from the PLC	
	ac.	Fan 20 Demand is set to 0 from the PLC	
	ad.	Fan 21 Demand is set to 0 from the PLC	
	ae.	Fan 22 Demand is set to 0 from the PLC	
	af.	Fan 23 Demand is set to 0 from the PLC	
	ag.	Fan 24 Demand is set to 0 from the PLC	
	ah.	Fan 25 Demand is set to 0 from the PLC	
	ai.	Fan 26 Demand is set to 0 from the PLC	
	aj.	Fan 27 Demand is set to 0 from the PLC	
	ak.	Fan 28 Demand is set to 0 from the PLC	
	al.	Fan 29 Demand is set to 0 from the PLC	
	am.	Fan 30 Demand is set to 0 from the PLC	
	an.	Fan 31 Demand is set to 0 from the PLC	
	ao.	Fan 32 Demand is set to 0 from the PLC	
	ap.	Fan 33 Demand is set to 0 from the PLC	
	aq.	Fan 34 Demand is set to 0 from the PLC	
	ar.	Fan 35 Demand is set to 0 from the PLC	
	as.	Fan 36 Demand is set to 0 from the PLC	
	at.	Fan 37 Demand is set to 0 from the PLC	
	au.	Fan 38 Demand is set to 0 from the PLC	
	av.	Fan 39 Demand is set to 0 from the PLC	
	aw.	Fan 40 Demand is set to 0 from the PLC	
	ax.	Fan 41 Demand is set to 0 from the PLC	
	ay.	Fan 42 Demand is set to 0 from the PLC	
	az.	Fan 43 Demand is set to 0 from the PLC	
	ba.	Fan 44 Demand is set to 0 from the PLC	
	bb.	Fan 45 Demand is set to 0 from the PLC	
	bc.	Fan 46 Demand is set to 0 from the PLC	
	bd.	Fan 47 Demand is set to 0 from the PLC	
	be.	Fan 48 Demand is set to 0 from the PLC	
	bf.	Fan 49 Demand is set to 0 from the PLC	
	bg.	Fan 50 Demand is set to 0 from the PLC	
	bh.	Fan 51 Demand is set to 0 from the PLC	
	bi.	Fan 52 Demand is set to 0 from the PLC	
	bj.	Fan 53 Demand is set to 0 from the PLC	
	bk.	Fan 54 Demand is set to 0 from the PLC	
	bl.	Fan 55 Demand is set to 0 from the PLC	
	bm.	Fan 56 Demand is set to 0 from the PLC	
	bn.	Fan 57 Demand is set to 0 from the PLC	
	bo.	Fan 58 Demand is set to 0 from the PLC	
	bp.	Fan 59 Demand is set to 0 from the PLC	
	bq.	Fan 60 Demand is set to 0 from the PLC	
	br.	Fan 61 Demand is set to 0 from the PLC	
	bs.	Fan 62 Demand is set to 0 from the PLC	
	bt.	Fan 63 Demand is set to 0 from the PLC	
	bu.	Fan 64 Demand is set to 0 from the PLC	
	bv.	Fan 65 Demand is set to 0 from the PLC	
	bw.	Fan 66 Demand is set to 0 from the PLC	
	bx.	Fan 67 Demand is set to 0 from the PLC	
	by.	Fan 68 Demand is set to 0 from the PLC	
	bz.	Fan 69 Demand is set to 0 from the PLC	
	ca.	Fan 70 Demand is set to 0 from the PLC	
	cb.	Fan 71 Demand is set to 0 from the PLC	
	cc.	Fan 72 Demand is set to 0 from the PLC	
	cd.	Fan 73 Demand is set to 0 from the PLC	
	ce.	Fan 74 Demand is set to 0 from the PLC	
	cf.	Fan 75 Demand is set to 0 from the PLC	
	cg.	Fan 76 Demand is set to 0 from the PLC	
	ch.	Fan 77 Demand is set to 0 from the PLC	
	ci.	Fan 78 Demand is set to 0 from the PLC	
	cj.	Fan 79 Demand is set to 0 from the PLC	
	ck.	Fan 80 Demand is set to 0 from the PLC	
	cl.	Fan 81 Demand is set to 0 from the PLC	
	cm.	Fan 82 Demand is set to 0 from the PLC	
	cn.	Fan 83 Demand is set to 0 from the PLC	
	co.	Fan 84 Demand is set to 0 from the PLC	
	cp.	Fan 85 Demand is set to 0 from the PLC	
	cq.	Fan 86 Demand is set to 0 from the PLC	
	cr.	Fan 87 Demand is set to 0 from the PLC	
	cs.	Fan 88 Demand is set to 0 from the PLC	
	ct.	Fan 89 Demand is set to 0 from the PLC	
	cu.	Fan 90 Demand is set to 0 from the PLC	
	cv.	Fan 91 Demand is set to 0 from the PLC	
	cw.	Fan 92 Demand is set to 0 from the PLC	
	cx.	Fan 93 Demand is set to 0 from the PLC	
	cy.	Fan 94 Demand is set to 0 from the PLC	
	cz.	Fan 95 Demand is set to 0 from the PLC	
	da.	Fan 96 Demand is set to 0 from the PLC	
	db.	Fan 97 Demand is set to 0 from the PLC	
	dc.	Fan 98 Demand is set to 0 from the PLC	
	dd.	Fan 99 Demand is set to 0 from the PLC	
	de.	Fan 100 Demand is set to 0 from the PLC	</

FIG. 25
(cont)

FIG. 25
(cont)

Failure Scenarios		Point in Alarm
Item	Description	
1.	Loss of Power to a Fan	
a.	Fan Status for the specific fan goes into ALARM	Fan Status
b.	Remaining fans continue to modulate to maintain "HA Temperature Setpoint" from any HA Temperature Sensor that goes above the Setpoint	
c.	"Fan CPM Feedback" continues to be calculated and displayed in CDS	
d.	"Fan CPM Demand" continues to display last value received/sent to the PLC	
2.	Return of Power to a Fan	
a.	Fan Status for the specific fan when energized goes back to OK	Fan Status
b.	Failed fan ramps up to "Fan CPM Demand" sent to the rest of fans (all fans have same Fan CPM Demand given)	
c.	Fans remain at "Fan CPM Demand" until HA Temperature Setpoint is reached	
3.	Loss of Communication to a Fan	Fan CPM Demand
a.	Fan continues to run at last known state	
b.	Return of Communication to a Fan	Fan Mode
a.	Fan continues to run at last known state	
b.	Once fan can read Fan CPM Demand, fan uses Demand signal rather than last known state	
5.	Loss of Power or Communication to a CCV	Chilled Water Valve Mode
a.	CCV for the designated coil stays at the position last known	
6.	Return of Power or Communication to a CCV	
a.	CCV for the designated coil stays at the position last known	
b.	Once fan can read Chilled Water Valve Demand, CCV uses Demand signal rather than last known state	
7.	Failure of a CCV not caused by Power/Comms	
a.	CCV is unable to meet "Coil Sensible Temperature Setpoint"	
b.	CCV begins to open up until it meets "Coil Sensible Temperature Setpoint"	
c.	CCV opens up to 100% and is still unable to meet "Coil Sensible Temperature Setpoint"	
d.	CCV remains at 100% open	
8.	Return of a failed CCV not caused by Power/Comms	
a.	CCV is 100% open	
b.	CCV begins to modulate until it meets "Coil Sensible Temperature Setpoint" for the designated coil	
9.	Failure of a HA Temperature Sensor	
a.	Remaining HA Temperature Sensors continue to control fans via the "HA Temperature Setpoint"	
10.	Return of a Failed HA Temperature Sensor	
a.	HA Temperature Sensor returns, and all HA Temperature Sensors continue to display readings	
11.	Failure of All (3) HA Temperature Sensor	
a.	All (3) Fans remain at last known state given from "Fan CPM Demand"	
12.	Return of any HA Temperature Sensor after All (3) Failure	
a.	All (3) Fans modulate to maintain "HA Temperature Setpoint" from working HA Temperature Sensor(s)	
13.	Failure of a CWS Temperature Sensor	
a.	Remaining CWS Temperature Sensor continues to monitor Supply Water temperature	
14.	Return of a CWS Temperature Sensor	
a.	CWS Temperature Sensor returns, and continues to display readings	

FIG. 26

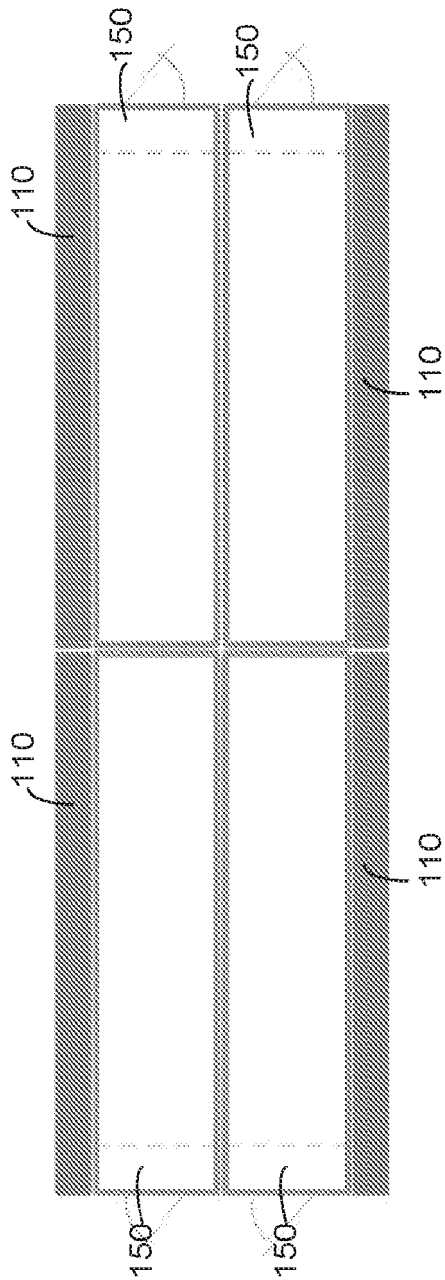


FIG. 27

