

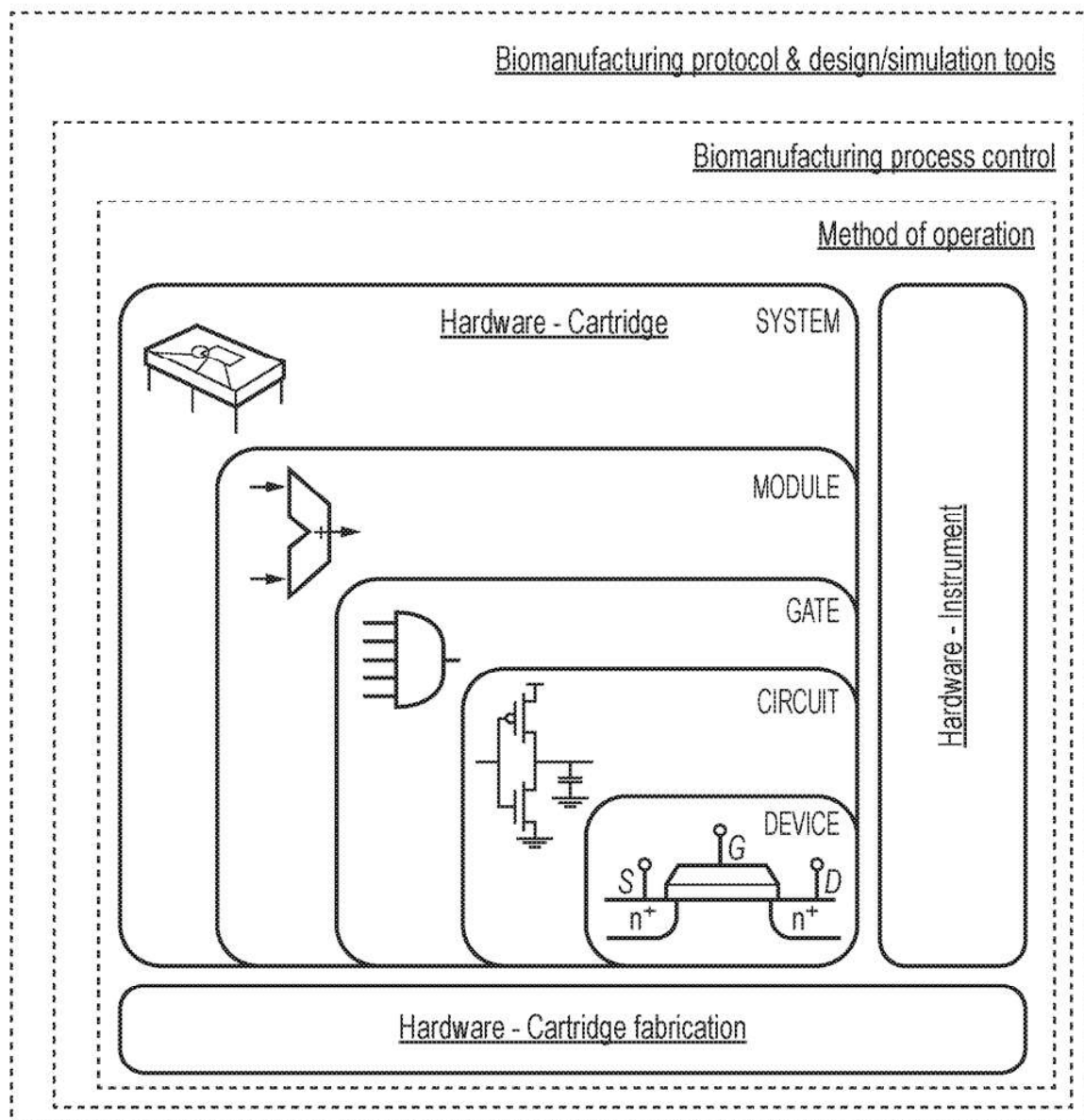


FIG. 1

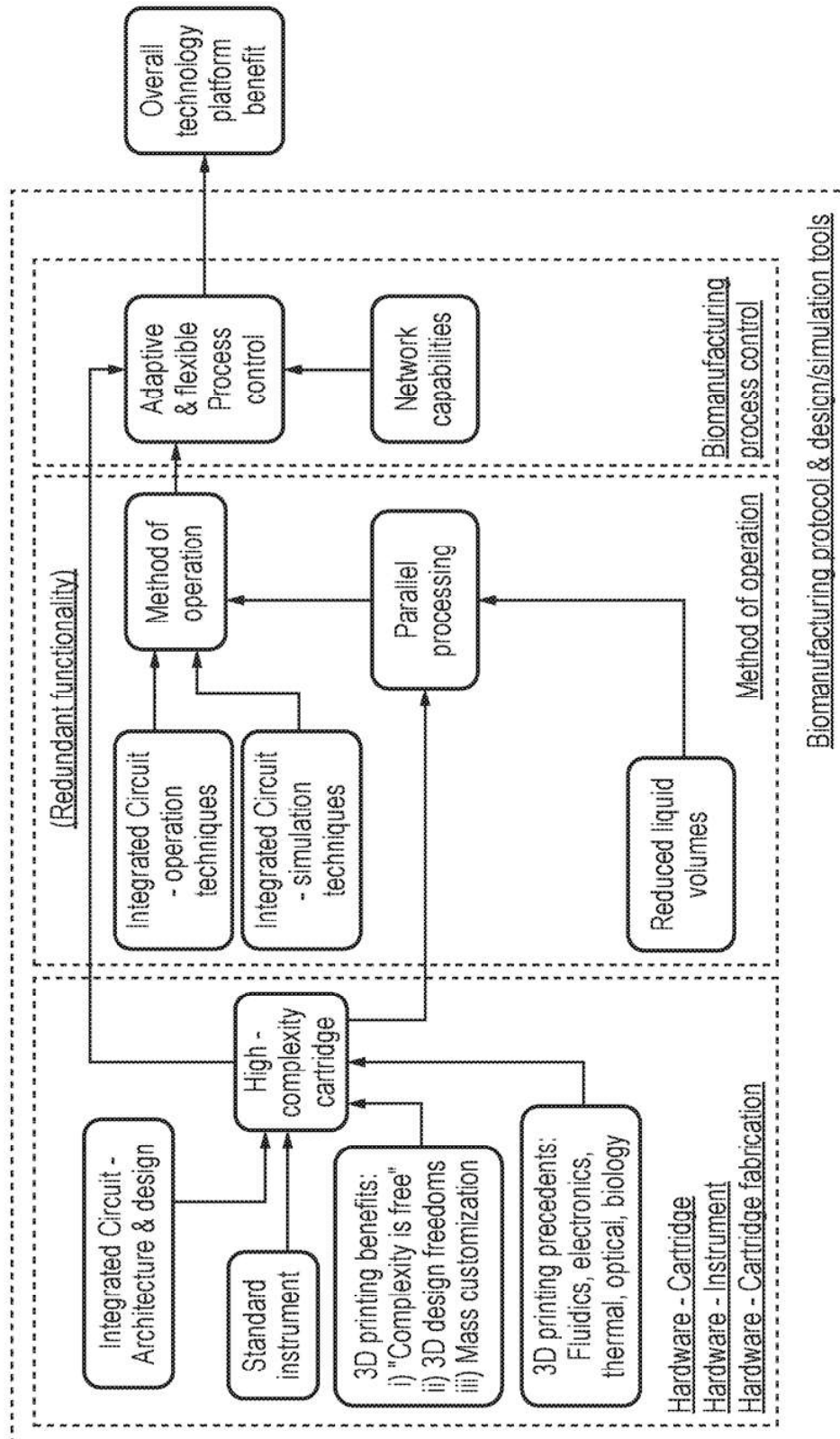


FIG. 2

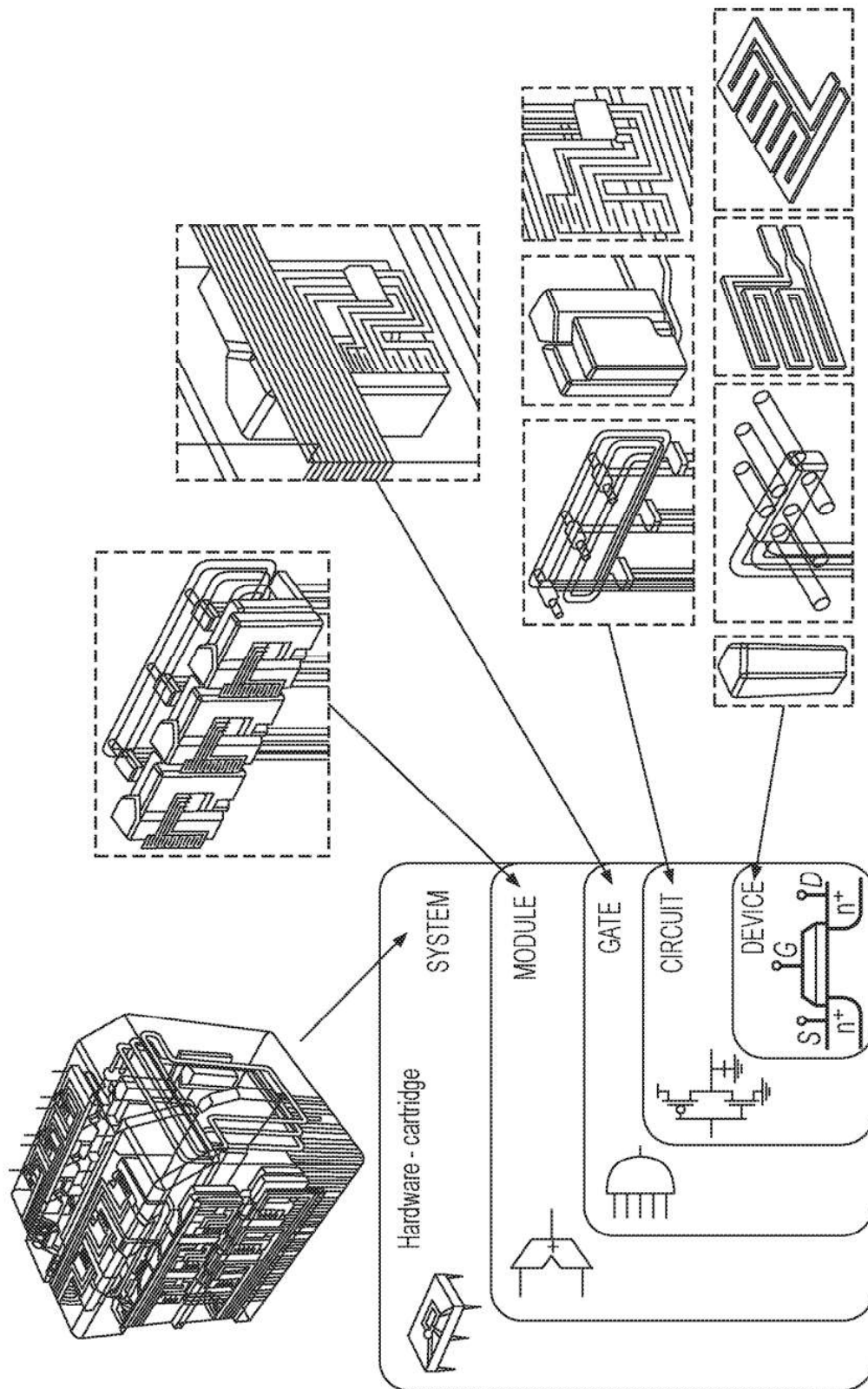


FIG. 3

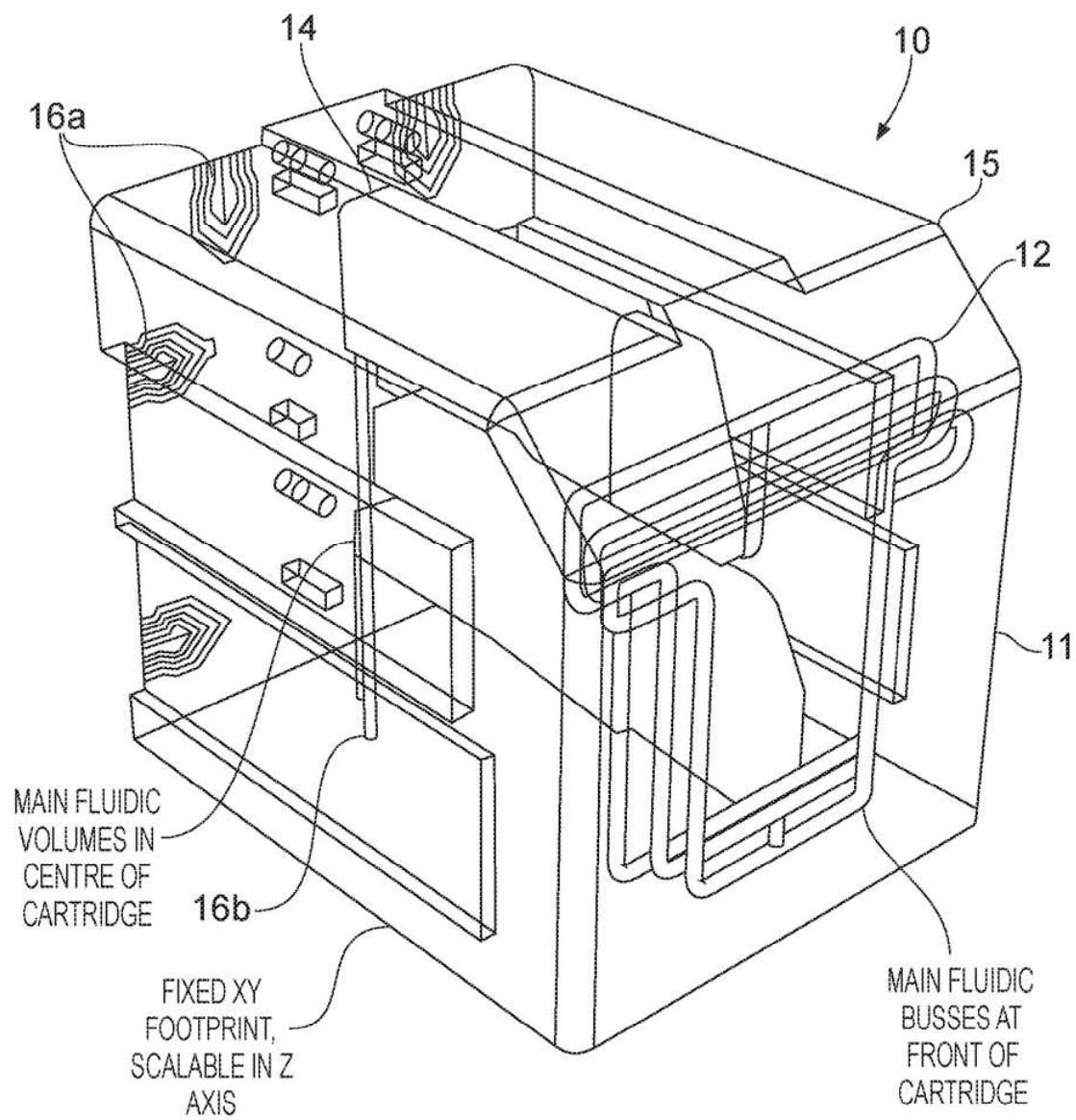


FIG. 4A

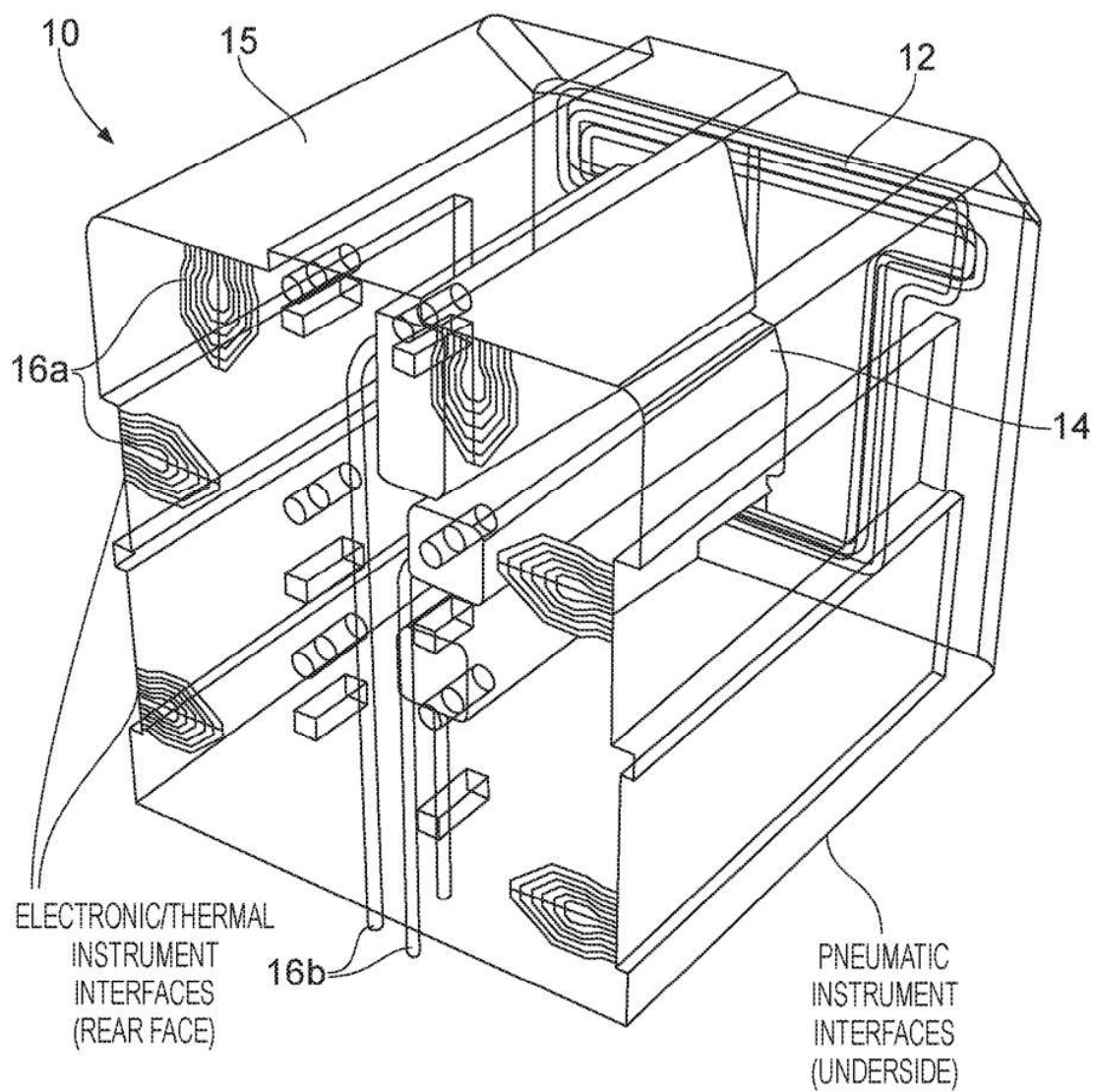


FIG. 4B

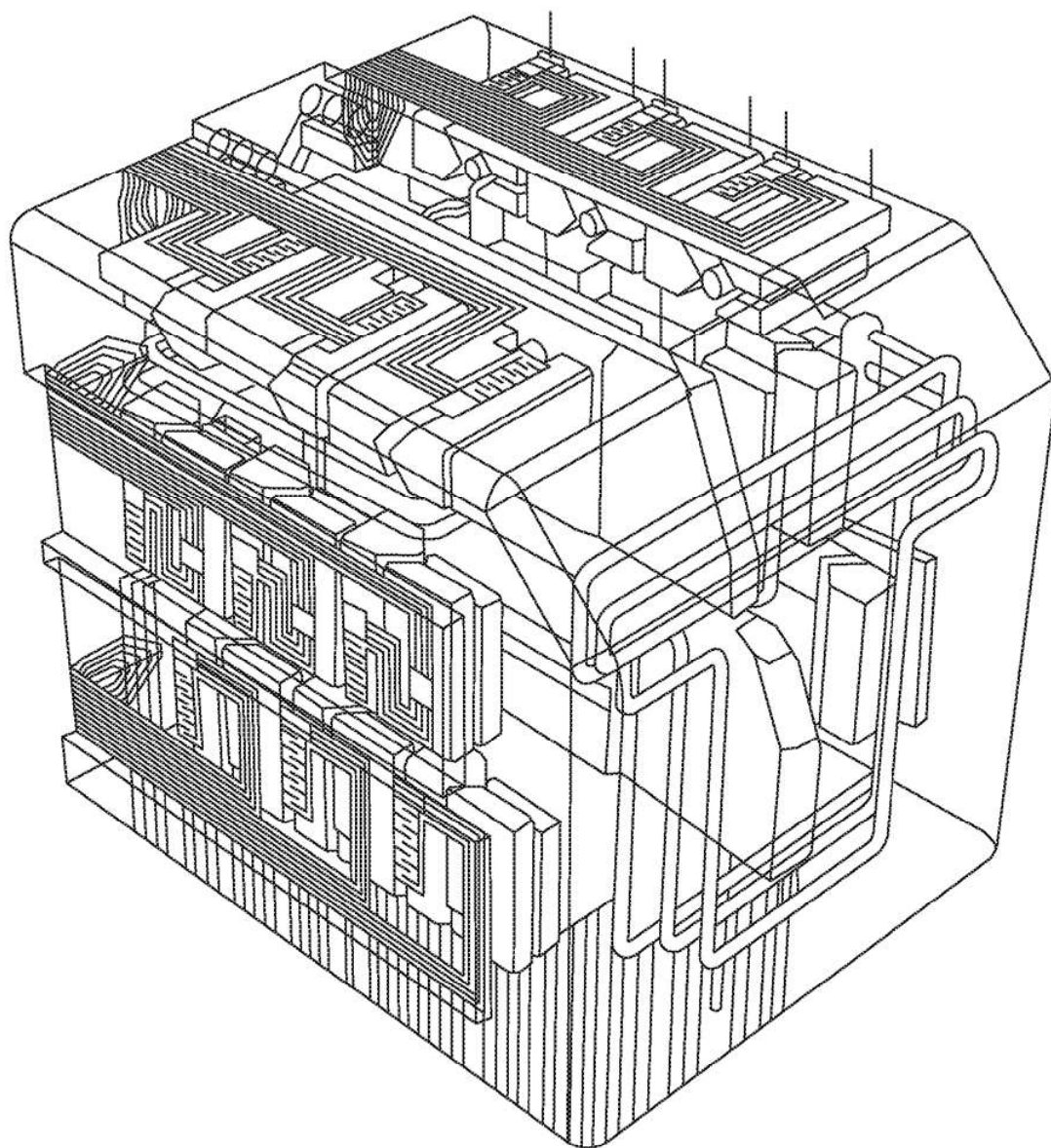


FIG. 5A

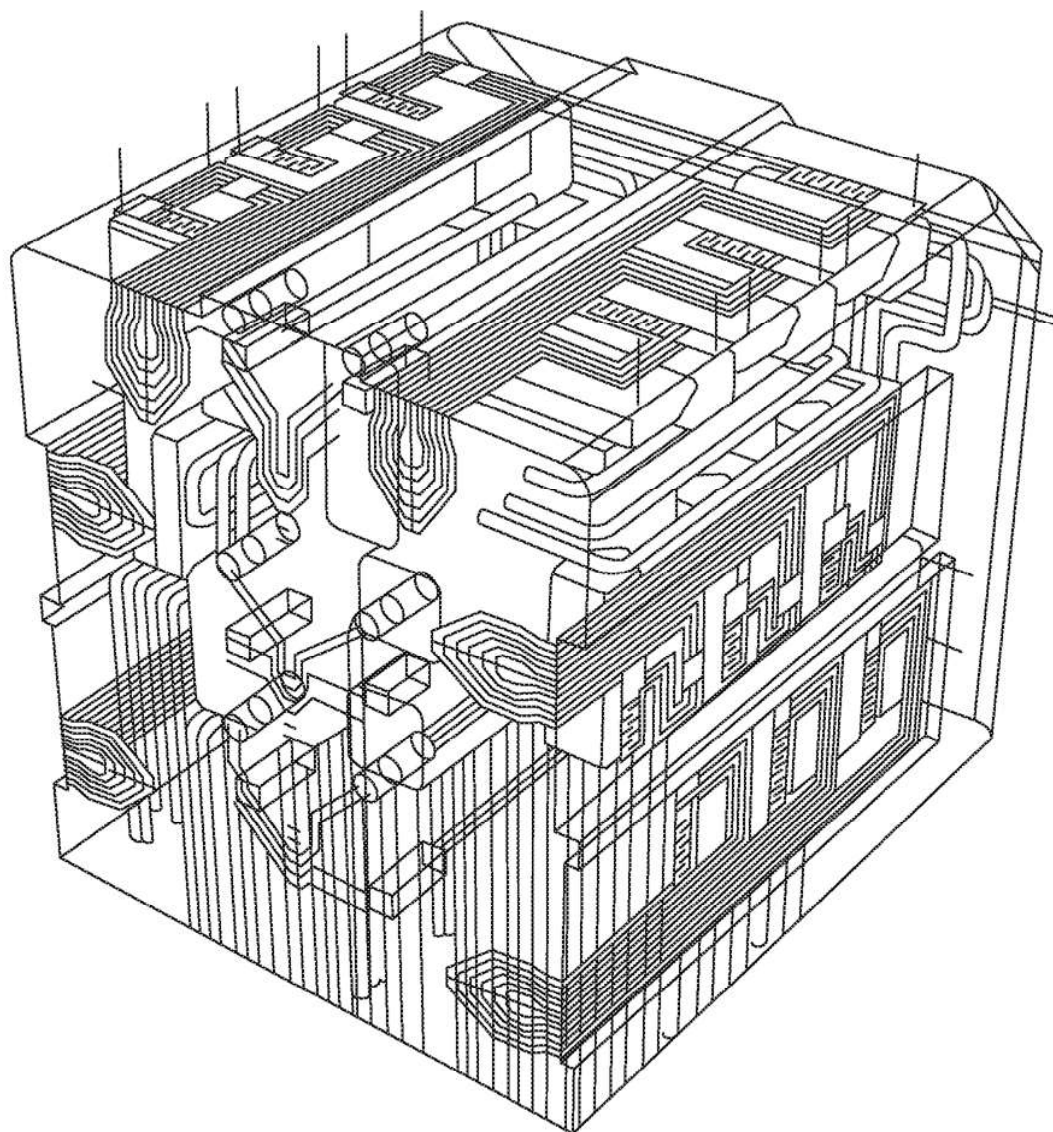


FIG. 5B

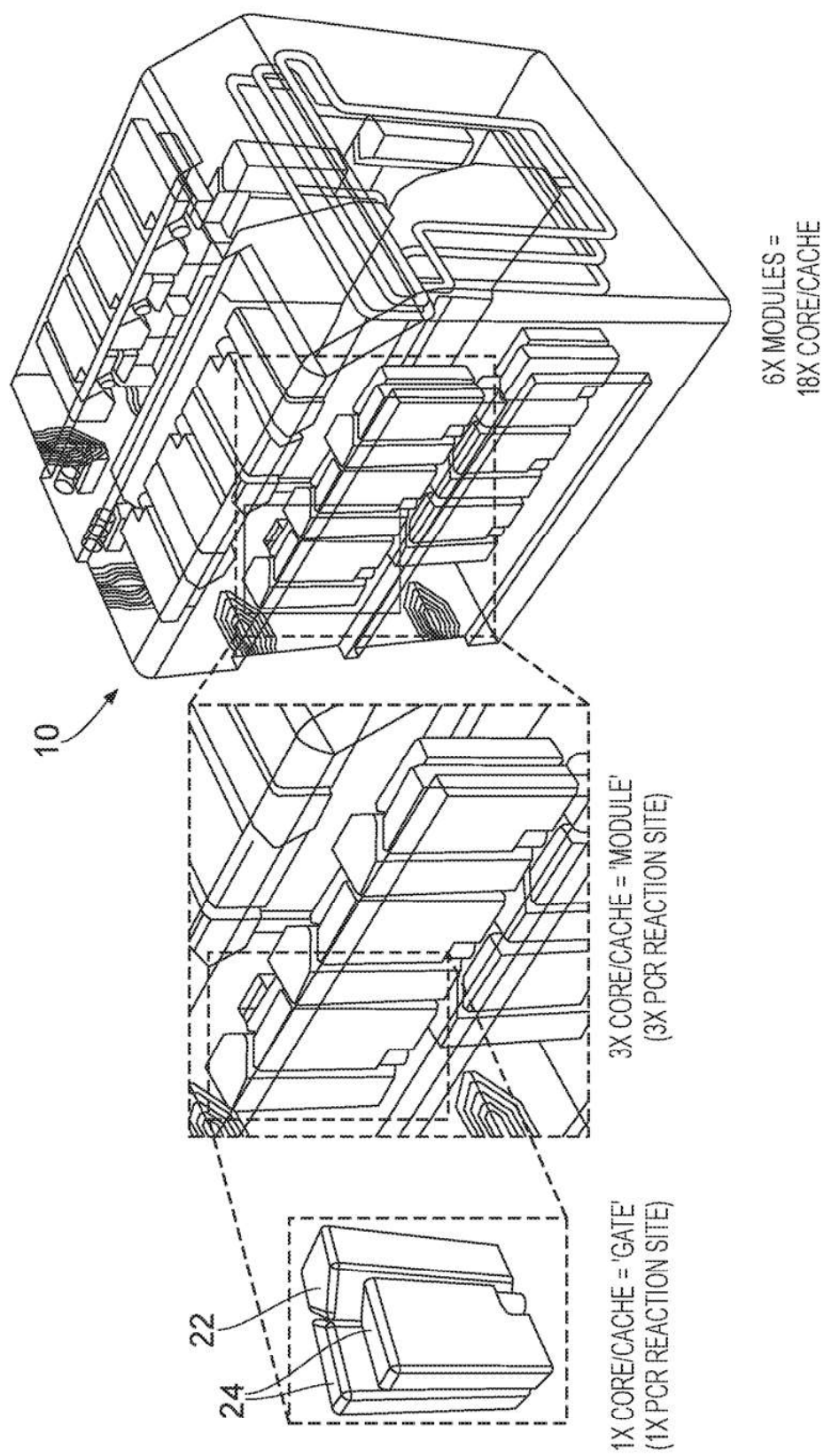


FIG. 6

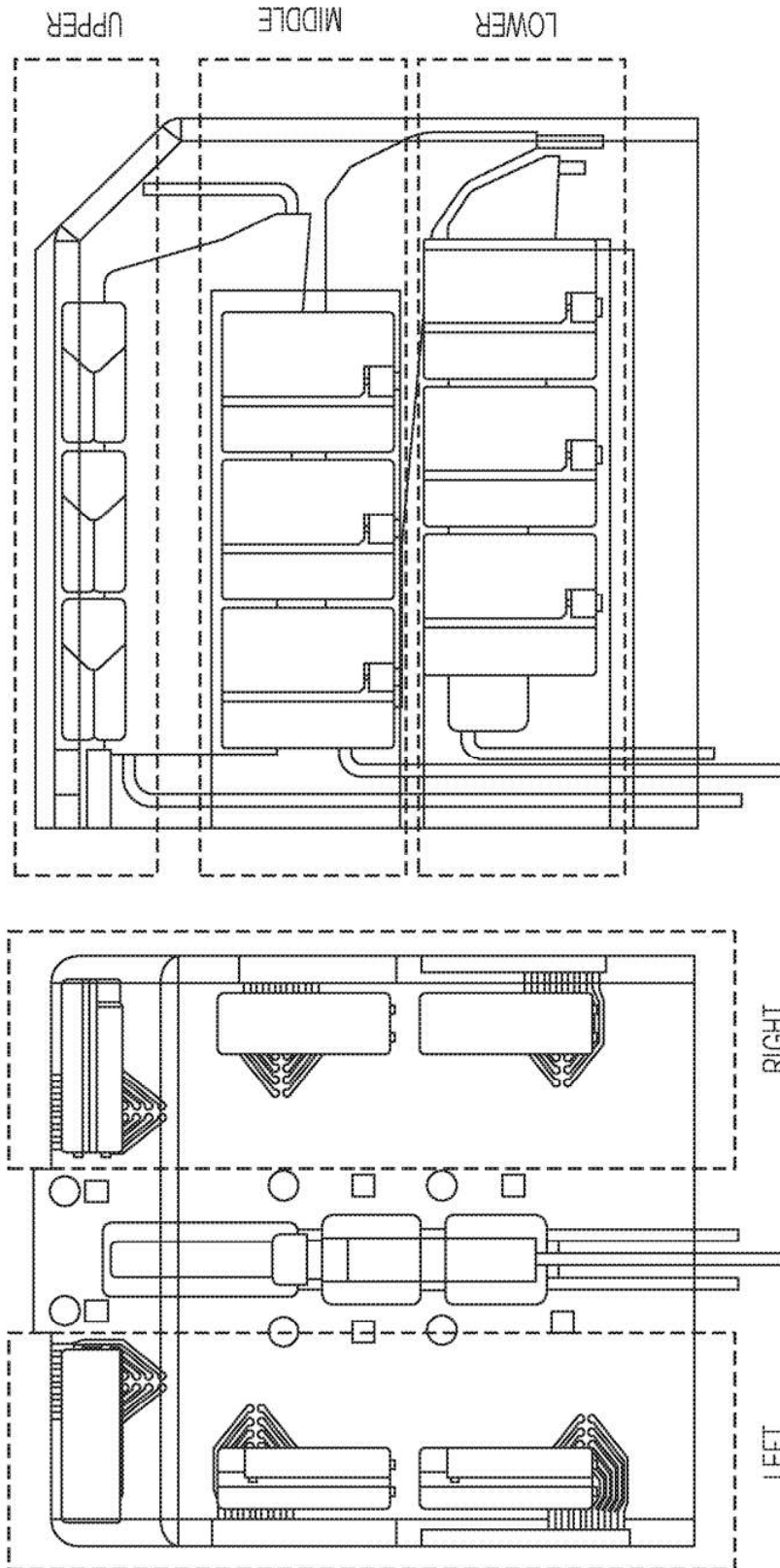


FIG. 7

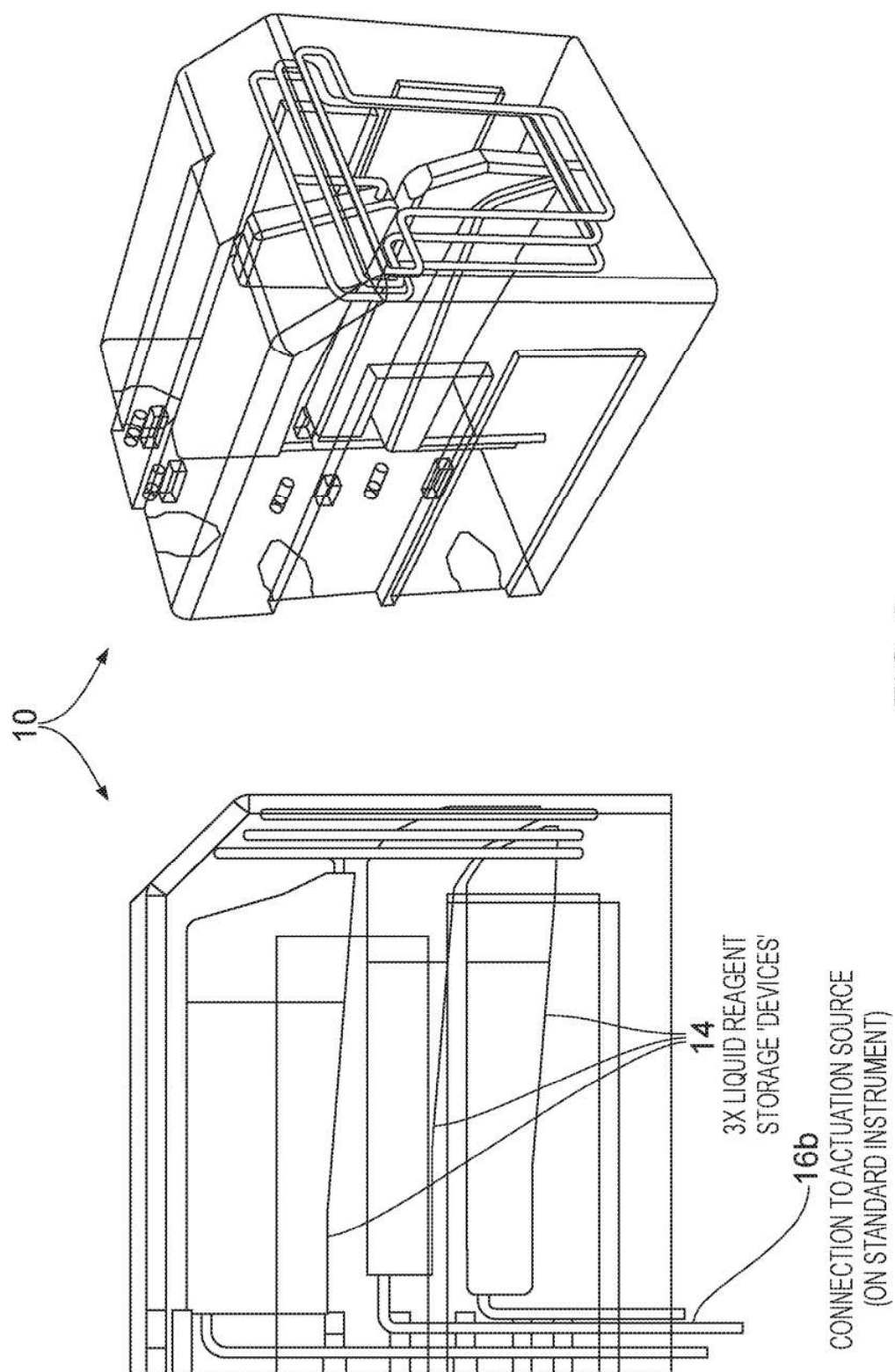


FIG. 8

11/59

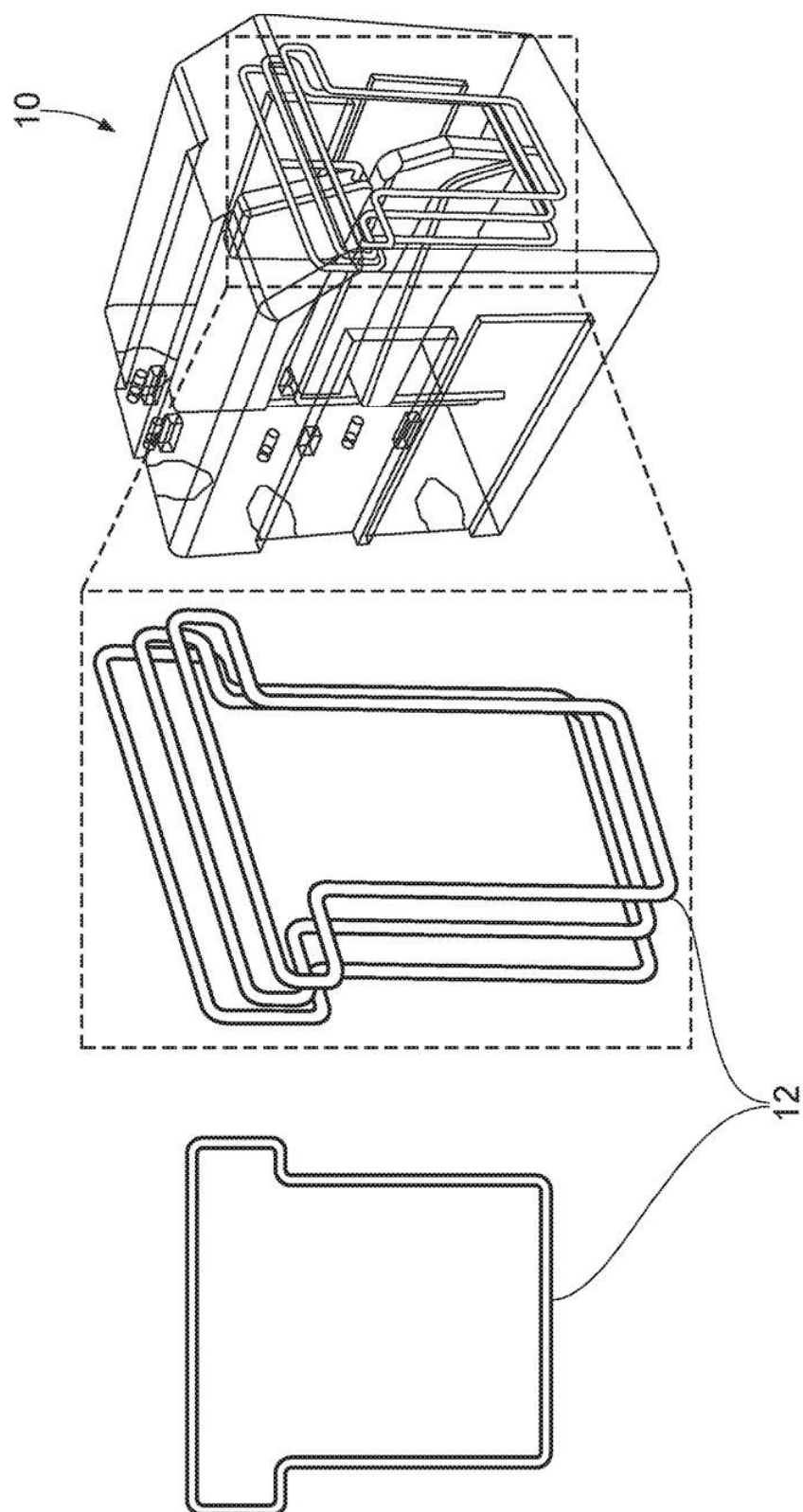


FIG. 9

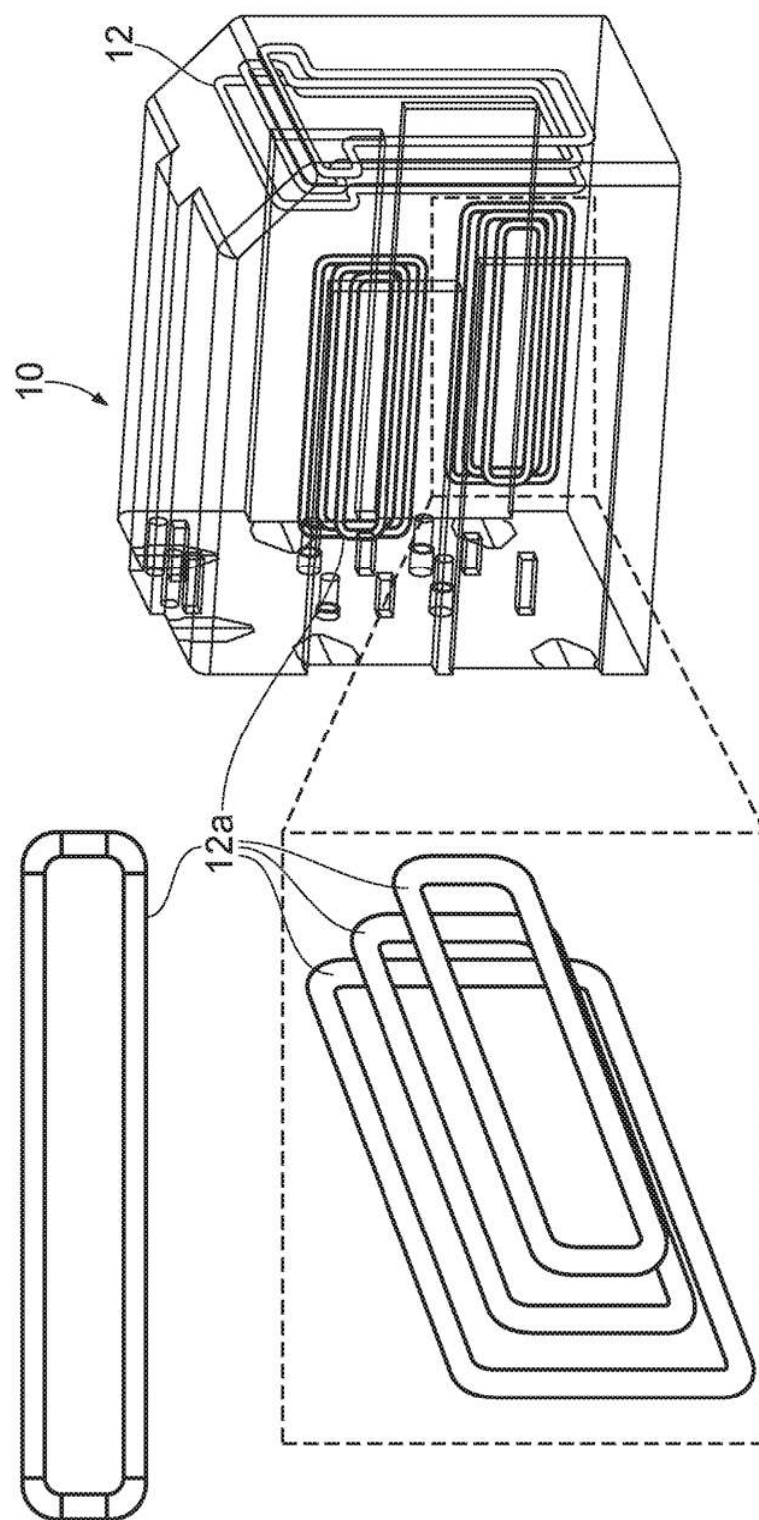


FIG. 10

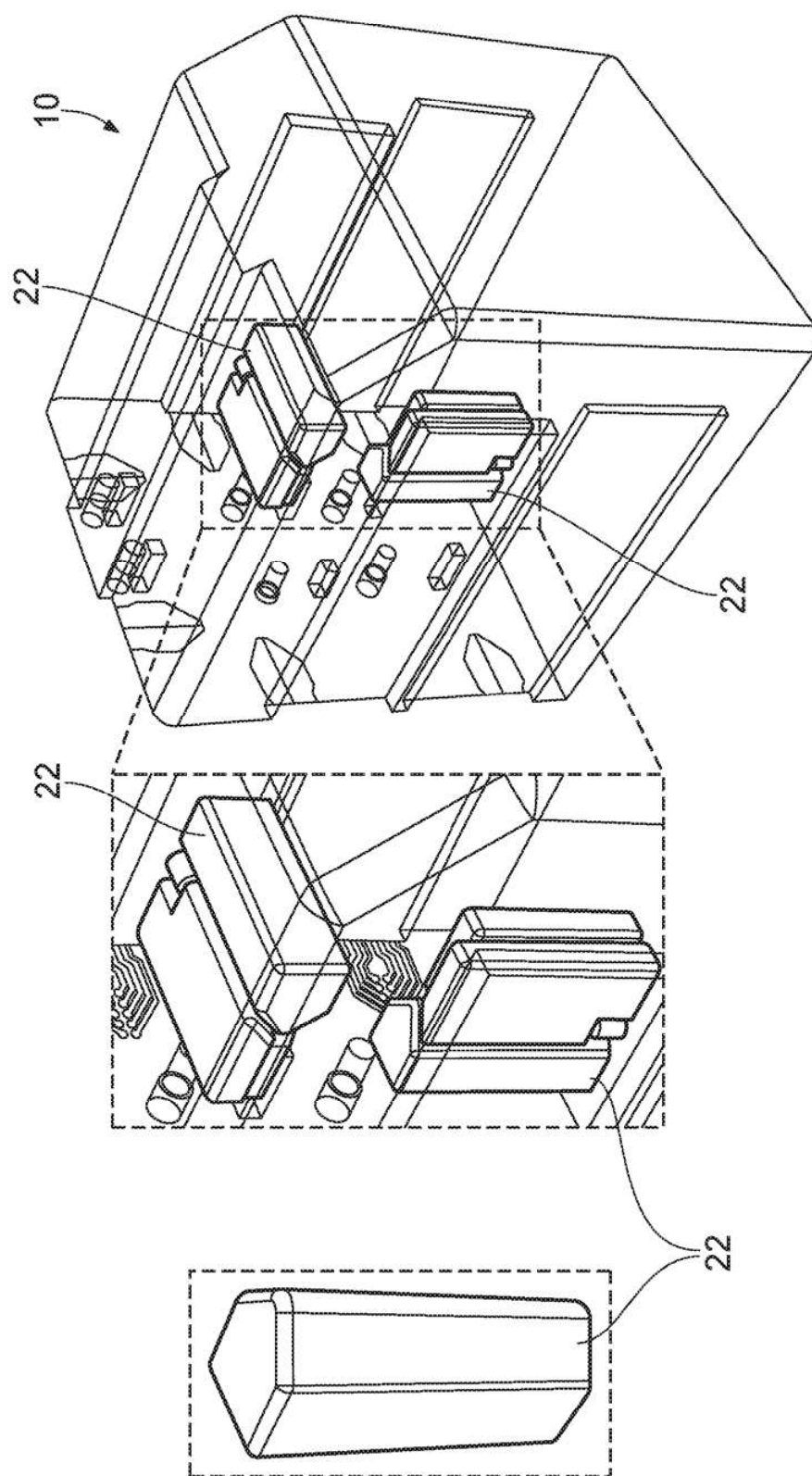


FIG. 11

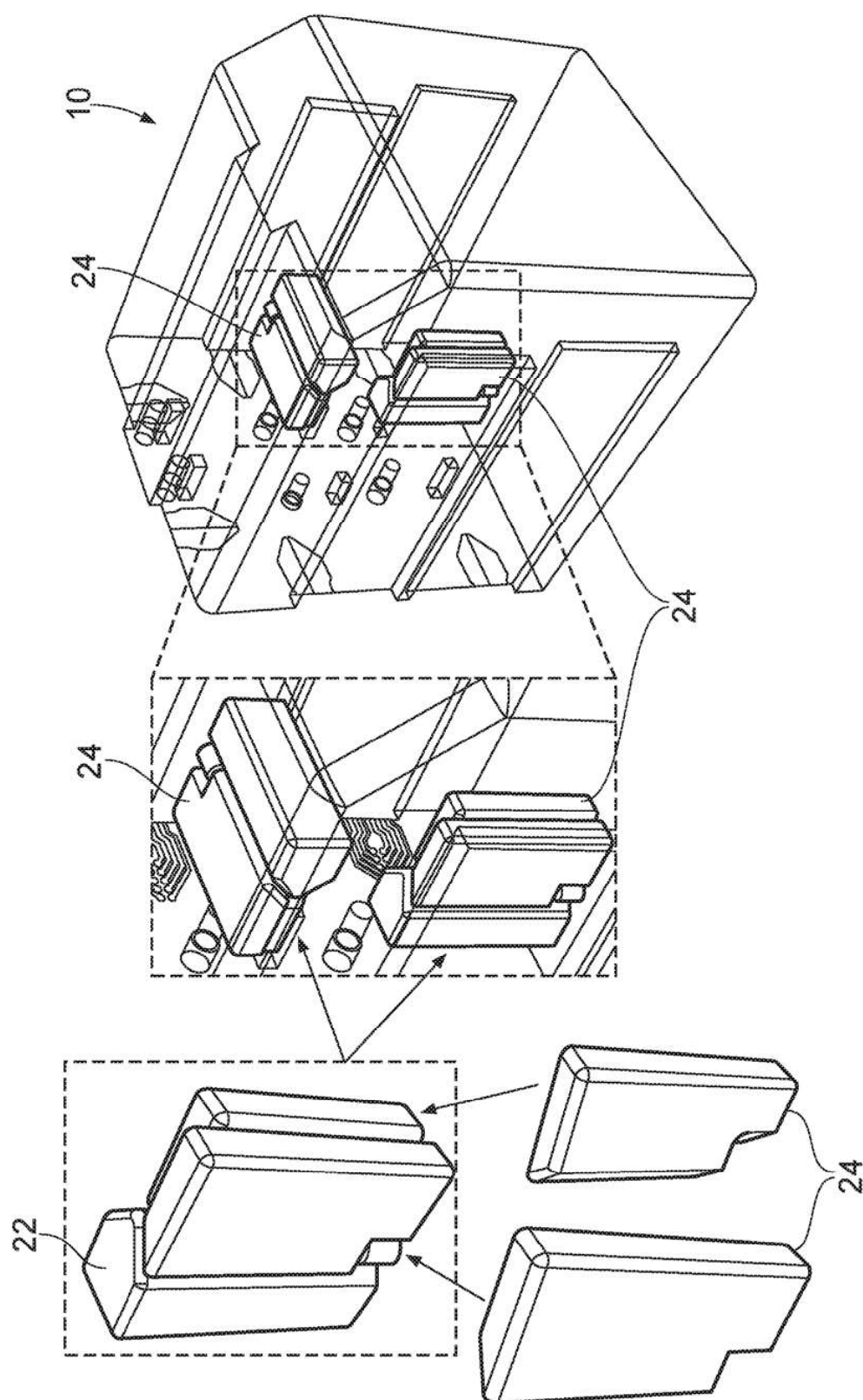


FIG. 12

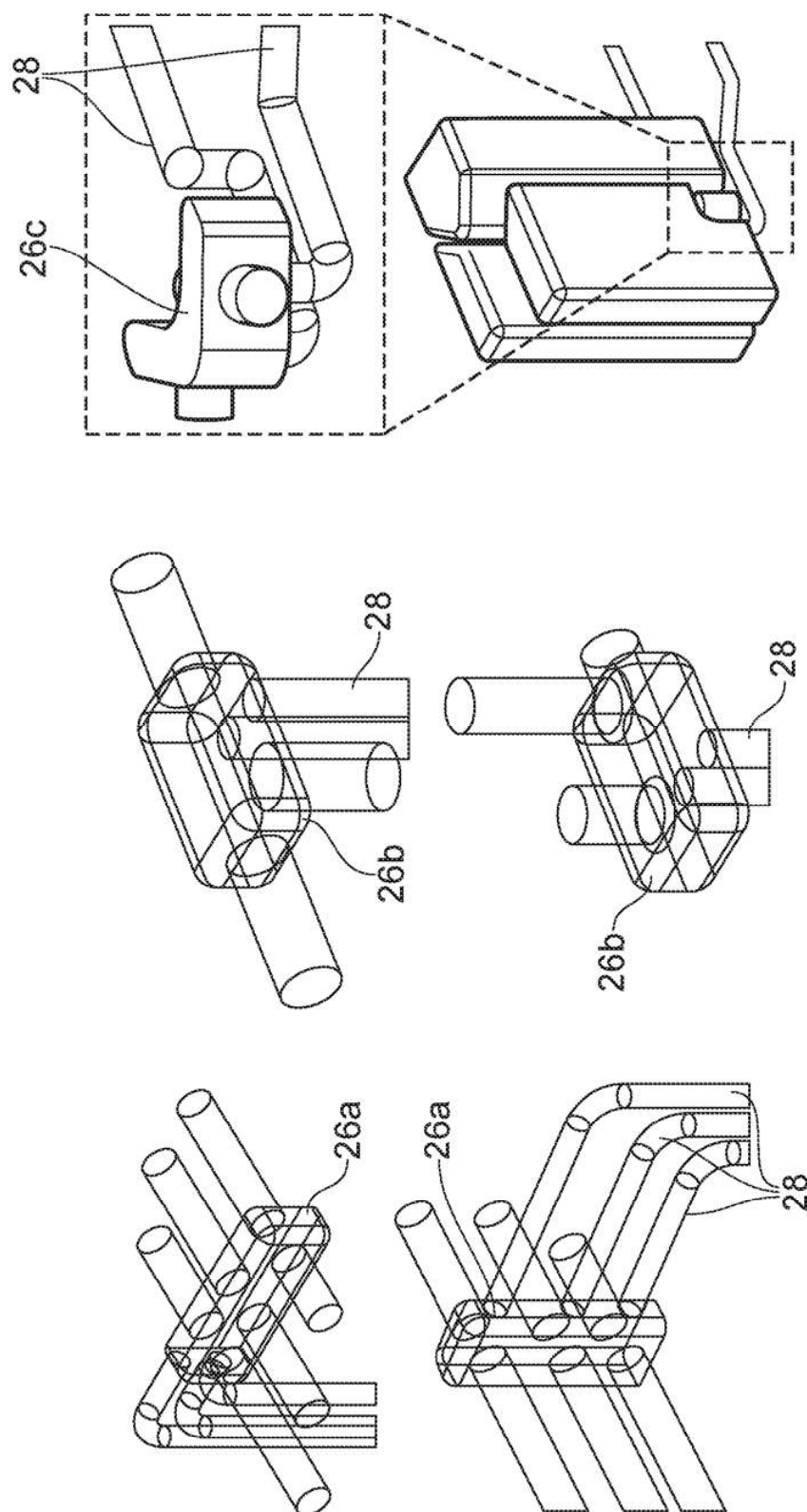


FIG. 13

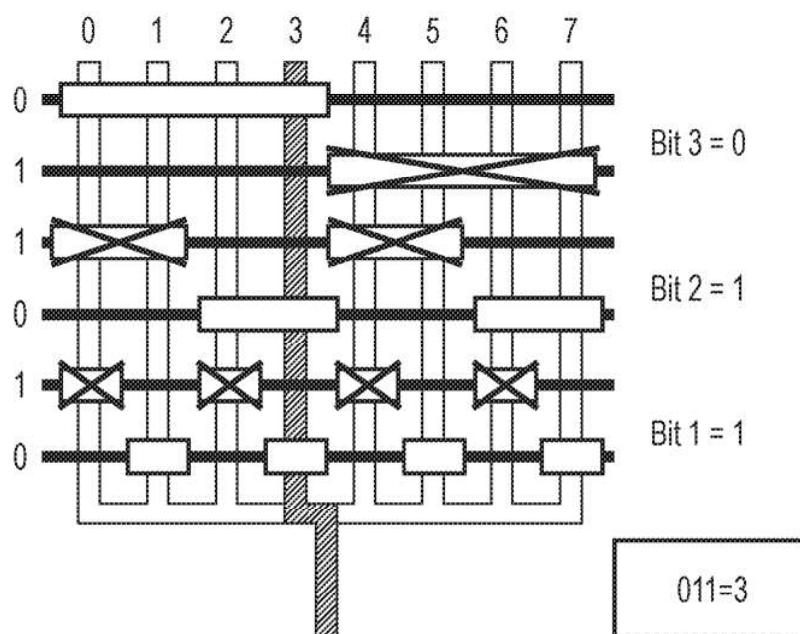


FIG. 14

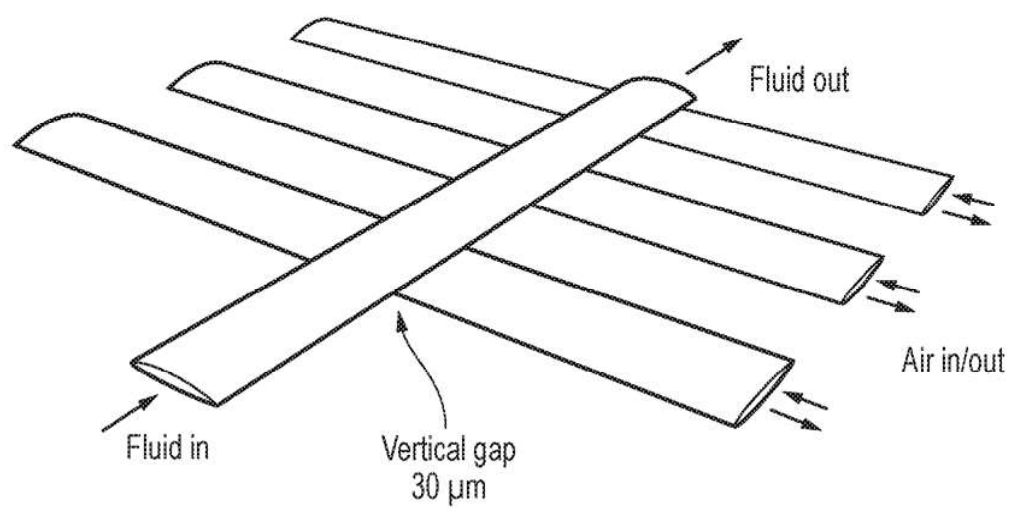


FIG. 15

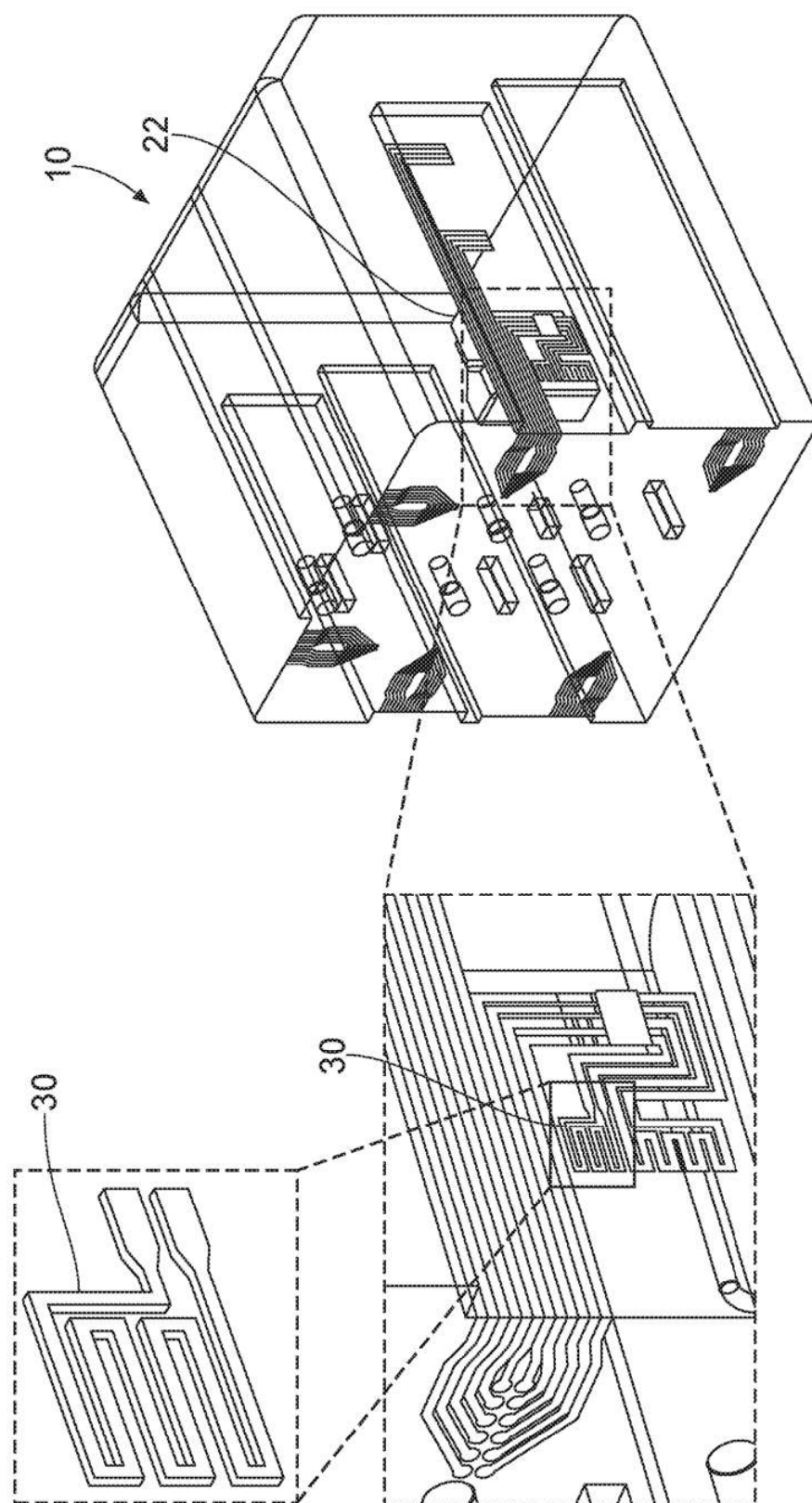


FIG. 16

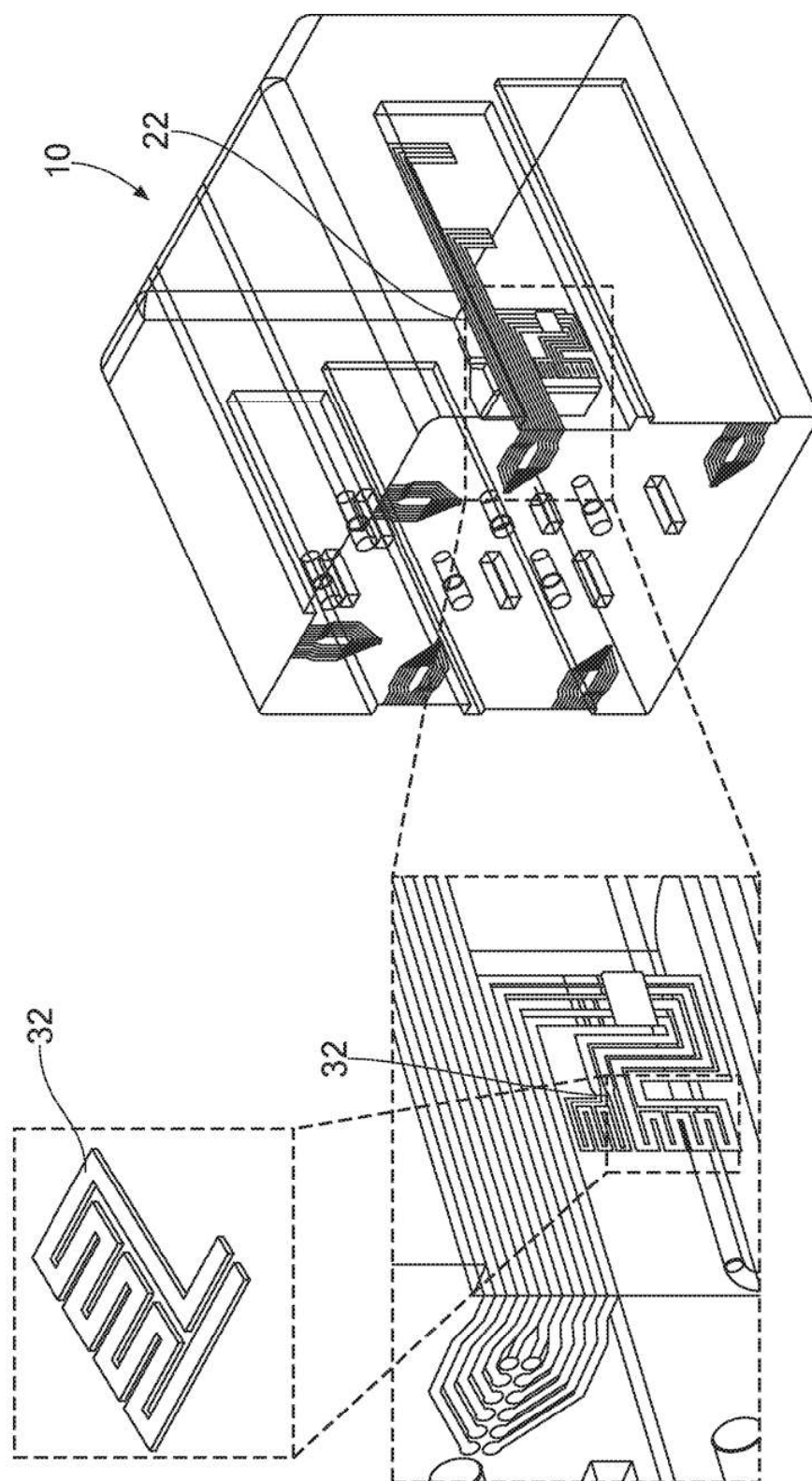


FIG. 17

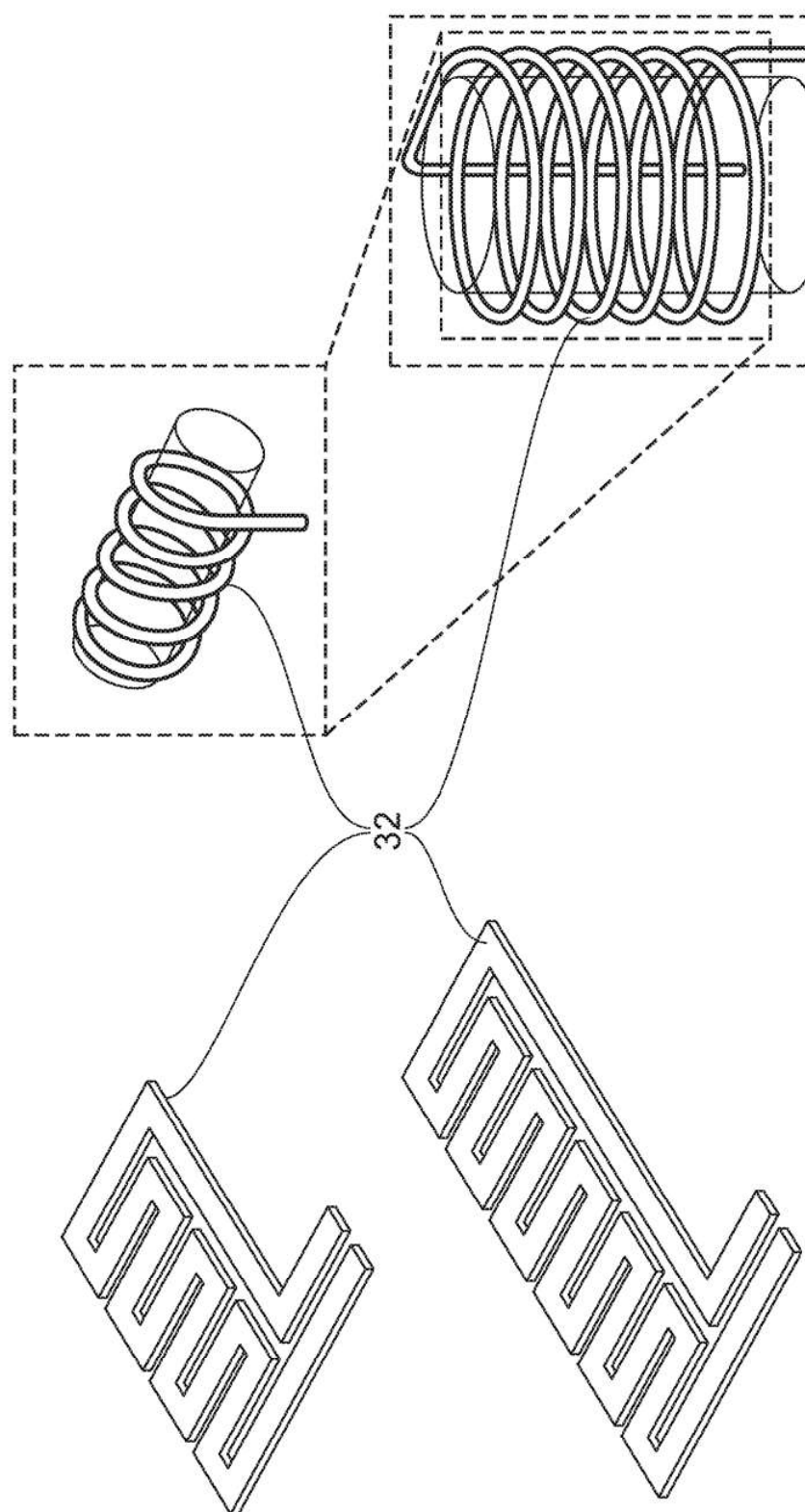


FIG. 18

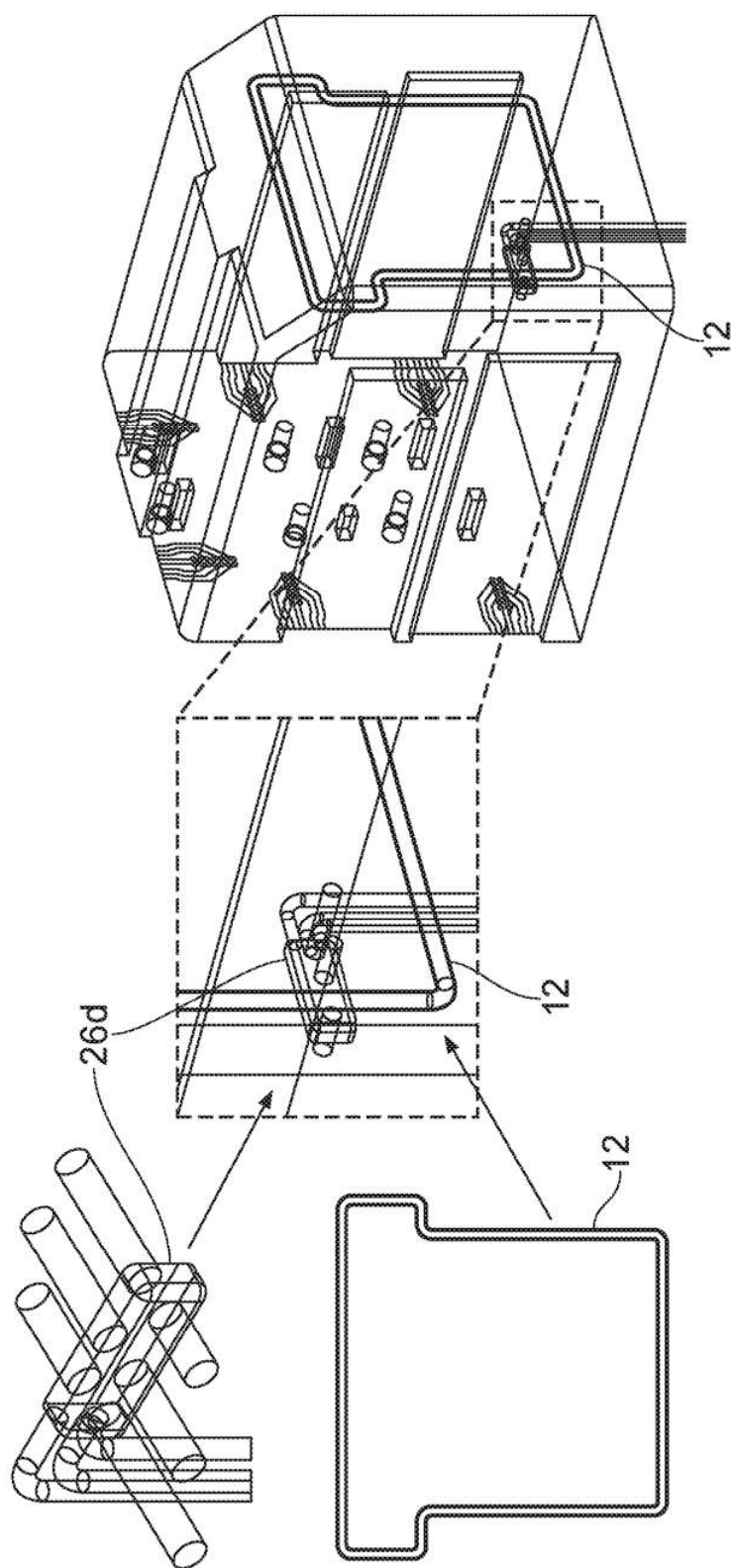


FIG. 19

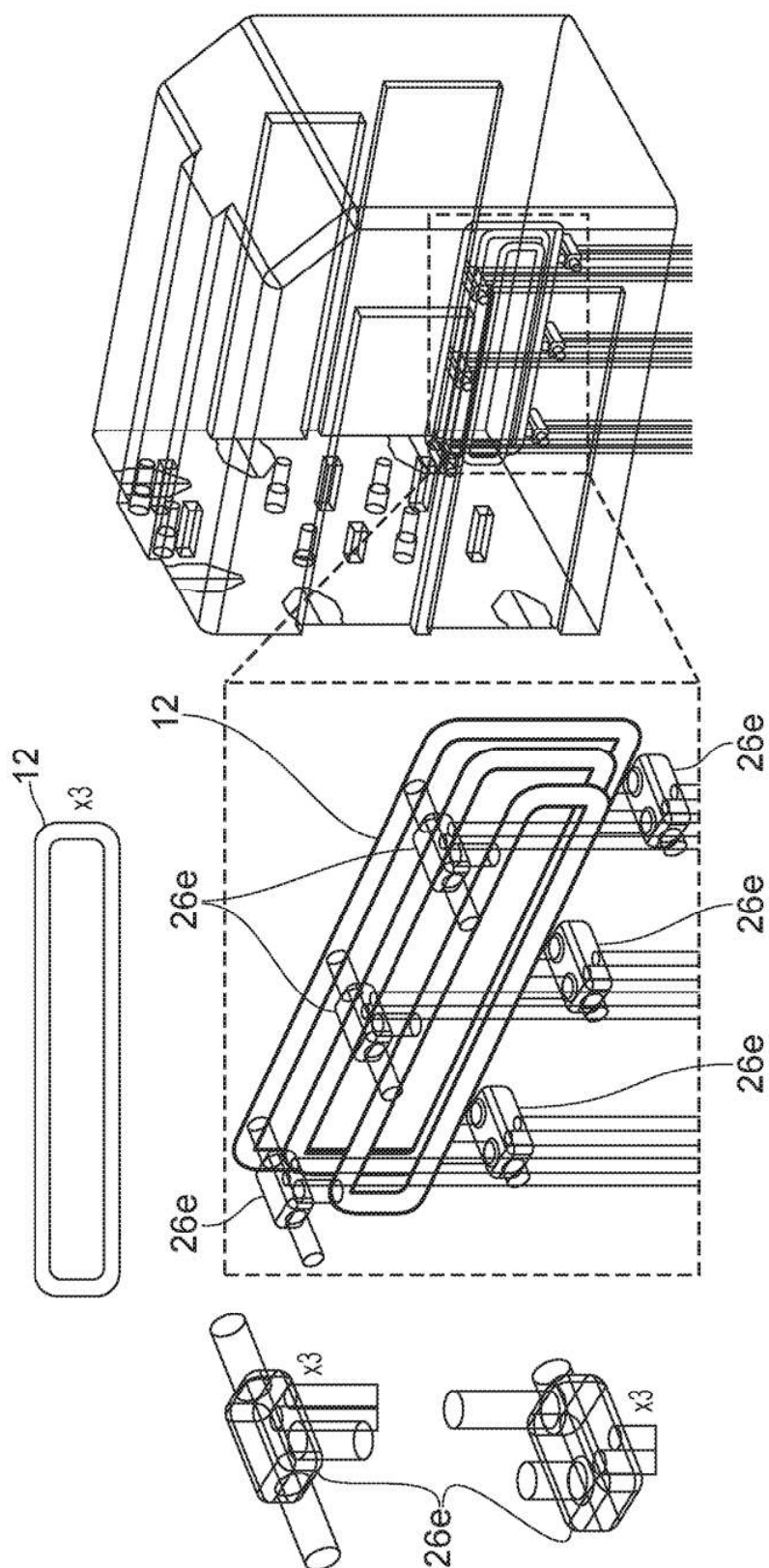


FIG. 20

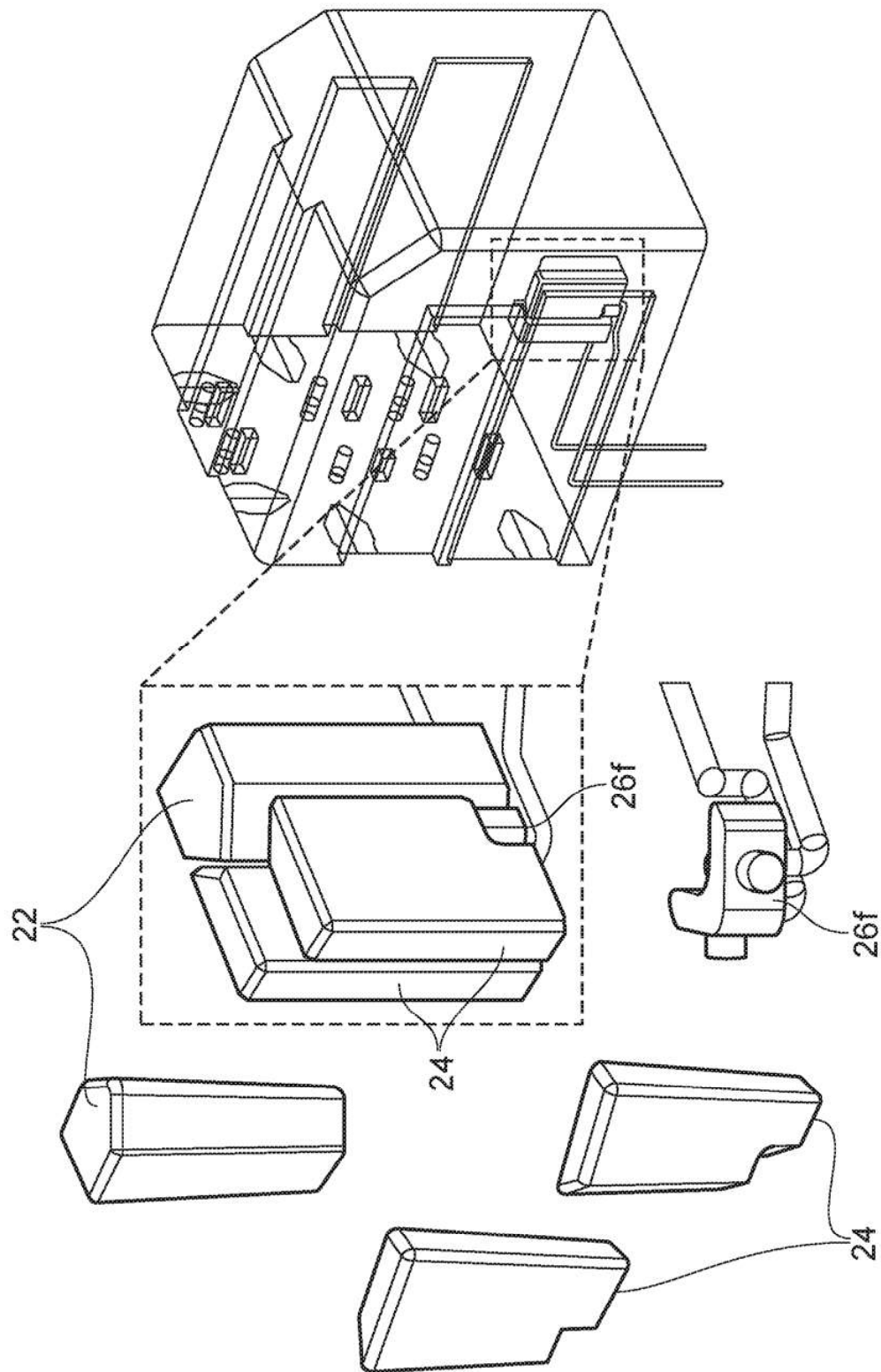


FIG. 21

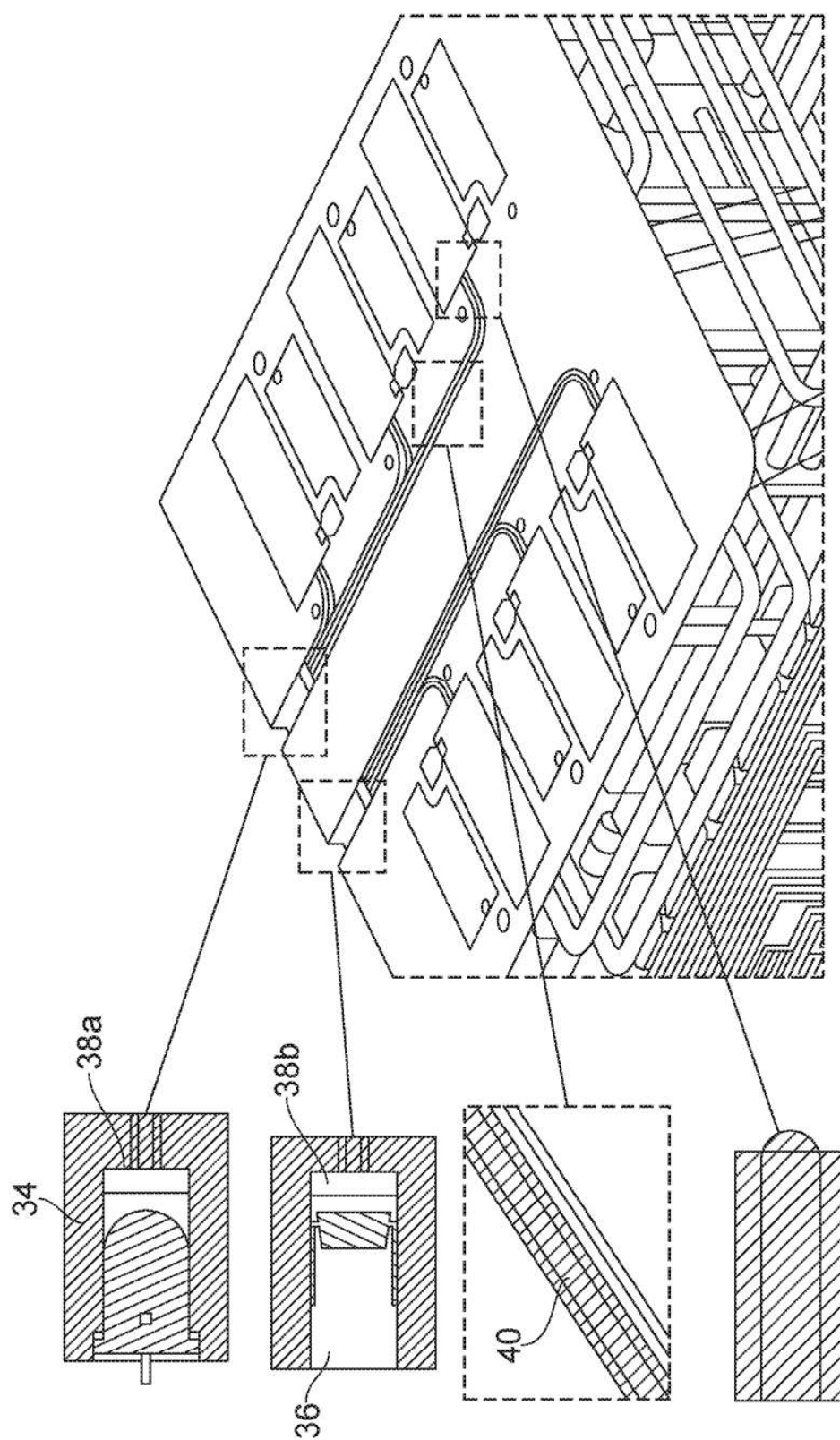


FIG. 22

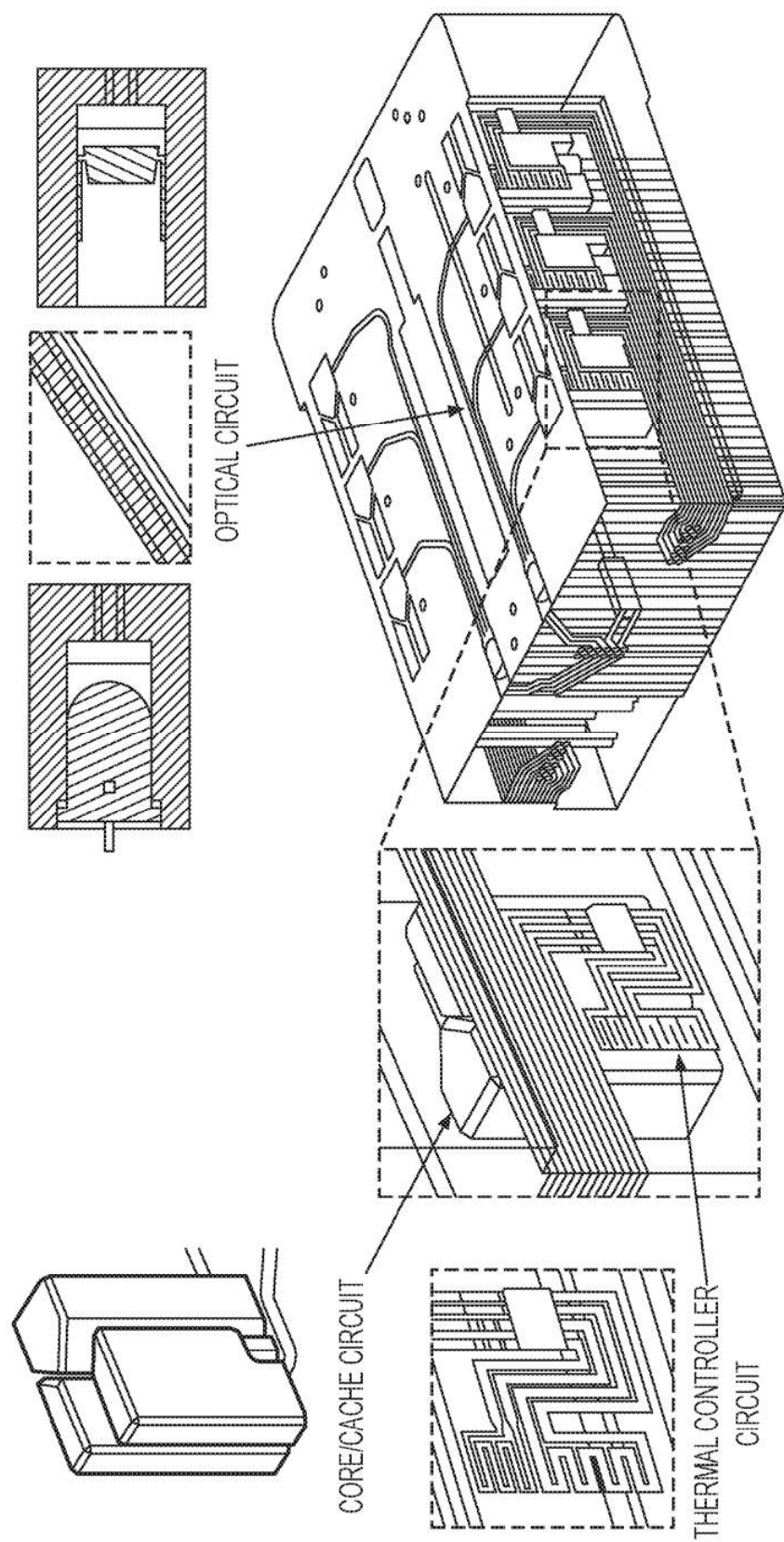


FIG. 23

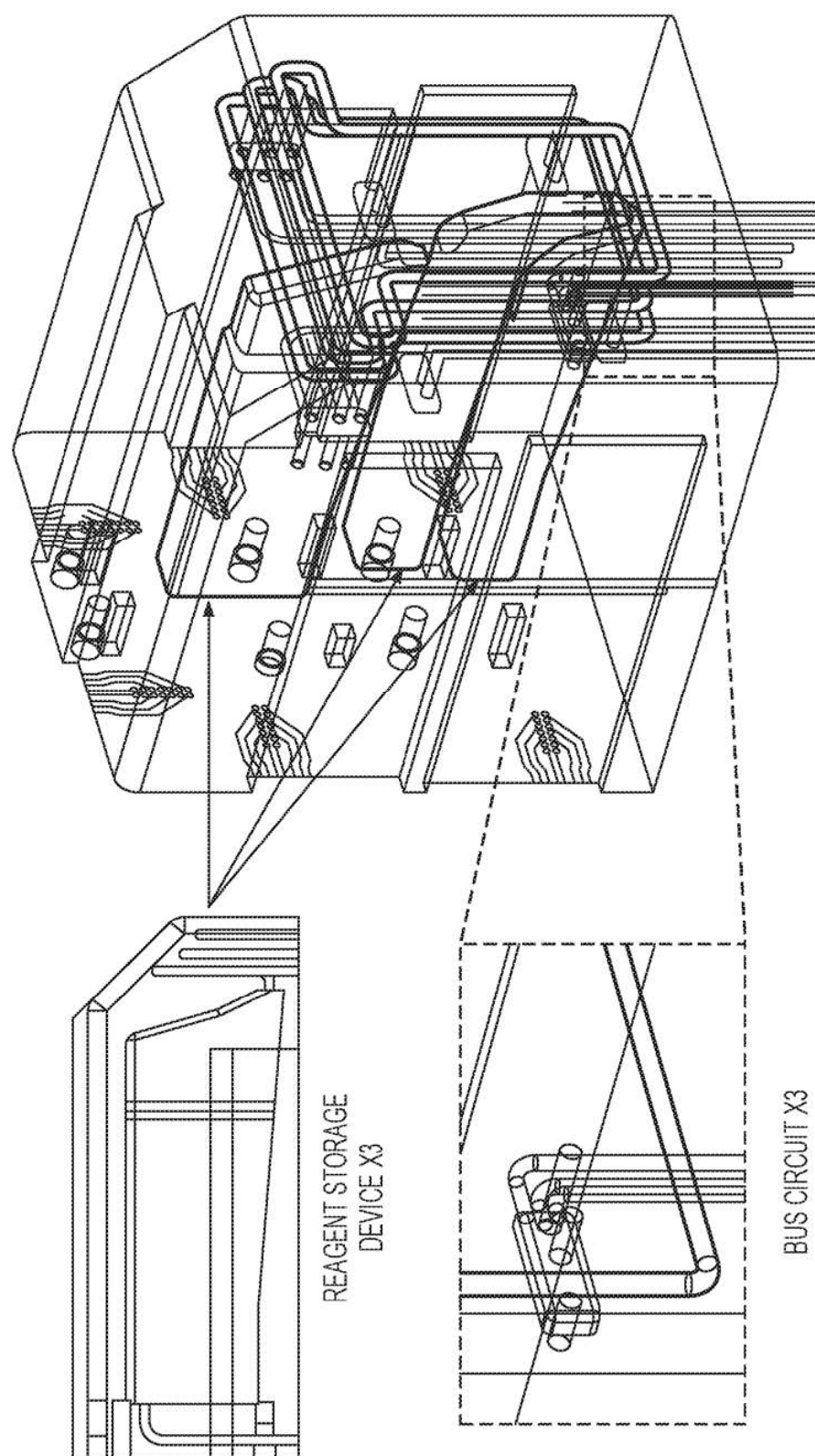


FIG. 24

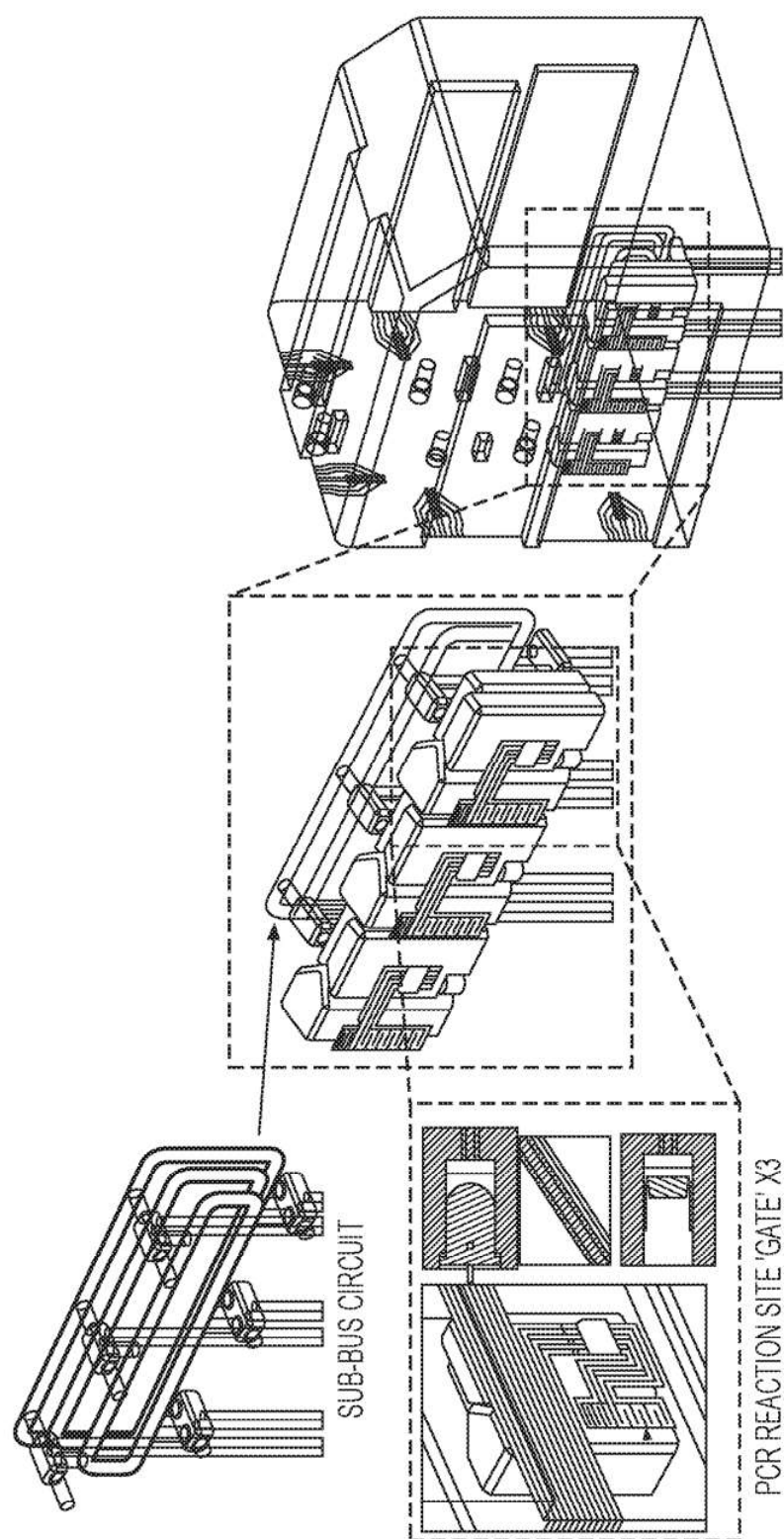


FIG. 25

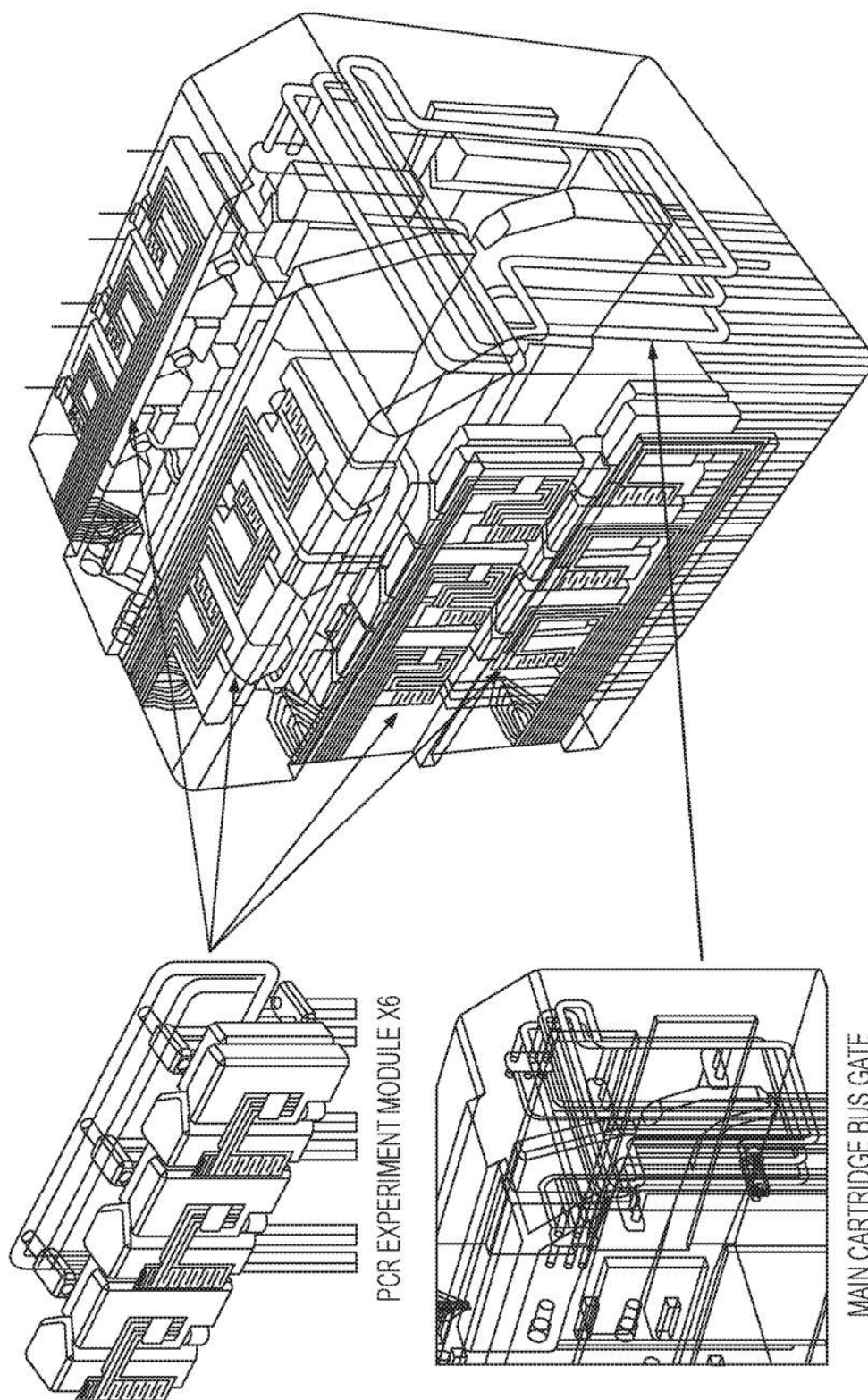


FIG. 26

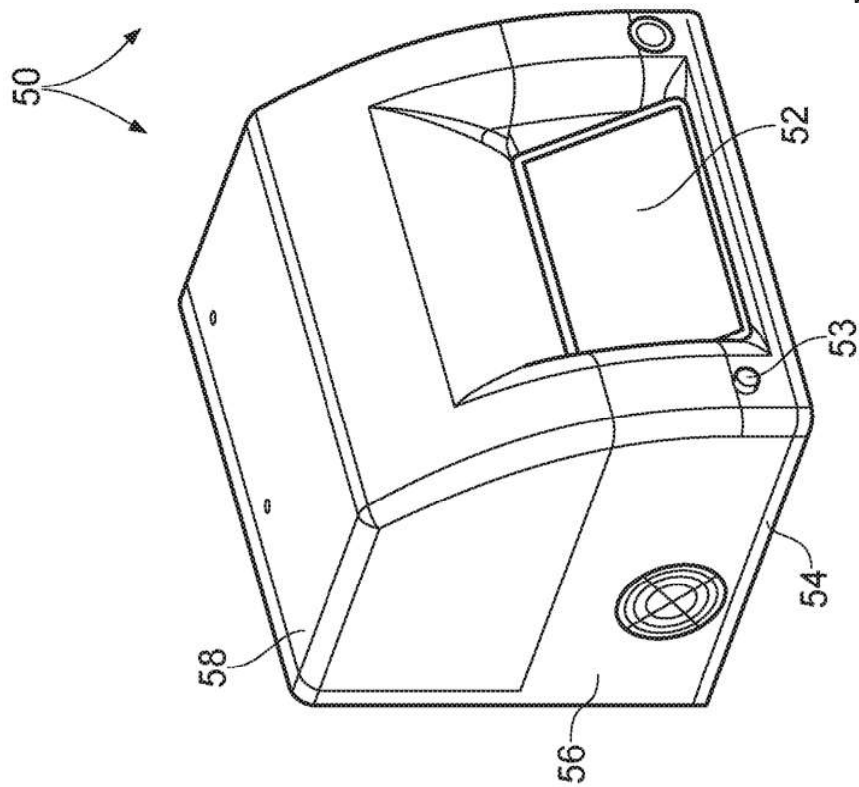
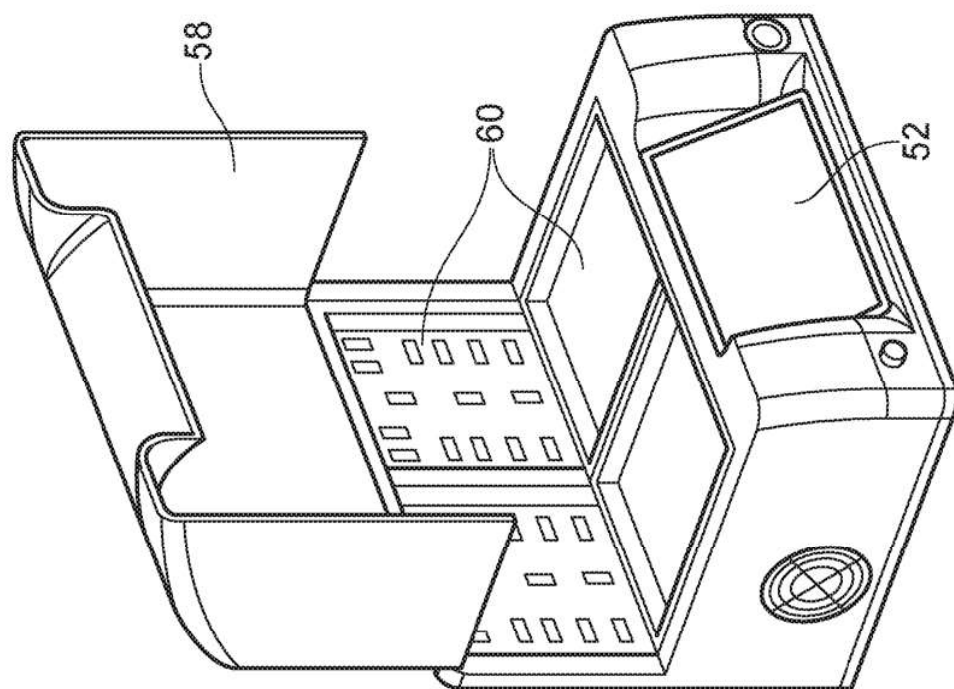


FIG. 27

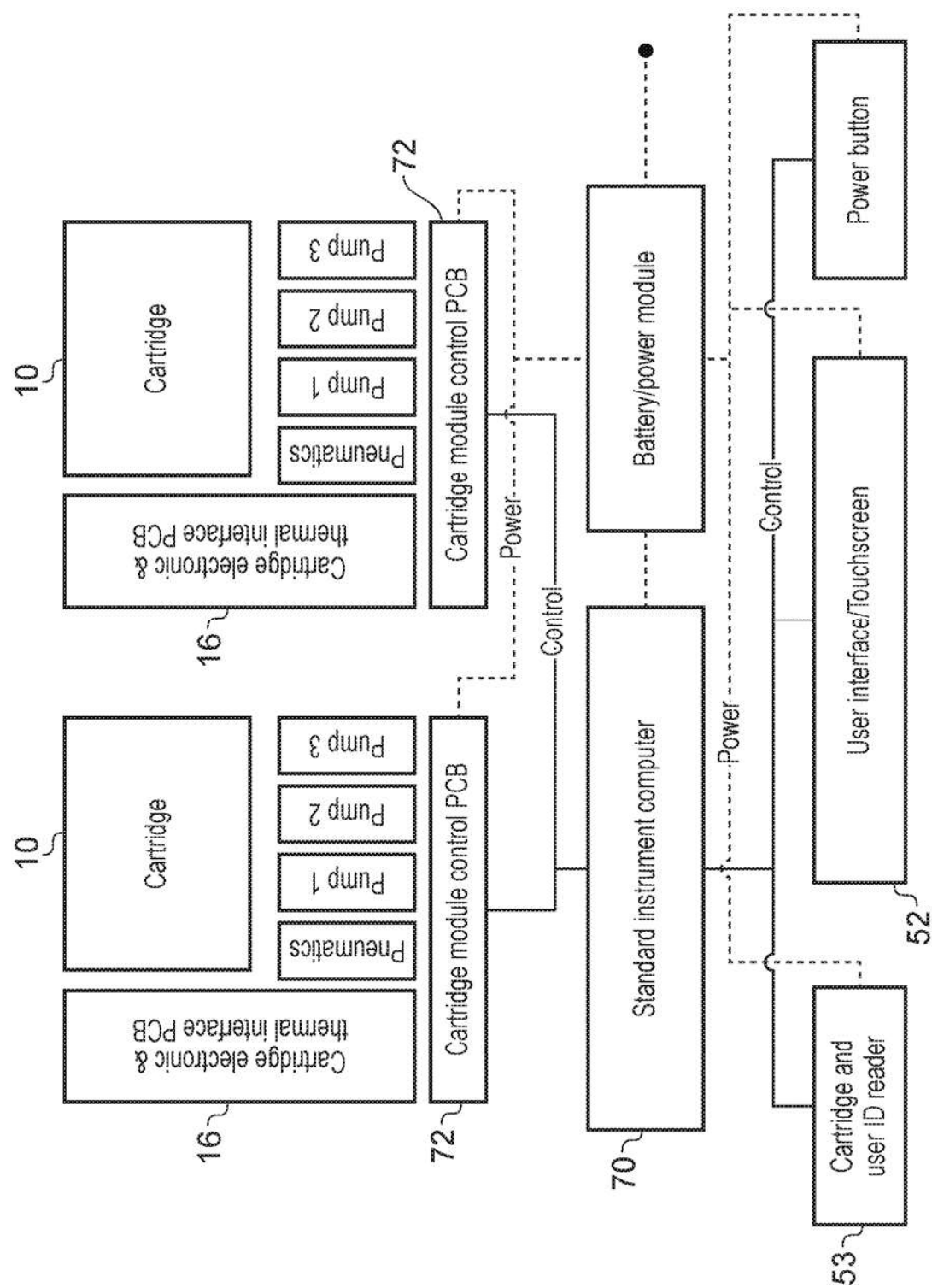


FIG. 28

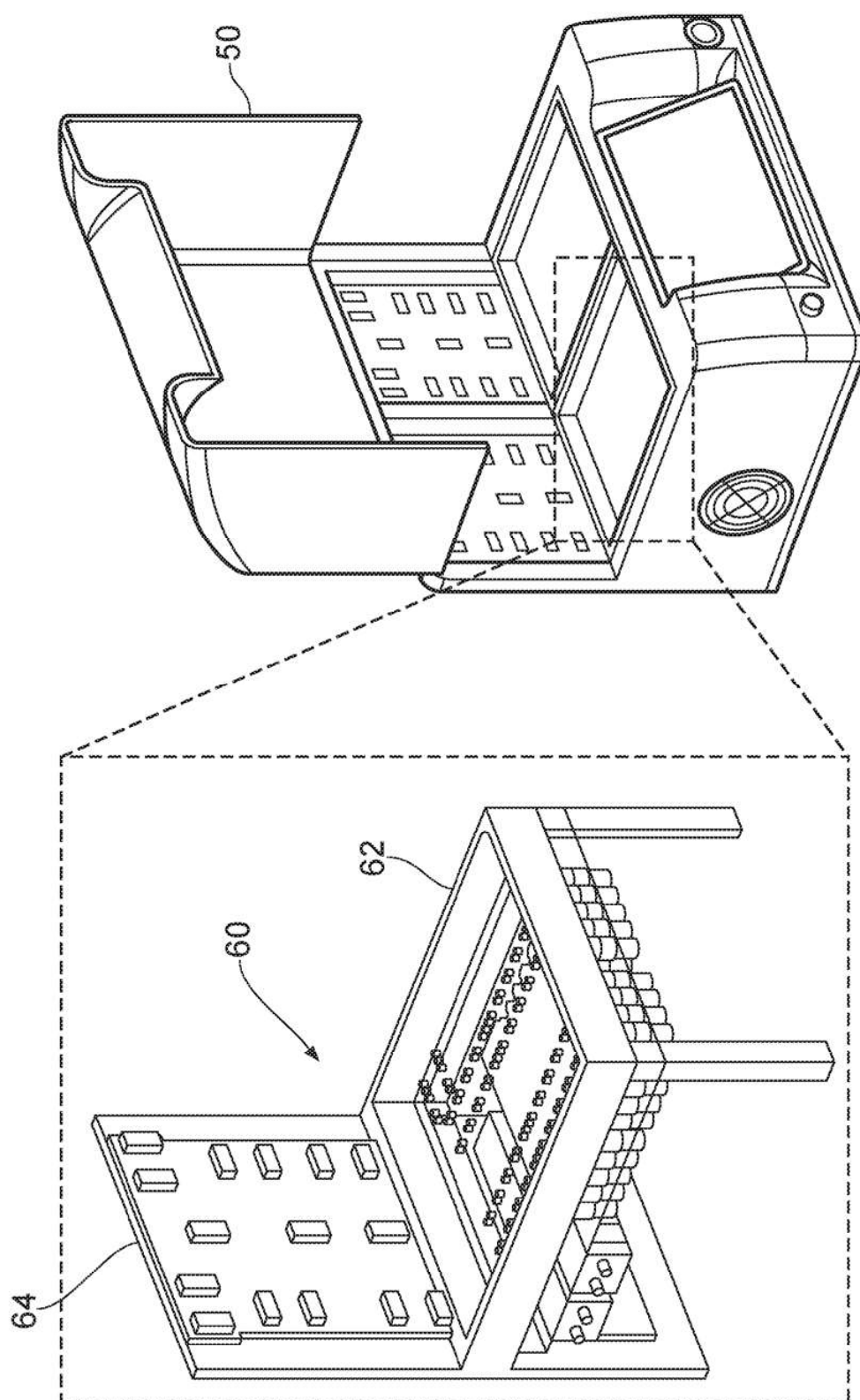


FIG. 29

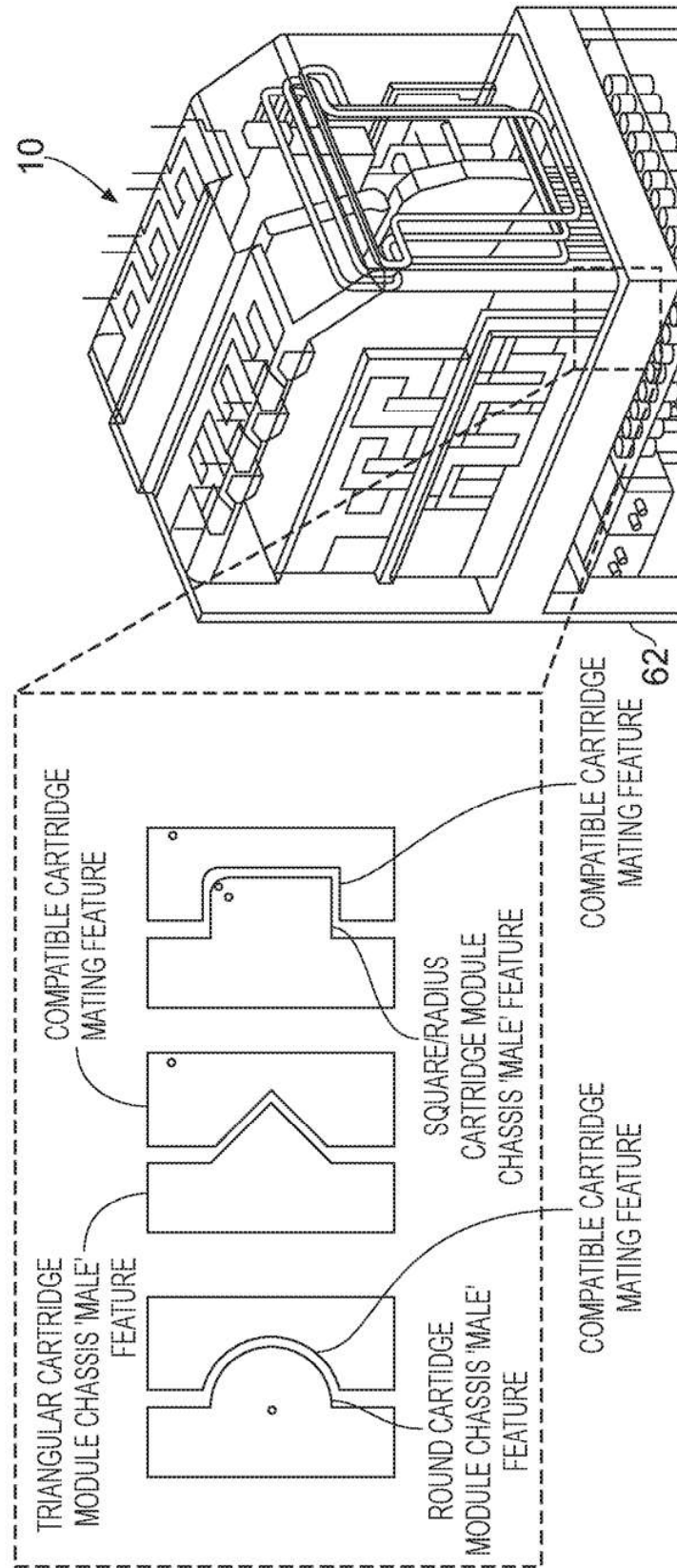


FIG. 30

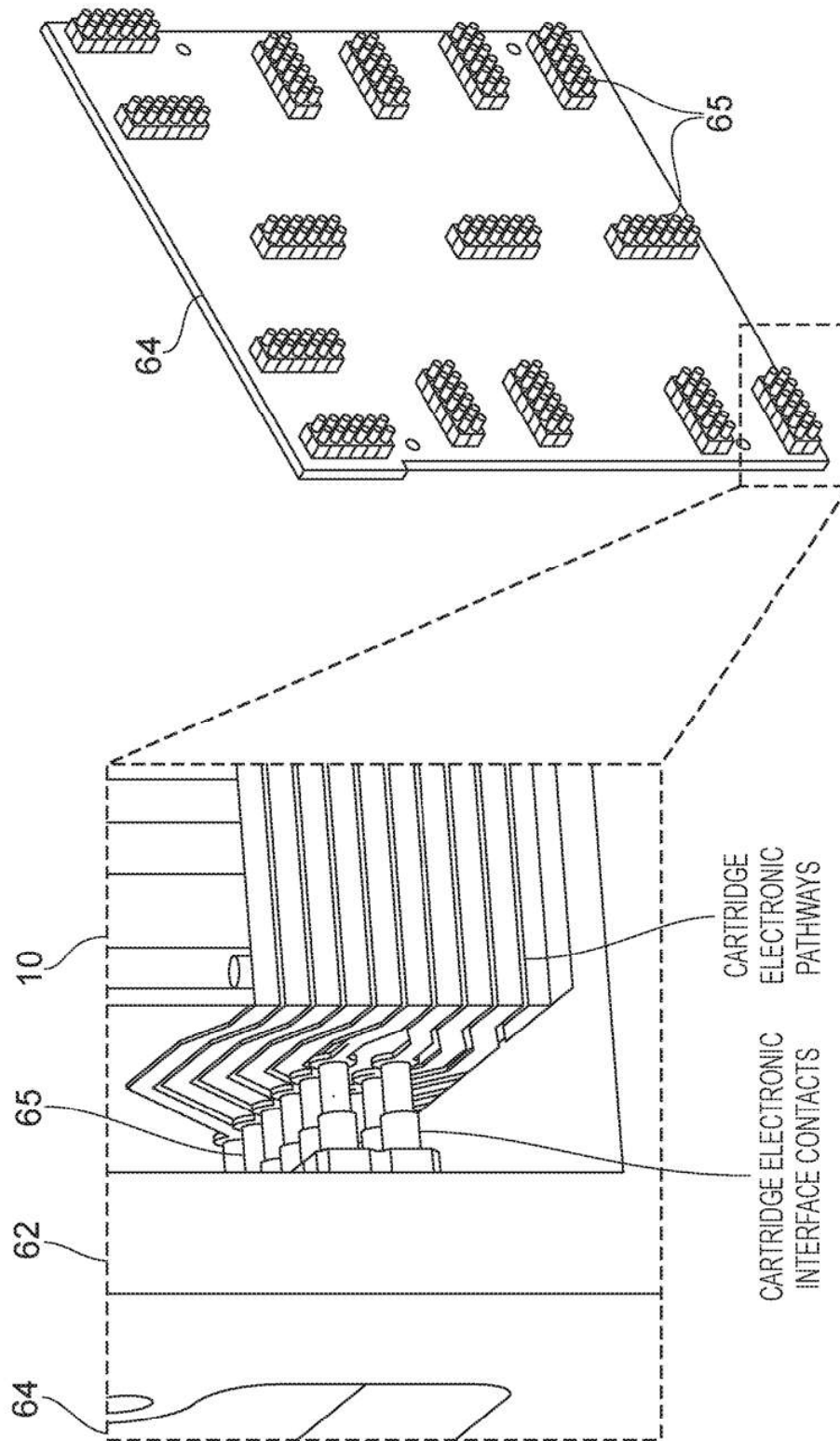


FIG. 31

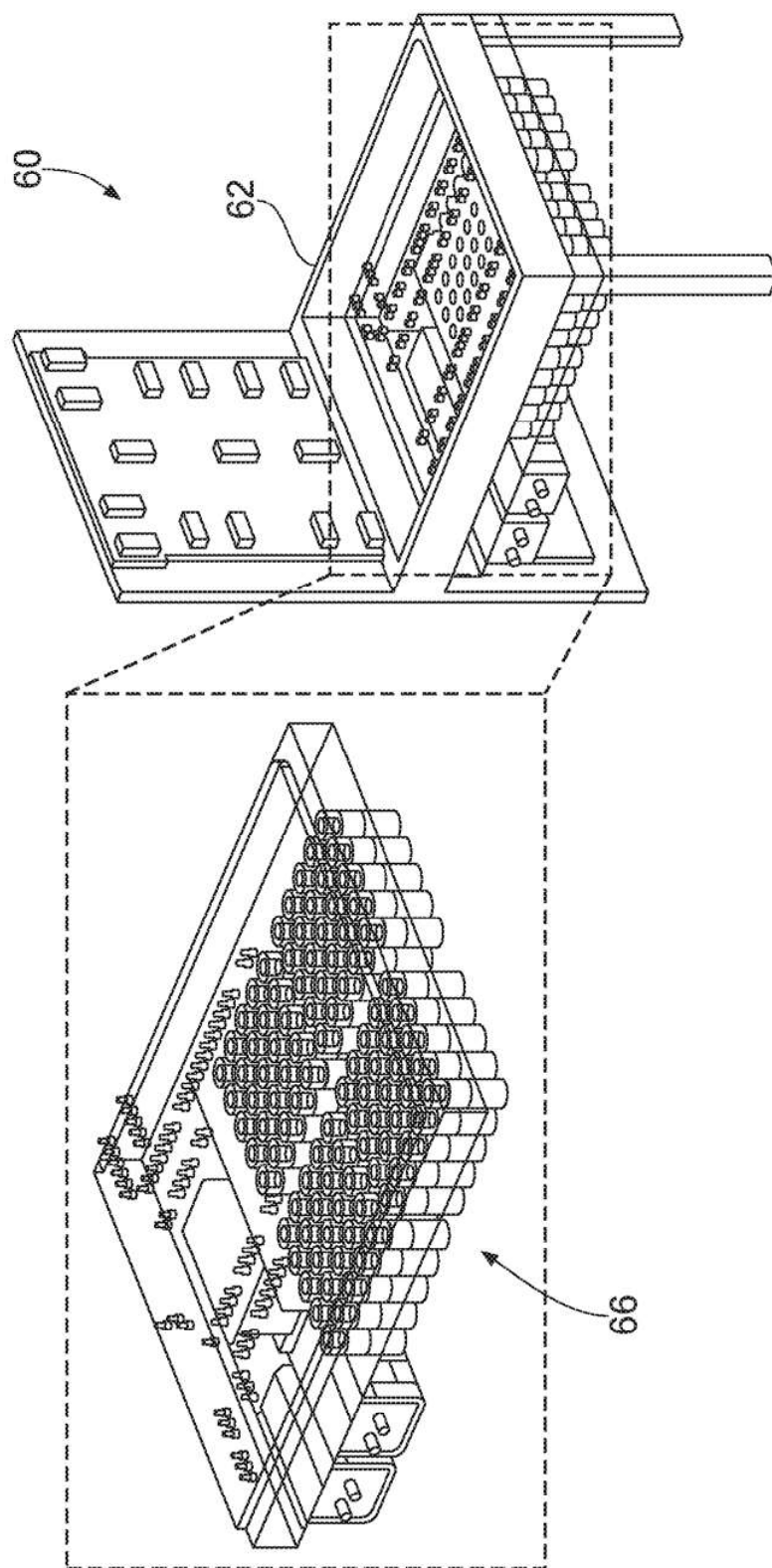
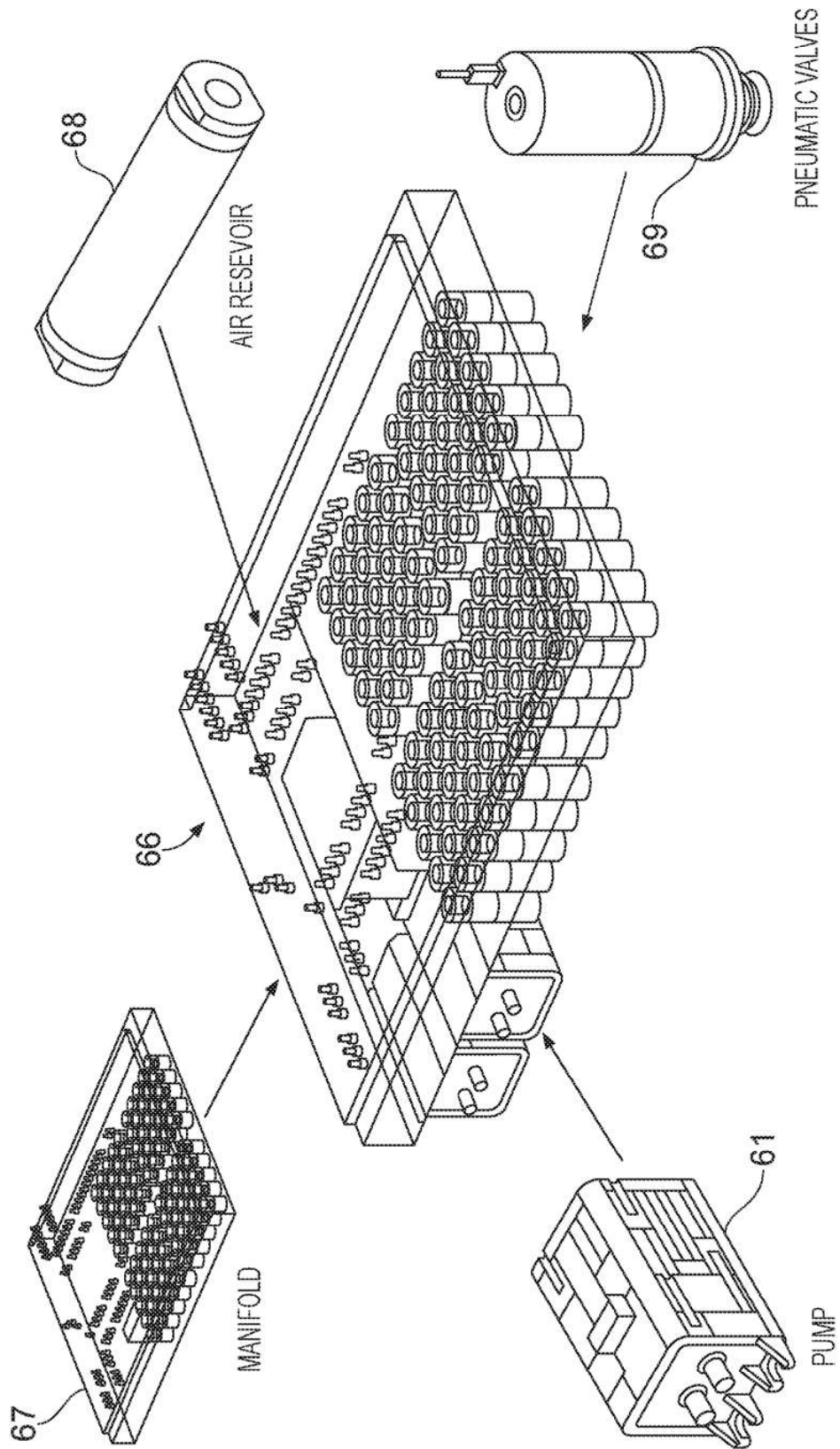
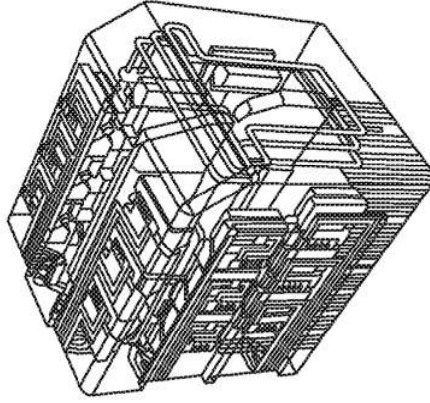


FIG. 32



Step 1.1c - Determine Liquid packet & clock cycle parameters

Liquids per sub-experiment	Volume per sub-experiment (mL)	Total number of sub-experiments (i.e. reaction vessels)	Liquid 'packet' size - See Note 1	Clock cycles to transport Liquid 'packet' - see Note 2	Estimated time value for clock cycle [secs] - See Note 3
Sample	2.76	36	4.0	4	28
Buffer	0.695	36	1	1	7
Nuclease-free water	0.695	36	1	1	7



Notes:

1. Liquid packet size - and resulting clock cycle - determined by smallest liquid volume per experiment - (see shaded row)
2. Clock cycle is determined as the time taken to transfer single liquid 'packet' one cartridge bus to another (see image)
3. Time value is an estimate for cartridge development purposes - can be updated later

Clock cycle illustration for single liquid 'packet'		
Clock cycle	Liquid packet Start location	Liquid packet Destination location
1	Sample reservoir	Main bus
2	Main bus	Module sub-bus
3	Module sub-bus	Cache
4	Cache	Core

FIG. 34

Step 1.1c - Identify liquid packets and assign IDs

Experiment	Sub-experiment	Packet ID	Liquid	Volume (mL)	Liquid 'packets'
1	1	S1	Sample	2.76	4
		B1	Buffer	0.695	1
		NW1	Nuclease-free water	0.695	1
	2	S2	Sample	2.76	4
		B2	Buffer	0.695	1
		NW2	Nuclease-free water	0.695	1
2	1	S3	Sample	2.76	4
		B3	Buffer	0.695	1
		NW3	Nuclease-free water	0.695	1
	2	S4	Sample	2.76	4
		B4	Buffer	0.695	1
		NW4	Nuclease-free water	0.695	1
3	1	S5	Sample	2.76	4
		B5	Buffer	0.695	1
		NW5	Nuclease-free water	0.695	1
	2	S6	Sample	2.76	4
		B6	Buffer	0.695	1
		NW6	Nuclease-free water	0.695	1
4	1	S7	Sample	2.76	4
		B7	Buffer	0.695	1
		NW7	Nuclease-free water	0.695	1
	2	S8	Sample	2.76	4
		B8	Buffer	0.695	1
		NW8	Nuclease-free water	0.695	1
5	1	S9	Sample	2.76	4
		B9	Buffer	0.695	1
		NW9	Nuclease-free water	0.695	1
	2	S10	Sample	2.76	4
		B10	Buffer	0.695	1
		NW10	Nuclease-free water	0.695	1
6	1	S11	Sample	2.76	4
		B11	Buffer	0.695	1
		NW11	Nuclease-free water	0.695	1
	2	S12	Sample	2.76	4
		B12	Buffer	0.695	1
		NW12	Nuclease-free water	0.695	1

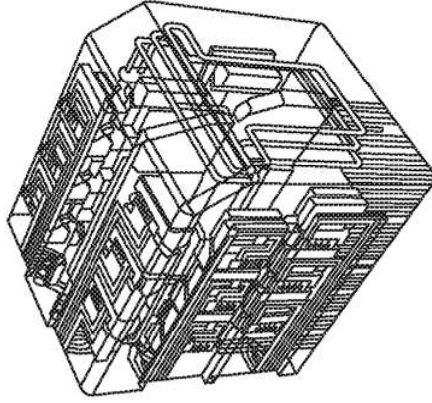
FIG. 35

7	1	S13	Sample	2.76	4
		B13	Buffer	0.695	1
		NW13	Nuclease-free water	0.695	1
	2	S14	Sample	2.76	4
		B14	Buffer	0.695	1
		NW14	Nuclease-free water	0.695	1
8	1	S15	Sample	2.76	4
		B15	Buffer	0.695	1
		NW15	Nuclease-free water	0.695	1
	2	S16	Sample	2.76	4
		B16	Buffer	0.695	1
		NW16	Nuclease-free water	0.695	1
9	1	S17	Sample	2.76	4
		B17	Buffer	0.695	1
		NW17	Nuclease-free water	0.695	1
	2	S18	Sample	2.76	4
		B18	Buffer	0.695	1
		NW18	Nuclease-free water	0.695	1
10	1	S19	Sample	2.76	4
		B19	Buffer	0.695	1
		NW19	Nuclease-free water	0.695	1
	2	S20	Sample	2.76	4
		B20	Buffer	0.695	1
		NW20	Nuclease-free water	0.695	1
11	1	S21	Sample	2.76	4
		B21	Buffer	0.695	1
		NW21	Nuclease-free water	0.695	1
	2	S22	Sample	2.76	4
		B22	Buffer	0.695	1
		NW22	Nuclease-free water	0.695	1
12	1	S23	Sample	2.76	4
		B23	Buffer	0.695	1
		NW23	Nuclease-free water	0.695	1
	2	S24	Sample	2.76	4
		B24	Buffer	0.695	1
		NW24	Nuclease-free water	0.695	1
	3	S25	Sample	2.76	4
		B25	Buffer	0.695	1
		NW25	Nuclease-free water	0.695	1

FIG. 35 (Continued)

Step 1.1c - Determine Liquid packet & clock cycle parameters

Liquids per sub-experiment	Volume per sub-experiment (mL)	Total number of sub-experiments (i.e. reaction vessels)	Liquid 'packet' size - See Note 1	Clock cycles to transport Liquid 'packet' - see Note 2	Estimated time value for clock cycle [secs] - See Note 3
Sample	2.76	36	4.0	4	28
Buffer	0.695	36	1	1	7
Nuclease-free water	0.695	36	1	1	7



Notes:

1. Liquid packet size - and resulting clock cycle - determined by smallest liquid volume per experiment - (see shaded row)
2. Clock cycle is determined as the time taken to transfer single liquid 'packet' one cartridge bus to another (see image)
3. Time value is an estimate for cartridge development purposes - can be updated later

Clock cycle illustration for single liquid 'packet'		
Clock cycle	Liquid packet Start location	Liquid packet Destination location
1	Sample reservoir	Main bus
2	Main bus	Module sub-bus
3	Module sub-bus	Cache
4	Cache	Core

FIG. 36

(A)

Pre-experiment fluidic transfer sub-routine										
Liquid 'packet' identification	Elapsed duration (Mins)	0.12	0.23	0.35	0.47	0.58	0.70	0.82	0.93	1.05
	Elapsed duration (secs)	7	14	21	28	35	42	49	56	63
	Clock cycle	1	2	3	4	5	6	7	8	9
S1	Sample	(Liquid Transfer) - Sample Reservoir to sample bus				(Liquid Transfer) - Sample bus to module bus				
B1	Buffer									
NW1	Nuclease-free water									
N/A	Core Optical read (LED & PD)									

FIG. 37

(A)

1.17	1.28	1.40	1.52	1.63	1.75	1.87	1.98	2.10
70	77	84	91	98	105	112	119	126
10	11	12	13	14	15	16	17	18
(Liquid Transfer) - Module bus to core			Wait-Mix with dried reagent & settle					
(Liquid Transfer) - Buffer reservoir to buffer bus	(Liquid Transfer) - Buffer bus to module bus	(Liquid Transfer) - Module bus to Cache 1	(Liquid Transfer) - Module bus to Cache 1	(Liquid Transfer) - Cache 1 to Core	Wait-Mix & settle			
			(Liquid Transfer) - Nuclease-free water reservoir to Nuclease- free water bus	(Liquid Transfer) - Nuclease-free water bus to module bus	(Liquid Transfer) - Module bus to Cache 2	(Liquid Transfer) - Cache 2 to Core	Wait-Mix & settle	
			(Optical read) - confirm Sample in Core		(Optical read) - confirm Buffer in Core		(Optical read) - confirm Nuclease-free water in Core	

FIG. 37 (Continued)

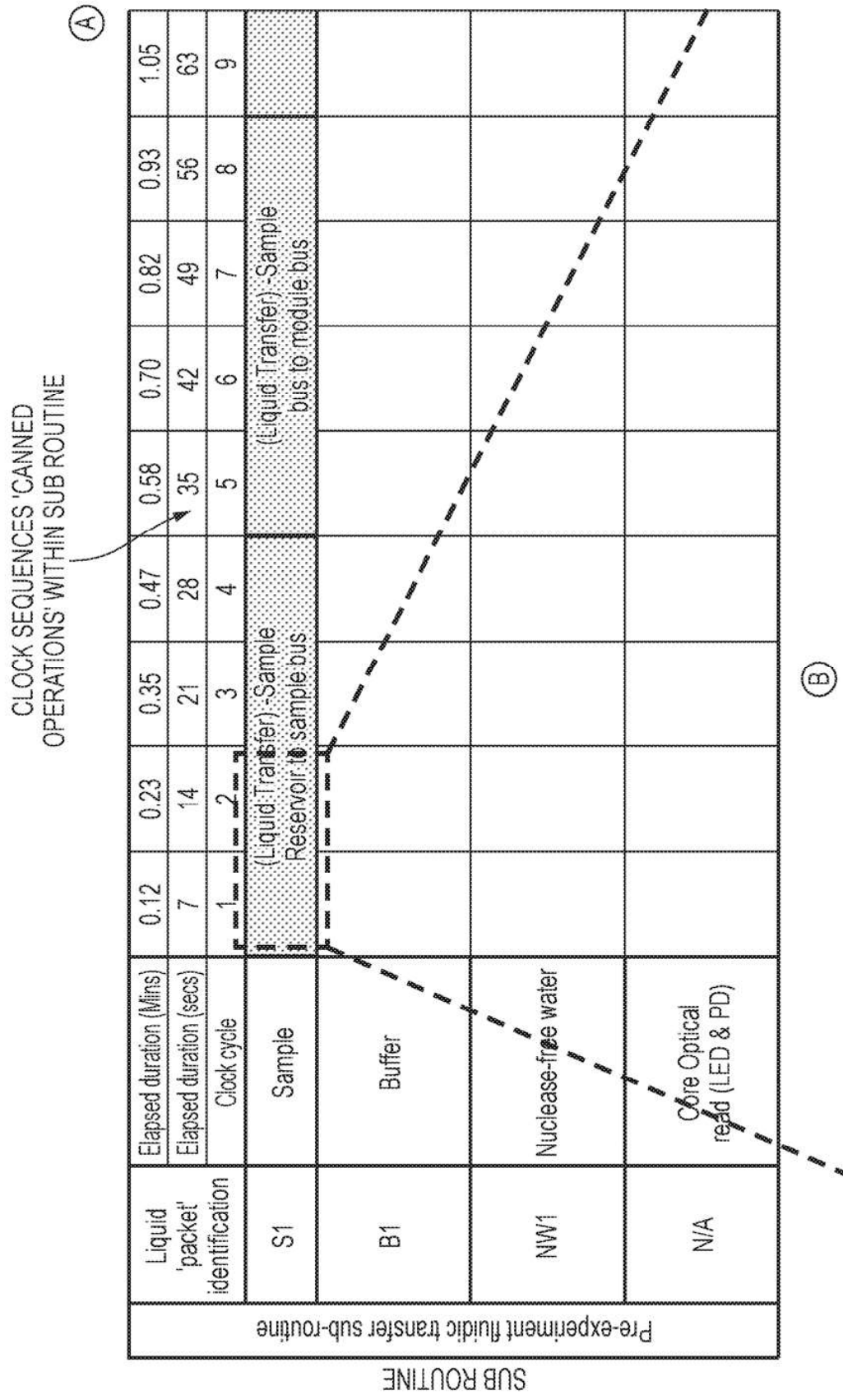


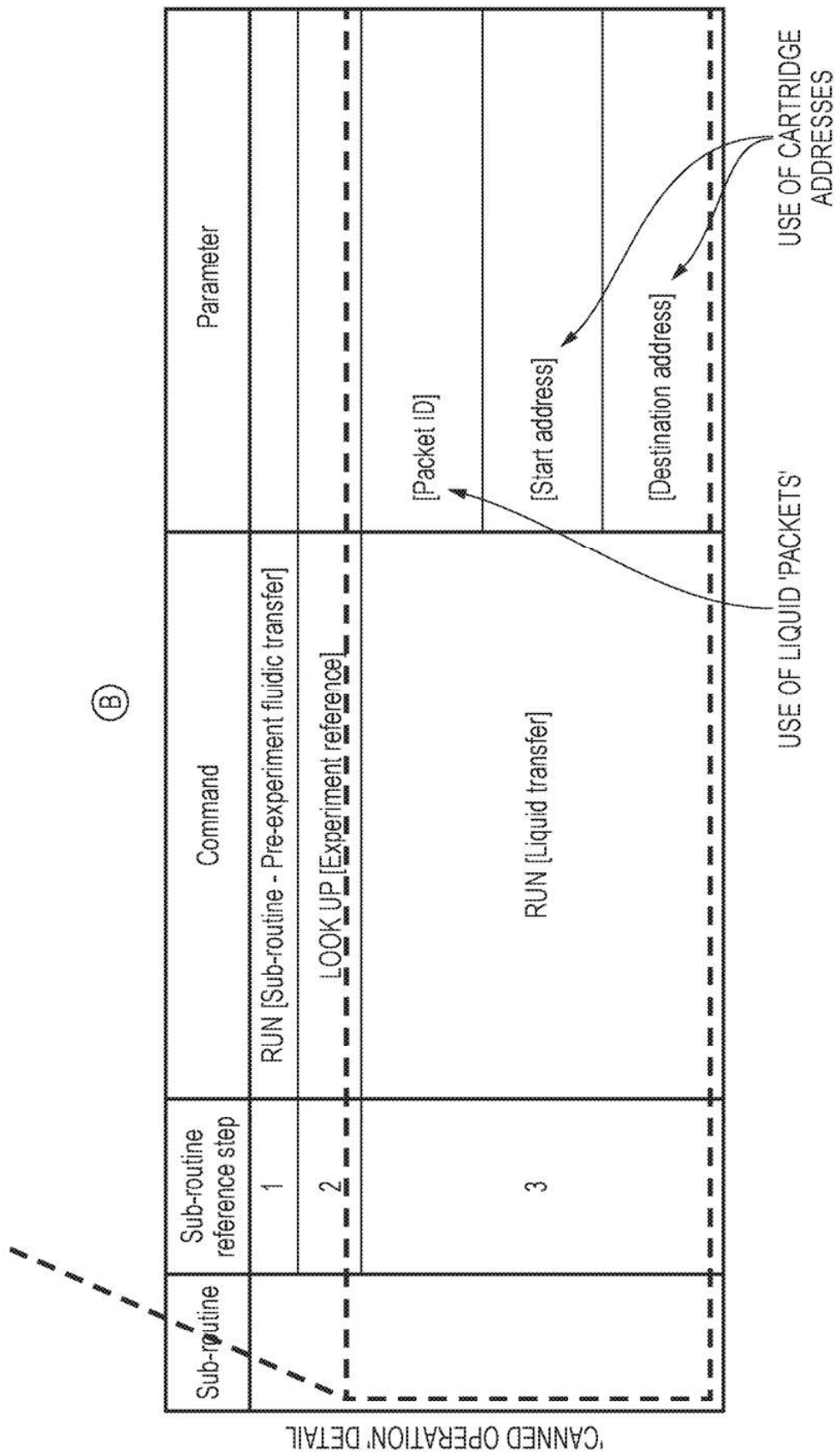
FIG. 38

A

1.17	1.28	1.40	1.52	1.63	1.75	1.87	1.98	2.10
70	77	84	91	98	105	112	119	126
10	11	12	13	14	15	16	17	18
(Liquid Transfer) - Module bus to core			Wait - Mix with dried reagent & settle					
(Liquid Transfer) - Buffer reservoir to buffer bus	(Liquid Transfer) - Buffer bus to module bus	(Liquid Transfer) - Module bus to Cache 1	(Liquid Transfer) - Cache 1 to Core		Wait - Mix & settle			
		(Liquid Transfer) - Nuclease-free water reservoir to Nuclease- free water bus	(Liquid Transfer) - Nuclease-free water bus to module bus		(Liquid Transfer) - Module bus to Cache 2	(Liquid Transfer) - Cache 2 to Core	Wait - Mix & settle	
		(Optical read) - confirm Sample in Core			(Optical read) - confirm Buffer in Core		(Optical read) - confirm Nuclease-free water in Core	

C

FIG. 38 (Continued)



'CANNED OPERATION' DETAIL

(C)

Value	Value - information source	Comment
		Identifies look-up table to use for specific experimental data
	Liquid packet list (see Appendix TBD)	
	Cartridge addressing scheme (see Appendix TBD)	
		Liquid transfer - Sample from Sample Reservoir to Sample bus

(D) FIG. 38 (Continued)

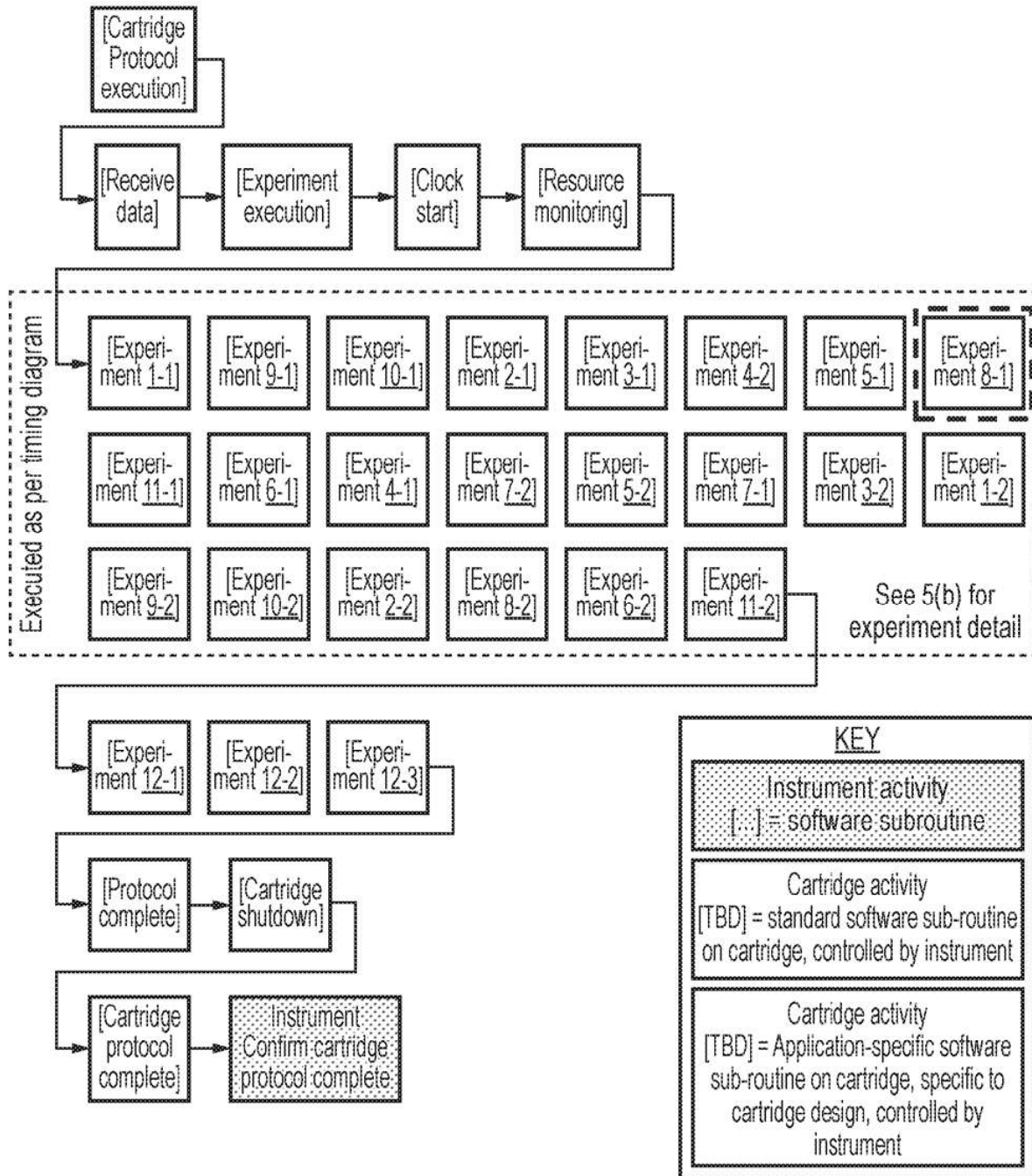
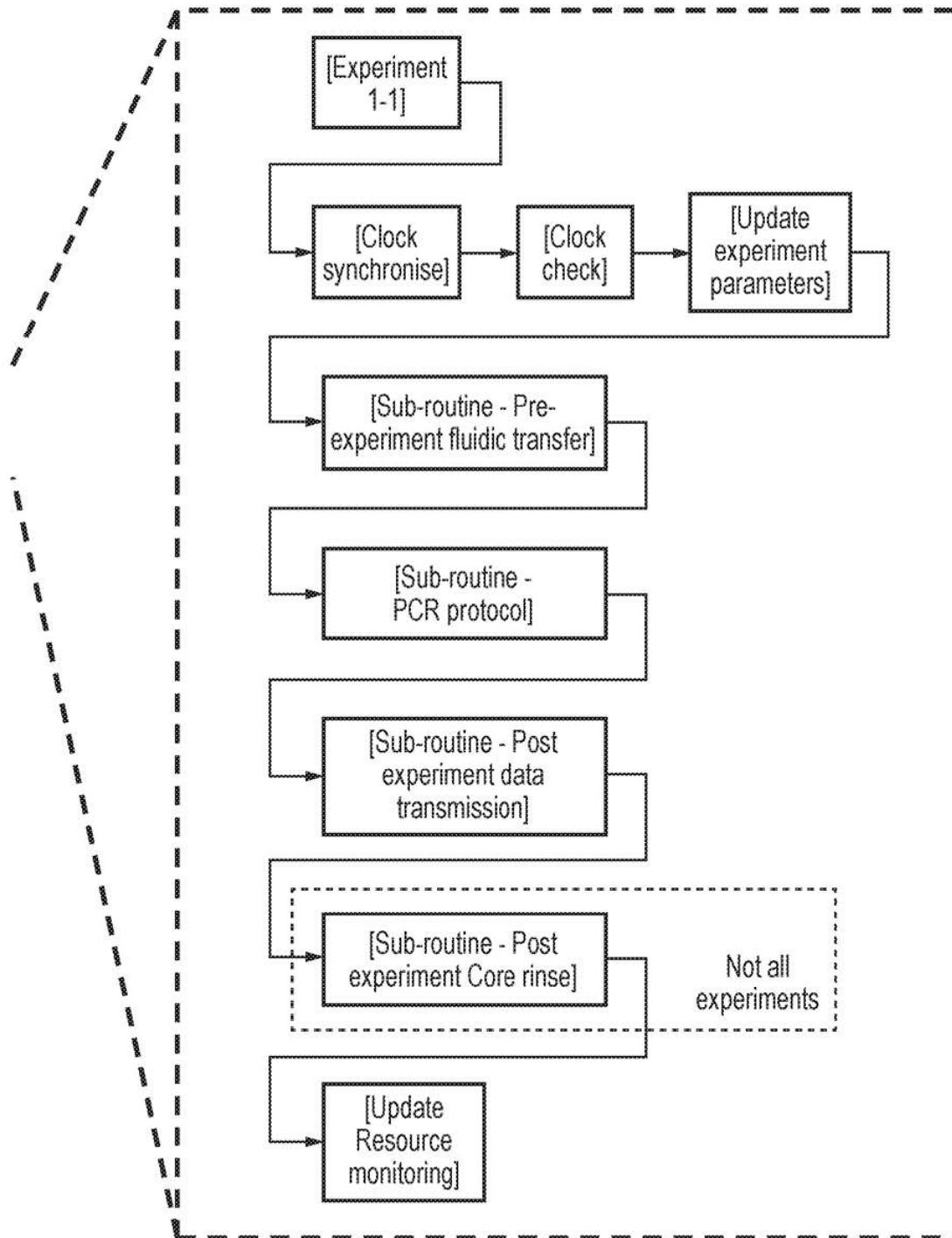


FIG. 39



INDIVIDUAL PCR EXPERIMENT EXECUTION LOGIC

FIG. 39 (Continued)

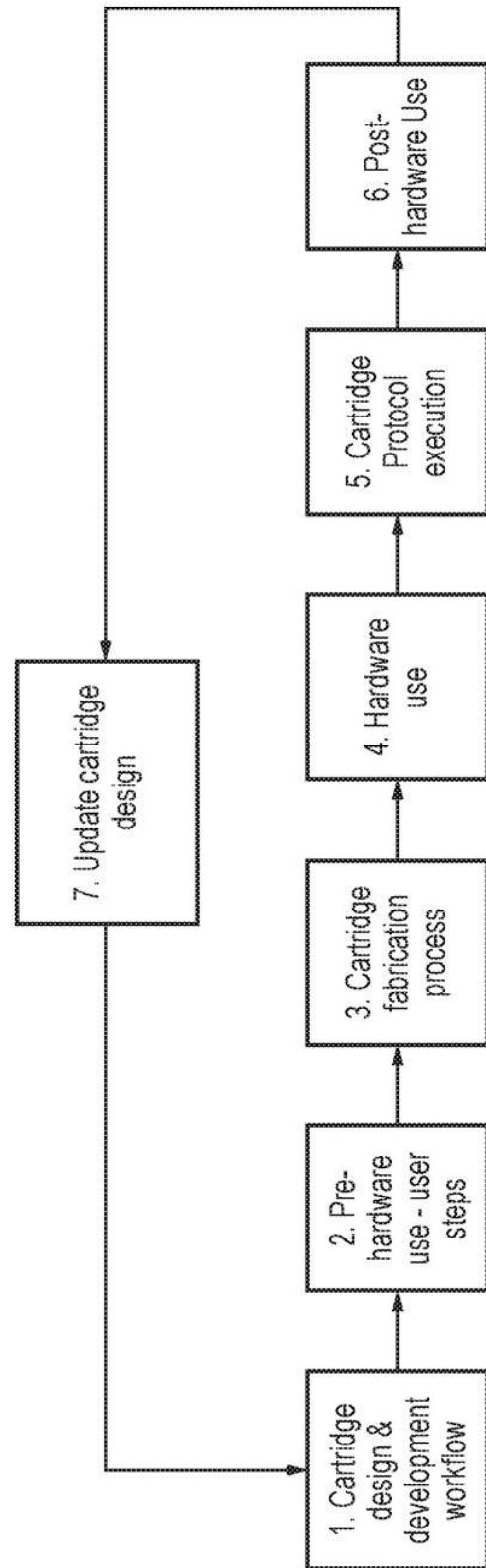


FIG. 40

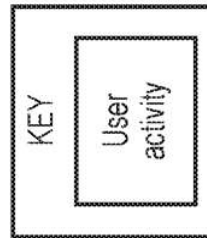
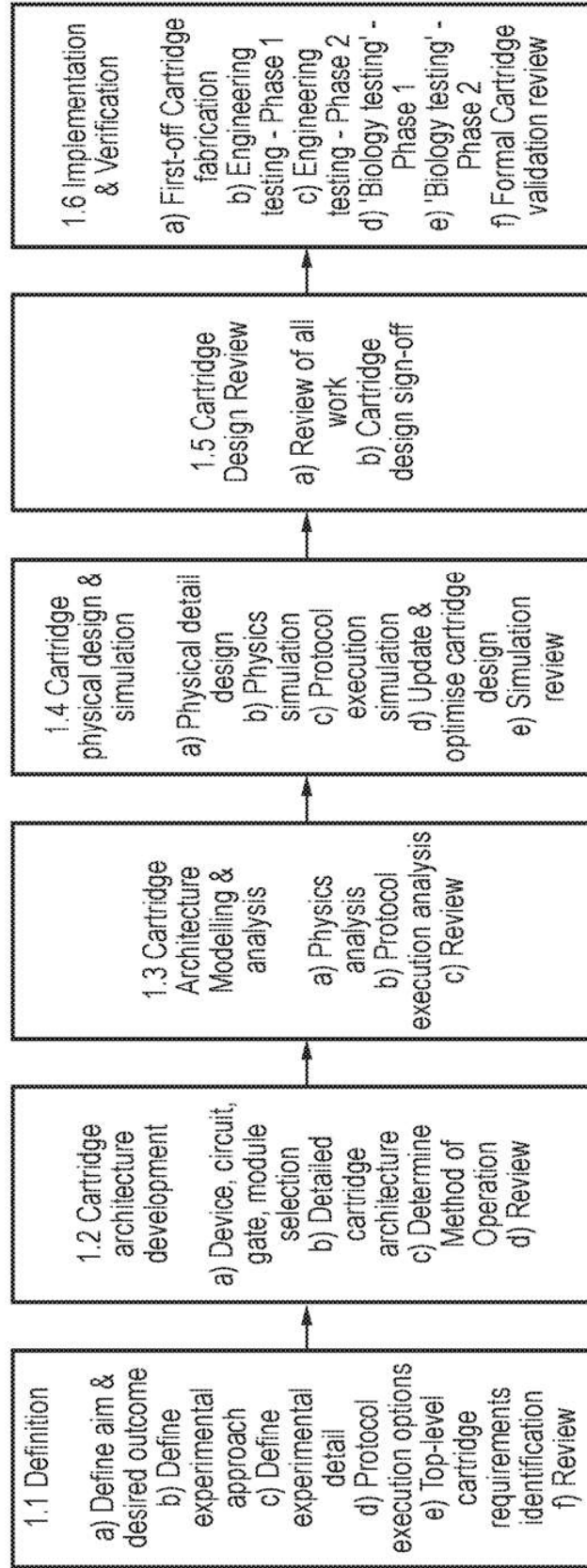


FIG. 41

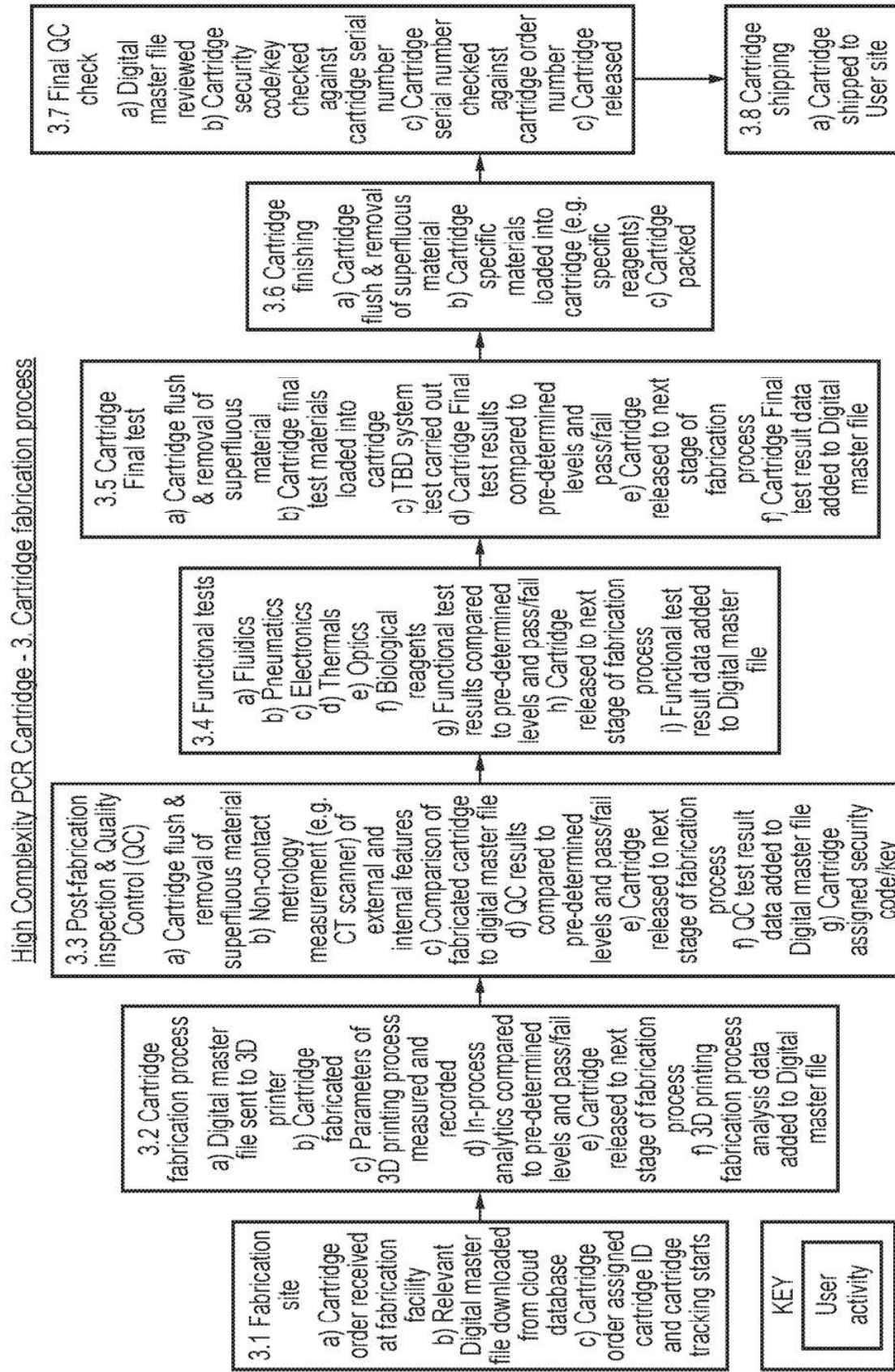


FIG. 42

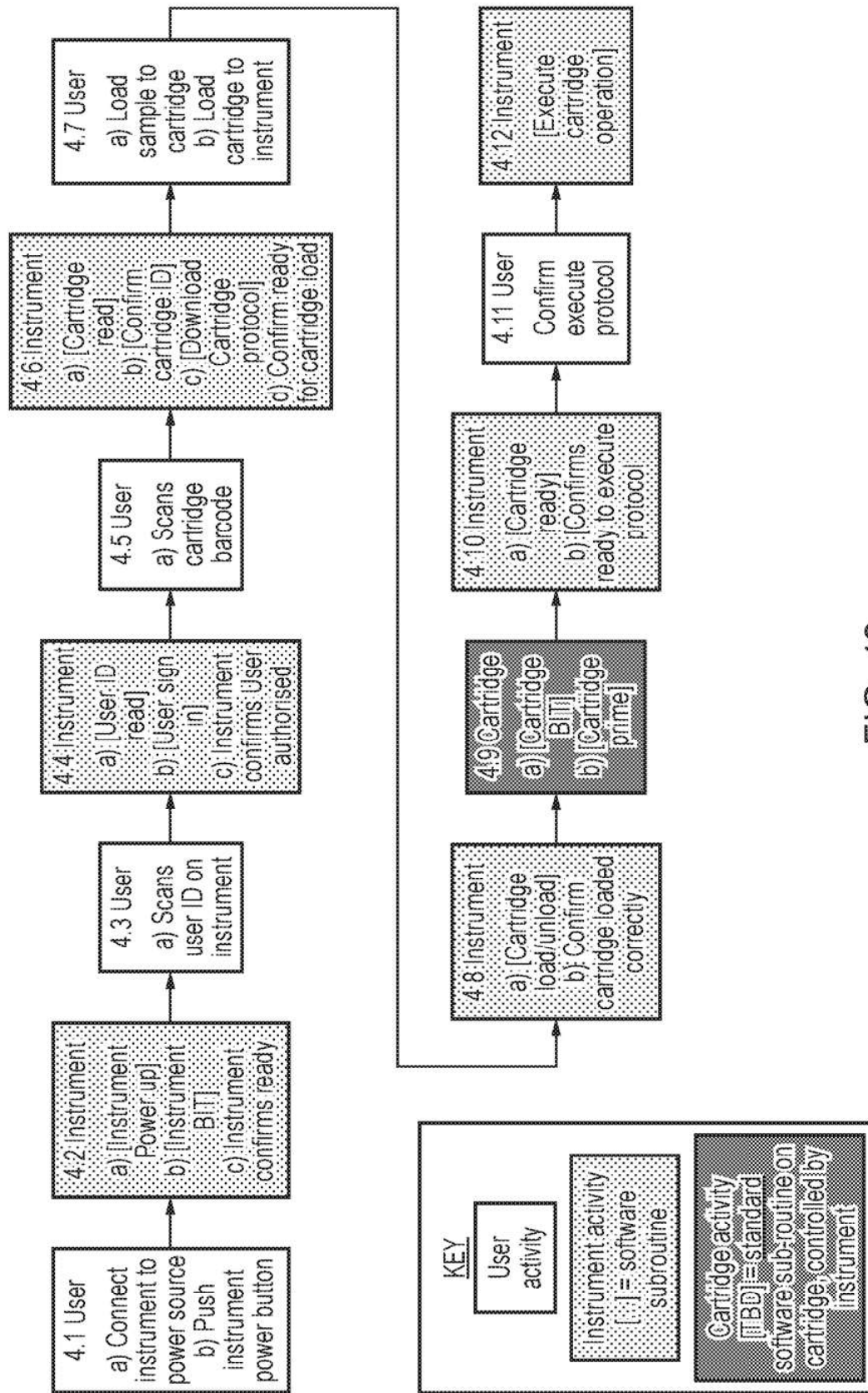


FIG. 43

High Complexity PCR Cartridge - 5(a)
Cartridge Protocol Execution

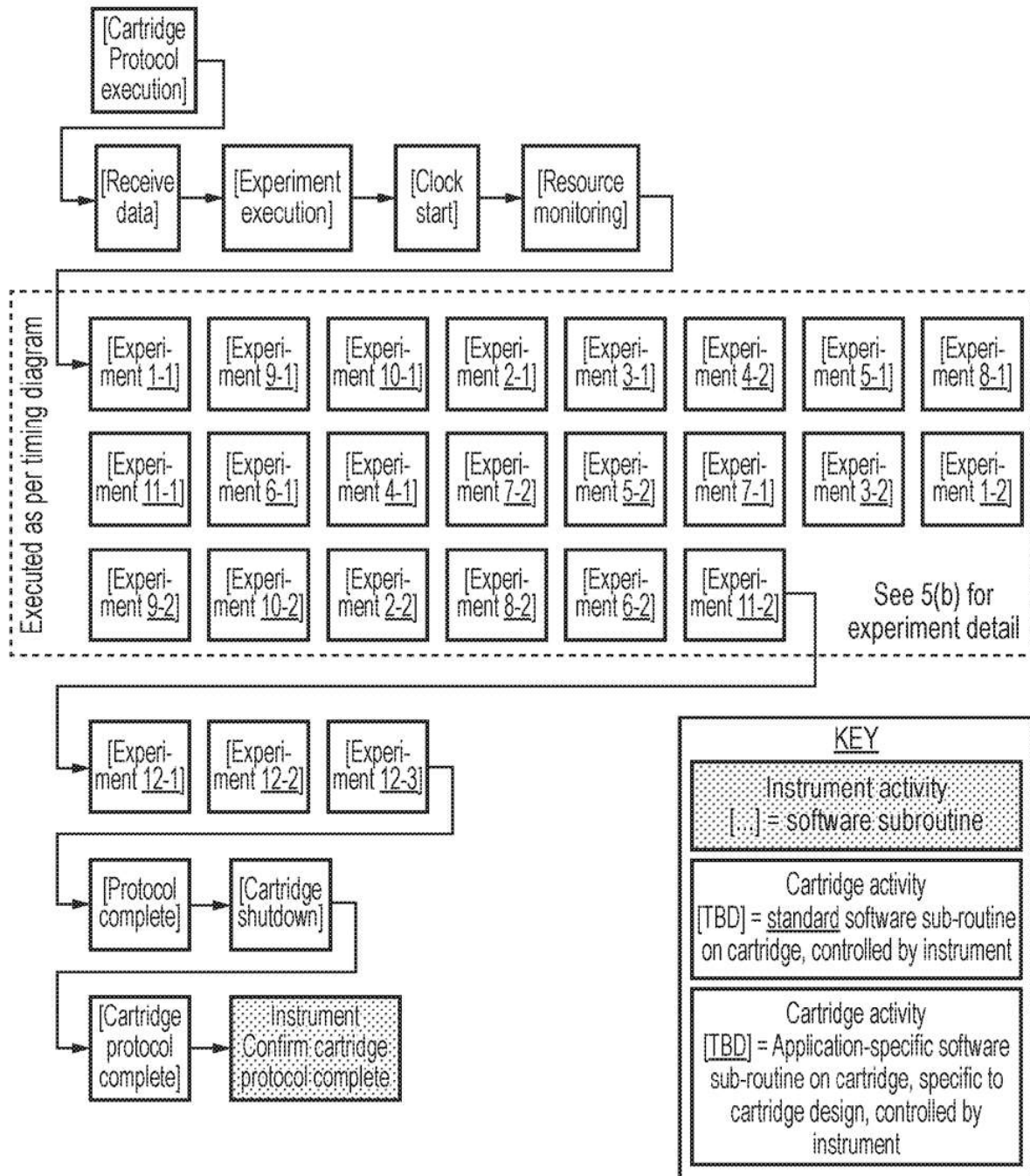


FIG. 44

High Complexity PCR Cartridge - 5(b).
Cartridge Protocol Execution - Experiment

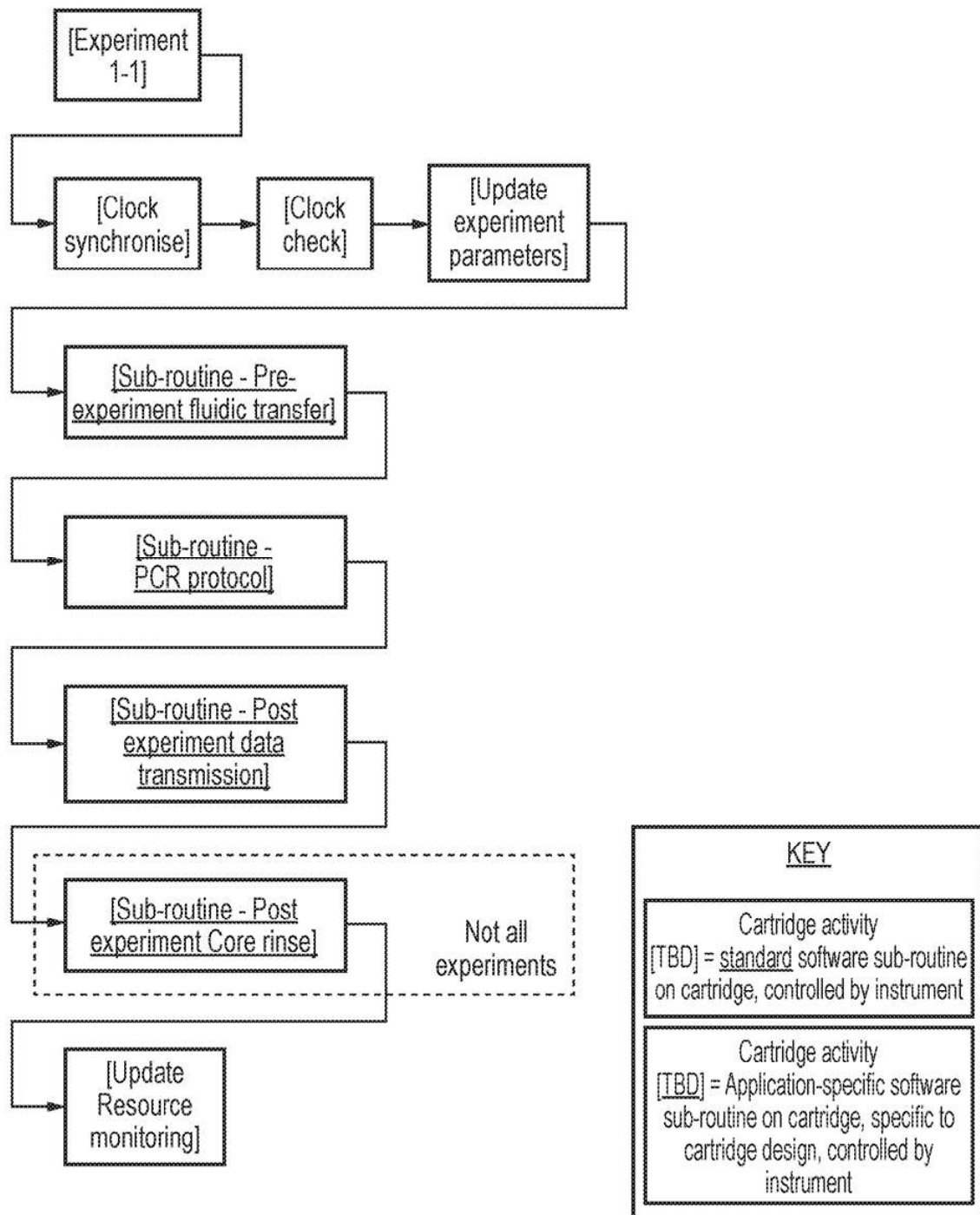


FIG. 45

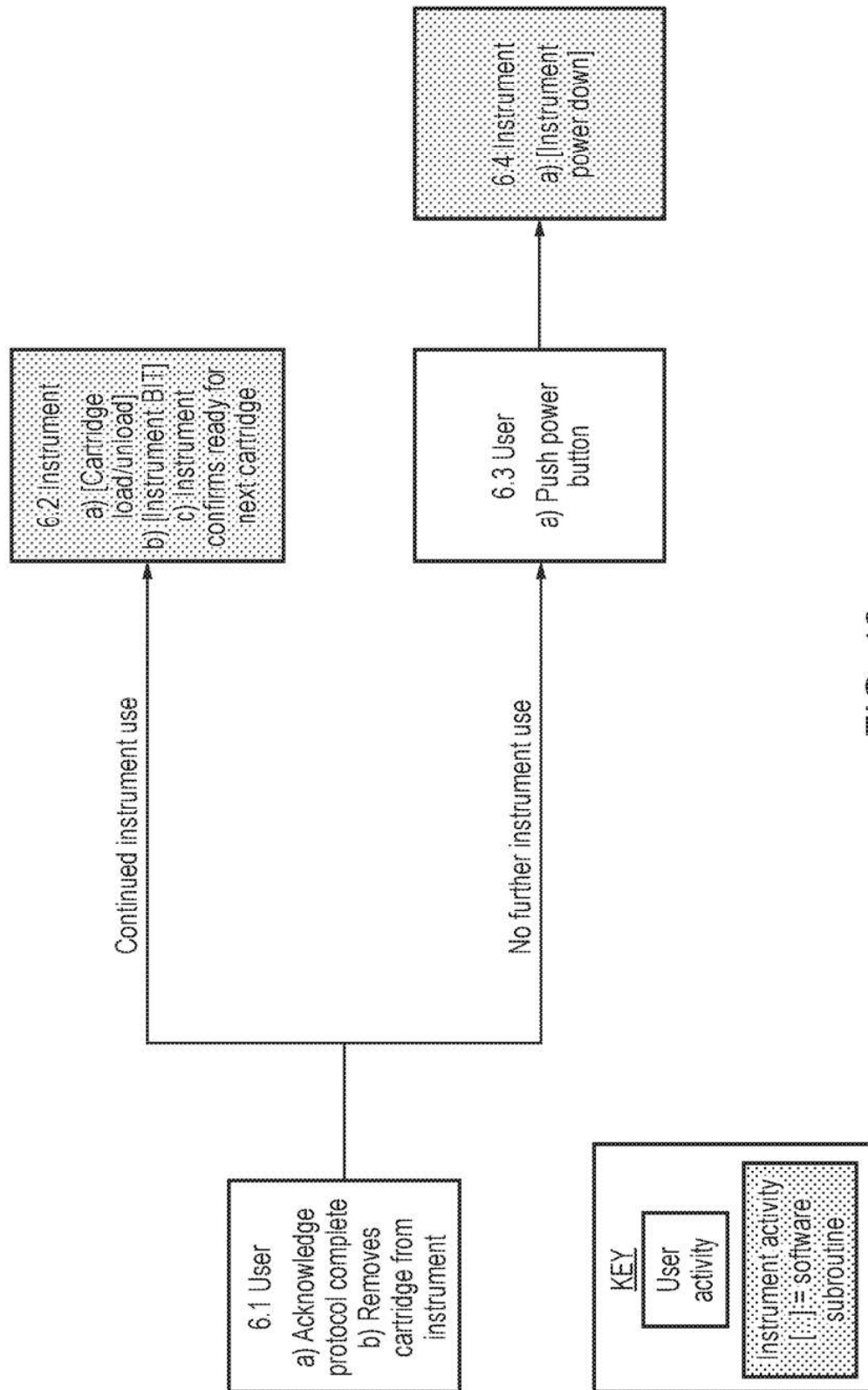


FIG. 46

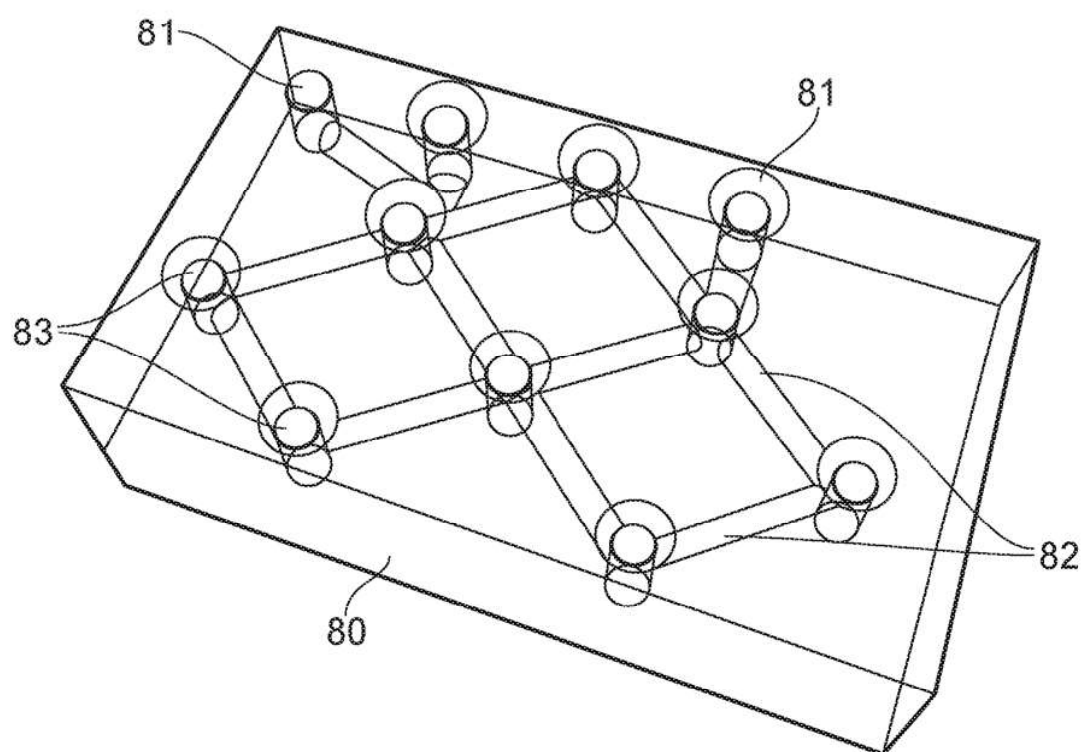


FIG. 47

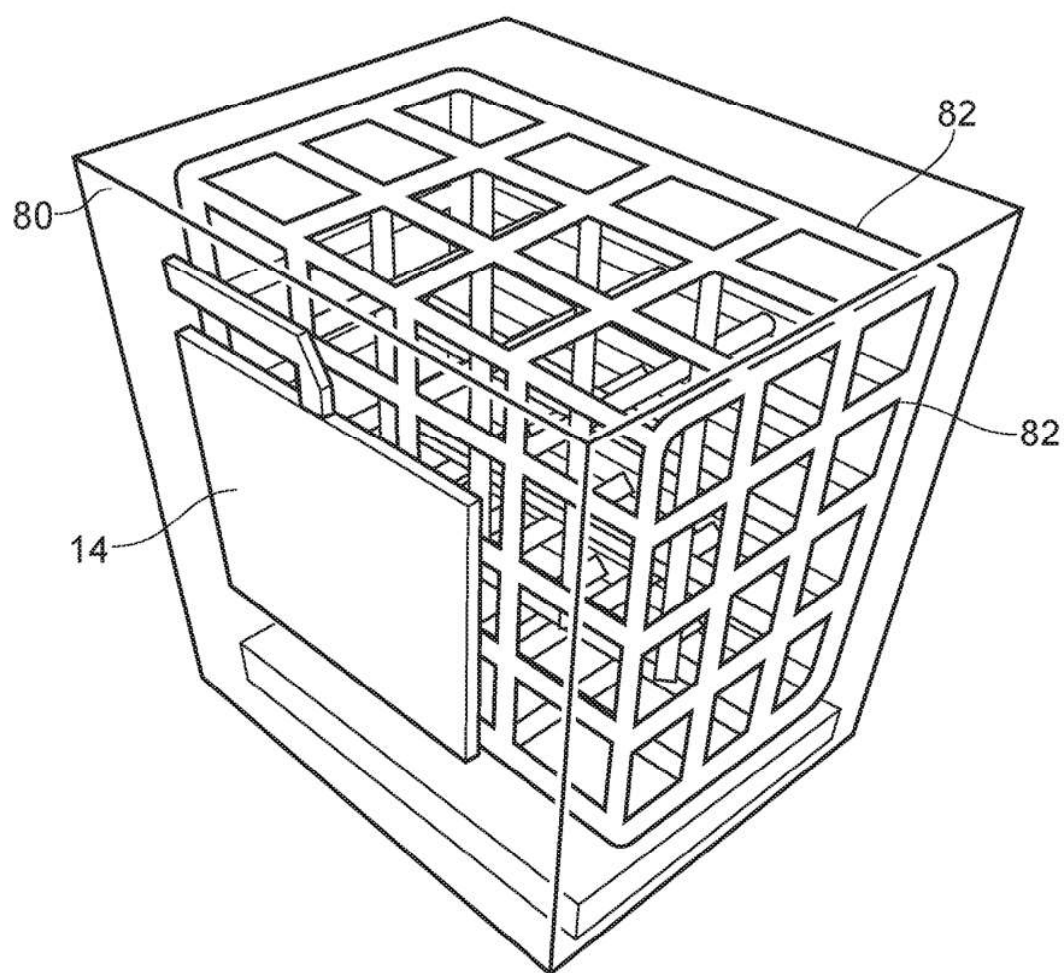


FIG. 48

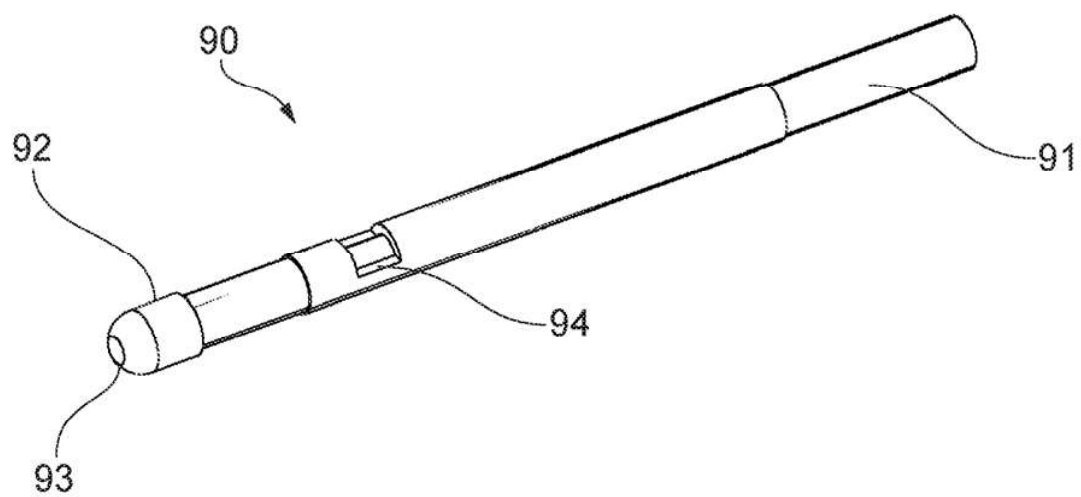


FIG. 49

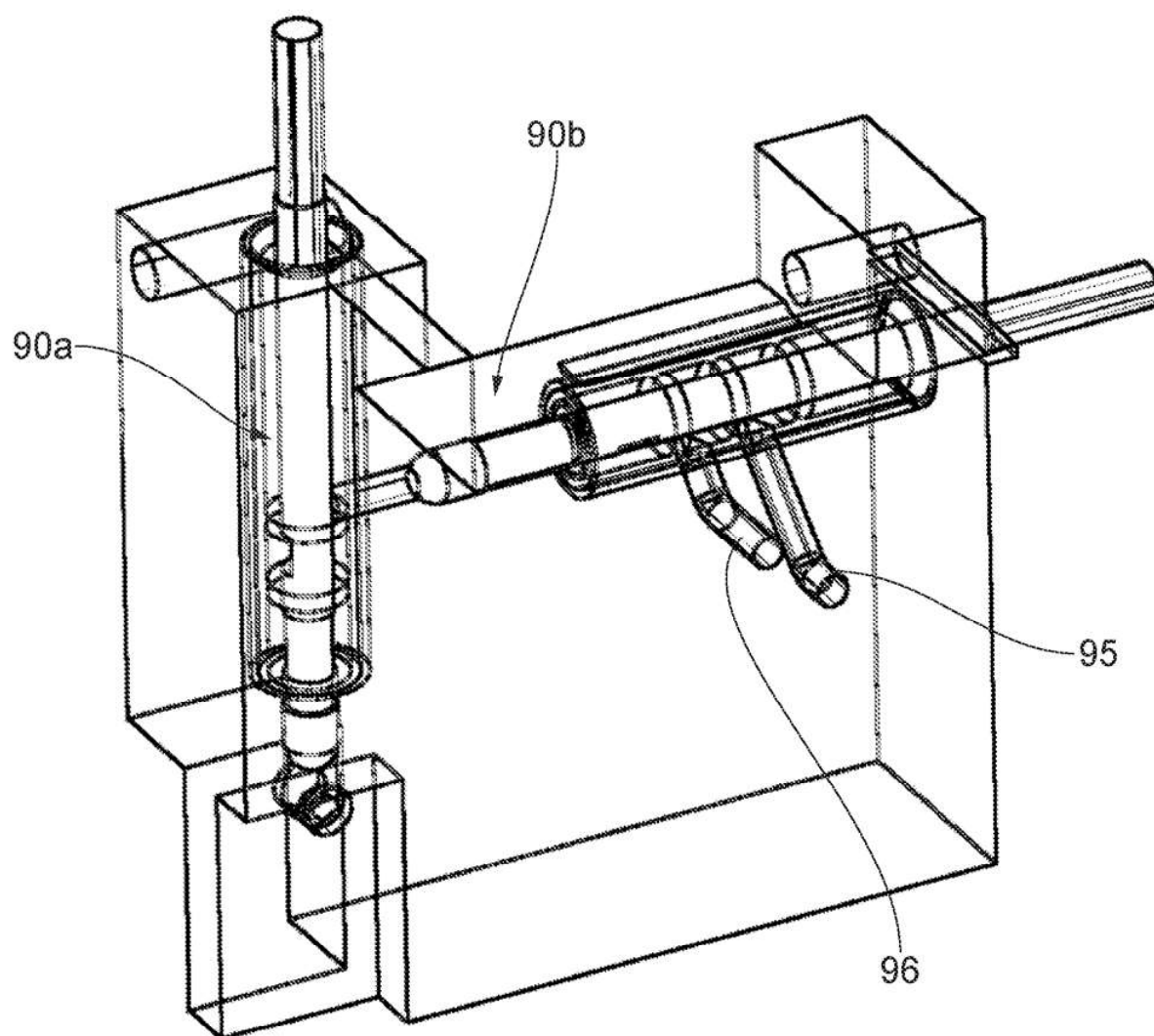


FIG. 50

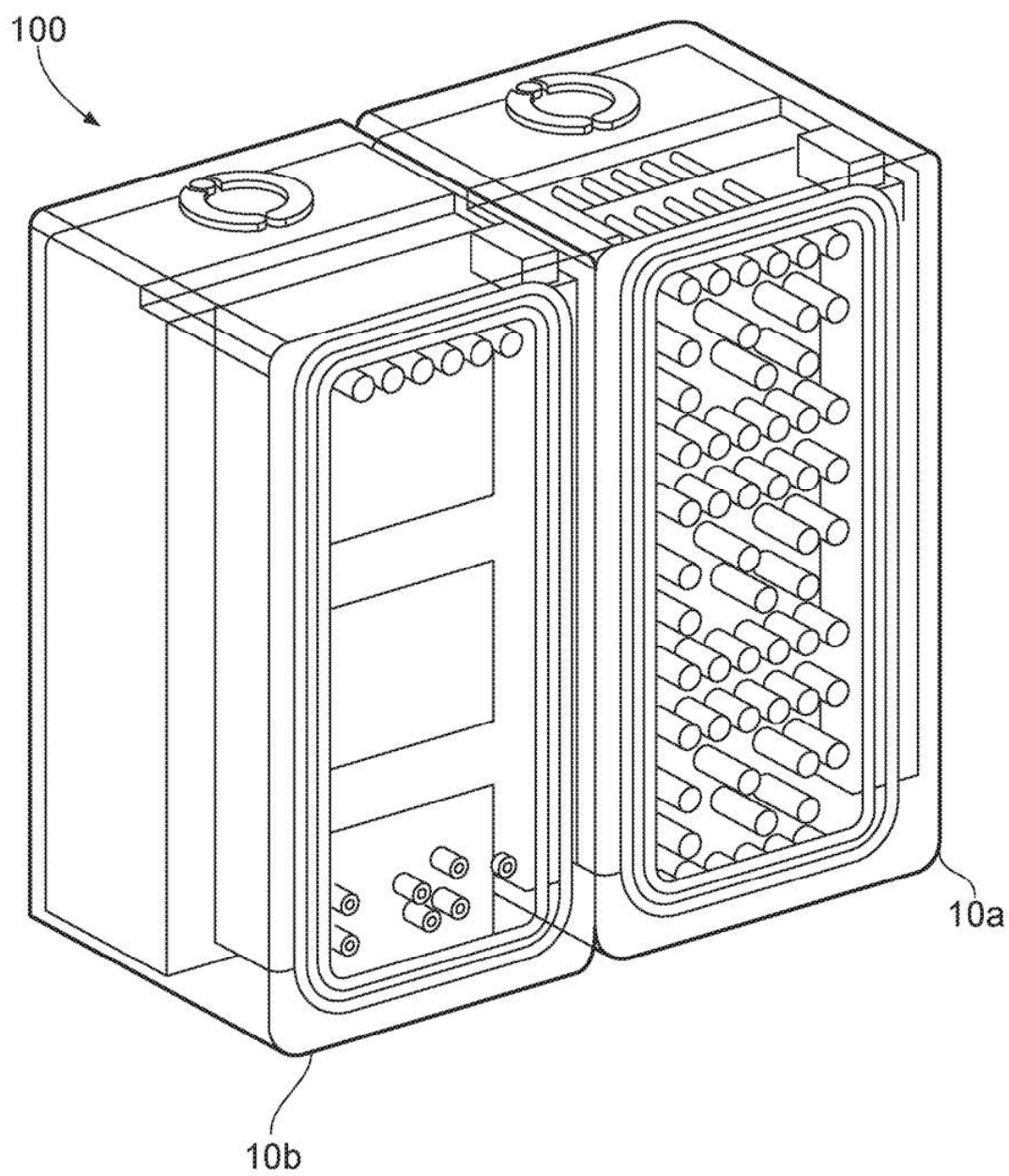


FIG. 51

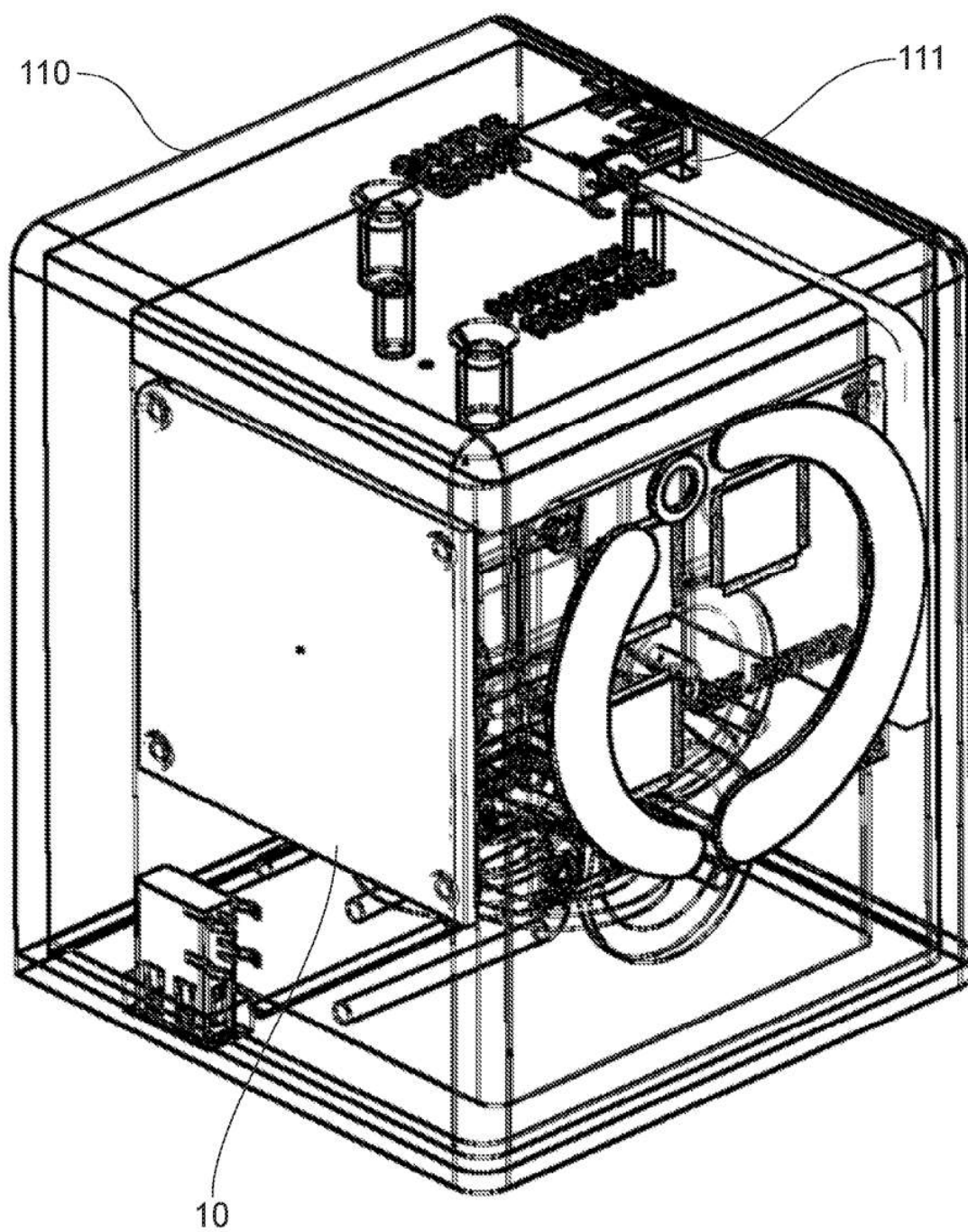


FIG. 52