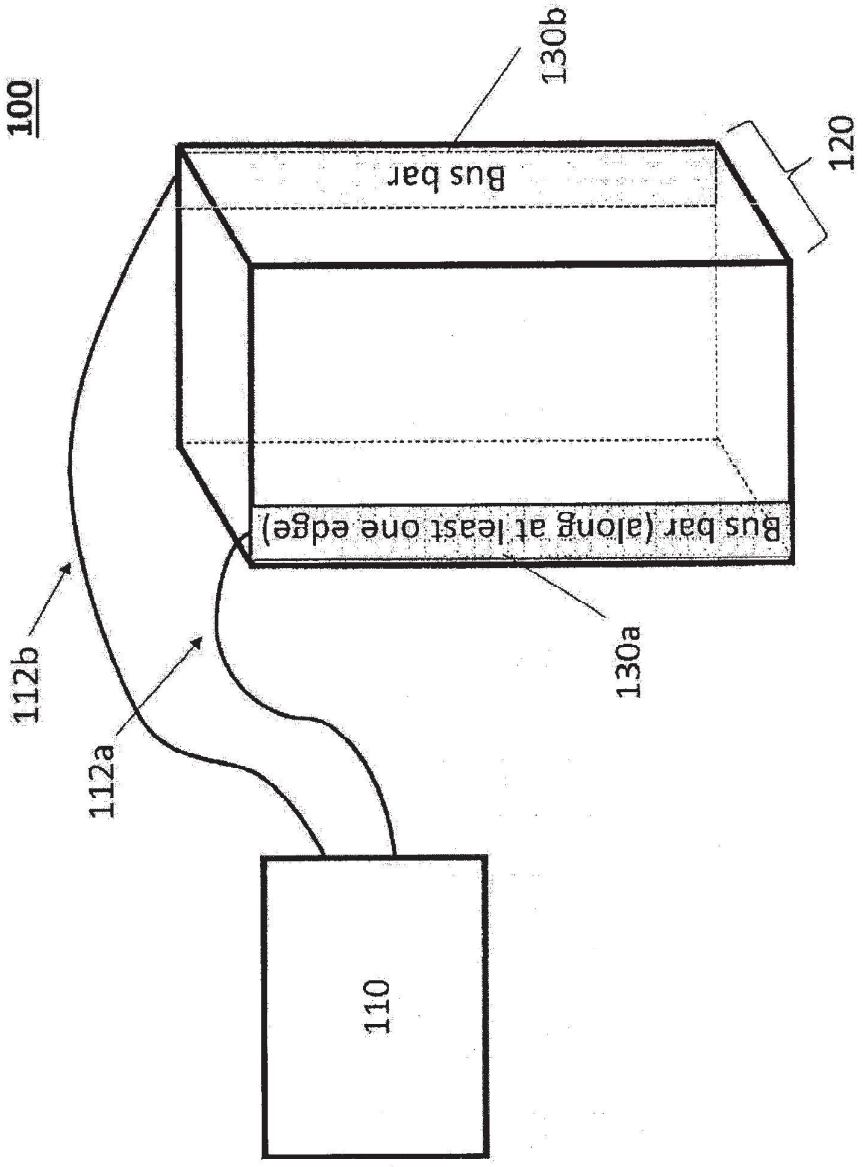

100
130b
120
Bus bar
Bus bar (along at least one edge)
112b
112a
130a
110

FIG.1A

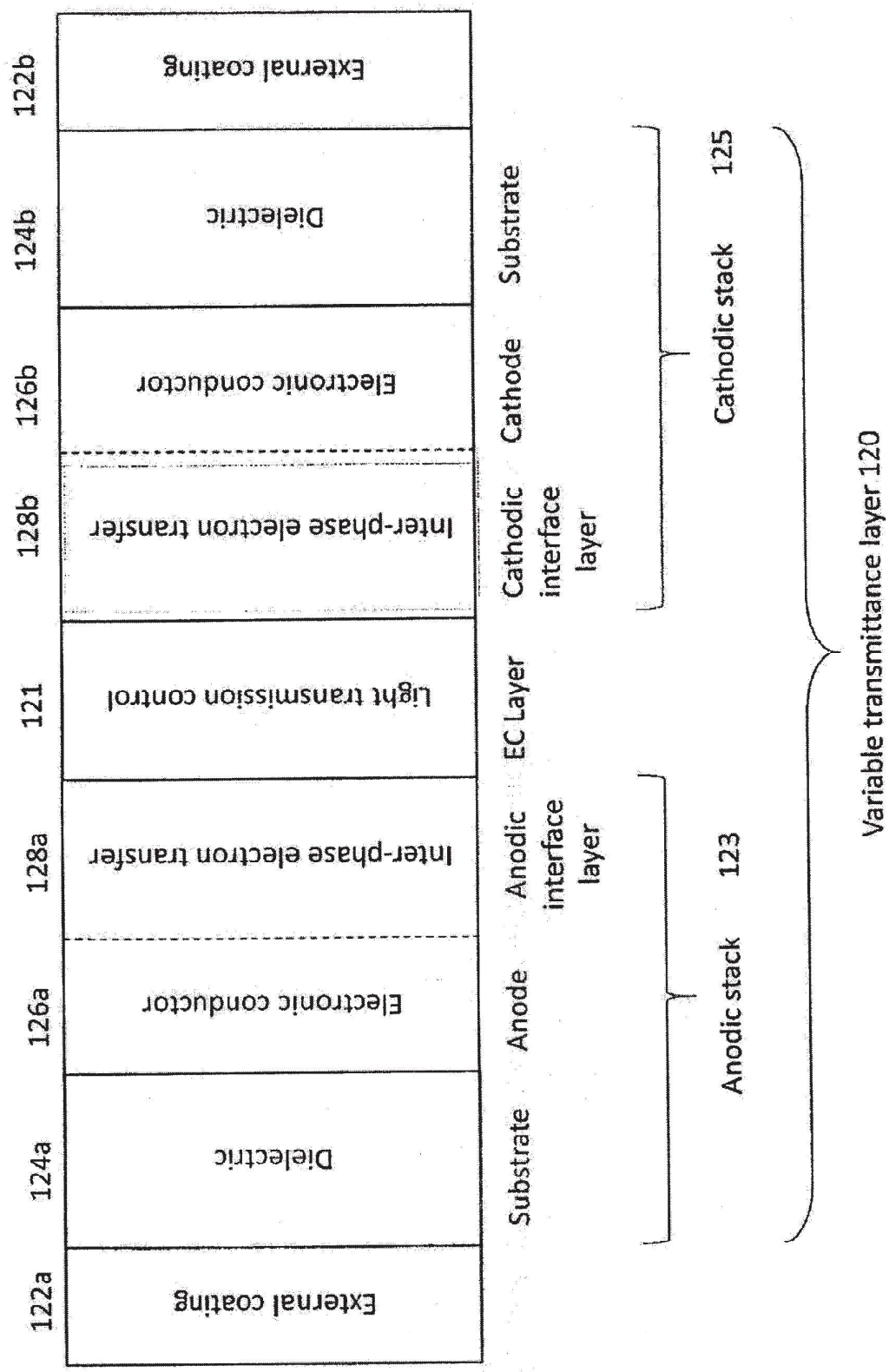

122a
External coating
124a
Dielectric
Substrate
126a
Electronic conductor
Anode
128a
Inter-phase electron transfer
Anodic interface layer
121
Light transmission control
EC Layer
128b
Inter-phase electron transfer
Cathodic interface layer
126b
Electronic conductor
Cathode
124b
Dielectric
Substrate
122b
External coating
Anodic stack 123
Cathodic stack 125
Variable transmittance layer 120

FIG.1B

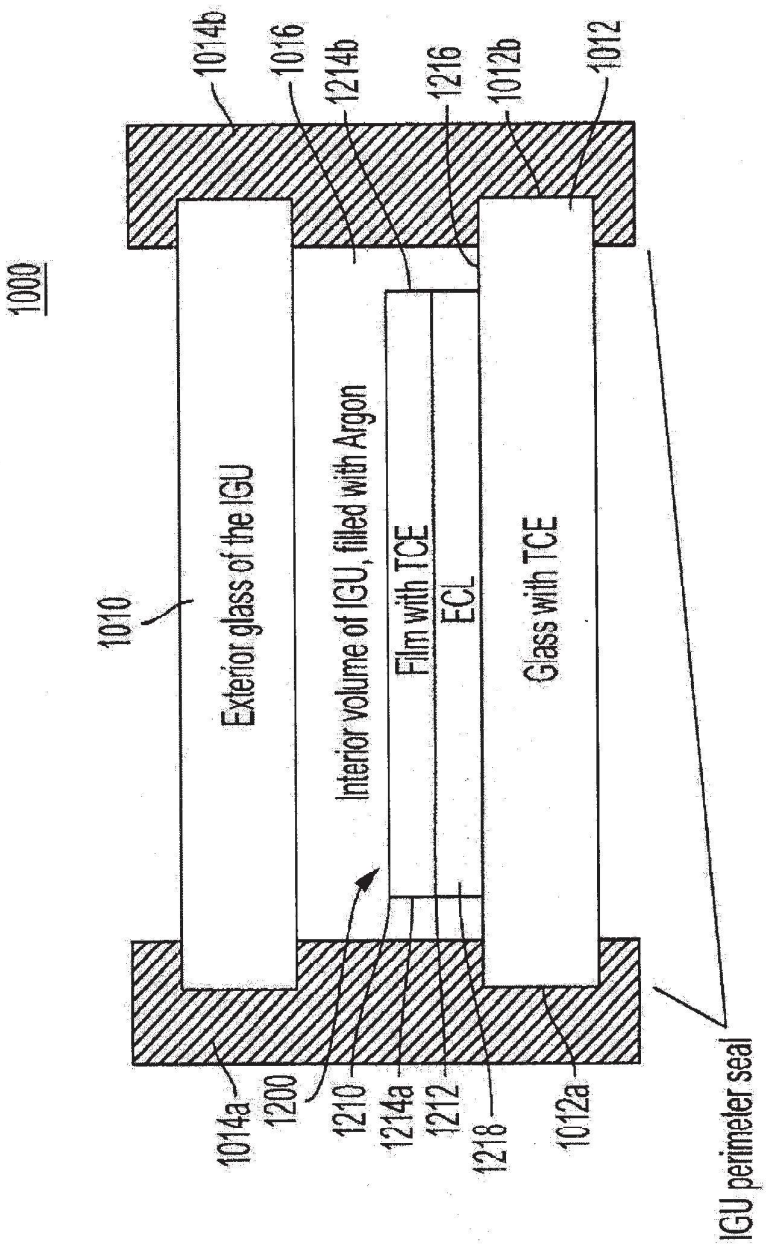

1000
1010
Exterior glass of the IGU
Interior volume of IGU, filled with Argon
Film with TCE
ECL
Glass with TCE
1014b
1016
1214b
1216
1012b
1012
1014a
1200
1210
1214a
1212
1218
1012a
IGU perimeter seal

FIG.1C

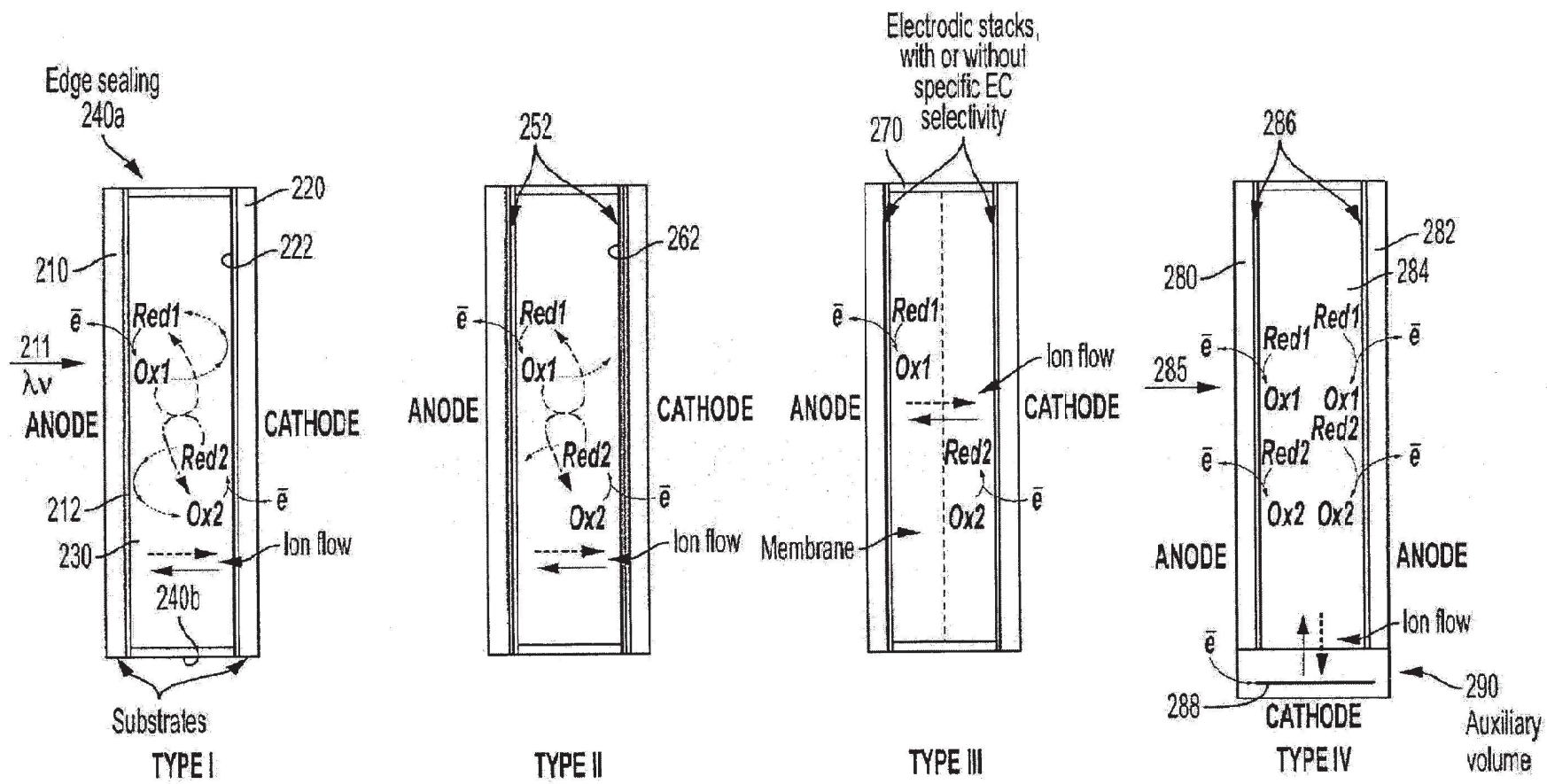

Edge sealing
240a
220
222
210
211
λν
ANODE
CATHODE
Red1
Ox1
Red2
Ox2
212
230
Ion flow
240b
Substrates
TYPE I
252
262
ANODE
CATHODE
Red1
Ox1
Red2
Ox2
Ion flow
TYPE II
Electrodic stacks, with or without specific EC selectivity
270
ANODE
CATHODE
Red1
Ox1
Red2
Ox2
Ion flow
Membrane
TYPE III
286
282
284
280
285
ANODE
ANODE
Red1
Ox1
Red2
Ox2
Ion flow
288
CATHODE
290
Auxiliary volume
TYPE IV

FIG.2

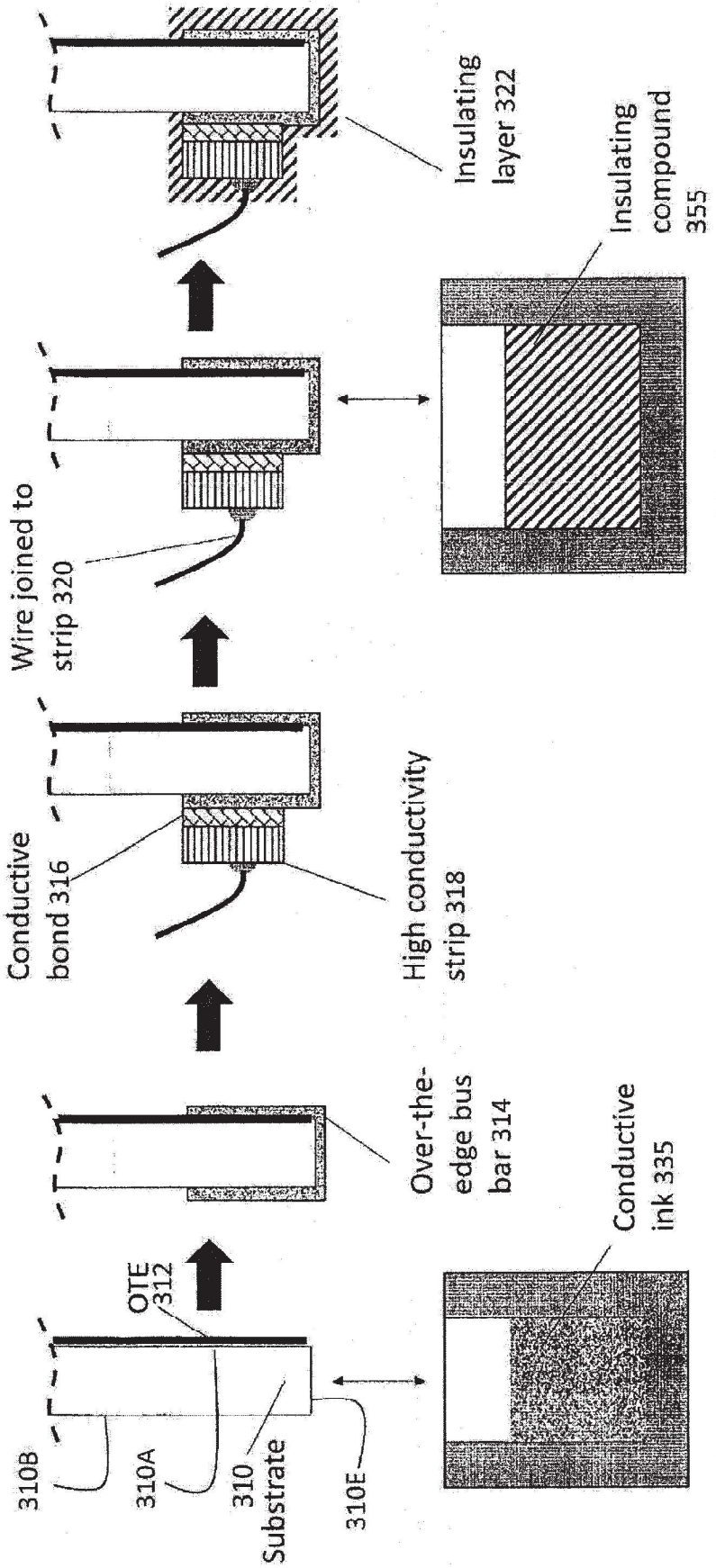

310B
310A
310
Substrate
310E
OTE
312
Over-the-
edge bus
bar 314
Conductive
bond 316
High conductivity
strip 318
Wire joined to
strip 320
Insulating
layer 322
Dipping
bath 1 330
Conductive
ink 335
Dipping
bath 2 350
Insulating
compound
355

FIG.3

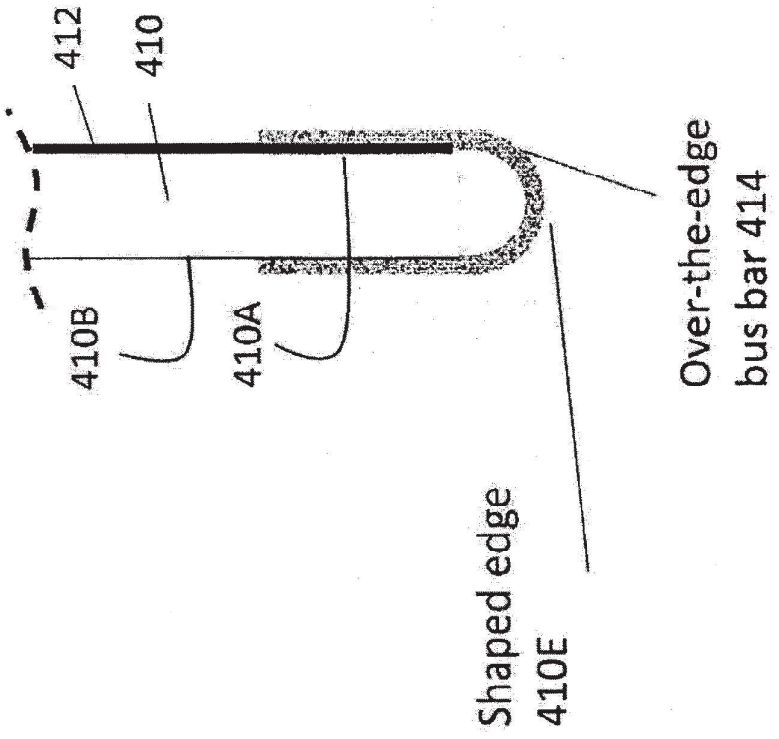


FIG.4

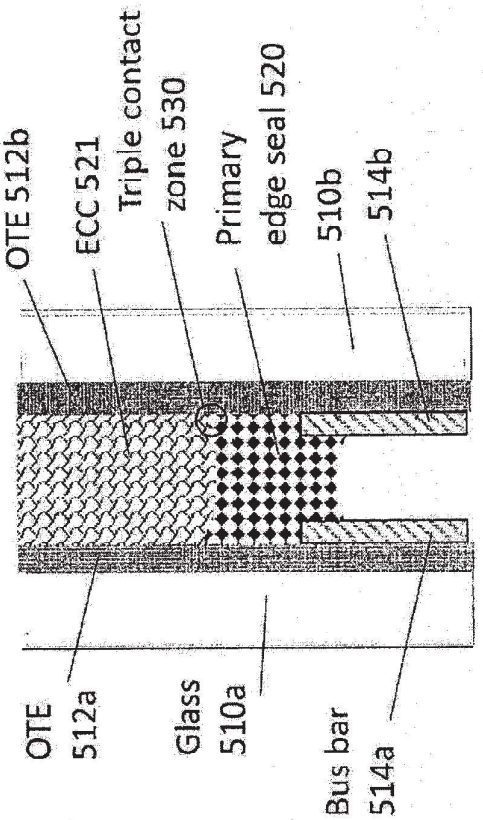

OTE 512b
ECC 521
Triple contact zone 530
Primary edge seal 520
510b
514b
OTE 512a
Glass 510a
Bus bar 514a

FIG.5A

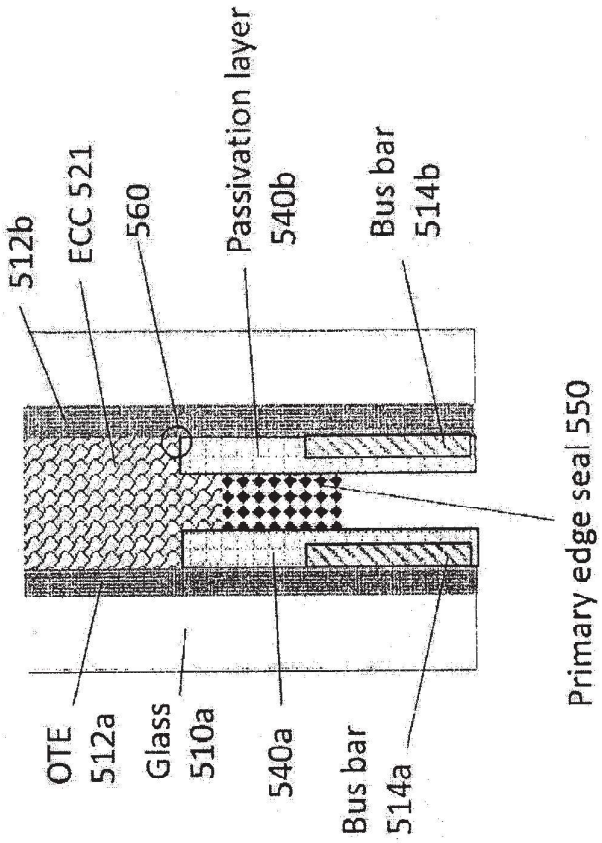

512b
ECC 521
560
Passivation layer 540b
Bus bar 514b
Primary edge seal 550
OTE 512a
Glass 510a
540a
Bus bar 514a

FIG.5B

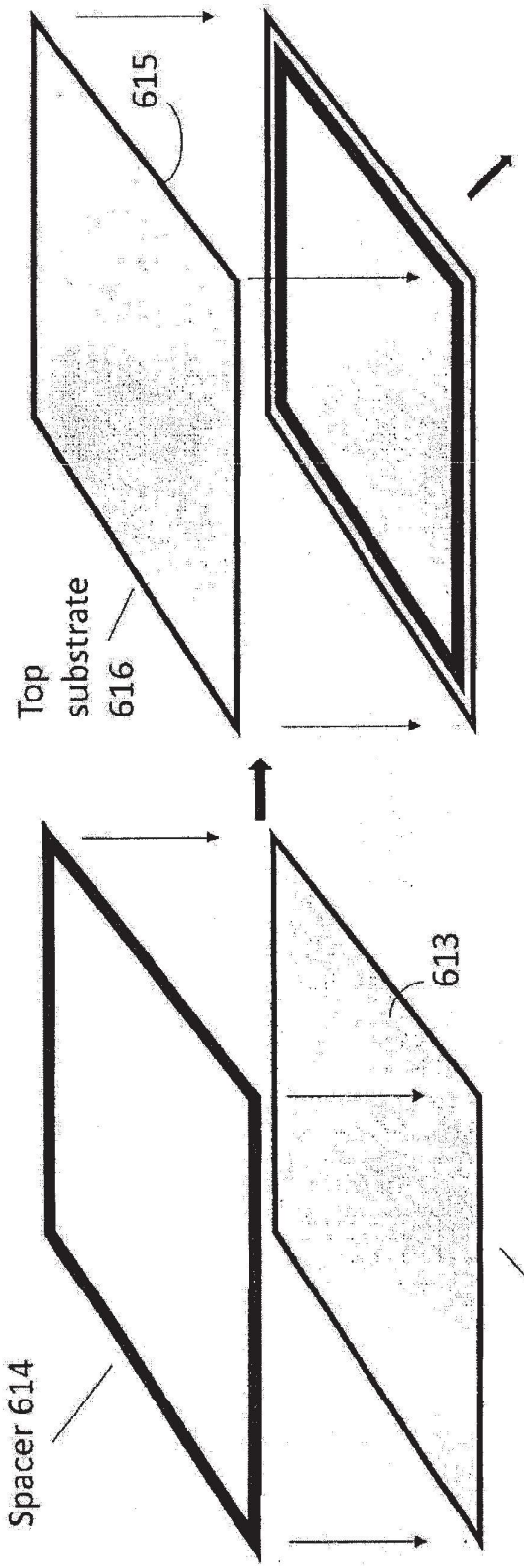


FIG.6A

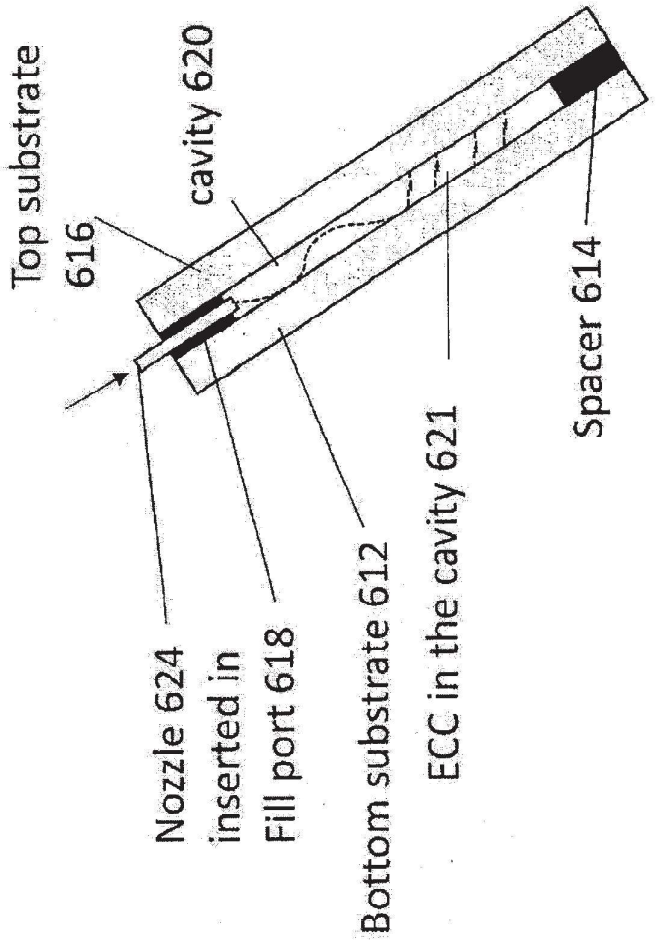

Top substrate
616
cavity 620
Nozzle 624
inserted in
Fill port 618
Bottom substrate 612
ECC in the cavity 621
Spacer 614

FIG.6B

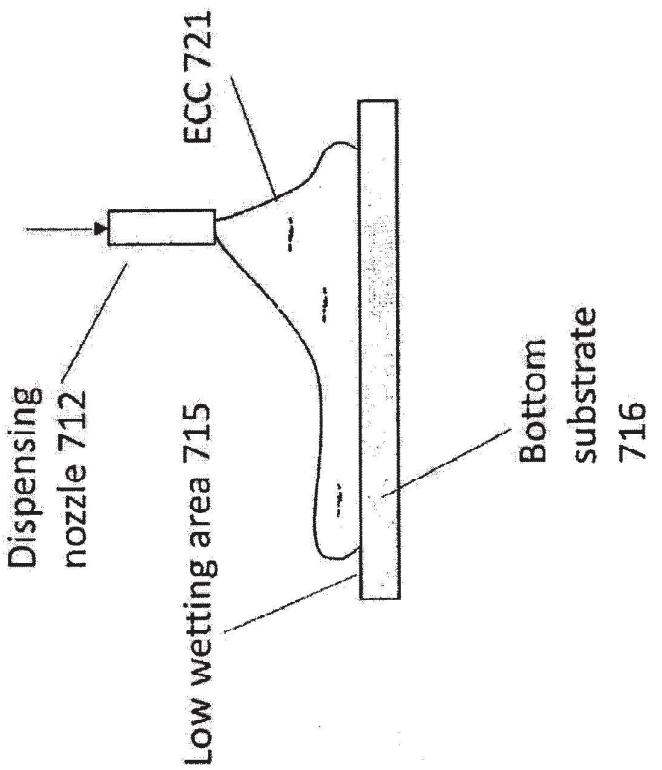

Dispensing nozzle 712
ECC 721
Low wetting area 715
Bottom substrate 716

FIG.7B

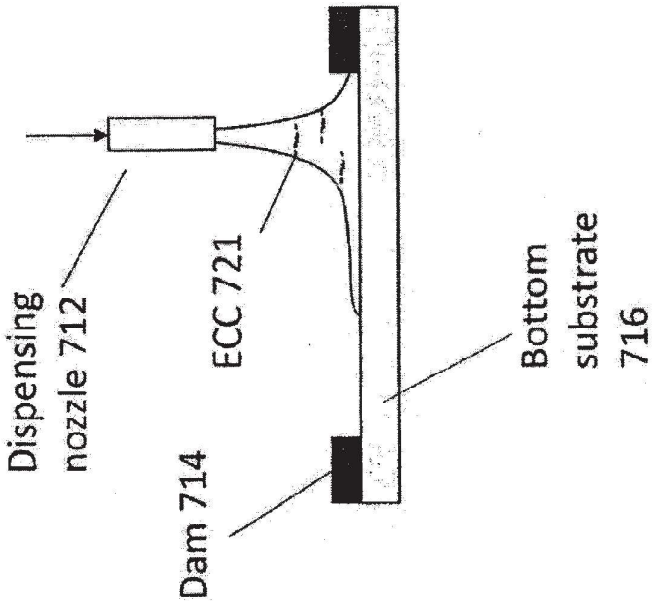

Dispensing nozzle 712
ECC 721
Dam 714
Bottom substrate 716

FIG.7A

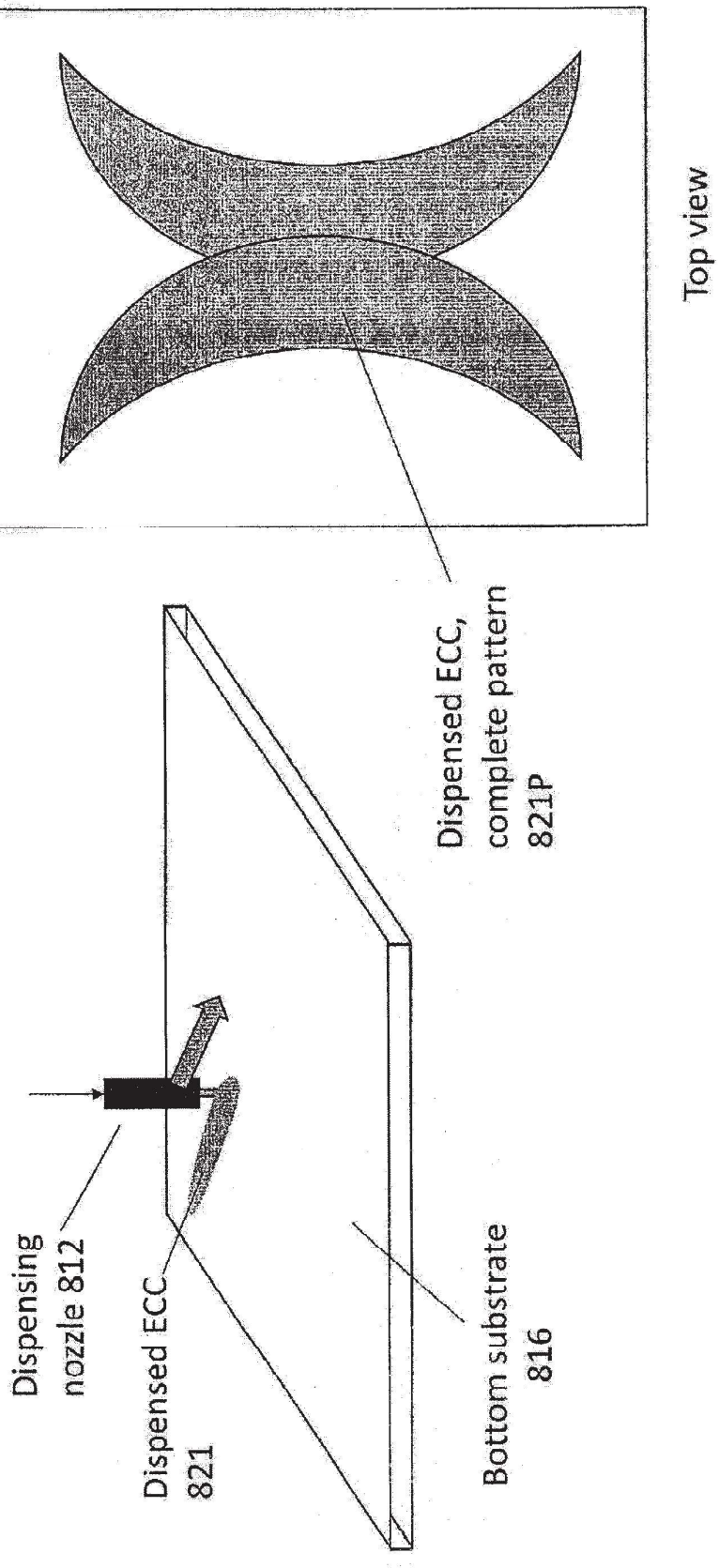

Top view
Dispensed ECC, complete pattern 821P
Dispensing nozzle 812
Dispensed ECC 821
Bottom substrate 816

FIG.8

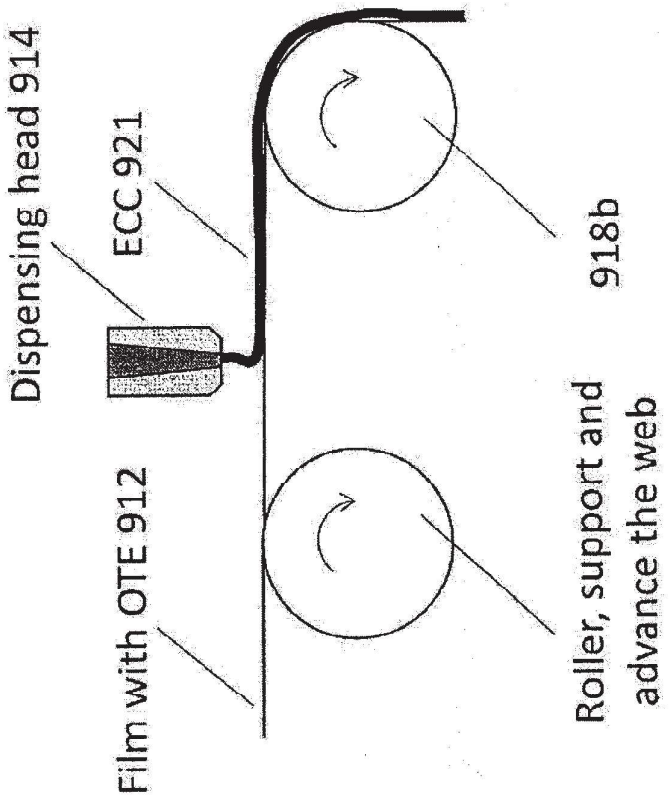

Dispensing head 914
ECC 921
Film with OTE 912
Roller, support and advance the web 918a
918b

FIG.9

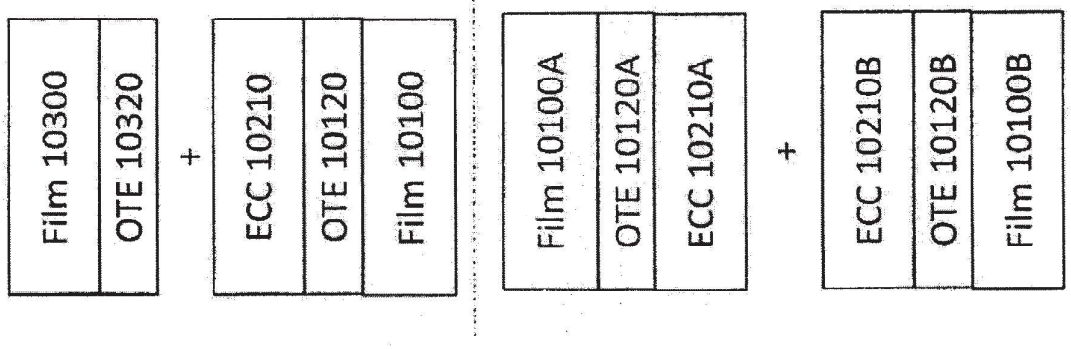


FIG.10B

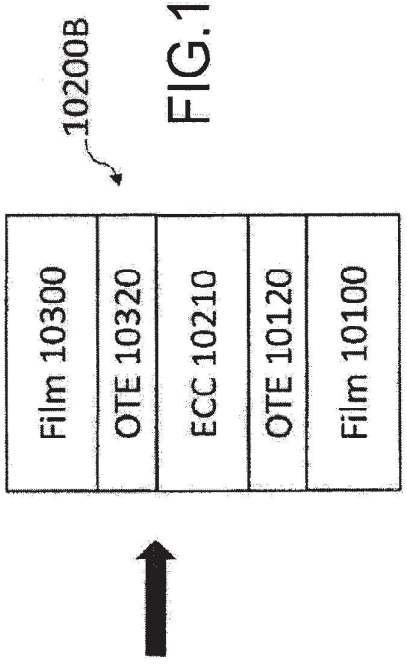
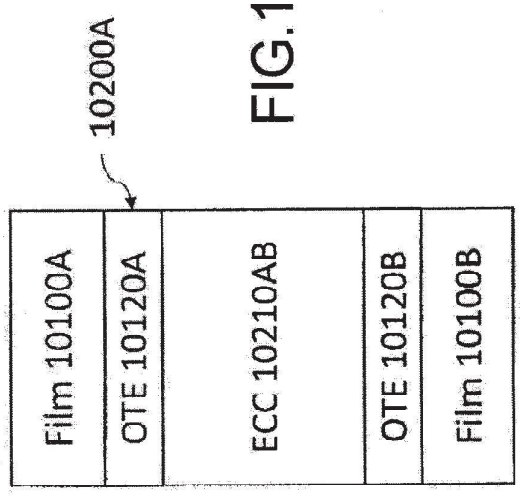


FIG.10A



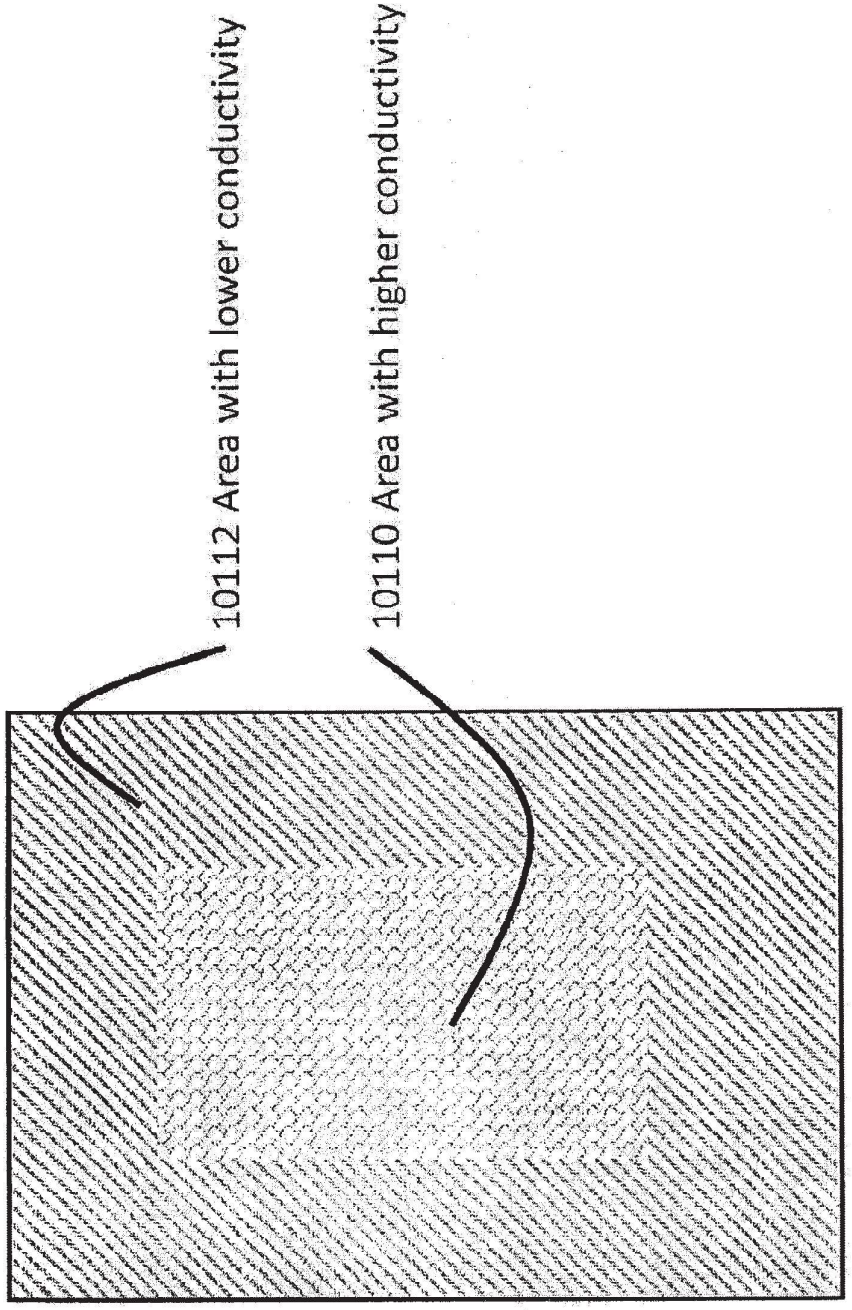

10112 Area with lower conductivity
10110 Area with higher conductivity

FIG.10C

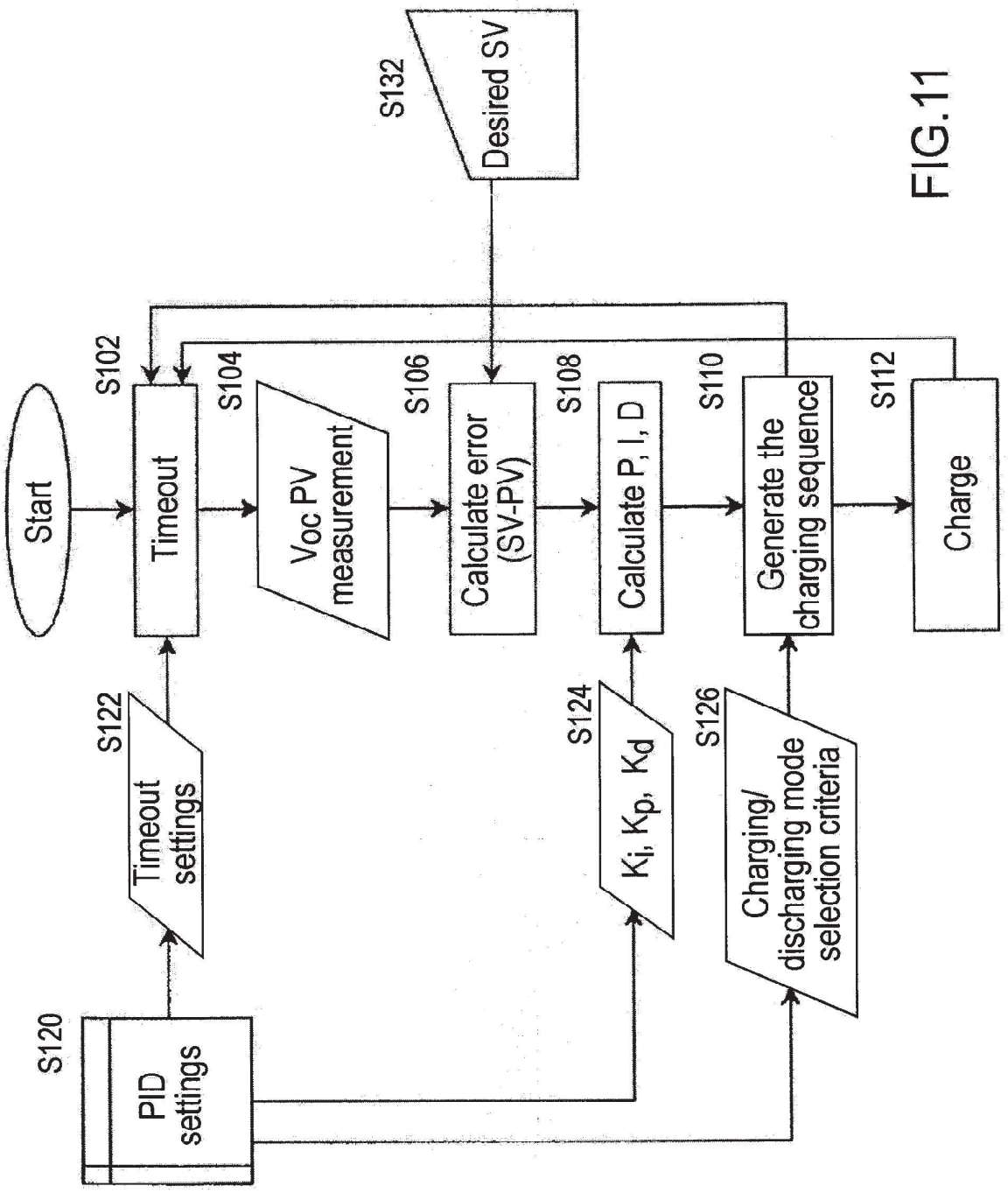
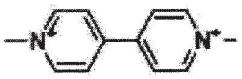
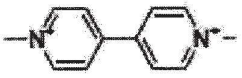

Start
S102
Timeout
S104
Voc PV measurement
S106
Calculate error (SV-PV)
S108
Calculate P, I, D
S110
Generate the charging sequence
S112
Charge
S132
Desired SV
S120
PID settings
S122
Timeout settings
S124
K_i, K_p, K_d
S126
Charging/ discharging mode selection criteria

FIG.11



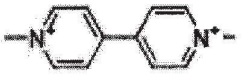
ClO_4^- ClO_4^-

1,1'-dimethyl-4,4'-bipyridinium diperchlorate (1)



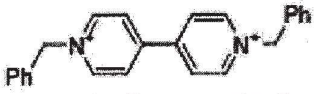
PF_6^- PF_6^-

1,1'-dimethyl-4,4'-bipyridinium bis(hexafluorophosphate) (2)



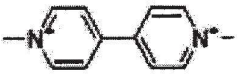
BF_4^- BF_4^-

1,1'-dimethyl-4,4'-bipyridinium bis(tetrafluoroborate) (3)



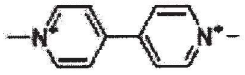
BF_4^- BF_4^-

1,1'-dibenzyl-4,4'-bipyridinium bis(tetrafluoroborate) (4)



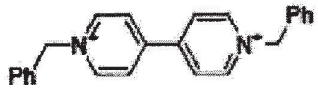
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1,1'-dimethyl-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (5)



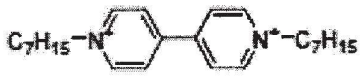
$(FSO_2)_2N^-$ $(FSO_2)_2N^-$

1,1'-dimethyl-4,4'-bipyridinium bis(fluorosulfonylimide) (6)



$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1,1'-dibenzyl-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (7)



$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1,1'-diheptyl-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (8)



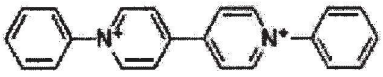
$4\ BF_4^-$

1,1"-(butane-1,4-diyl)bis(1-methyl-4,4'-bipyridinium) tetrakis(tetrafluoroborate) (9)



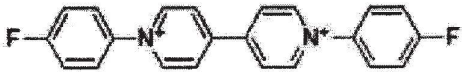
$4(CF_3SO_2)_2N^-$

1',1"-(butane-1,4-diyl)bis(1-methyl-4,4'- bipyridinium) tetrakis(tetrafluoromethane-sulfonylimide) (10)



$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

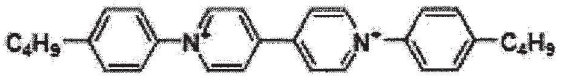
1,1'-diphenyl-4,4'-bipyridinium bis(tetrafluoromethanesulfonylimide) (11)



$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

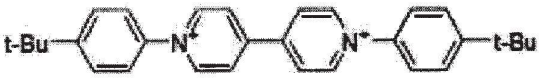
1,1'-bis(4-fluorophenyl)-4,4'-bipyridinium bis(trifluoromethane-sulfonylimide) (12)

FIG.12A



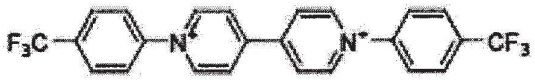
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1,1'-bis(4-butylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (13)



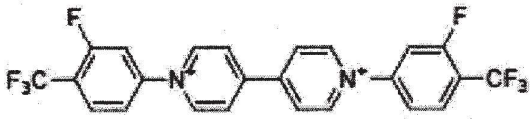
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1,1'-bis(4-tert-butylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (14)



$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1,1'-bis(4-trifluoromethylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (15)



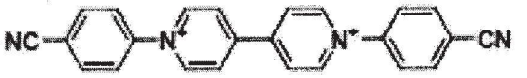
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1,1'-bis(4-trifluoromethyl-3-fluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (16)



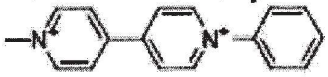
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1,1'-bis(4-(pentafluoro-λ6-sulfanyl)phenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (17)



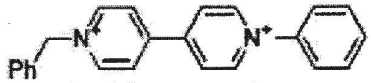
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1,1'-bis(4-cyanophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (18)



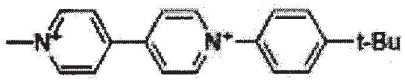
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1-methyl-1'-phenyl-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (19)



$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1-benzyl-1'-phenyl-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (20)



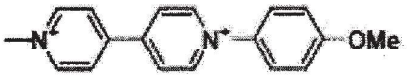
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1-methyl-1'-(4-tert-butylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (21)



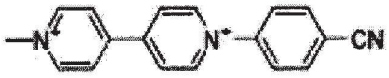
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1-methyl-1'-(4-fluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (22)



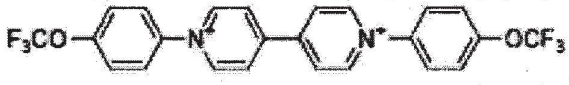
$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

1-methyl-1'-(4-trifluoromethylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (23)



$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

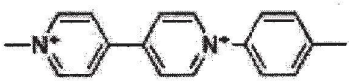
1-methyl-1'-(4-cyanophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (24)



$(CF_3SO_2)_2N^-$ $(CF_3SO_2)_2N^-$

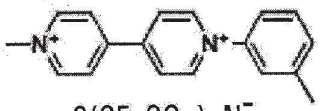
1,1'-bis(4-trifluoromethoxyphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (25)

FIG.12B



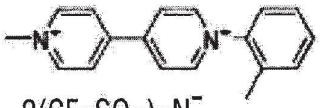
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(p-tolyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (26)



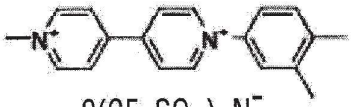
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(m-tolyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (27)



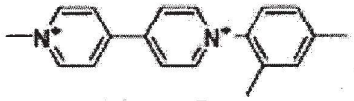
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(o-tolyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (28)



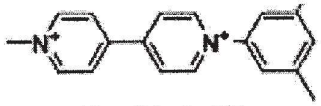
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(3,4-dimethylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (29)



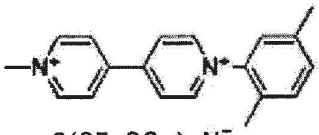
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2,4-dimethylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (30)



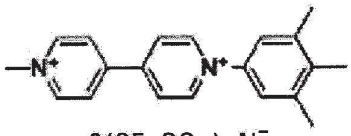
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(3,5-dimethylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (31)



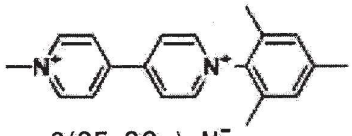
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2,5-dimethylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (32)



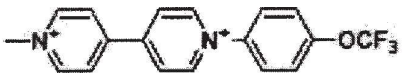
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(3,4,5-trimethylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (33)



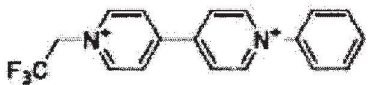
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2,4,6-trimethylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (34)



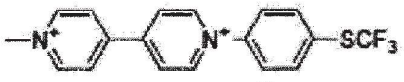
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(4-trifluoromethoxyphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (35)



$2(CF_3SO_2)_2N^-$

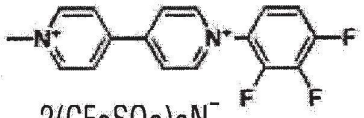
1-phenyl-1'-(2",2",2"-trifluoroethyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (36)



$2(CF_3SO_2)_2N^-$

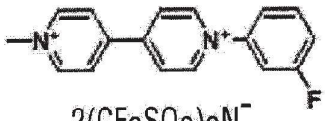
1-methyl-1'-(4-trifluoromethylthiophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (37)

FIG.12C



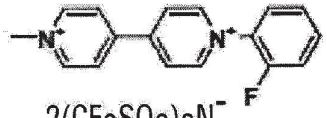
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2,3,4-trifluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (38)



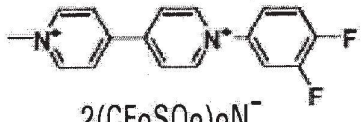
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(3-fluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (39)



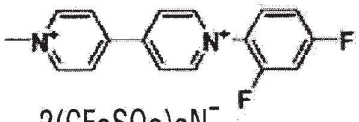
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2-fluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (40)



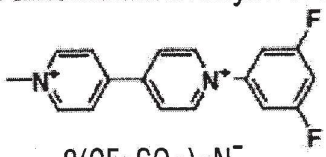
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2-difluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (41)



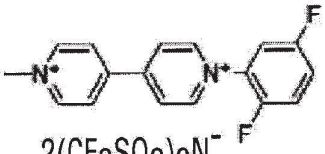
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2,4-difluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (42)



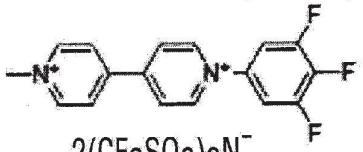
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(3,5-difluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (43)



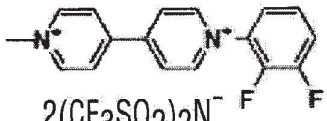
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2,5-difluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (44)



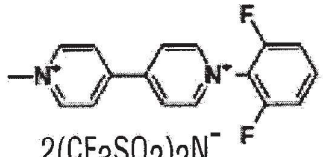
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(3,4,5-trifluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (45)



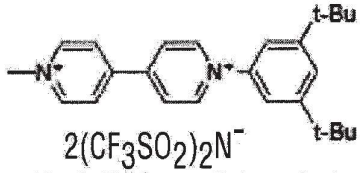
$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2,3-difluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (46)



$2(CF_3SO_2)_2N^-$

1-methyl-1'-(2,6-difluorophenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (47)



$2(CF_3SO_2)_2N^-$

1-methyl-1'-(3,5-di-tert-butylphenyl)-4,4'-bipyridinium bis(trifluoromethanesulfonylimide) (48)

FIG.12D