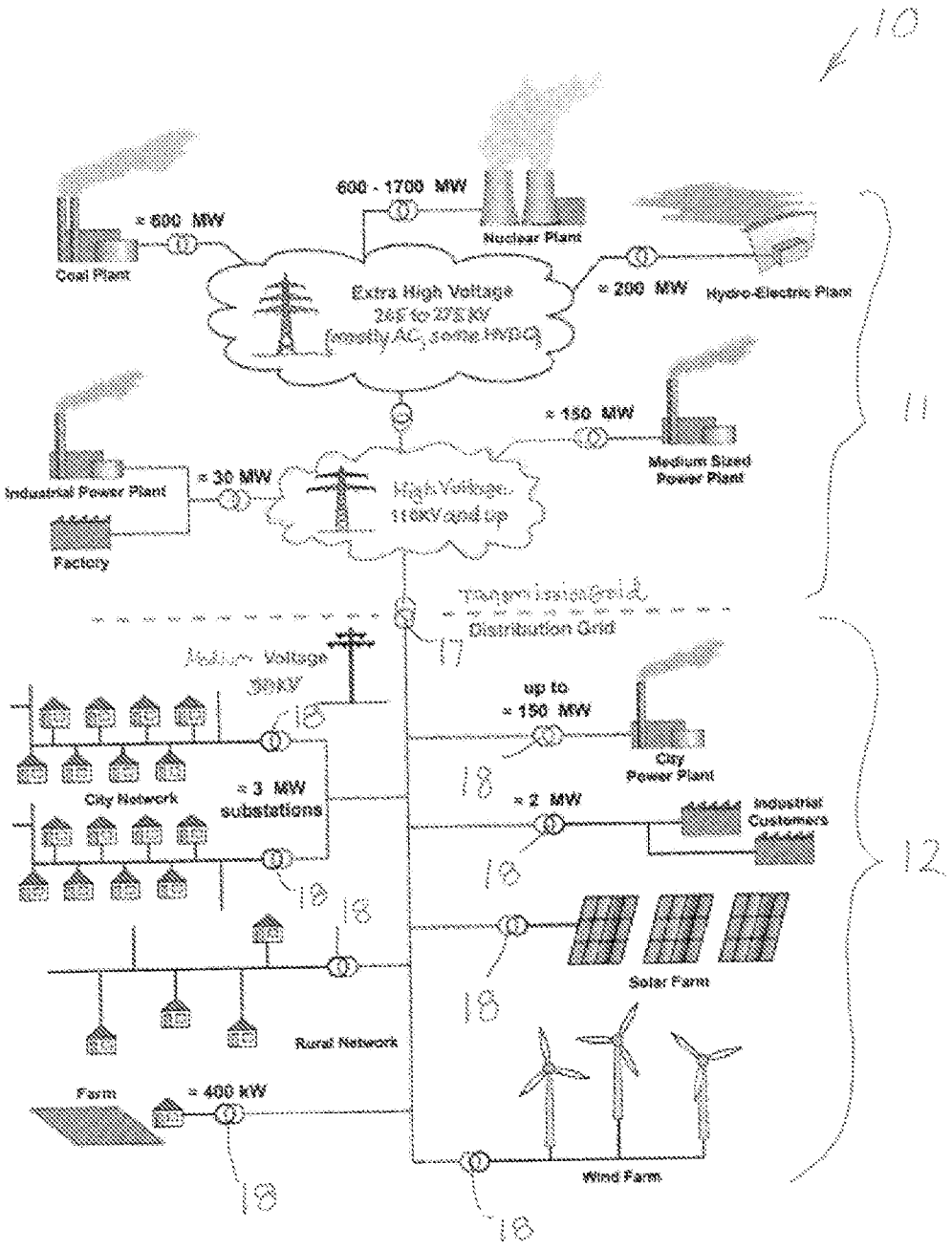

10
600 - 1700 MW
Nuclear Plant
≈ 600 MW
Coal Plant
Extra High Voltage
345 to 275 KV
(mostly AC, some HVDC)
≈ 200 MW
Hydro-Electric Plant
≈ 150 MW
Medium Sized
Power Plant
11
≈ 30 MW
Industrial Power Plant
Factory
High Voltage
110KV and up
Transmission Grid
Distribution Grid
17
Medium Voltage
35KV
up to
≈ 150 MW
City
Power Plant
18
City Network
≈ 3 MW
substations
≈ 2 MW
Industrial
Customers
12
Solar Farm
Rural Network
Farm
≈ 400 kW
Wind Farm

FIG. 1A

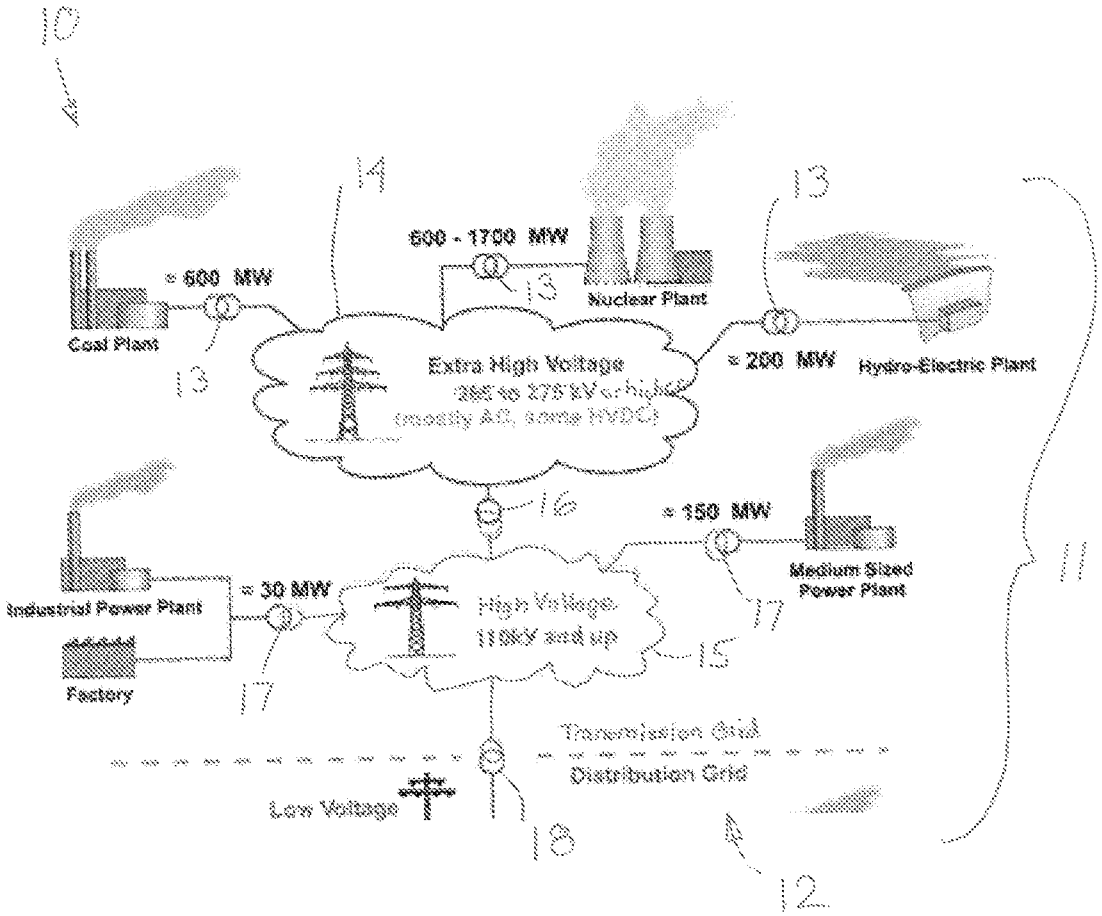

10
14
13
600 - 1700 MW
Nuclear Plant
≈ 600 MW
Coal Plant
13
Extra High Voltage
(mostly AC, some HVDC)
≈ 200 MW
Hydro-Electric Plant
16
≈ 150 MW
Medium Sized
Power Plant
11
Industrial Power Plant
≈ 30 MW
Factory
High Voltage
115KV and up
17
15
Transmission Grid
Distribution Grid
Low Voltage
18
12

FIG. 1B

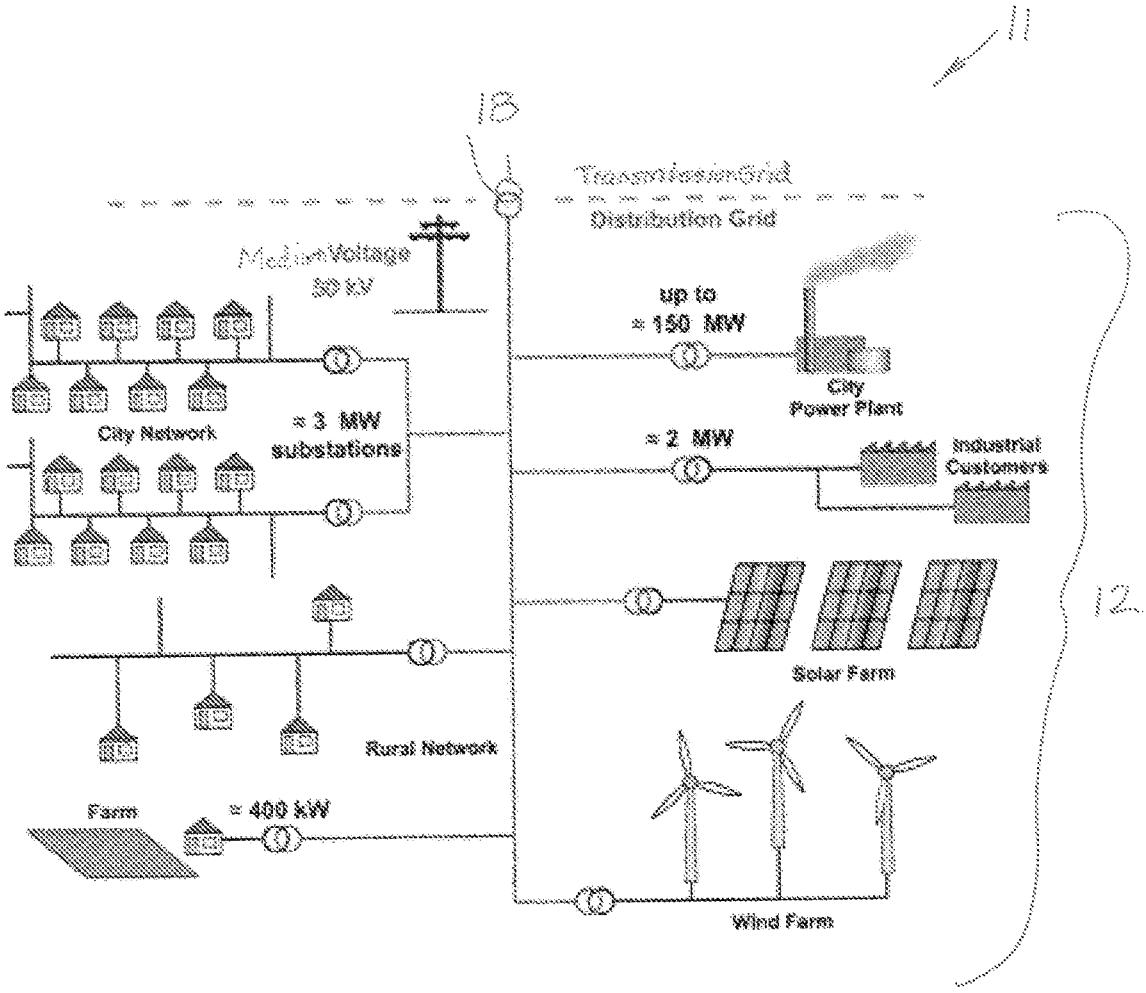
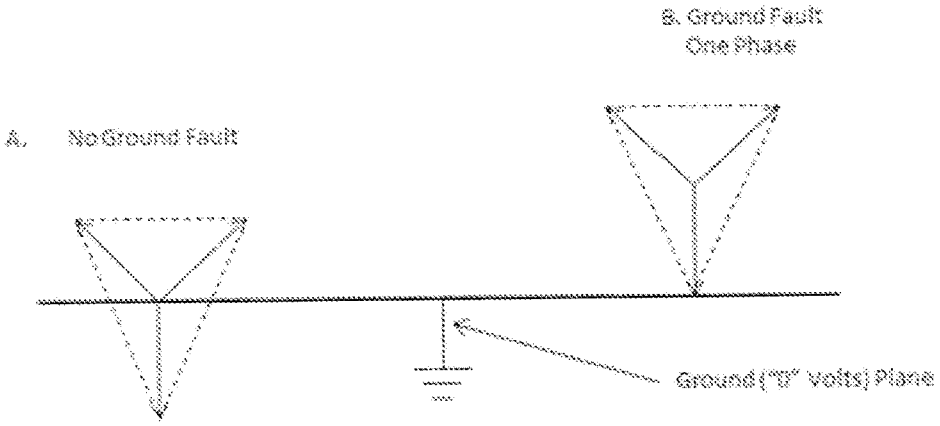

11
13
Transmission Grid
Distribution Grid
Medium Voltage
50 kV
up to
≈ 150 MW
City
Power Plant
City Network
≈ 3 MW
substations
≈ 2 MW
Industrial
Customers
12
Solar Farm
Rural Network
Farm
≈ 400 kW
Wind Farm

FIG. 1C



Voltages:

A. No Ground Fault, Voltages Are:
Phase to Phase=480 Volts
Phase to Ground = 277 Volts

A. Ground Fault on One Phase, Typical
Voltages Are:
Phase to Phase (Ungrounded Phases) =480 Volts
Phase to Ground (Ungrounded Phases) =480 Volts
Phase to Ground (Grounded Phase) = 0 Volts

FIG. 2

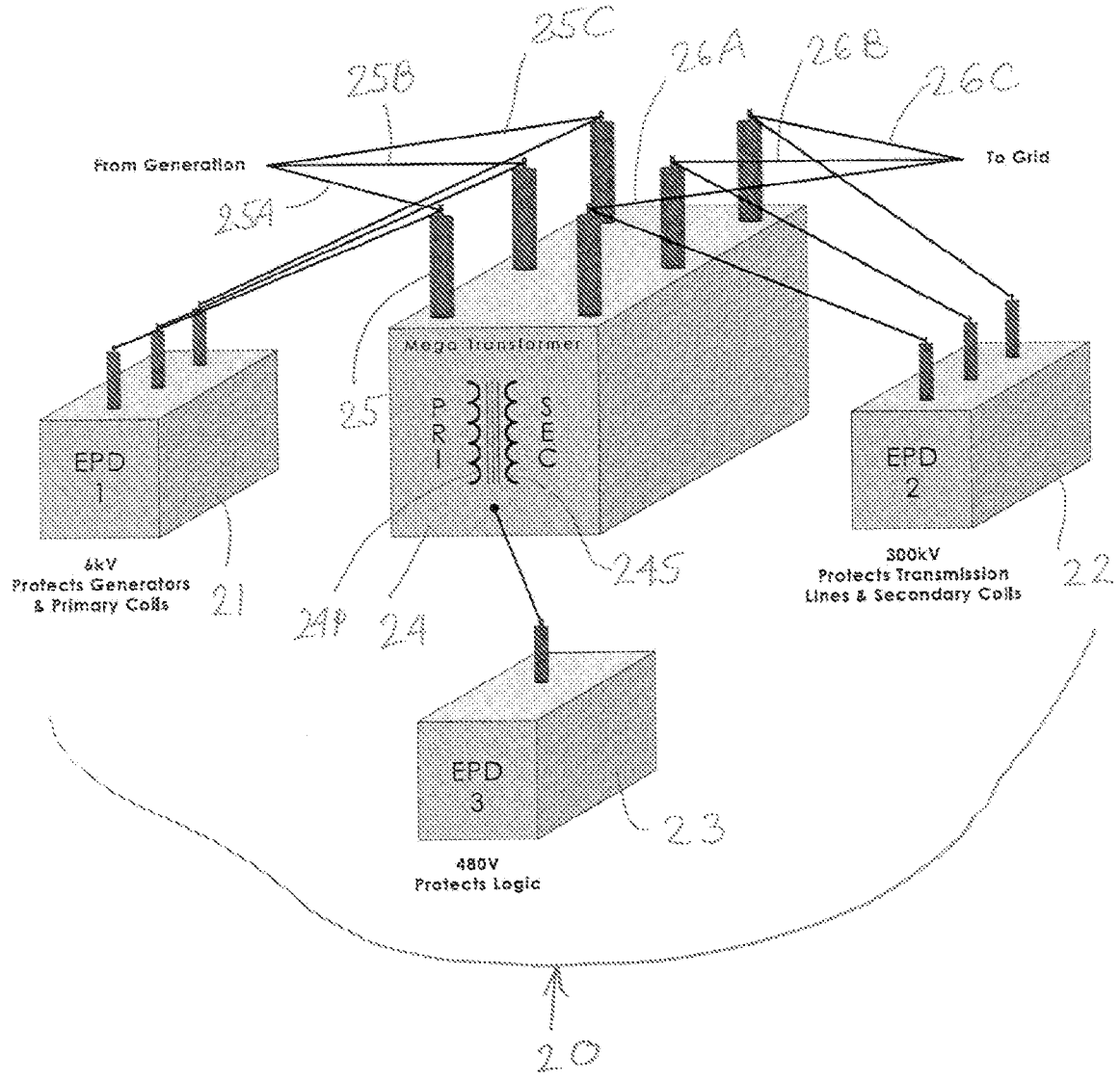

25C
26A
26B
25B
26C
From Generation
To Grid
25A
Mega Transformer
PRI
SEC
25
EPD
1
EPD
2
EPD
3
4kV
Protects Generators
& Primary Coils
21
24P
24
245
380kV
Protects Transmission
Lines & Secondary Coils
22
480V
Protects Logic
23
20

FIG. 3

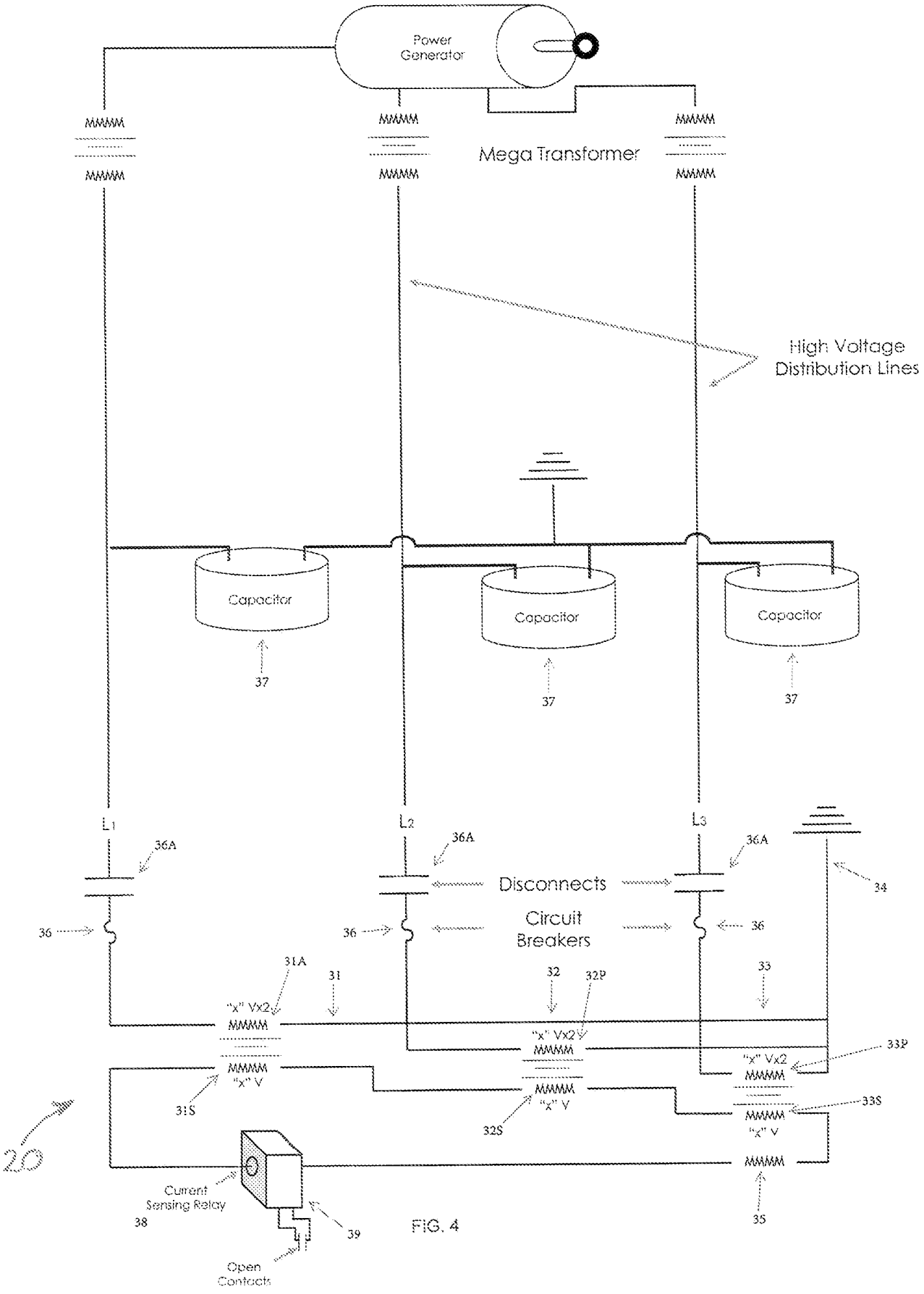

Power Generator
Mega Transformer
High Voltage Distribution Lines
Capacitor
Capacitor
Capacitor
37
37
37
L1
L2
L3
36A
36A
36A
Disconnects
Circuit Breakers
36
36
36
34
31A
31
32
32P
33
"x" Vx2
"x" Vx2
"x" Vx2
33P
"x" V
"x" V
"x" V
31S
32S
33S
35
20
Current Sensing Relay
38
39
Open Contacts

FIG. 4

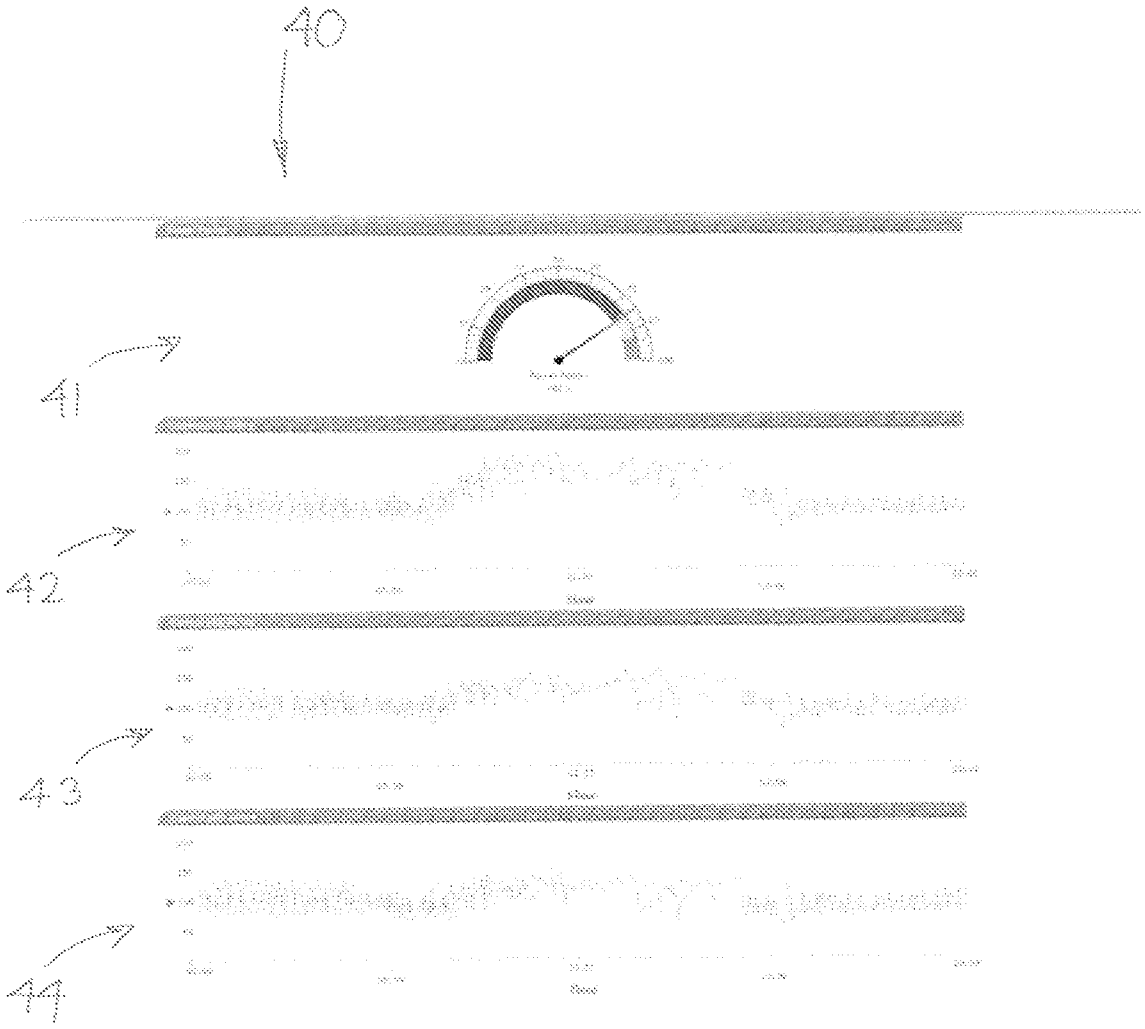


FIG. 5

A graphical representation of the three phases reaction to the injected E1 pulse.

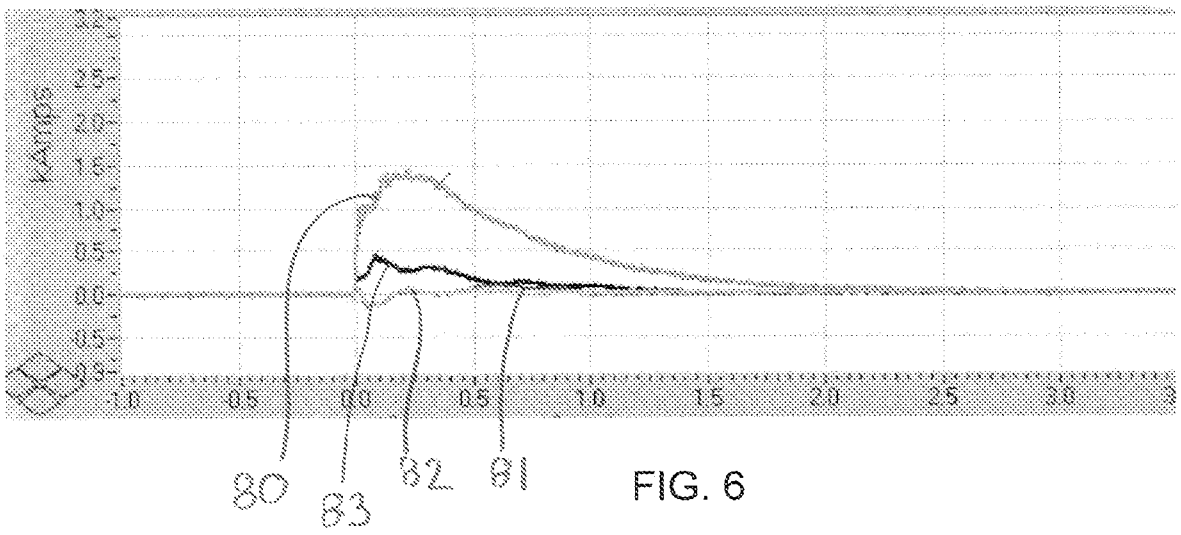


FIG. 6

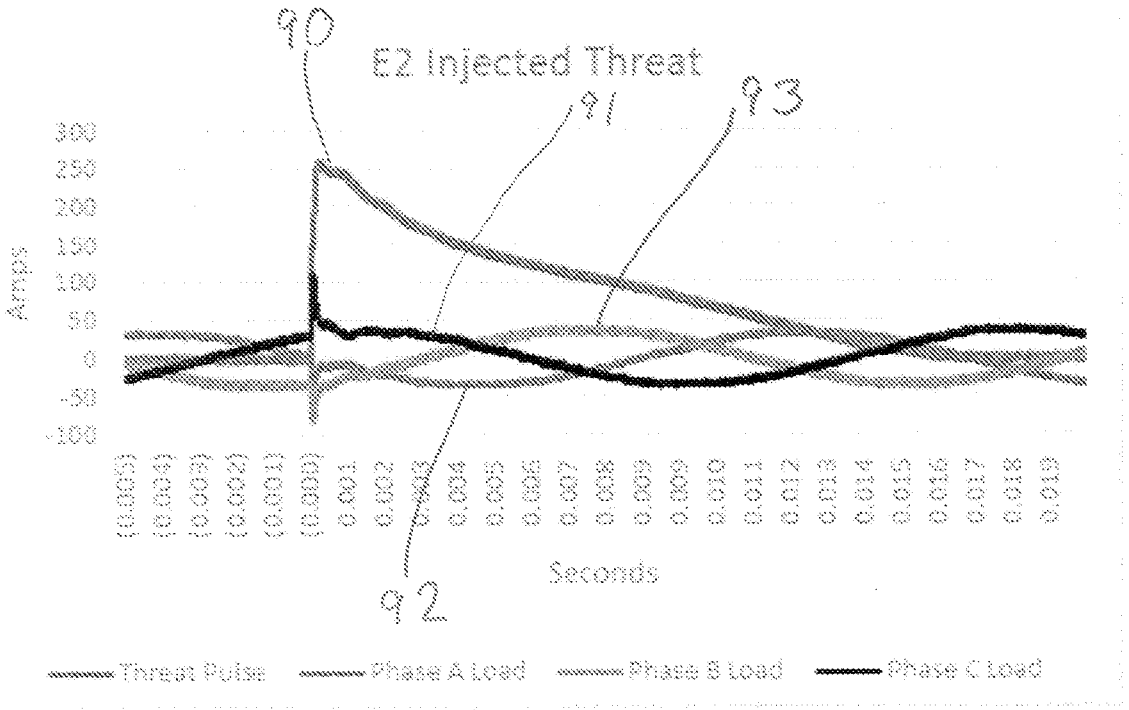


FIG. 7

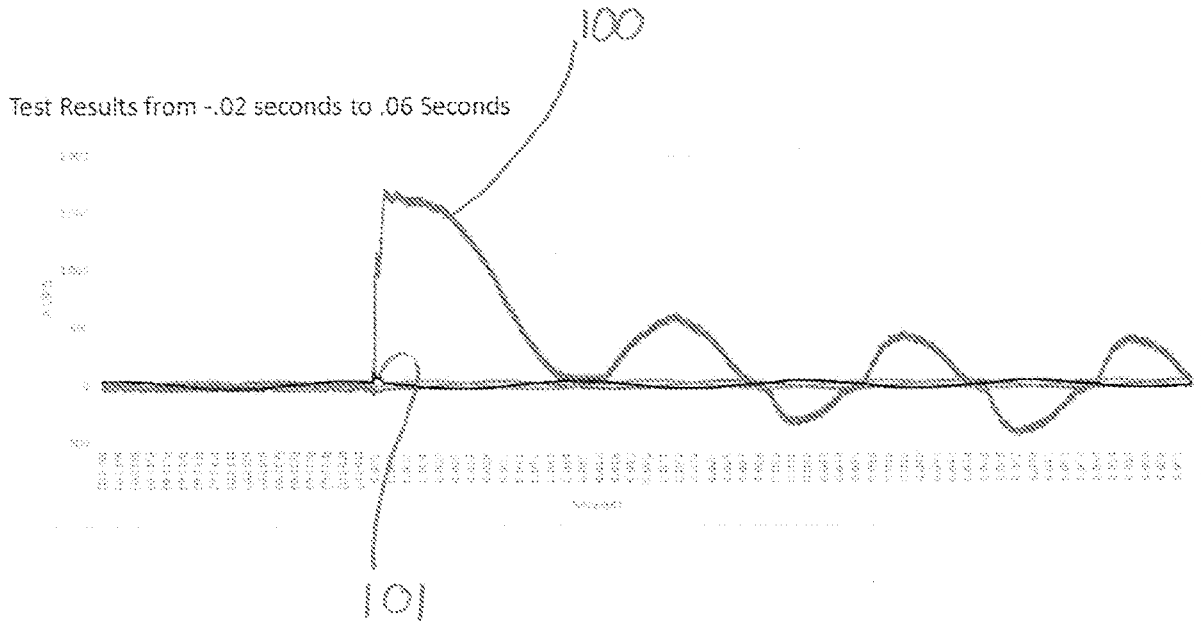

100
Test Results from -.02 seconds to .06 Seconds
101

FIG. 8

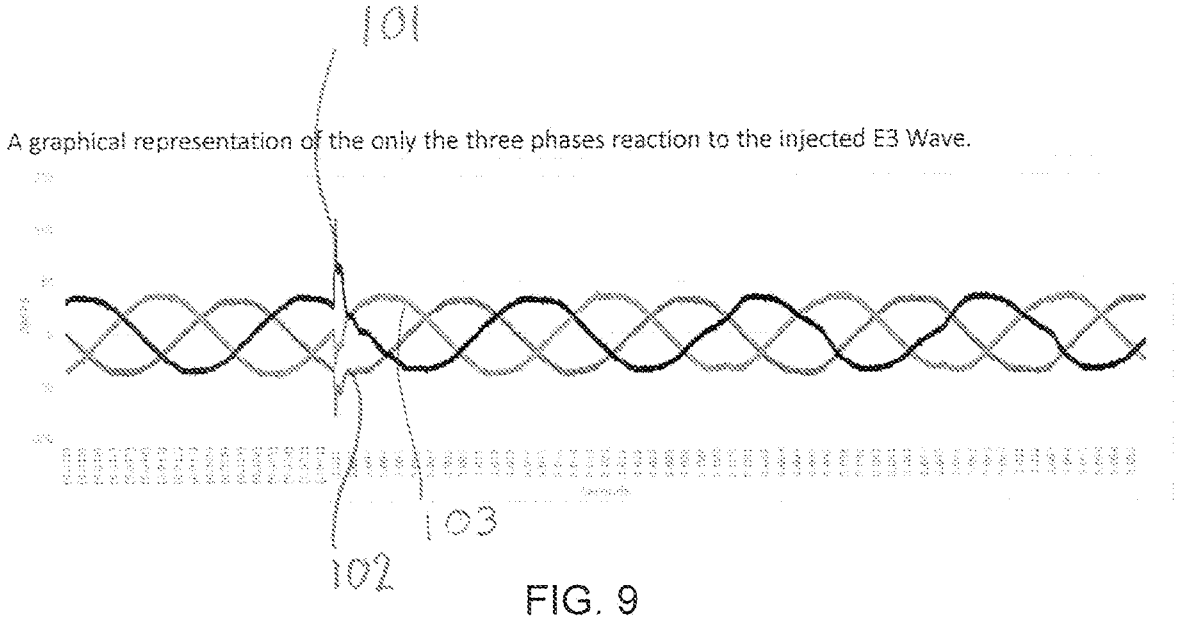

101
A graphical representation of the only the three phases reaction to the injected E3 Wave.
103
102

FIG. 9