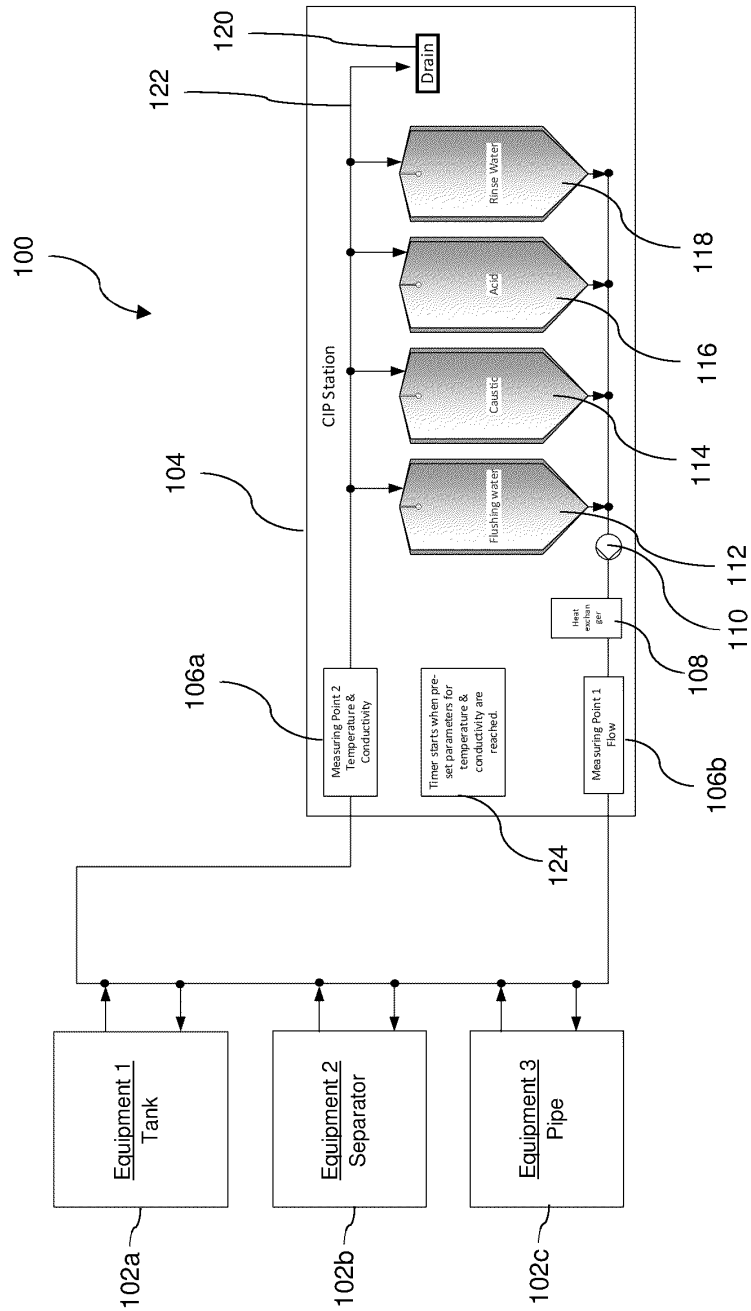


Fig. 1 (prior art)

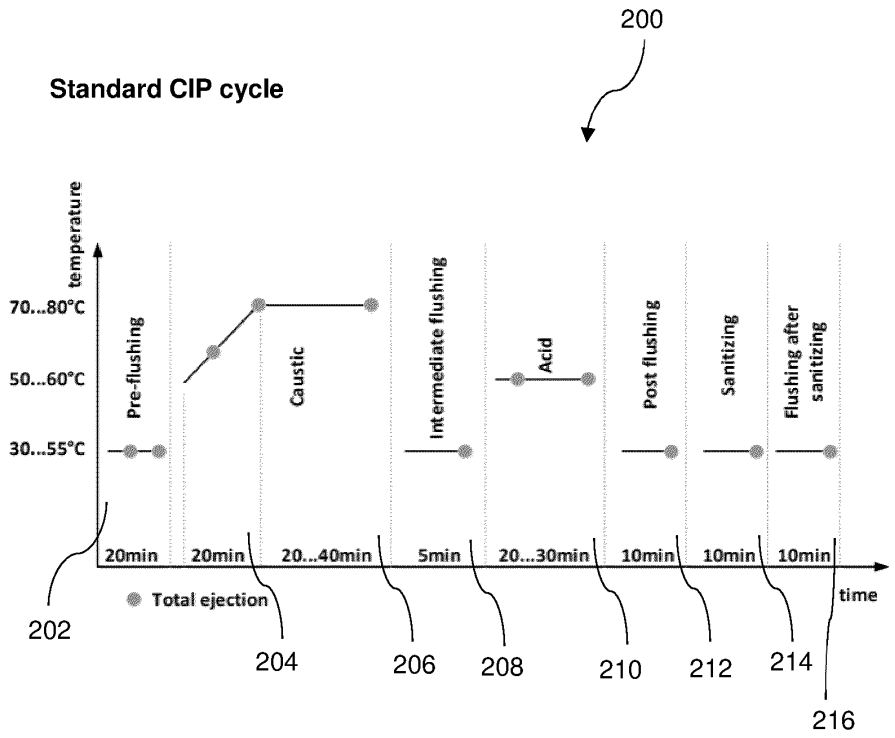


Fig. 2 (prior art)

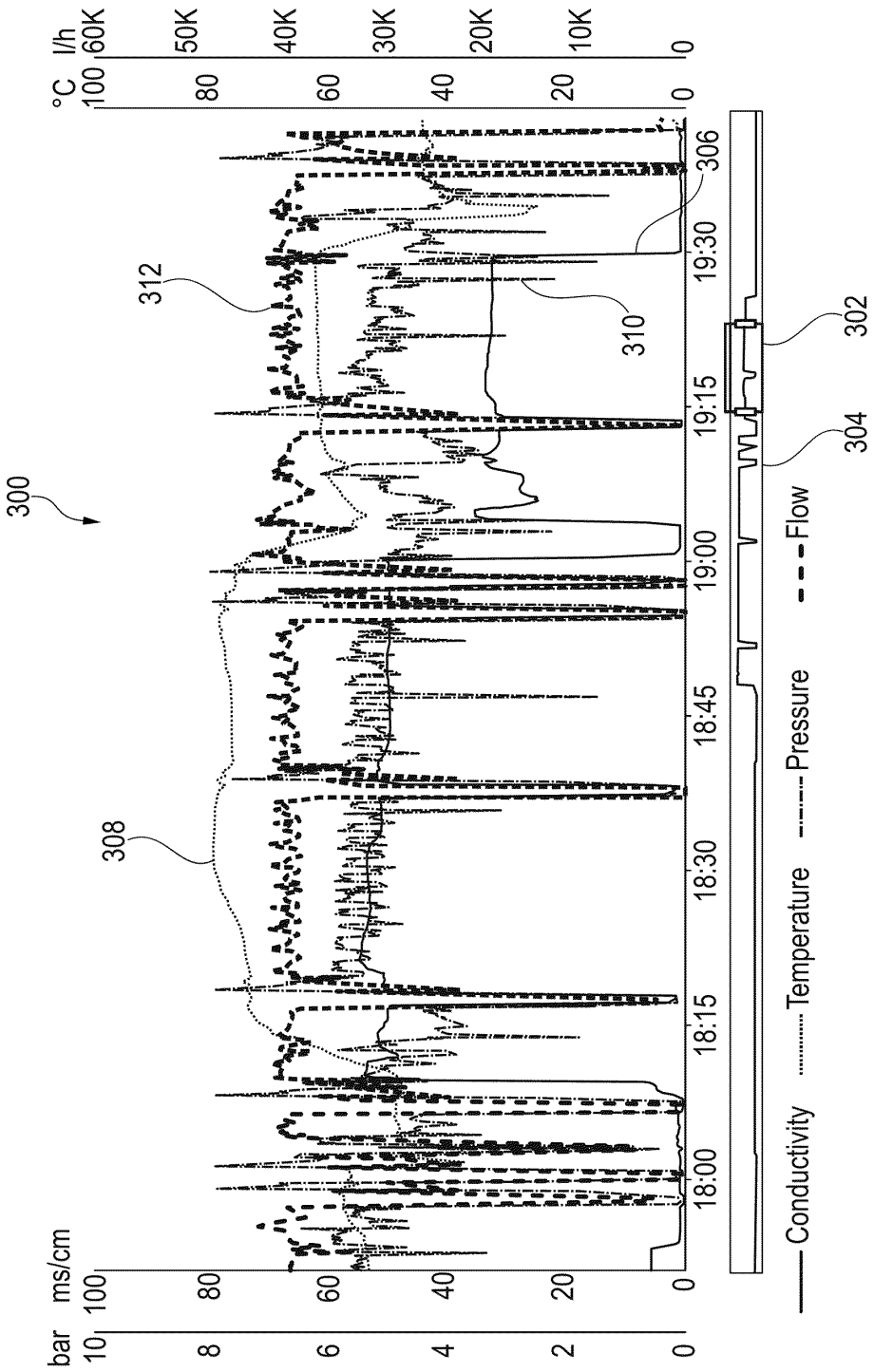

300
308
312
310
306
302
304
bar
ms/cm
°C
l/h
18:00
18:15
18:30
18:45
19:00
19:15
19:30
Conductivity
Temperature
Pressure
Flow

Fig. 3

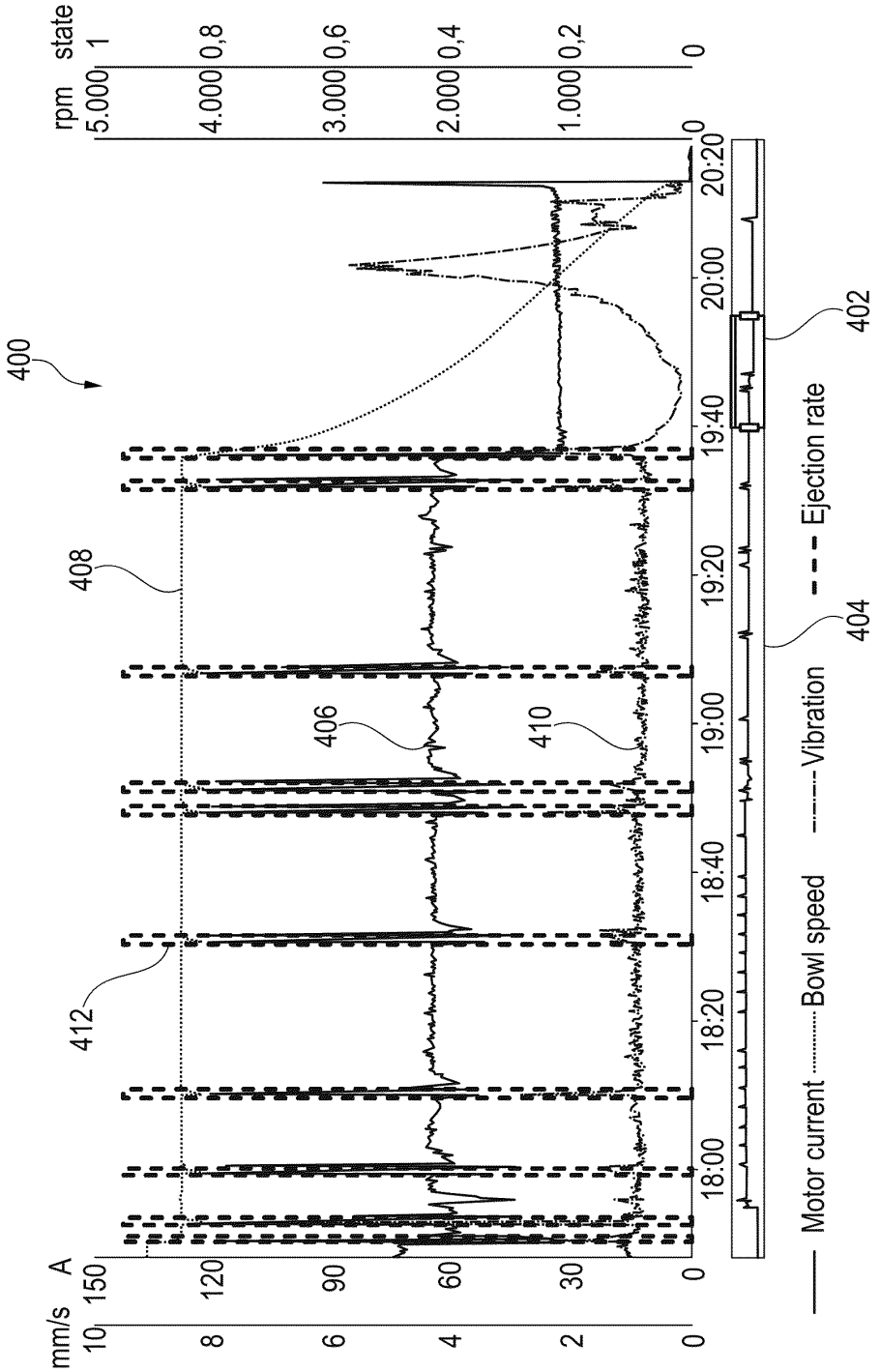

400
408
406
410
412
402
404
rpm
state
5.000
4.000
3.000
2.000
1.000
0
1
0,8
0,6
0,4
0,2
mm/s
A
10
8
6
4
2
0
150
120
90
60
30
0
18:00
18:20
18:40
19:00
19:20
19:40
20:00
20:20
Motor current
Bowl speed
Vibration
Ejection rate

Fig. 4

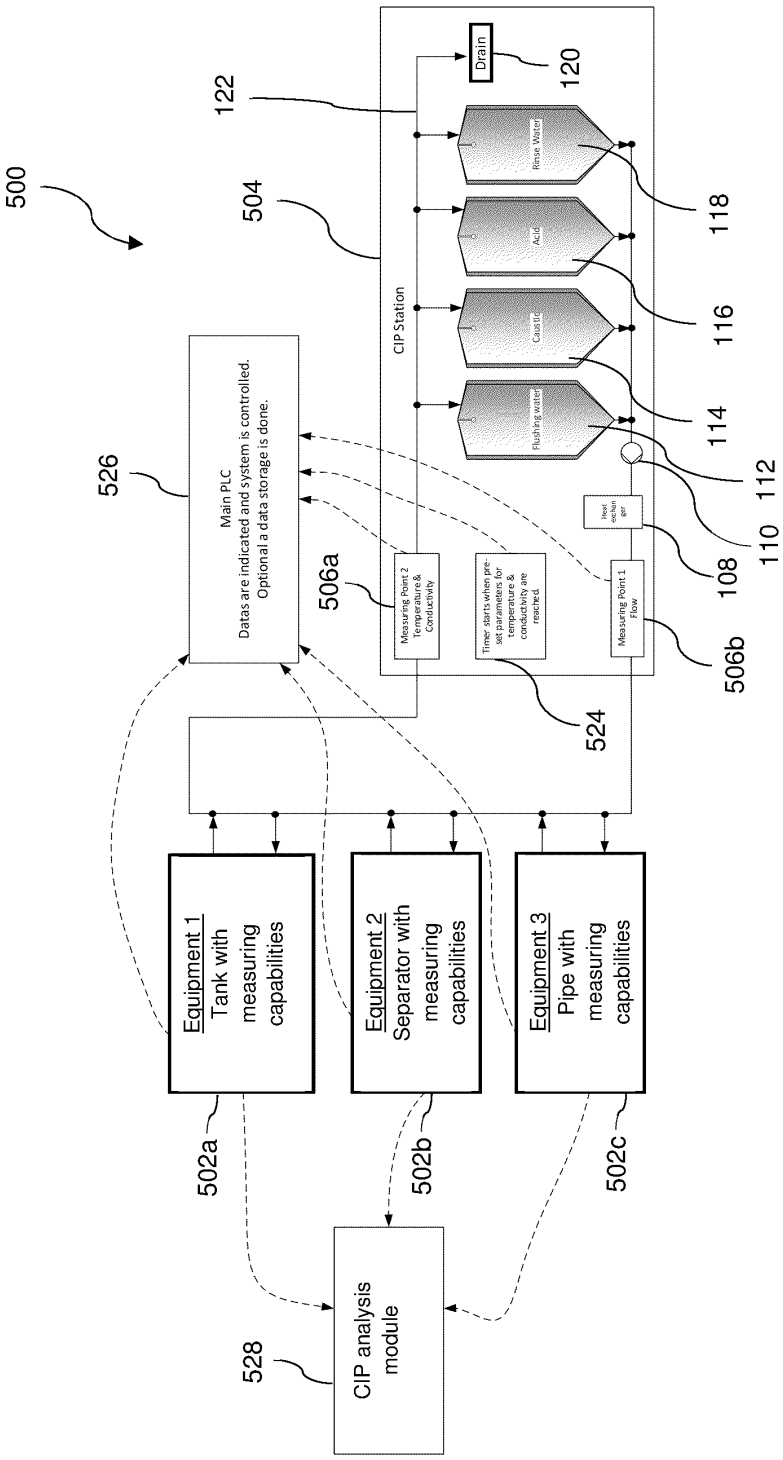

500
504
122
526
CIP Station
Drain
120
Reuse Water
Acid
Caustic
Flushing water
118
116
114
112
110
108
506a
506b
524
Main PLC
Datas are indicated and system is controlled.
Optional a data storage is done.
Measuring Point 2
Temperature &
Conductivity
Timer starts when pre-
set parameters for
temperature &
conductivity are
reached.
Measuring Point 1
Flow
Equipment 1
Tank with
measuring
capabilities
Equipment 2
Separator with
measuring
capabilities
Equipment 3
Pipe with
measuring
capabilities
502a
502b
502c
528
CIP analysis
module

Fig. 5

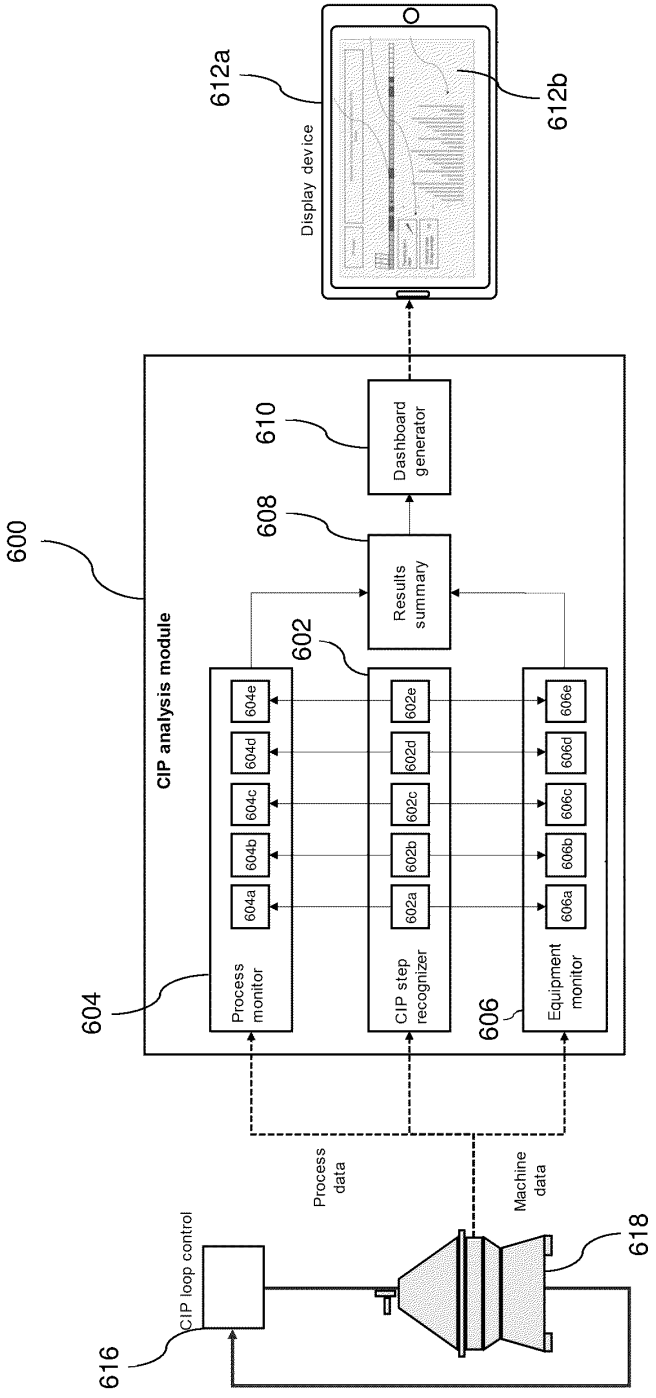

612a
612b
Display device
600
CIP analysis module
610
Dashboard generator
608
Results summary
602
604
Process monitor
CIP step recognizer
606
Equipment monitor
604a
604b
604c
604d
604e
602a
602b
602c
602d
602e
606a
606b
606c
606d
606e
Process data
Machine data
616
CIP loop control
618

Fig. 6

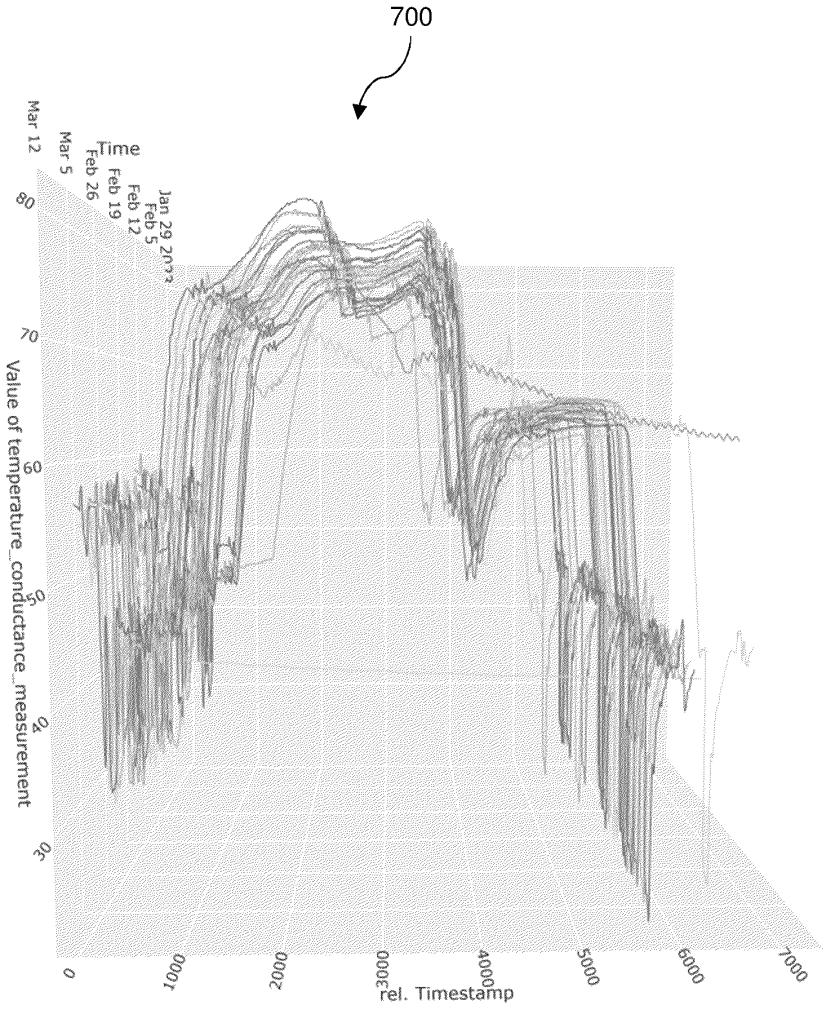

700
Time
Mar 12
Mar 5
Feb 26
Feb 19
Feb 12
Feb 5
Jan 29 2022
Value of temperature_conductance_measurement
80
70
60
50
40
30
0
1000
2000
3000
4000
5000
6000
7000
rel. Timestamp

Fig. 7

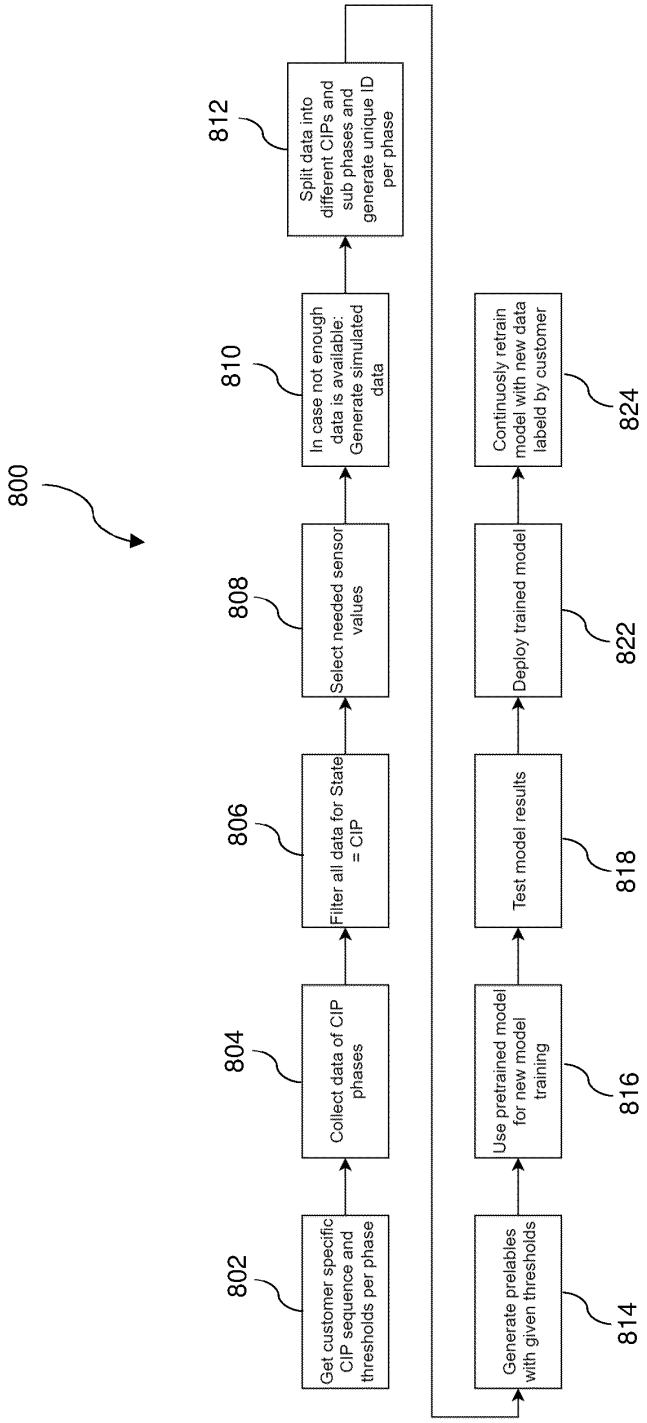

800
802
Get customer specific CIP sequence and thresholds per phase
804
Collect data of CIP phases
806
Filter all data for State = CIP
808
Select needed sensor values
810
In case not enough data is available: Generate simulated data
812
Split data into different CIPs and sub phases and generate unique ID per phase
814
Generate prelables with given thresholds
816
Use pretrained model for new model training
818
Test model results
822
Deploy trained model
824
Continuosly retrain model with new data labeld by customer

Fig. 8

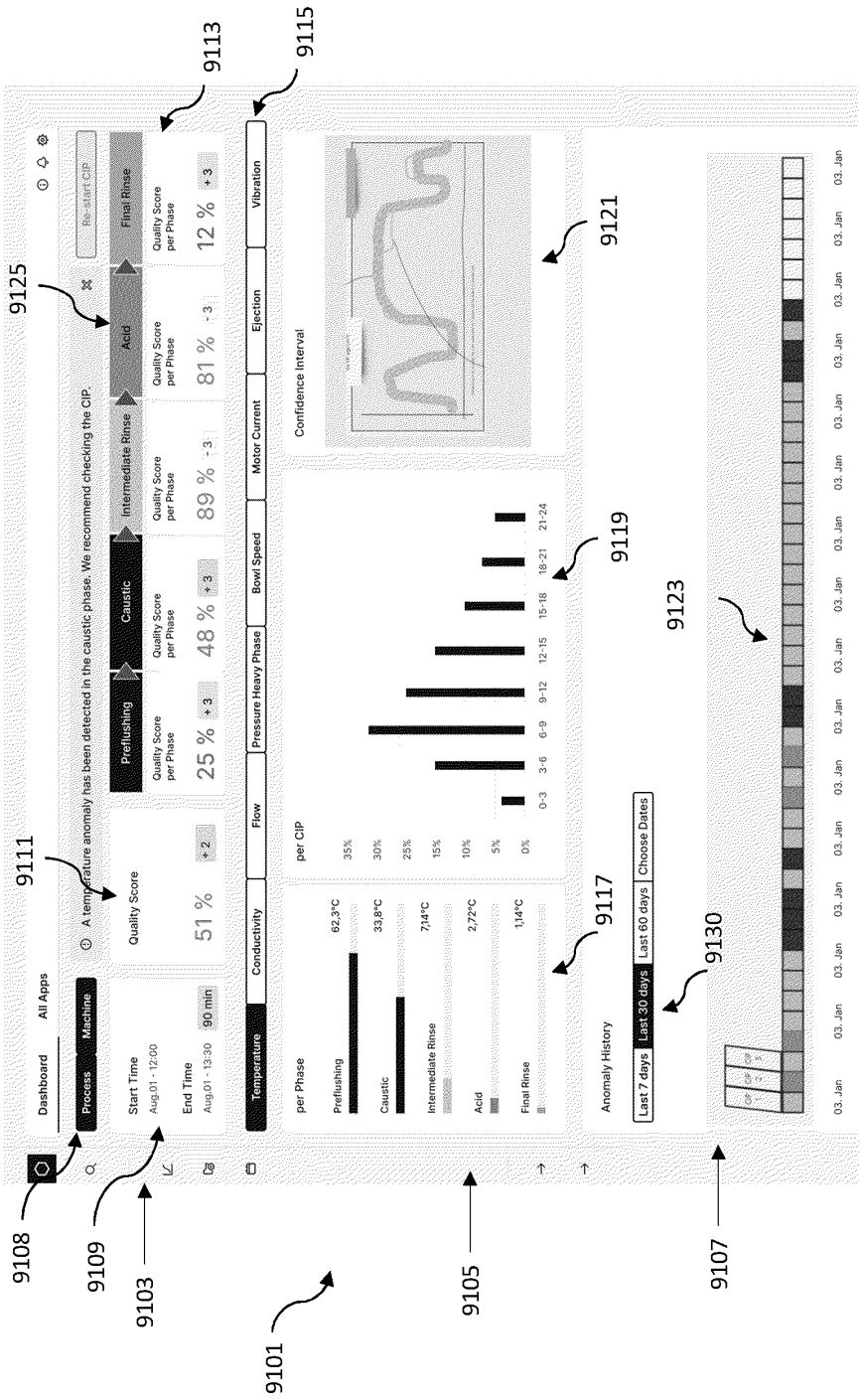

9108
9109
9103
9101
9105
9107
9111
9113
9115
9117
9119
9121
9123
9125
9130
Dashboard
All Apps
Process
Machine
Start Time
Aug.01 - 12:00
End Time
Aug.01 - 13:30
90 min
A temperature anomaly has been detected in the caustic phase. We recommend checking the CIP.
Quality Score
51 %
+ 2
Preflushing
Caustic
Intermediate Rinse
Acid
Final Rinse
Quality Score per Phase
25 %
+ 3
48 %
+ 3
89 %
- 3
81 %
- 3
12 %
+ 3
Re-start CIP
Temperature
Conductivity
Flow
Pressure Heavy Phase
Bowl Speed
Motor Current
Ejection
Vibration
per Phase
per CIP
Confidence Interval
Anomaly History
Last 7 days
Last 30 days
Last 60 days
Choose Dates
62,3°C
33,8°C
7,14°C
2,72°C
1,14°C
35%
30%
25%
15%
10%
5%
0%
0-3
3-6
6-9
9-12
12-15
15-18
18-21
21-24
03. Jan

Fig. 9

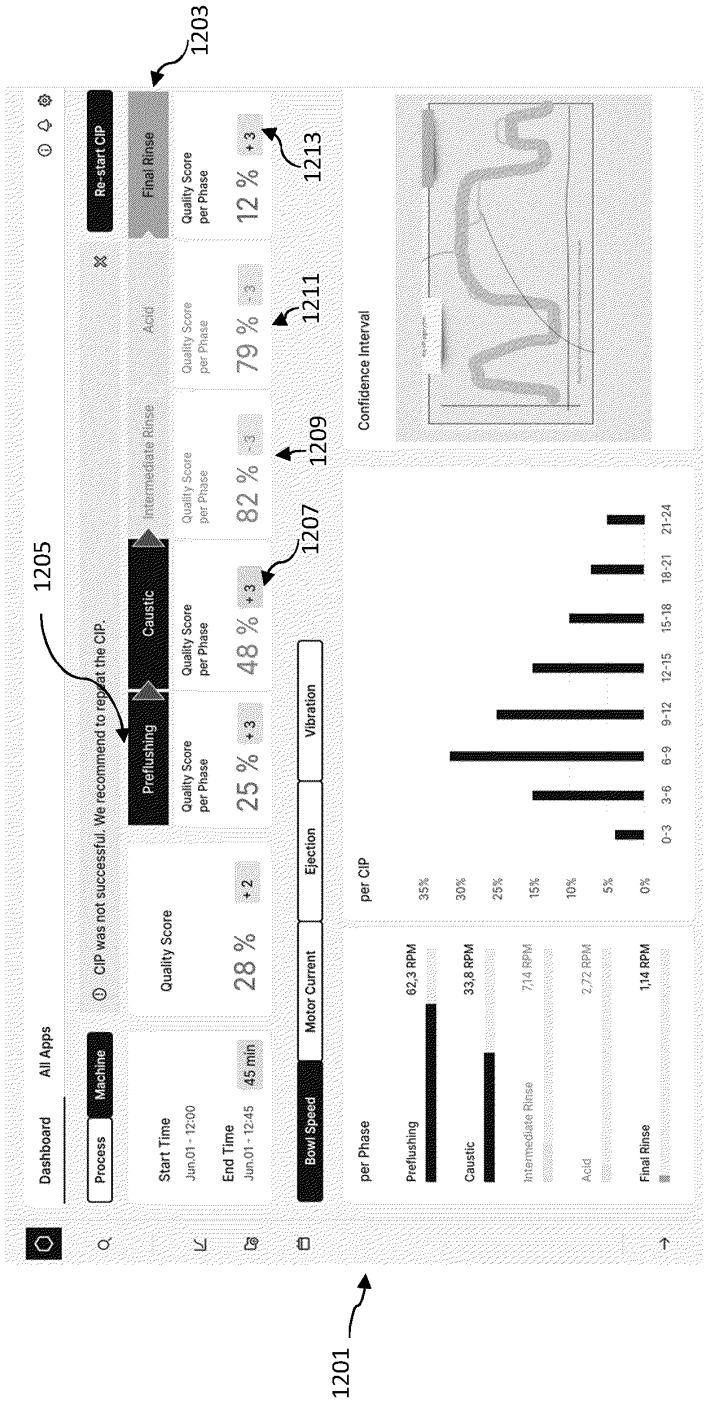

1201
1203
1205
1207
1209
1211
1213
Dashboard
All Apps
Process
Machine
CIP was not successful. We recommend to repeat the CIP.
Re-start CIP
Start Time
Jun.01 - 12:00
End Time
Jun.01 - 12:45
45 min
Quality Score
28 %
+ 2
Preflushing
Caustic
Intermediate Rinse
Acid
Final Rinse
Quality Score per Phase
25 %
+ 3
48 %
+ 3
82 %
-3
79 %
-3
12 %
+ 3
Bowl Speed
Motor Current
Ejection
Vibration
per Phase
Preflushing
62,3 RPM
Caustic
33,8 RPM
Intermediate Rinse
7,14 RPM
Acid
2,72 RPM
Final Rinse
1,14 RPM
per CIP
35%
30%
25%
15%
10%
5%
0%
0-3
3-6
6-9
9-12
12-15
15-18
18-21
21-24
Confidence Interval

Fig. 10