

FIG. 1

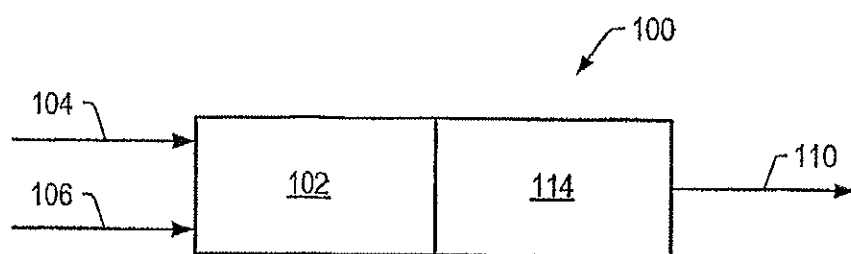


FIG. 2A

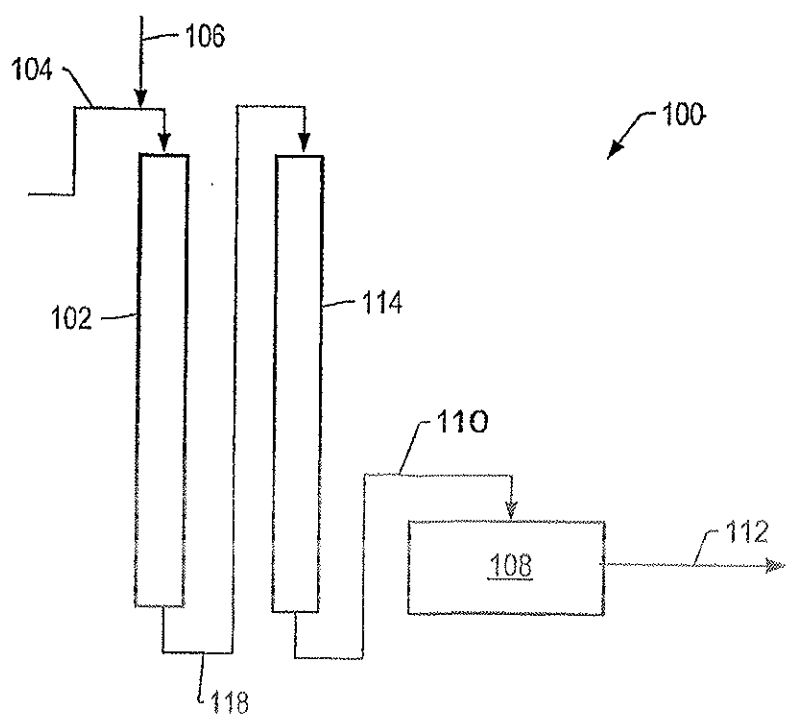


FIG. 2B

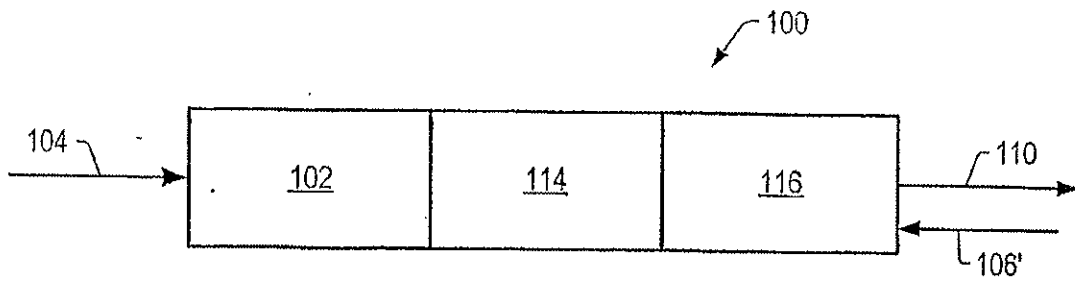


FIG. 3A

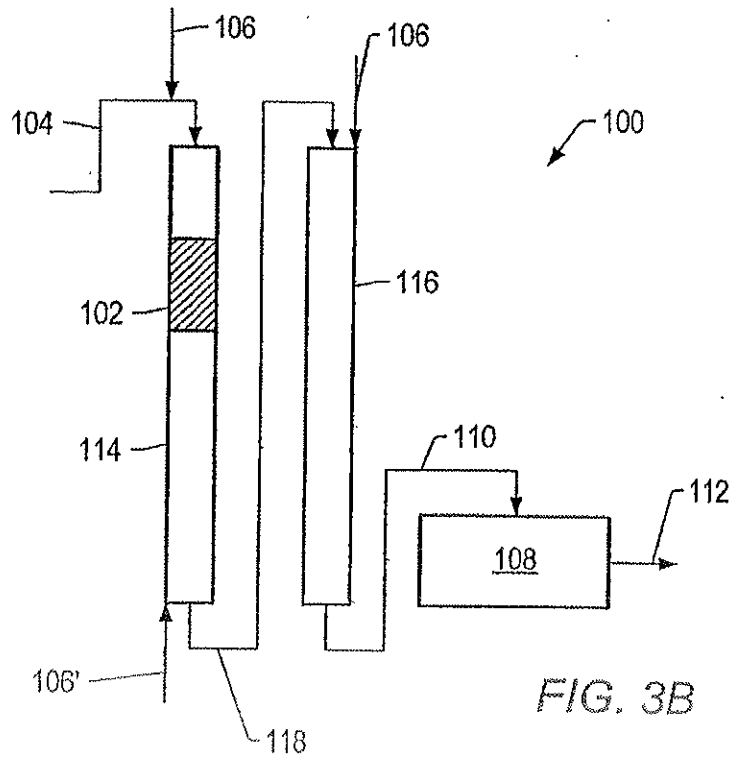


FIG. 3B

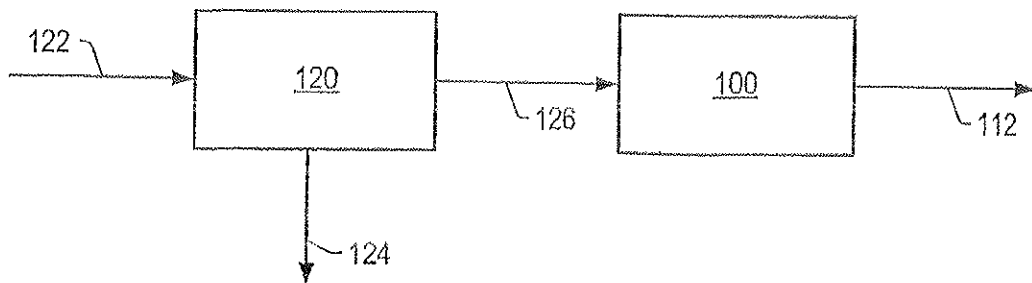


FIG. 4

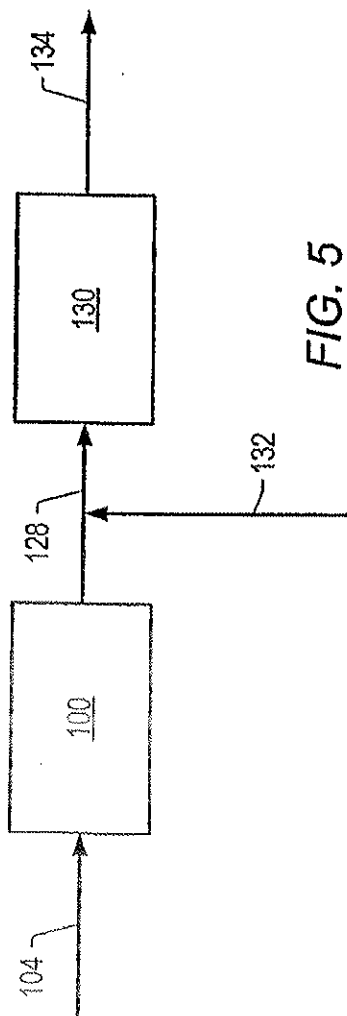


FIG. 5

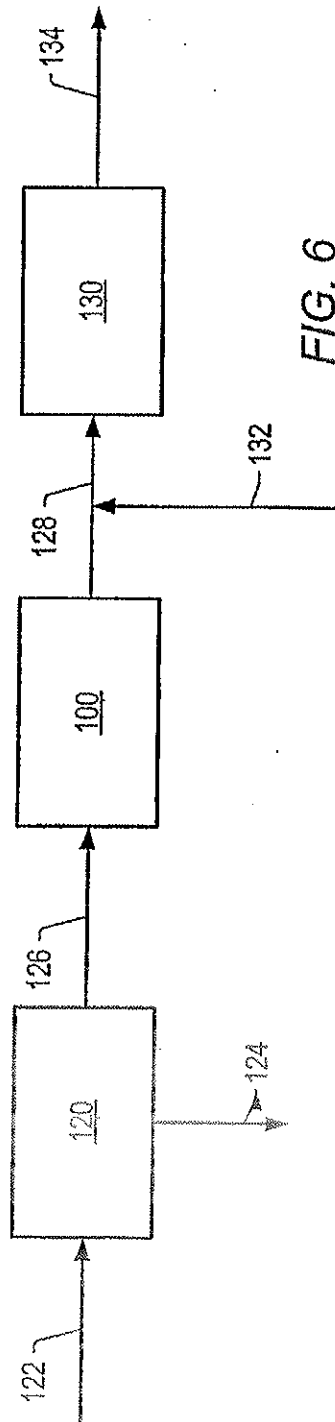


FIG. 6

Table 1

Property	Crude Feed	Crude Product
Example	5	5
TAN	0.8	0.09
API Gravity	24.9	28.6
Density at 15.56 °C (60 °F), g/cm ³	0.9046	0.8838
Hydrogen, wt%	11.68	12.54
Carbon, wt%	85.24	86.43
Sulfur, wt%	2.24	0.75
Oxygen, wt%	0.29	0.07
Nitrogen, wt%	0.19	0.16
Total Basic Nitrogen, wt%	0.05	0.05
Nickel, wtpm	27	7.6
Vanadium, wtpm	59	14.8
Micro-Carbon Residue, wt%	6.6	4.4
C ₅ Asphaltenes, wt%	5.21	2.3
Distillate, wt%	20.5	22.1
VGO, wt%	31.3	31.8
Residue, wt%	28.3	25.5
P-Value	4.5	4.5
Viscosity at 37.8 °C (100 °F), cSt	17.4	14.8

FIG. 7

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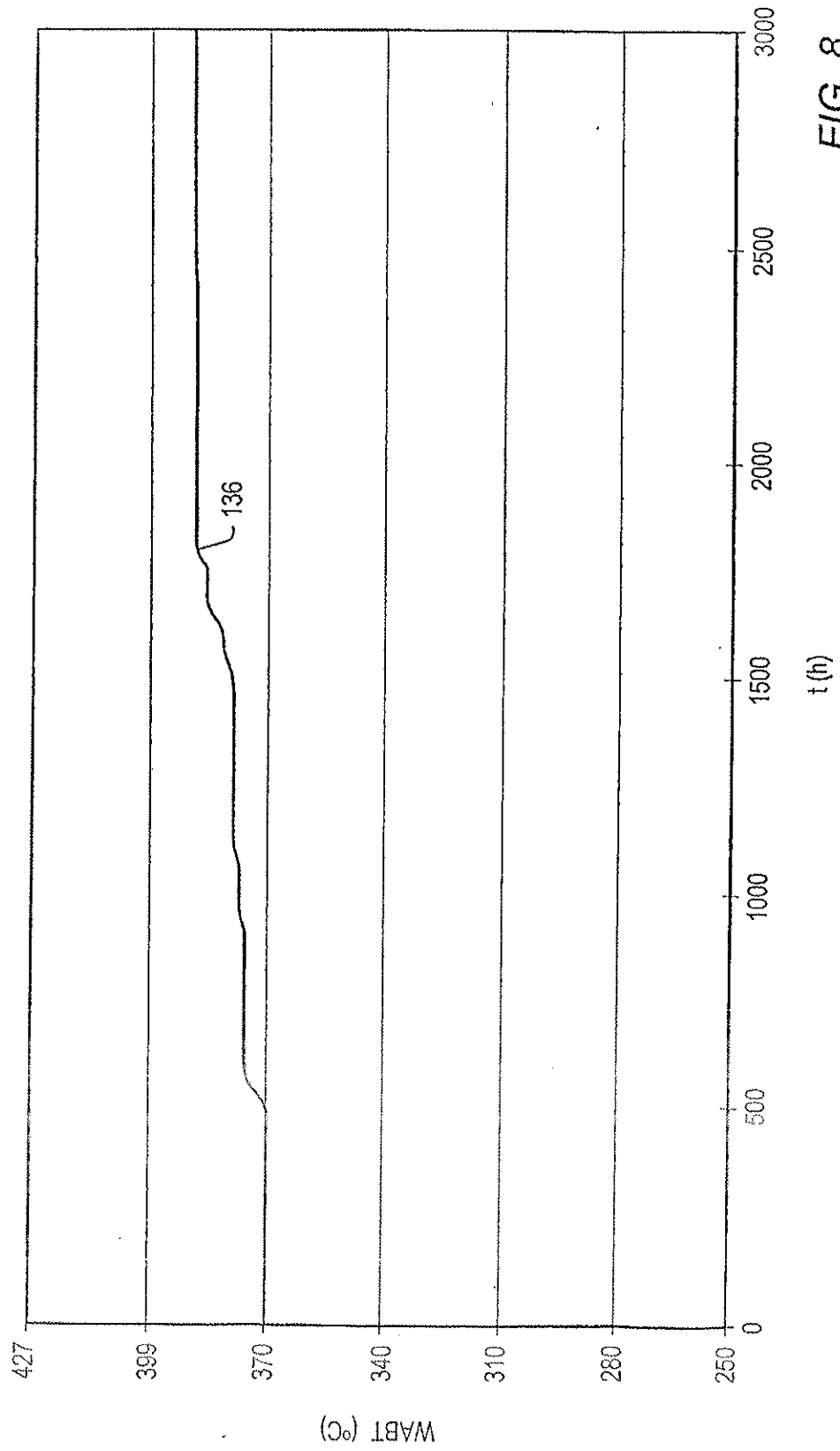


FIG. 8

TABLE 2

Property	Crude Feed	Crude Product
Example Number	6	6
TAN	10.3	0.42
API Gravity	13.2	12.5
Density at 15.56 °C (60 °F), g/cm ³	0.9776	0.9824
Hydrogen, wt%	11.54	11.71
Carbon, wt%	86.89	87.28
Sulfur, wt%	0.31	0.23
Oxygen, wt%	0.90	0.34
Nitrogen, wt%	0.38	0.39
Total Basic Nitrogen, wt%	0.14	0.15
Nickel, wtppm	13.7	10.7
Vanadium, wtppm	3.4	2.9
Iron, wtppm	19	2.5
Sodium, wtppm	37	24
Micro-Carbon Residue, wt%	7.2	6.7
C ₅ Asphaltenes, wt%	4.8	4.8
Distillate wt%	17.6	17.8
VGO wt%	44.6	44.1
Residue, wt%	37.8	37.8
P-Value	5	5
Viscosity at 37.8 °C (100 °F), cSt	6880	3893

FIG. 9

TABLE 3

Property	Crude Feed	Crude Product
Example Number	7	7
TAN	3.7	0.16
API Gravity	15.0	16.2
Density at 15.56 °C (60 °F), g/cm ³	0.9659	0.9582
Hydrogen, wt%	11.4	11.6
Carbon, wt%	87.1	87.4
Sulfur, wt%	0.43	0.33
Oxygen, wt%	0.42	0.20
Nitrogen, wt%	0.52	0.50
Total Basic Nitrogen, wt%	0.16	0.18
Nickel, wtppm	12.4	11.0
Vanadium, wtppm	19.2	15
Iron, wtppm	10.4	0.8
Calcium, wtppm	5.4	1.9
Sodium, wtppm	117	6
Zinc, wtppm	2.5	0.6
Potassium, wtppm	46	3
Micro-Carbon Residue, wt%	8.3	7.9
C ₅ Asphaltenes, wt%		6.3
Distillate wt%	15.6	19.4
VGO wt%	39.6	37.6
Residue, wt%	38.8	40.1
Viscosity at 37.8 °C (100 °F), cSt	1224	862

FIG. 10

Table 4

Property	Crude Feed	Crude Product	Crude Product	Crude Product	Crude Product
Example Number		8	9	10	11
TAN	0.8	0.04	0.04	0.04	0.05
API Gravity	19.6	22.3	22.95	21.7	22.9
Density at 15.56 °C (60 °F), g/cm ³	0.9363	0.9198	0.9162	0.9236	0.9165
Hydrogen, wt%	11.68	12.0	12.10	11.91	12.08
Carbon, wt%	85.24	86.10	86.2	85.90	86.25
Sulfur, wt%	1.91	1.6	1.3	1.8	1.3
Oxygen, wt%	0.9	0.15	0.14	0.15	0.14
Nitrogen, wt%	0.22	0.20	0.19	0.22	0.20
Total Basic Nitrogen, wt%	0.06	NA	NA	NA	NA
Nickel, wtppm	27	18	15	14	14
Vanadium, wtppm	69	41	35	29	33
Micro-Carbon Residue, wt%	7.5	5.8	5.9	6.5	6.0
C ₅ Asphaltenes, wt%	6.0	4.0	4.0	3.4	3.9
VGO, wt%	30.0	34.6	34.6	35.1	34.8
Residue, wt%	34.9	31.5	31.2	31.2	31.0
P-Value	---	3.1	3.2	4.5	3.2
Hydrogen Uptake, Nm ³ /m ³	---	29.3	40.3	18.9	35.3
Viscosity at 100 °F, cSt	177	62.6	59.7	72.7	58.3

FIG. 11

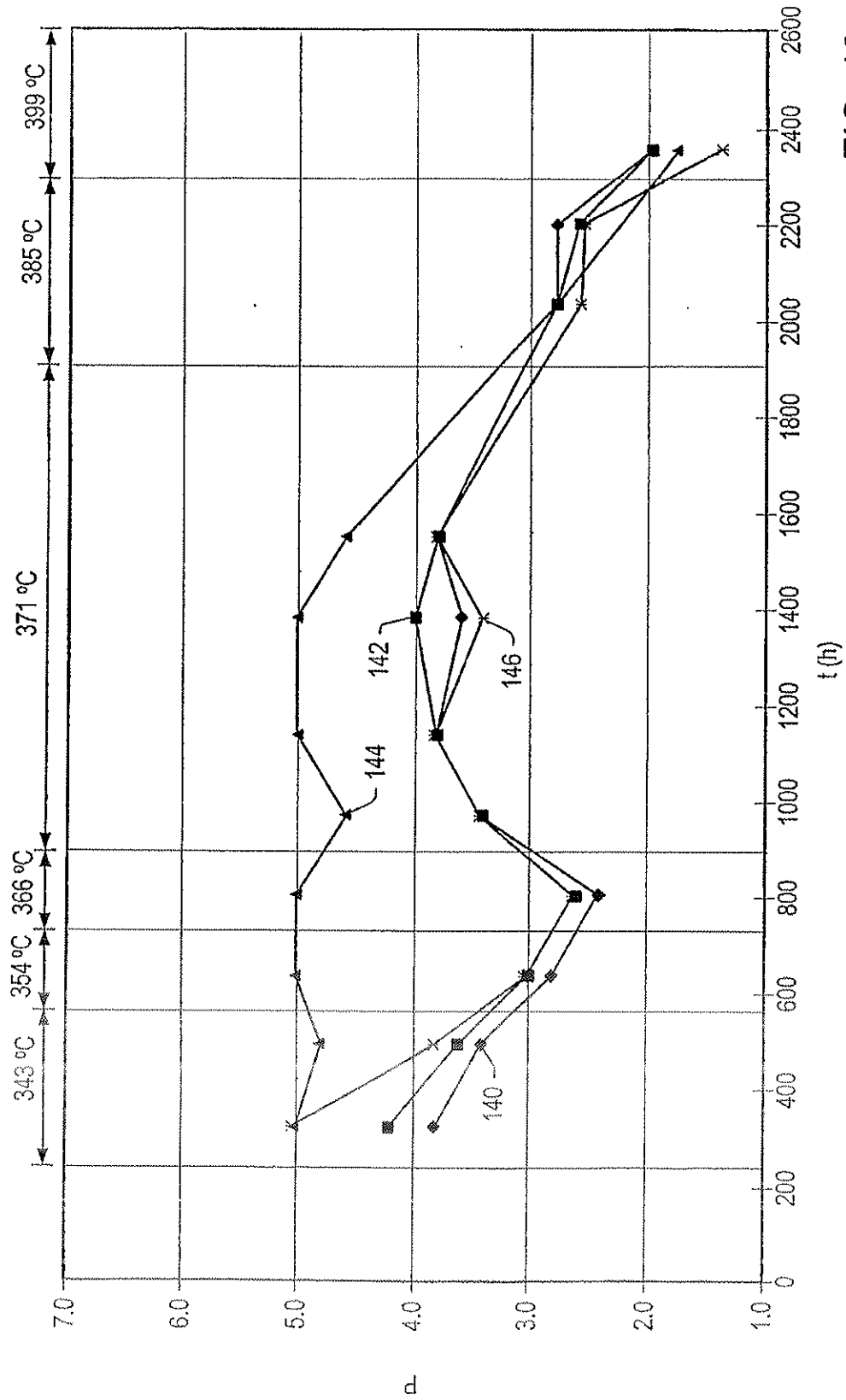


FIG. 12

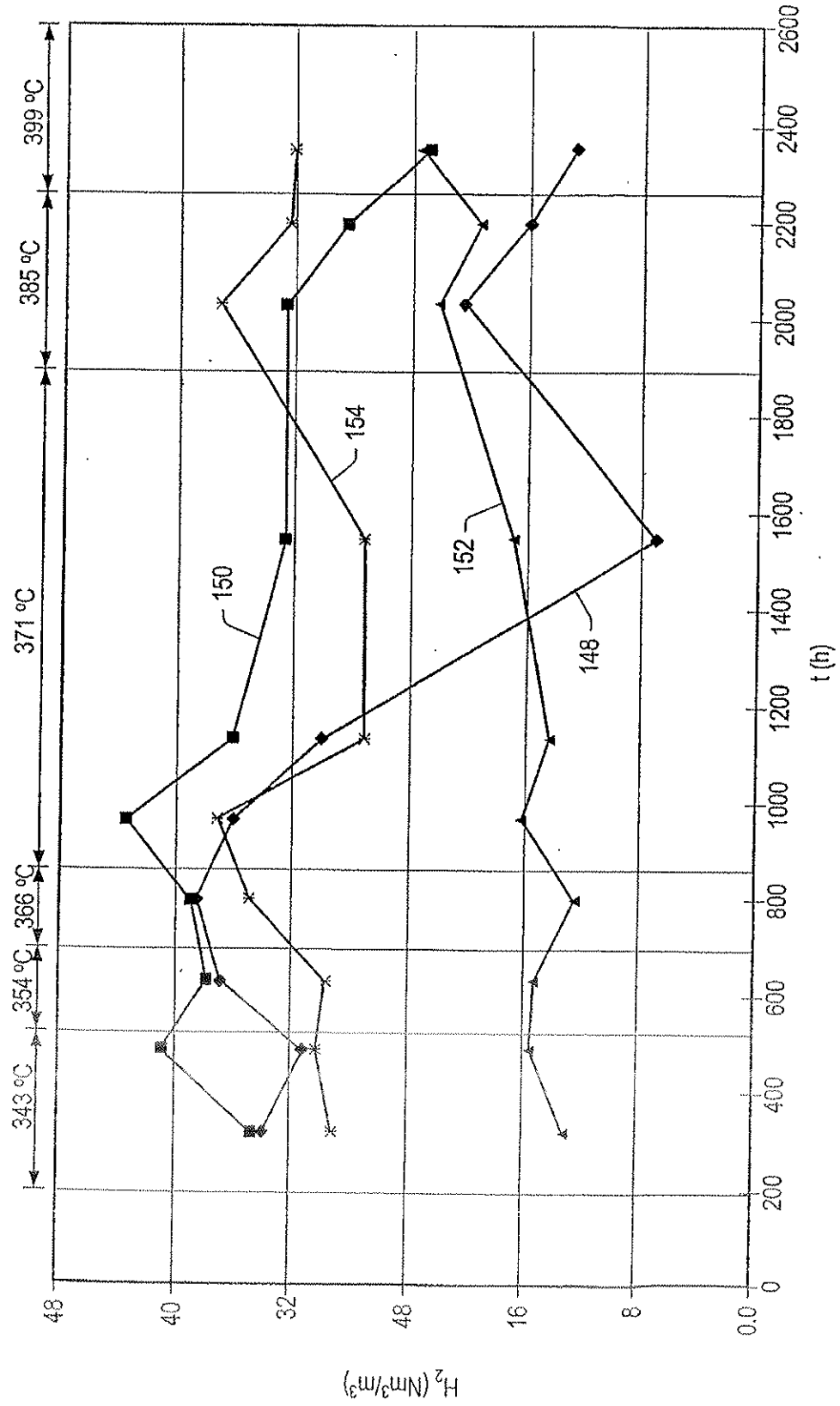


FIG. 13

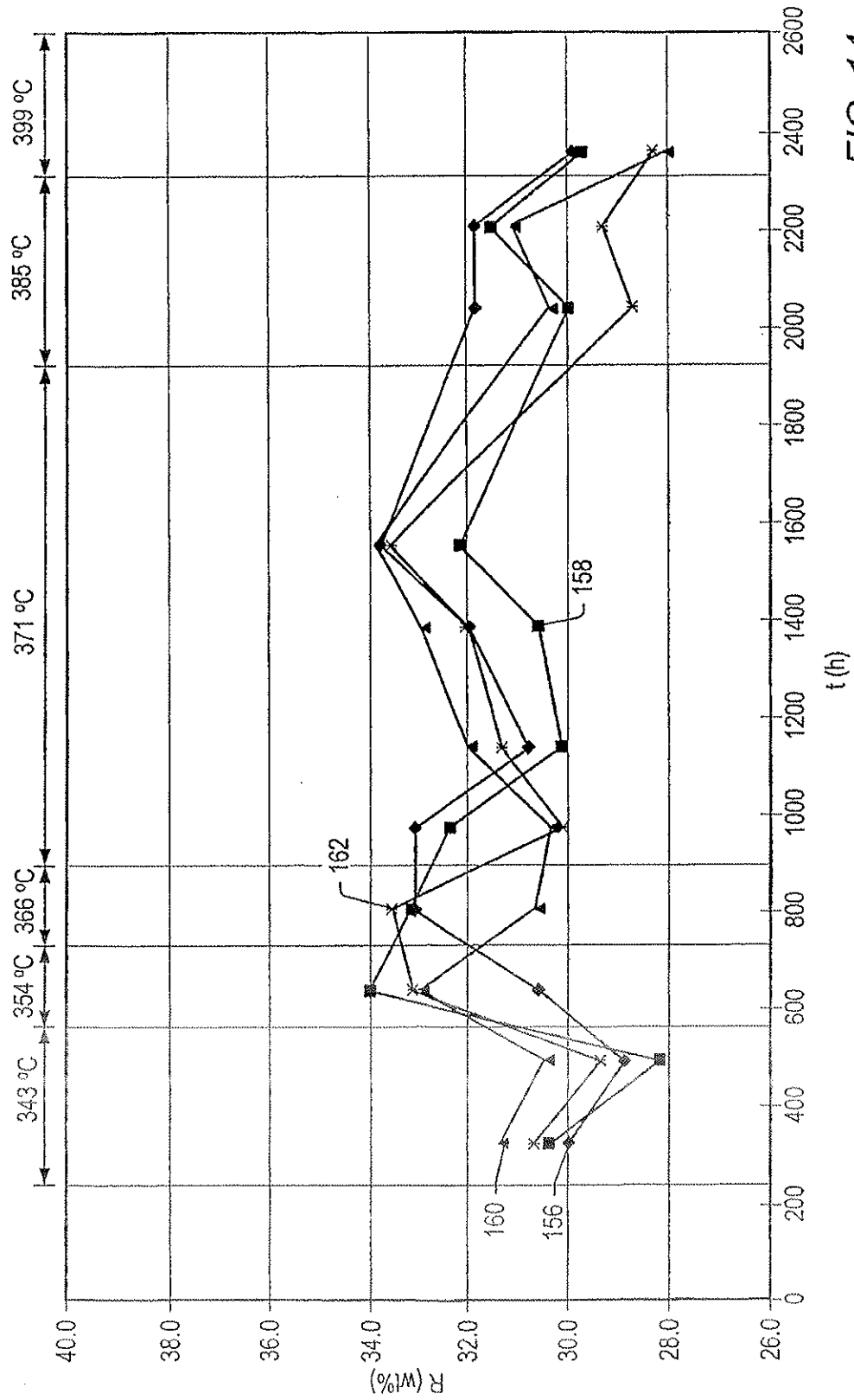


FIG. 14

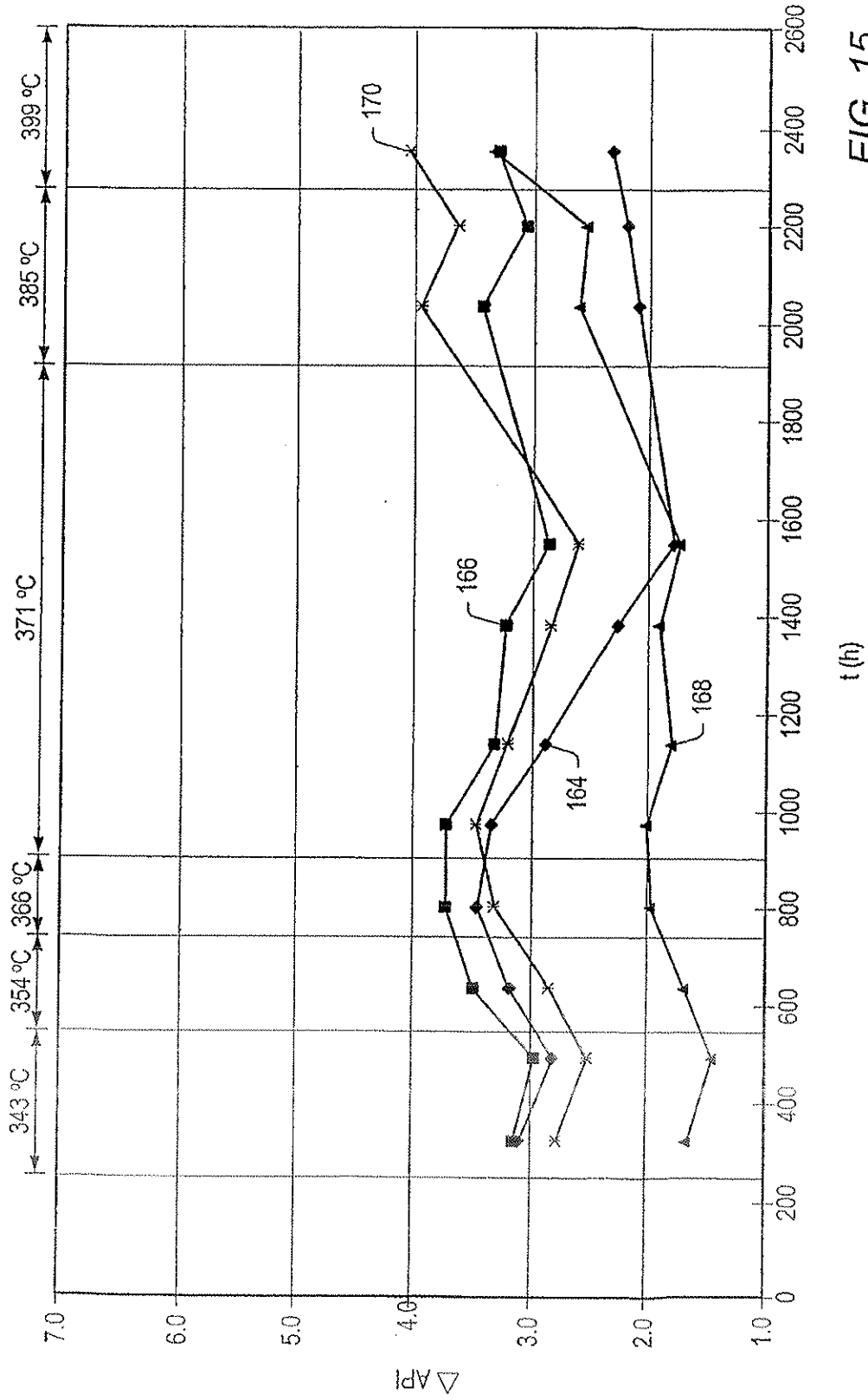


FIG. 15

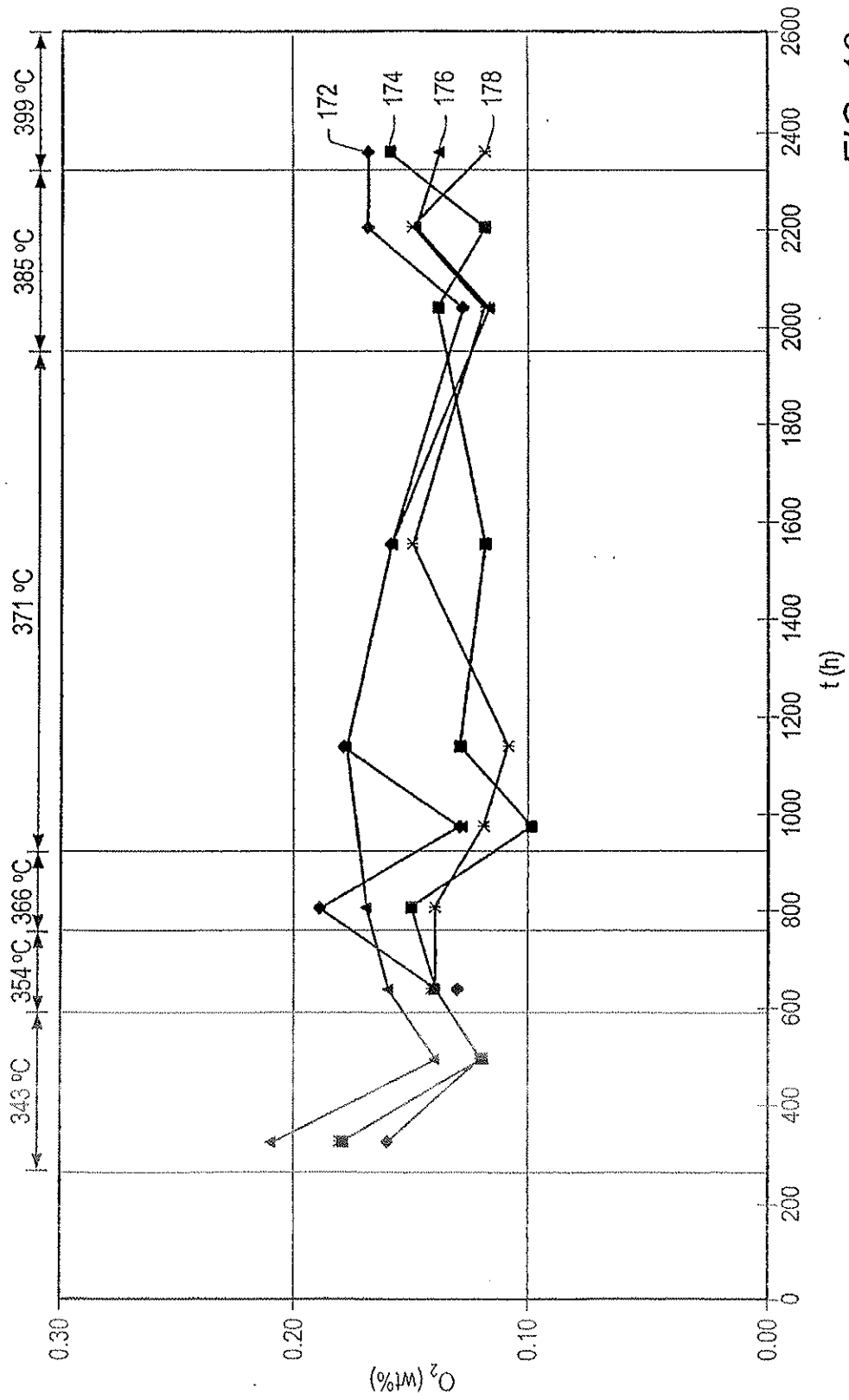


FIG. 16

Table 5

Property	Crude Feed	Crude Product	Crude Product	Crude Product	Crude Product
Example No.		15	16	17	18
Catalyst (% of total amount of catalyst in all contacting zones)	---	V(25%); Mo(75%)	V(50%); Mo(50%)	V(50%); Mo/V(50%)	Pyrex Beads
TAN	9.3	0.9	1.4	1.4	8
API Gravity	13.8	14.2	14.1	13.8	13.5
Density at 15.56 °C (60 °F), g/cm ³	0.9740	0.9712	0.9711	0.9716	0.9758
Hydrogen, wt%	11.50	11.59	11.62	11.58	11.48
Carbon, wt%	86.83	87.23	87.26	87.28	86.80
Sulfur, wt%	0.34	0.29	0.31	0.32	0.34
Oxygen, wt%	0.90	0.43	0.30	0.41	0.72
Nitrogen, wt%	0.42	0.42	0.41	0.41	0.42
Total Basic Nitrogen, wt%	0.14	0.14	0.14	0.14	0.14
Nickel, wtppm	14	14	14	14	14
Vanadium, wtppm	4	4	4	4	4
Iron, wtppm	32	3	4	4	18
Sodium, wtppm	---	9	10	7	
Potassium, wtppm	---	84	60	90	147
Calcium, wtppm	---	26	31	30	29
Zinc, wtppm	---	9	4	3	5
Micro-Carbon Residue, wt%	7.4	7.2	7.2	7.3	7.9
C ₅ Asphaltenes, wt%	5.5	4.1	4.0	4.1	5.0
VGO, wt%		41.7	41.3	41.3	40.8
Residue, wt%	37.8	41.9	41.7	42.4	43.2
P-Value	5	5	5	5	5
Hydrogen Uptake, Nm ³ /m ³	---	-1.0	1.9	-2.4	-8.9
Viscosity at 37.8 °C (100 °F), cSt	6830	4600	4240	5156	7576

FIG. 17

Table 6

Property	Crude Feed	Crude Product	Crude Feed	Crude Product
Example Number	6	6	19	19
LHSV, h ⁻¹	---	1	---	12.3
TAN	10.3	0.42	9.3	4
API Gravity	13.2	12.5	13.8	14.5
Density at 15.56 °C (60 °F), g/cm ³	0.9776	0.9824	0.9740	0.9695
Hydrogen, wt%	11.54	11.71	11.50	44.68
Carbon, wt%	86.89	87.28	86.83	87.28
Sulfur, wt%	0.31	0.23	0.34	0.28
Oxygen, wt%	0.90	0.34	---	0.42
Nitrogen, wt%	0.38	0.39	0.42	0.41
Nickel, ppm	13.7	10.7	13.5	12.8
Vanadium, ppm	3.4	2.9	3.7	3.3
Sodium, wppm	37	24	37	20
Calcium, wtppm	72	---	72	52
Zinc, wtppm	46	---	46	<0.4
Potassium, wppm	320	---	310	183
Micro-Carbon Residue, wt%	7.2	6.7	7.4	7.1
C ₅ Asphaltenes, wt%	4.8	4.8	5.5	4.6
Distillate, wt%	17.6	17.8	---	18.33
VGO, wt%	44.6	44.1	---	41.8
Residue, wt%	37.8	37.8	37.8	38.6
Viscosity at 37.8 °C (100 °F), cSt	6880	3893	6830	3774
				4276

FIG. 18

Table 7

Property	Crude Feed	Crude Product	Crude Feed	Crude Product
Example Number	6	6	20	20
TAN	10.3	0.42	9.3	0.7
API Gravity	13.2	12.5	13.8	14.7
Density at 15.56 °C (60 °F), g/cm ³	0.9776	0.9824	0.9740	0.9678
Hydrogen, wt%	11.54	11.71	11.50	11.68
Carbon, wt%	86.89	87.28	86.8	87.42
Sulfur, wt%	0.31	0.23	0.34	0.24
Oxygen, wt%	0.90	0.34	---	0.20
Nitrogen, wt%	0.38	0.39	0.42	0.40
Nickel, ppm	13.7	10.7	13.5	10.9
Vanadium, ppm	3.4	2.9	3.7	3.3
Iron, ppm	19	2.5	32	13
Sodium, wppm	37	24	37	9.8
Potassium, wppm	320	---	310	175
Micro-Carbon Residue, wt%	7.2	6.7	7.4	6.8
C ₅ Asphaltenes, wt%	4.8	4.8	5.5	3.9
Distillate, wt%	17.6	17.8	---	17.8
VGO, wt%	44.6	44.1	---	42.8
Residue, wt%	37.8	37.8	37.8	40.1
P-Value	5	5	5	5
Viscosity at 37.8 °C (100 °F), cSt	6880	3893	6830	3781

FIG. 19