

Fig. A199

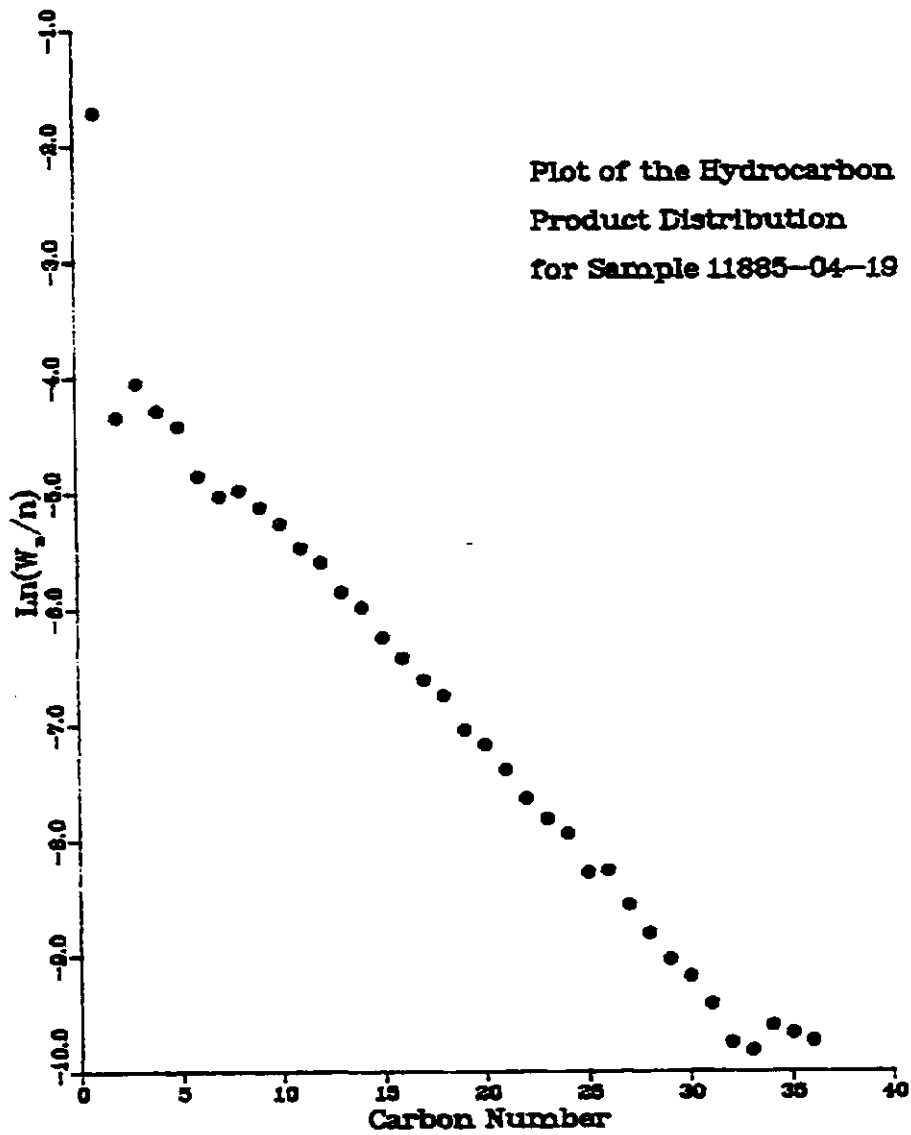


Fig. A200

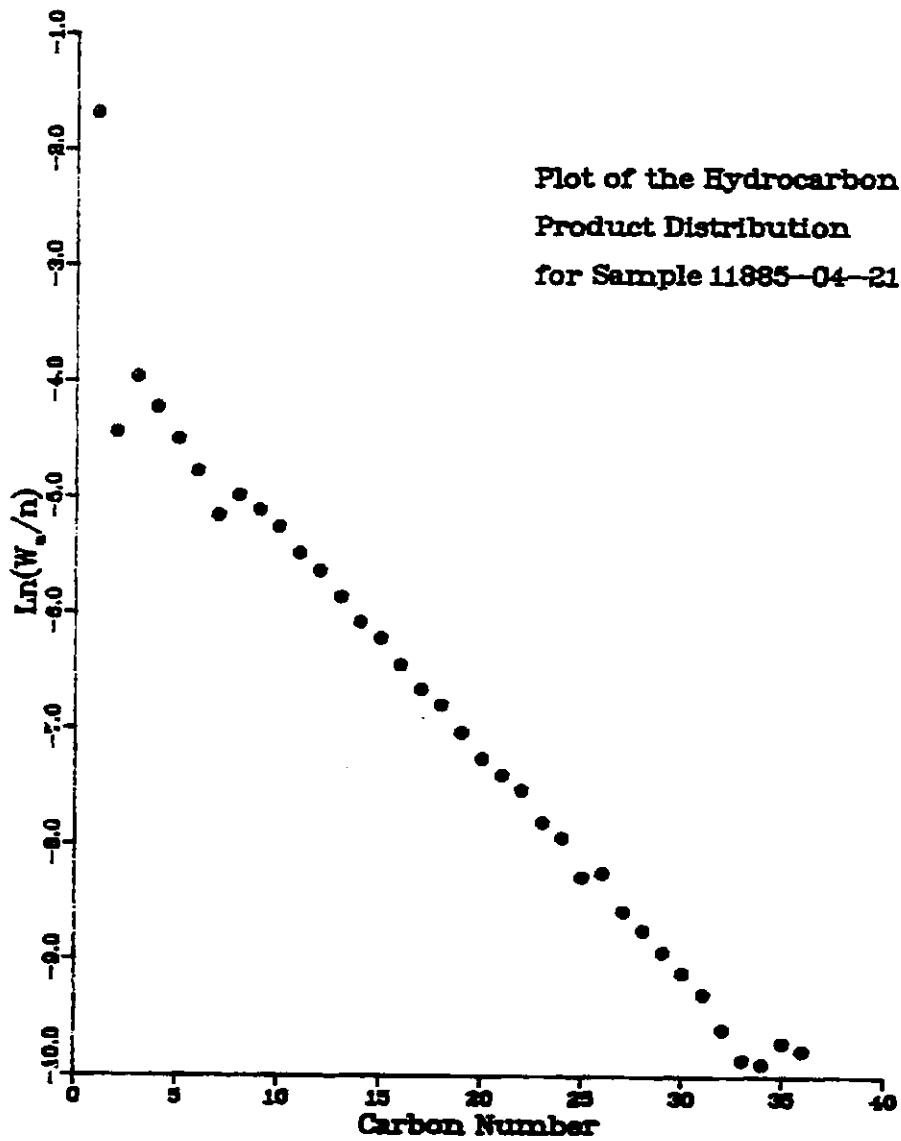


Fig. A201

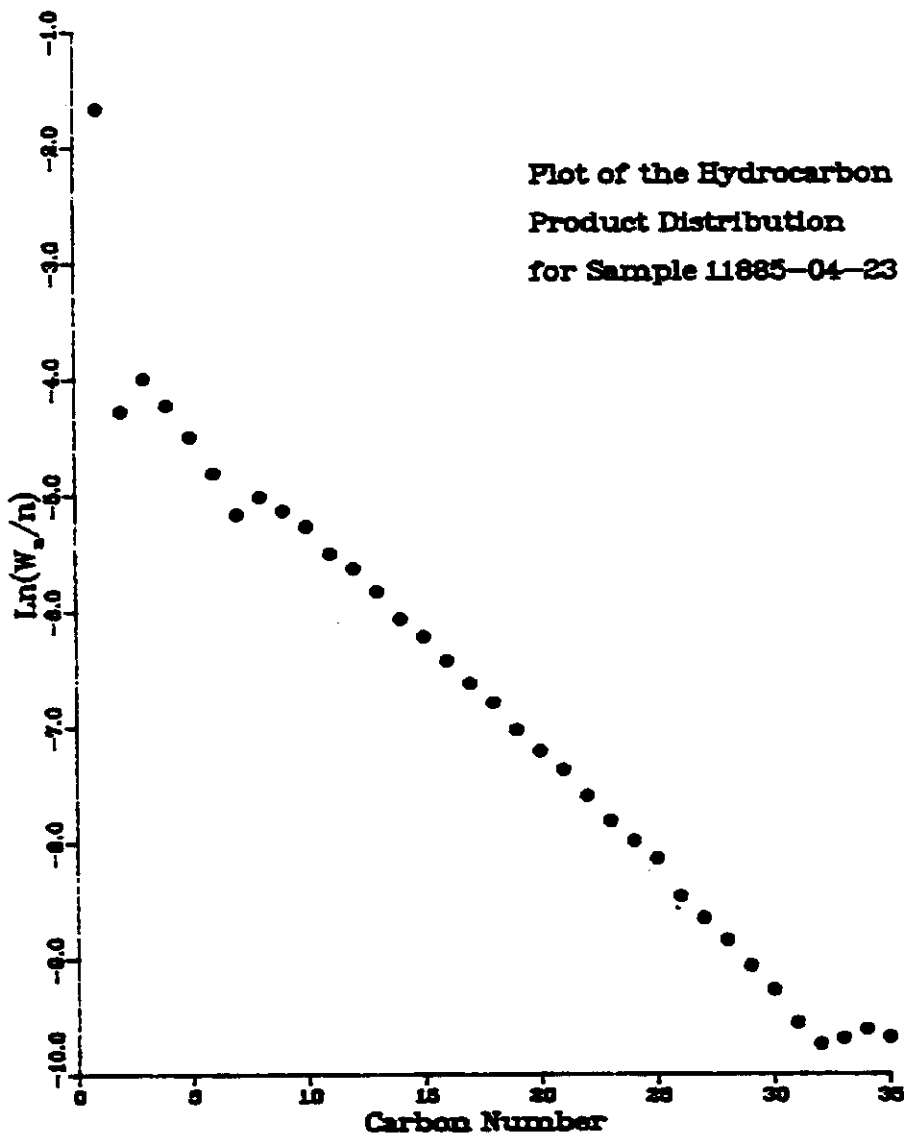


Fig. A202

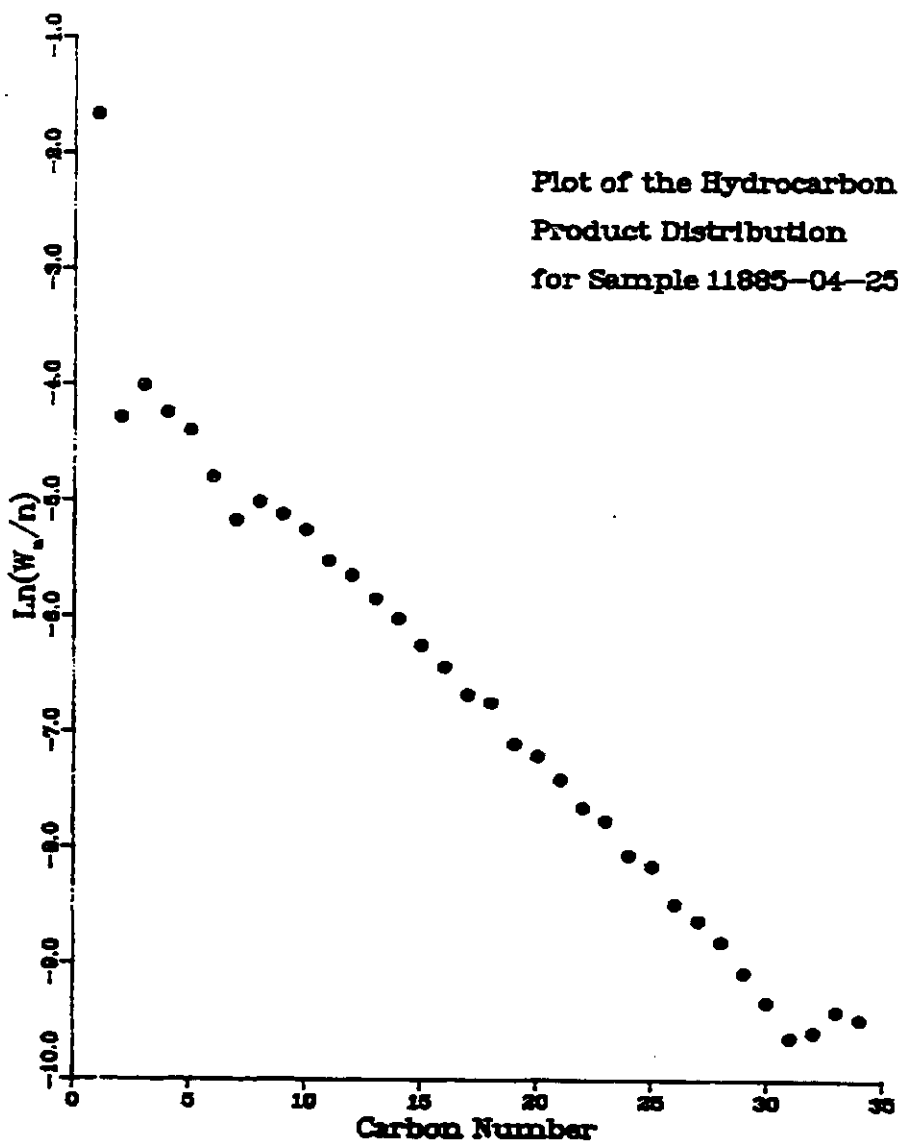
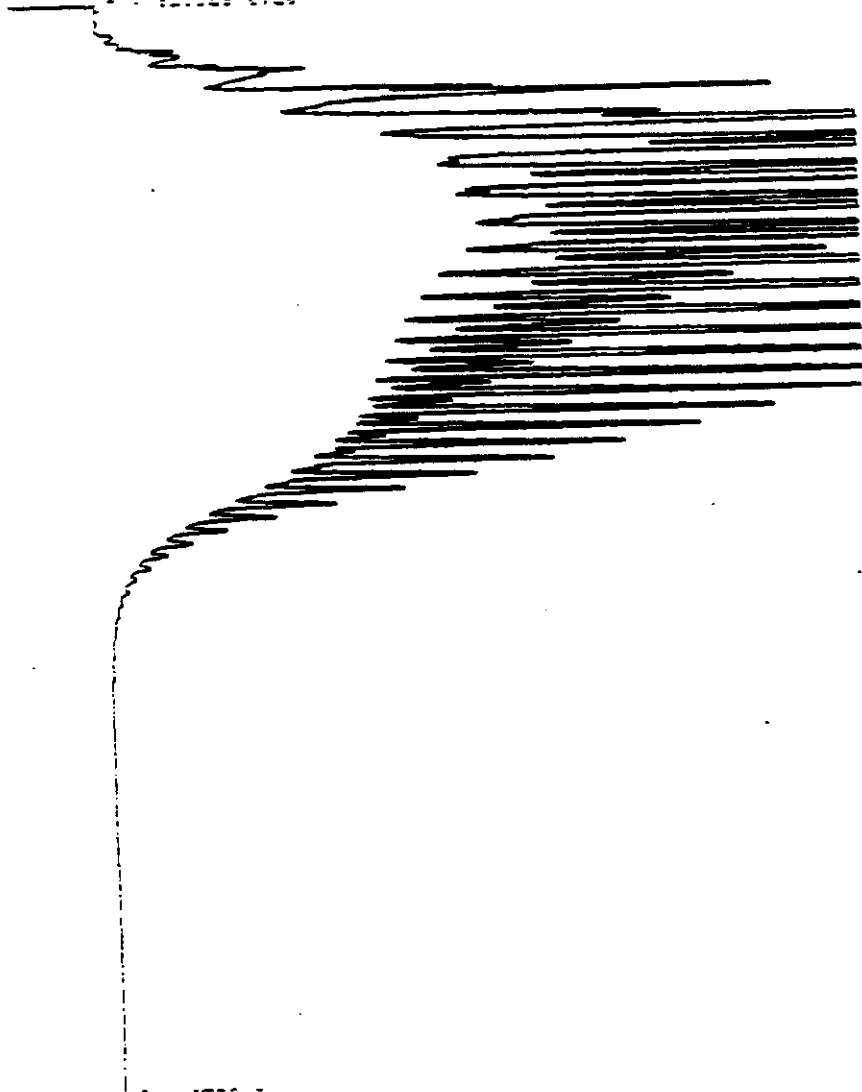


Fig. A203

1 23 7575 107 7575

275 11028 2.80



280 5722 8.4

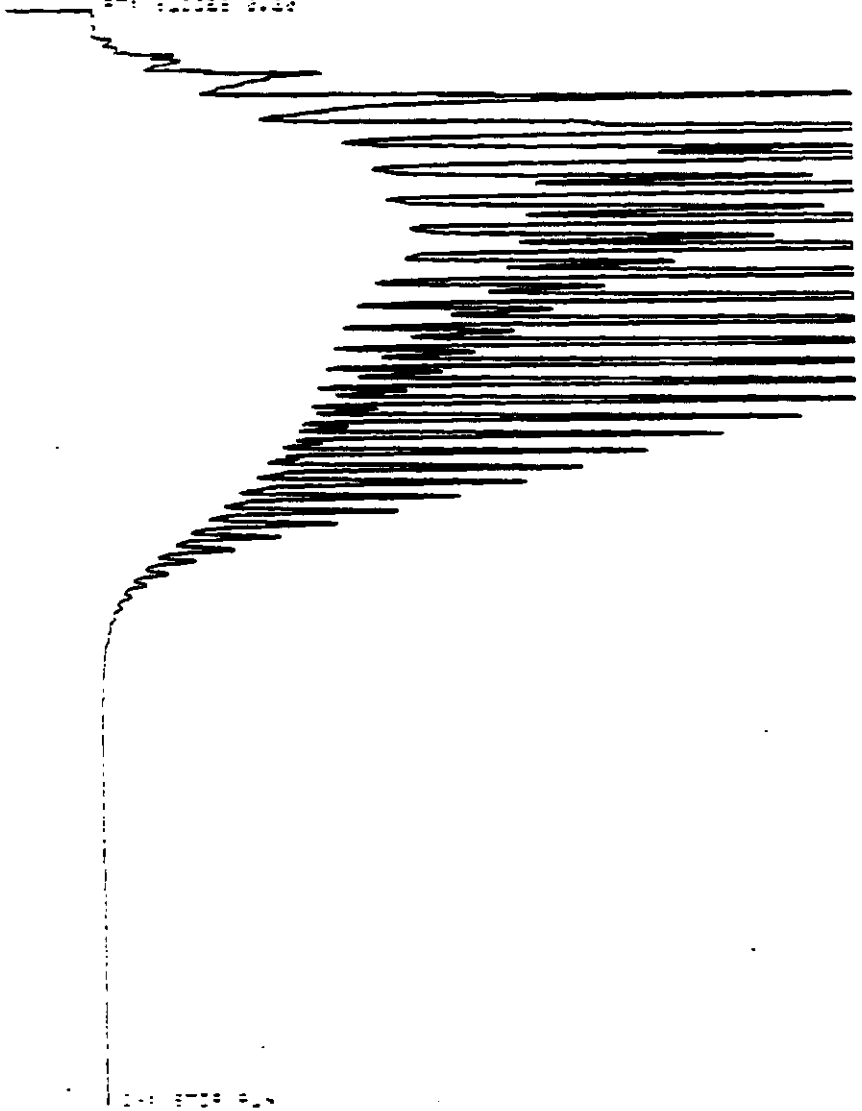
300 11028 2.80

Fig. A204

100

DATE TEST NOT READ

TIME 11:22 8.32



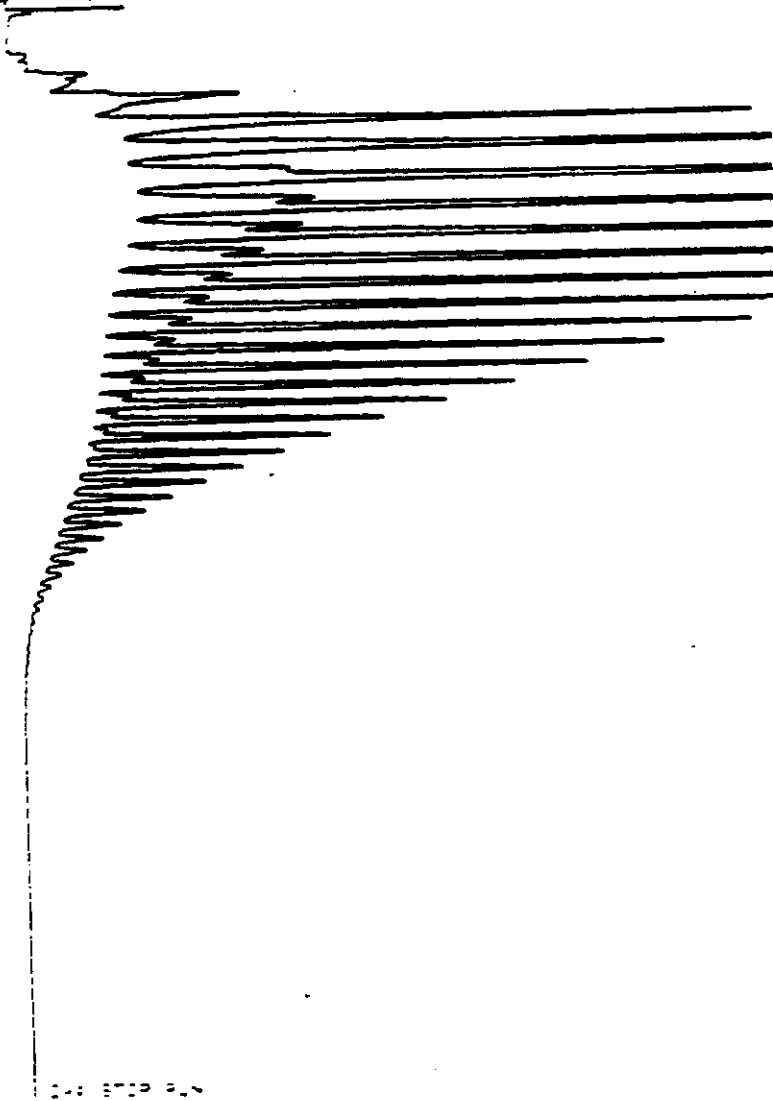
DATE TEST NOT READ

TIME 11:22 8.32

Fig. A205

TEMPERATURE NOT RECORDED

STP. ELIEN: 0.20



STP. ELIEN: 0.20

STP. ELIEN: 0.20

Fig. A206

Table A25

RESULT OF SYNGAS OPERATION

RUN NO. 11885-04
 CATALYST Co/X4/X8-U103+U101 11864-37C 250 CC 103.4G(128.2 @END +24.8G)
 FEED H2:CO:ARGON OF 50:50:0 @ 1260 CC/MN OR 302 GHSV

RUN & SAMPLE NO.	11885-04-01	885-04-03	885-04-05	885-04-07	885-04-07
FEED H2:CO:AR	50:50: 0	50:50: 0	50:50: 0	49:50: 0	50:50: 0
HRS ON STREAM	18.5	43.5	67.5	90.5	114.5
PRESSURE, PSIG	298	298	297	299	296
TEMP. C	263	260	260	260	260
FEED CC/MIN	1260	1260	1260	1260	1260
HOURS FEEDING	18.50	25.00	24.00	23.00	24.00
EFFLNT GAS LITER	824.20	1223.25	1211.80	1163.75	1234.17
GM AQUEOUS LAYER	138.10	163.64	149.53	138.11	141.95
GM OIL	44.32	52.89	48.93	53.30	53.47
MATERIAL BALANCE					
GM ATOM CARBON %	90.09	93.22	95.42	96.31	97.61
GM ATOM HYDROGEN %	96.11	97.24	97.28	98.14	98.31
GM ATOM OXYGEN %	98.83	100.67	102.18	101.21	102.37
RATIO CHX/(H2O+CO2)	0.7075	0.7202	0.7356	0.8016	0.8054
RATIO X IN CHX	2.4316	2.4326	2.4339	2.4276	2.4312
USAGE H2/CO PRDPT	2.4634	2.4598	2.4319	2.3250	2.3249
FEED H2/CO FRM EFFLNT	1.0668	1.0431	1.0195	1.0109	1.0072
RESIDUAL H2/CO RATIO	0.6112	0.6567	0.6545	0.6533	0.6569
RATIO CO2/(H2O+CO2)	0.0339	0.0302	0.0310	0.0329	0.0321
K SHIFT IN EFFLNT	0.0214	0.0204	0.0209	0.0222	0.0218
SPECIFIC ACTIVITY SA	0.6516	0.5917	0.5716	0.5975	0.5871
CONVERSION					
ON CO %	24.60	21.43	20.54	21.39	21.00
ON H2 %	56.80	50.53	48.99	49.20	48.48
ON CO+H2 %	41.22	36.29	34.90	35.37	34.79
PRDPT SELECTIVITY, WT %					
CH4	17.12	17.16	17.35	16.87	16.97
C2 HC'S	2.19	2.14	2.23	2.11	2.50
C3H8	1.91	2.23	2.34	2.22	2.31
C3H6=	2.07	2.49	2.51	2.33	2.29
C4H10	1.73	1.82	1.81	1.74	1.75
C4H8=	3.23	3.57	3.60	3.37	3.28
C5H12	1.98	1.83	1.79	1.76	1.86
C5H10=	2.61	0.28	2.79	2.12	2.17
C6H14	3.41	3.46	2.60	2.54	2.55
C6H12= & CYCLO'S	2.96	2.95	2.38	2.36	2.35
C7+ IN GAS	10.43	13.04	12.41	10.70	11.73
LIQ HC'S	50.36	49.05	48.19	51.86	50.24
TOTAL	100.00	100.00	100.00	100.00	100.00

Table A25 (continued)

SUB-GROUPING					
C1 -C4	28.26	29.40	29.84	28.65	29.10
C5 -420 F	43.04	39.70	39.56	39.20	39.25
420-700 F	26.37	25.87	24.82	26.19	25.71
700-END PT	2.33	5.03	5.78	5.96	5.94
C5+-END PT	71.74	70.60	70.16	71.35	70.90
ISO/NORMAL MOLE RATIO					
C4	0.2078	0.1304	0.0940	0.0871	0.0835
C5	0.2118	0.1136	0.0876	0.0820	0.0731
C6	1.4127	1.0304	0.5284	0.5059	0.4614
C4=	0.3177	0.0536	0.0560	0.0576	0.0502
PARAFFIN/OLEFIN RATIO					
C3	0.8791	0.8525	0.8883	0.9069	0.9608
C4	0.5184	0.4916	0.4848	0.4977	0.5154
C5	0.7365	6.4588	0.6215	0.8037	0.8303
SCHULZ-FLORY DISTRBTN					
ALPHA (EXP(SLOPE))	0.8010	0.8362	0.8387	0.8406	0.8400
RATIO CH4/(1-A)**2	4.3219	6.3961	6.6711	6.6395	6.6263
ALPHA FRM CORRELATION	0.8346	0.8313	0.8314	0.8315	0.8313
ALPHA (EXPTL/CORR)	0.9597	1.0059	1.0088	1.0109	1.0105
W%CH4 FRM CORRELATION	19.7475	20.1555	20.1027	20.0763	20.1595
W%CH4 (EXPTL/CORR)	0.8671	0.8513	0.8630	0.8405	0.8420
LIQ HC COLLECTION					
PHYS. APPEARANCE	CLR &SLD	CLR &SLD	CLR BL	CLR &SLD	CLDY &SLD
DENSITY	0.763	0.766	0.760	0.760	0.762
N, REFRACTIVE INDEX	1.4289	1.4311	1.4309	1.4300	1.4236
SIMULT'D DISTILATN					
10 WT % @ DEG F	295	301	301	299	301
16	326	337	339	333	339
50	446	475	481	473	478
84	600	655	670	664	669
90	643	702	716	714	716
RANGE(16-84 %)	274	318	331	331	330
WT % @ 420 F	43.00	37.00	36.50	38.00	37.00
WT % @ 700 F	95.37	89.75	88.00	88.50	88.17

NEW FORMAT JAN 25,85

Table A26

RESULT OF SYNGAS OPERATION

RUN NO.	11885-04				
CATALYST	Co/X4/X8-U103+U101 11864-37C 250 CC 103.4G(128.2 @END +24.8G)				
FEED	H2:CO:ARGON OF 50:50:0 @ 1260 CC/MN OR 302 GHSV				
RUN & SAMPLE NO.	11885-04-11	885-04-13	885-04-15	885-04-17	885-04-19
FEED H2:CO:AR	50:50: 0	50:50: 0	50:50: 0	50:50: 0	50:50: 0
HRS ON STREAM	137.5	161.5	185.5	208.0	236.0
PRESSURE, PSIG	295	297	296	293	297
TEMP. C	260	260	261	260	259
FEED CC/MIN	1260	1260	1260	1260	1260
HOURS FEEDING	23.00	24.00	24.00	22.25	27.92
EFFLNT GAS LITER	1194.88	1253.80	1261.30	1189.78	1507.80
GM AQUEOUS LAYER	134.87	140.09	127.53	123.77	151.31
GM OIL	47.97	50.83	47.44	46.54	52.90
MATERIAL BALANCE					
GM ATOM CARBON %	98.12	99.75	98.64	99.50	98.80
GM ATOM HYDROGEN %	99.24	99.17	98.11	101.16	99.90
GM ATOM OXYGEN %	102.56	103.72	101.23	102.69	102.94
RATIO CHX/(H2O+CO2)	0.8176	0.8365	0.8848	0.8631	0.8183
RATIO X IN CHX	2.4358	2.4457	2.4396	2.4256	2.4439
USAGE H2/CO PRDNT	2.3087	2.2807	2.2179	2.2501	2.3121
FEED H2/CO FRM EFFLNT	1.0114	0.9942	0.9946	1.0167	1.0111
RESIDUAL H2/CO RATIO	0.6648	0.6472	0.6707	0.6897	0.6932
RATIO CO2/(H2O+CO2)	0.0327	0.0351	0.0363	0.0322	0.0326
K SHIFT IN EFFLNT	0.0225	0.0235	0.0253	0.0229	0.0233
SPECIFIC ACTIVITY SA	0.5836	0.6078	0.5425	0.5535	0.5318
CONVERSION					
ON CO %	21.09	21.24	20.93	20.96	19.64
ON H2 %	48.13	48.73	46.68	46.38	44.90
ON CO+H2 %	34.69	34.94	33.77	33.77	32.34
PRDT SELECTIVITY, WT %					
CH4	17.32	18.08	17.65	16.78	17.96
C2 HC'S	2.74	2.19	2.74	2.28	2.60
C3H8	2.45	2.25	2.58	2.65	2.50
C3H6=	2.47	2.16	2.46	2.94	2.72
C4H10	1.87	1.82	1.93	2.13	1.83
C4H8=	3.76	3.48	3.85	4.32	3.64
C5H12	2.04	2.05	2.38	2.11	1.93
C5H10=	2.27	4.43	4.10	3.77	4.07
C6H14	3.44	2.27	2.44	2.36	2.33
C6H12= & CYCLO'S	2.10	3.15	2.48	2.30	2.36
C7+ IN GAS	12.95	11.85	13.10	12.09	12.94
LIQ HC'S	46.59	46.26	44.28	46.28	45.11
TOTAL	100.00	100.00	100.00	100.00	100.00

Table A26 (continued)

SUB-GROUPING						
CI -C4	30.61	29.99	31.22	31.10	31.25	
C5 -420 F	40.04	40.41	40.89	39.06	40.10	
420-700 F	23.88	23.80	22.78	22.54	23.08	
700-END PT	5.47	5.81	5.11	7.31	5.56	
C5+-END PT	69.39	70.01	68.78	68.90	68.75	
ISO/NORMAL MOLE RATIO						
C4	0.1126	0.0738	0.1106	0.1435	0.0579	
C5	0.1005	0.0727	0.0839	0.0590	0.0512	
C6	0.8333	0.1731	0.2325	0.2119	0.1360	
C4+	0.0587	0.0496	0.0608	0.0635	0.0543	
PARAFFIN/OLEFIN RATIO						
C3	0.9448	0.9937	1.0024	0.8583	0.8779	
C4	0.4789	0.5052	0.4852	0.4757	0.4851	
C5	0.8750	0.4496	0.5652	0.5437	0.4617	
SCHULZ-FLORY DISTRBTN						
ALPHA (EXP(SLOPE))	0.8333	0.8334	0.8288	0.8355	0.8303	
RATIO CH4/(1-A)**2	6.2302	6.5122	6.0201	6.1988	6.2349	
ALPHA FRM CORRELATION						
ALPHA (EXPTL/CORR)	1.0031	1.0016	0.9983	1.0079	1.0019	
W%CH4 FRM CORRELATION						
W%CH4 (EXPTL/CORR)	20.3396	19.9343	20.7015	20.8946	20.7444	
LIQ HC COLLECTION						
PHYS. APPEARANCE	CLDY &SLD	CLDY &SLD	CLDY WAXY	CLDY &WAX	CLDY &WAX	
DENSITY	0.765	0.766	0.761	0.765	0.765	
N, REFRACTIVE INDEX	1.4232	1.4235	1.4233	1.4245	1.4236	
SIMULT'D DISTILATN						
10 WT % @ DEG F	301	303	301	308	307	
16	339	340	339	341	341	
50	478	483	476	486	480	
84	668	671	665	698	669	
90	715	724	714	764	724	
RANGE(16-84 %)	329	331	326	357	328	
WT % @ 420 F	37.00	36.00	37.00	35.50	36.50	
WT % @ 700 F	88.25	87.45	88.45	84.20	87.67	

NEW FORMAT JAN 25,85

Table A27

RESULT OF SYNGAS OPERATION

RUN NO. 11885-04
 CATALYST Co/X4/X8-U103+U101 11864-37C 250 CC 103.4G(128.2 @END +24.8G)
 FEED H2:CO:ARGON OF 50:50:0 @ 1260 CC/MN OR 302 GHSV

RUN & SAMPLE NO.	11885-04-21	885-04-23	885-04-25
FEED H2:CO:AR	50:50: 0	50:50: 0	50:50: 0
HRS ON STREAM	258.0	282.0	306.0
PRESSURE, PSIG	297	296	295
TEMP. C	259	260	259
FEED CC/MIN	1260	1260	1260
HOURS FEEDING	22.00	24.00	24.00
EFFLNT GAS LITER	1200.13	1302.55	1316.55
GM AQUEOUS LAYER	118.24	129.56	126.41
GM OIL	39.85	43.16	41.17
MATERIAL BALANCE			
GM ATOM CARBON %	99.58	99.09	98.86
GM ATOM HYDROGEN %	100.04	99.71	99.97
GM ATOM OXYGEN %	103.75	103.42	103.25
RATIO CHX/(H2O+CO2)	0.8161	0.8096	0.8029
RATIO X IN CHX	2.4558	2.4603	2.4644
USAGE H2/CO PRDPT	2.3198	2.3264	2.3403
FEED H2/CO FRM EFFLNT	1.0046	1.0063	1.0112
RESIDUAL H2/CO RATIO	0.6896	0.6890	0.7025
RATIO CO2/(H2O+CO2)	0.0328	0.0338	0.0330
K SHIFT IN EFFLNT	0.0234	0.0241	0.0240
SPECIFIC ACTIVITY SA	0.5268	0.5029	0.5020
CONVERSION			
ON CO %	19.32	19.37	18.85
ON H2 %	44.62	44.79	43.62
ON CO+H2 %	32.00	32.12	31.30
PRDPT SELECTIVITY, WT %			
CH4	18.54	18.87	18.94
C2 HC'S	2.37	2.77	2.75
C3H8	2.64	2.70	2.74
C3H6=	3.07	2.83	2.70
C4H10	2.13	2.01	2.15
C4H8=	3.72	3.84	3.58
C5H12	1.97	2.04	2.35
C5H10=	3.56	3.53	3.82
C6H14	2.52	2.43	2.56
C6H12= & CYCLO'S	2.51	2.46	2.38
C7+ IN GAS	13.50	13.22	13.51
LIQ HC'S	43.46	43.30	42.52
TOTAL	100.00	100.00	100.00

Table A27 (continued)

SUB-GROUPING			
C1 -C4	32.48	33.02	32.86
C5 -420 F	39.28	38.83	39.50
420-700 F	22.38	22.84	22.58
700-END PT	5.87	5.30	5.06
C5+-END PT	67.52	66.98	67.14
ISO/NORMAL MOLE RATIO			
C4	0.0524	0.0505	0.0484
C5	0.0452	0.0455	0.0647
C6	0.1263	0.1189	0.1271
C4=	0.0466	0.0535	0.0508
PARAFFIN/OLEFIN RATIO			
C3	0.8206	0.9116	0.9666
C4	0.5526	0.5043	0.5789
C5	0.5381	0.5623	0.5986
SCHULZ-FLORY DISTRIBUTION			
ALPHA (EXP(SLOPE))	0.8297	0.8285	0.8276
RATIO CH4/(1-A)**2	6.3899	6.4139	6.3703
ALPHA FROM CORRELATION			
ALPHA (EXPTL/CORR)	1.0009	0.9994	0.9994
W%CH4 FROM CORRELATION			
W%CH4 (EXPTL/CORR)	20.6659	20.8811	20.9461
W%CH4 (EXPTL/CORR)	0.8970	0.9037	0.9044
LIQ HC COLLECTION			
PHYS. APPEARANCE	CLDY WAXY	CLDY WAXY	CLDY WAXY
DENSITY	0.763	0.766	0.761
N, REFRACTIVE INDEX	1.4236	1.4235	1.4234
SIMULT'D DISTILLATION			
10 WT % @ DEG F	315	316	317
16	343	343	343
50	485	485	484
84	679	668	666
90	733	722	717
RANGE(16-84 %)	336	325	323
WT % @ 420 F	35.00	35.00	35.00
WT % @ 700 F	86.50	87.75	88.11

NEW FORMAT JAN 25,85

I. Summary

While none of the eight catalysts tested this quarter matched the catalyst of Run 11677-11 in stability, there was one stable and effective catalyst among them and much valuable information was gained.

The effects of process changes in Run 11723-17 (Catalyst 1) are very informative. The higher pressure is not an advantage in these cobalt systems. It raises the initial activity only a little, and accelerates the deactivation rate to the degree that after a relatively short time on stream at 500 psig the syngas conversion is lower than it was at 300 psig. This suggests that tests be run to see whether pressures below 300 psig might enhance stability still further.

The results with X₈ were mixed. Although chemically related to X₆, in cobalt Fischer-Tropsch catalysts it acts somewhat differently. It does lower the production of methane, for which purpose the optimum concentration seems to be 2 percent as much X₈ as cobalt, but it does not lower the water gas shift activity as much as X₆ does. In addition, it did not perform well in combination with X₄ when both were at low concentrations. At higher levels, in Catalyst 7 (Run 1185-02), the combination produced an active and stable catalyst.

Thorium appears to be essential in a catalyst containing the

X₄/X₈ combination. It seems to enhance their useful effects, and to minimize their tendency to lower the catalyst's specific activity.

The effects of potassium are also mixed. It does increase the water gas shift activity, as in iron catalysts, but it does not contribute to chain growth and seems to impair the catalyst's stability.