AD NUMBER

AD867046

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; Feb 1970. Other requests shall be referred to Air Force Aero Propulsion Lab, Wright-Patterson AFB, OH 45433.

AUTHORITY

AFAPL ltr dtd 12 Apr 1972

REPRODUCTION QUALITY NOTICE

This document is the best quality available. The copy furnished to DTIC contained pages that may have the following quality problems:

- Pages smaller or larger than normal.
- Pages with background color or light colored printing.
- Pages with small type or poor printing; and or
- Pages with continuous tone material or color photographs.

Due to various output media available these conditions may or may not cause poor legibility in the microfiche or hardcopy output you receive.

☐ If this block is checked, the copy furnished to DTIC contained pages with color printing, that when reproduced in Black and White, may change detail of the original copy.

AFAPL-TR-67-114
Part III, Volume II

AD 867046

VAPORIZING AND ENDOTHERMIC FUELS FOR ADVANCED ENGINE APPLICATION

Part III. Studies of Thermal and Catalytic Reactions, Thermal Stabilities, and Combustion Properties of Hydrocarbon Fuels

A.C. Nixon, G.H. Ackerman, L.E. Faith, H.T. Henderson,
A.W. Ritchie, L.B. Ryland, T.M. Shryne

Shell Development Company,
A Division of Shell Oil Company

TECHNICAL REPORT AFAPL-TR-67-114, Part III, Volume II

February 1970

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Air Force Aero Propulsion Laboratory. /AFPL

Air Force Aero Propulsion Laboratory
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio

258

NOTICES

APPENDIX

APPENDIX (Contd)

APPENDIX (Contd)

Calculation Procedure for Mach 8 Engine

Station 1.

Use the following formulas from Ref. 12 to calculate the inlet area:

$$I_f = \frac{n_e(H_f)J}{V_1}$$

$$W_f = \frac{n_n(F_g)}{I_f}$$

$$A_1 = \frac{W_f}{(F/A)(\rho_1(V_1)}$$

Assume: $n_e = .412$

$n_n = .95$

$H_f = 18894$ Btu/lbm fuel

At 100,000 ft and M = 8

$T_1 = 420.1°R$

$P_1 = 22.32 \text{ lb/ft}^2$

$\rho_1 = .000996 \text{ lbm/ft}^3$

$V_1 = 8050.96$ ft/sec

$$I_f = \frac{(.412)(18894)(778)}{(8051)}$$

$I_f = 752.23$ sec

Assume: $L/D = 6$

$L = 450{,}000$ lb

$D = F_g = 75000$ lb

Therefore:

$$W_f = \frac{(.95)(75000)}{752.23}$$

$W_f = 94.72$ lbm/sec fuel

To Calculate the stoichiometric fuel-air ratio (F/A) assume the fuel is MCH converted to H_2 and C_7H_8:

$$.75\ H_2 + .25\ C_7H_8 + 2.625\ O_2 + 2.625(3.76)N_2 \rightarrow$$

$$1.75\ H_2O + 1.75\ CO_2 + 9.87\ N_2$$

The average molecular weight of the fuel: 25.25

$$F/A = \frac{(1 \text{ mole of fuel})(25.25 \text{ lbm molecular weight})}{(9.87 + 2.625 \text{ moles air})(28.95 \text{ lbm molecular weight})}$$

$$\boxed{F/A = .0698} \quad \text{Assuming E.R} = 1.0$$

$$A_1 = \frac{94.72}{(.0698)(.000996)(8051)}$$

$$\boxed{A_1 = 169.23 \text{ ft}^2}$$

Station 3.

Use the Dugger Equation for the total pressure drop from Station 1 to 3:

$$n_d = 1 - \frac{\left(\frac{P_{t_1}}{P_{t_3}}\right)^{\bar{\gamma}-1/\bar{\gamma}} - 1}{((\bar{\gamma} - 1)/2)M_1^2}$$

Assume: $n_d = .959$

$\bar{\gamma} = 1.4$

then

$$\frac{\bar{\gamma} - 1}{\bar{\gamma}} = \frac{1.4 - 1}{1.4} = .286$$

$$\frac{(P_{t_1}/P_{t_3})^{.286} - 1}{((1.4 - 1)/2)(8)^2} = 1 - .959$$

$$(P_{t_1}/P_{t_3})^{.286} = 1.5248$$

$$(P_{t_1}/P_{t_3}) = 4.36$$

From the isentropic flow tables at M = 8

$$P_1/P_{t_1} = .000102$$

$$P_{t_1} = \frac{22.32 \text{ lb/ft}^2}{(.000102)(144 \text{ in}^2/\text{ft}^2)}$$

$$P_{t_1} = 1519 \text{ lb/in}^2$$

$$P_{t_3} = \frac{1512\ lb/in^2}{4.30}$$

$$P_{t_3} = 348\ lb/in^2$$

Assume:

$M_3 = 2.5$ then

From the isentropic flow tables at M = 2.5

$$P_3/P_{t_3} = .05853$$

$P_3 = 20.4\ lb/in^2$

Assume the enthalpy at 1 and 3 are equal:

$$h_{t_1} = h_{t_3} = h_3 + \frac{(M_3\ 49.1\sqrt{T_3})^2}{2g_cJ}$$

$$h_{t_1} = 100.32 + \frac{\left((8)(49.1)\sqrt{420.1}\right)^2}{(2)(32.2)(778)}$$

$$h_{t_1} = 1394\ Btu/lbm$$

By trial and error $T_3 = 2500°R$

$$h_{t_3} = 732.33 + \frac{\left((2.5)49.1\sqrt{2500}\right)^2}{(2)(32.2)(778)}$$

$h_{t_3} = 1395$ close enough

$$\rho_3 = \frac{(20.4)(144)}{(53.34)(2500)}$$

$\rho_3 = .0220\ lbm/ft^3$

Station 5.

By an iterative procedure calculate the heat transfer from the combustion area assuming 2000°R wall temperature and thus the total temperature rise. Then using a Rayleigh line relationship the remaining conditions at Station 5 may be determined.

First calculate the flow area and heat transfer area:

$$m = \rho_3 A_3 V_3 = \rho_1 A_1 V_1$$

$$V_3 = (2.5)(49.1)\sqrt{2500}$$

$$V_3 = 6140$$

$$A_3 = \frac{\rho_1 A_1 V_1}{\rho_3 V_3} = \frac{(.000996)(169)(8051)}{(.0220)(6140)}$$

$$\boxed{A_3 = 10.0} \qquad 10.0 = \pi r_1^2 - \pi r_3^2 = 169 - \pi r_3^2$$

$$r_3 = 7.11 \text{ ft}$$

Hydraulic Diameter D_h

$$D_h = \frac{4A_3}{P_w} = \frac{4(10.0)}{2\pi(7.11) + 2\pi(7.28)}$$

$$\underline{D_h = .444}$$

Assume time for combustion and mixing can be accomplished in 2 μsec = .002 sec and the average velocity in the combustor is 5000 ft/sec.
The length of the combustor then is L

$$L = (.002)(5000)$$

$$\boxed{L = 10 \text{ ft}}$$

Forming a heat balance on the combustion area

$$(h_P' - h_{P_o}') - (h_R' - h_{R_o}') - q = -h_{RP_o}$$

where:
- h_R' = enthalpy of the reactants
- h_P' = enthalpy of the products
- h_{RP_o} = heat of combustion
- q = heat transferred per lbm fuel

Heat of combustion calculation:

$$h_{RP_o} = m_{C_7H_8}(h_{RP_o})_{C_7H_8} + m_{H_2}(h_{RP_o})_{H_2}$$

$$m_{C_7H_8} = .938 \text{ lbm } C_7H_8/\text{lbm fuel}$$

$$m_{H_2} = .062 \text{ lbm } H_2/\text{lbm fuel}$$

$(h_{RF_o})_{C_7H_8} = -17601$ Btu/lbm

$(h_{RF_o})_{C_7H_8} = -51593$ Btu/lbm

$h_{RF_o} = (.938)(-17601) + (.062)(-51593)$

$h_{RF_o} = -19708.5$ Btu/lbm fuel

The reactants:

$$h_R' - h_{R_o}' = (h' - h_o')_{air} + (h' - h_o')_{fuel}$$

$$(h' - h_o')_{air} = n_{air} \frac{M_{air}}{M_{fuel}} (h_{2500} - h_{537})$$

$$= \frac{(2.625 + 9.87)\ 28.95}{25.25} (645.78 - 128.34)$$

$(h' - h_o')_{air} = 7412.8$ Btu/lbm fuel

$$(h' - h_o')_{fuel} = C_{P_{fuel}}(t - t_o)$$

Assume: $C_{P_{fuel}} = .766$ Btu/lbm - °F

$t = 900$ °F

$$(h' - h_o')_{fuel} = (.766)(900 - 77)$$

$(h' - h_o')_{fuel} = 631$ Btu/lbm fuel

$h_R' - h_{R_o}' = 8043.8$ Btu/lbm fuel

The products:

Calculate enthalpy of products as function of temperature and make plot.

Constituent	n	$\bar{h}_{537}$	$\bar{h}_{4000}$	$n\Delta h$	$\bar{h}_{5000}$	$n\Delta h$	$\bar{h}_{5380}$	$n\Delta h$
CO_2	1.75	4030	49231	79102	64000	104948	69677	114881
H_2O	1.75	4258	40489	63404	53327	85871	58339	94991
N_2	9.87	3730	31329	272406	40080	358773	43436	391898
				414913		549591		601771

$$(h_P' - h_{P_o}')_t = \frac{n\Delta h}{M_f} = \frac{n\Delta h}{25.25}$$

Temp, °R	$(h_{P}' - h_{P_c}')_t$ Btu/lbm Fuel
4000	16432
5000	21766
5380	23833

} See plot on following page (Figure 72)

Estimate of Heat Transfer From the Combustor:

Procedure:

1. Assume Temperature at Station 5
2. Calculate Mach Number and pressure at Station 5 from Rayleigh line
3. Assume linear variation of pressure and temperature over length of combustor
4. Calculate density, velocity, viscosity, Reynolds Number, Nusselt Number, correction constant for high velocity heat transfer, thermal conductivity, heat transfer coefficient, adiabatic wall temperature and the final product, hPΔt, where P is the wetted perimeter, $\Delta t = t_{AW} - t_W$ and t_W = 2000°R, and h is the local heat transfer coefficient.
5. From curve of hPΔt vs x calculate heat transferred;

$$q = -\int_{x=0}^{x=L} hP\Delta t\,dx$$

6. From q and $(h' - h_O')_P$, $(h' - h_O')_R$ and h_{RP_O} calculate temperature at Station 5.
7. Return to 2 until temperature used to calculate values and calculated temperature are equal.

Example:
Station 3:

M = 2.5

P = 20.4

T = 2500°R

(P/P*) = .24616

(T/T*) = .3787

Assume T_5 = 5637.5°R

$$(T/T^*)_5 = (T/T^*)_3\ T_5/T_3 = (.3787)\ \frac{(5637.5)}{(2500.)}$$

$$(T/T^*)_5 = .8540$$

From Rayleigh Line:

$M_5 = 1.31$

$(P/P^*)_5 = .70535$

$P_5 = (P/P^*)_5/(P/P^*)_3\ P_3 = (.70535)/(.24616)\ (20.4$

$P_5 = 58.45\ \text{lb/in}^2$

x	P	T	ρ	V	μ x 10^{-5}	Re x 10^{6}	Nu_i (M→0)	M	c	Nu	k
0	20.4	2500	.022	6150	3.4	1.76	1330	2.50	.65	864.5	.048
2	28.0	3110	.024	5633	3.8	1.58	1270	2.06	.75	952.5	.056
4	35.6	3740	.026	5200	4.2	1.43	1220	1.73	.81	988.2	.062
6	43.3	4370	.027	5007	4.6	1.30	1170	1.54	.84	982.8	.0685
8	51.0	5000	.028	4872	4.9	1.24	1145	1.40	.88	1007.6	.074
10	58.45	5637.5	.028	4828	5.2*	1.17	1110	1.31	.89	987.9	.079*

* Extrapolated (based on air at low pressures)

x	Pr	Pr 1/3	T_{AW}/T	T_{AW}	Δt	h	hPΔt
0	.73	.90	2.125	5312.5	3312.5	93.4	2.80 x 10^7
2	.75	.91	1.77	5504.7	3504.7	120.1	3.81 x 10^7
4	.79	.92	1.55	5797.0	3797.0	138.0	4.74 x 10^7
6	.90	1.0	1.47	6423.9	4423.9	151.6	6.07 x 10^7
8	1.00	1.0	1.39	6950.0	4950.0	167.9	7.52 x 10^7
10	1.00	1.0	1.34	7554.3	5554.3	175.8	8.84 x 10^7

In the above calculations the following expression were used:

$\rho = P/RT$ where $R = 53.34$

$V = \rho_1/V_1/\rho = 135.2/\rho$

$$Re = \frac{V\ D_h\ \rho}{\mu}$$

$Nu_i = f(Re, Pr)$ from Kays[14] expression for turbulent flow inside concentric annulli at $r_i/r_o = 1.0$ (See Figure 73)

$M = V/(49.1\sqrt{T})$

C = From Kays page 13.28 for affect of high velocity on Stanton No.

$$Nu = CNu_i$$

$$h = \frac{Nu\,k}{D_h}$$

$$T_{AW}/T = 1 + \frac{Pr^{1/3}}{2}(\gamma - 1)M^2 \quad \text{where } \gamma = 1.4$$

$$\Delta t = (T_{AW} - T_W) = (T_{AW} - 2000)$$

$$P = 2\pi r_i + 2\pi r_o = 90.5 \text{ ft}$$

Then: $$q' = -\int_{x=0}^{x=L} (hP\Delta t)_x \, dx$$ This is expression is integrated graphically from Figure 74

$$q' = -5.575 \times 10^8 \text{ Btu/hr}$$

$$m_{air} = \rho_1 A_1 V_1 = 4.879 \times 10^6 \text{ lbm/hr}$$

$$q = -\frac{5.575 \times 10^8}{4.879 \times 10^6}$$

$$q = -1.1426 \times 10^2 \text{ Btu/lbm air}$$

$$q' = -\frac{1.1426 \times 10^2}{.0698}$$

$$\underline{q' = -1637 \text{ Btu/lbm fuel}}$$

Now to calculate the combustion temperature:

$$(h' - h_o')_P - (h' - h_o')_R - q' = -h_{RP_o}$$

$$(h' - h_o')_P - 8043.8 + 1637 = -(-19708.5)$$

$$\therefore (h' - h_o)_P = 26115.3 \text{ Btu/lbm fuel}$$

From curve in Figure 75 this gives a temperature:

$T_5 = 5800°R$ which does not agree with assume temp, $\therefore$ recalculate

However, by plotting the calculated temperatures vs the assumed temperatures we can find the point they are equal. In addition by plotting the heat transferred vs the assumed temperature we can obtain the actual heat transfer at the actual temperature - see curves in Figure 75.

This yields:

$T_5 = 5791°R$
$q' = 1727$ Btu/lbm fuel

Then $(T/T*)_5 = (.3787)\,\frac{(5791)}{(2500)}$

$(T/T*)_5 = .8774$ from Rayleigh line we get

$$\boxed{M_5 = 1.265}$$

$(P/P*)_5 = .740$

$P_5 = \frac{(.740)}{(.24610)}\,(20.4$

$$\boxed{P_5 = 61.3\ \text{lb/in}^2}$$

Station 6.

Assume:
1. Isentropic expansion from 5 to 6.
2. $A_6 = 313.58\ \text{ft}^2$ (D = 20 ft)

$(A/A*)_6 = (A/A*)_5\,\frac{A_6}{A_5} = \frac{(1.052)(313.58)}{10.0}$

$(A/A*)_6 = 32.89$

$$\boxed{M_6 = 5.28}$$

$(P/P_o)_6 = .001538$

$P_6 = \frac{(.001538)(61.3)}{.377}$

$$\boxed{P_6 = .250\ \text{lb/in}^2}$$

$T_6 = \frac{(T/T_o)_6}{(T/T_o)_5}\,T_5$

$T_6 = \frac{(.15415)(5791)}{.758}$

$$\boxed{T_6 = 1177.88\,°R}$$

$V = (5.28)(49.1)\sqrt{1177.88}$

$V_6 = 8897.48$ ft/sec

$$\rho e = \frac{36.05}{(53.34)(1177.88)}$$

$\rho_e = .000574 \ lbm/ft^3$

Calculate Thrust, Specific Impulse, and Overall Efficiency:

$$\left.\begin{array}{l} \text{Thrust} = Fg = f_e - f_1 - P_1(A_e - A_1) \\ f_e = A_e\left(P_e + n_n \dfrac{\rho_e V_e^2}{g_c}\right) \\ f_1 = A_1\left(P_1 + \dfrac{\rho_1 V_1^2}{g_c}\right) \\ n_n = .95 \end{array}\right\} \text{From Dugger}^{12)}$$

$$f_1 = 169\left(22.32 + \frac{(.000996)(8051)^2}{32.2}\right)$$

$f_1 = 342644.1$ lb

$$f_e = 313.58\left(36.05 + \frac{.95(.000574)(8897.48)^2}{32.2}\right)$$

$f_e = 431703.9$ lb

$$Fg = 431703.9 - 342644.1 - 22.32(313.58 - 169.)$$

$$\boxed{Fg = 85833.22 \text{ lb}}$$

Specific Impulse:

$$I_f = \frac{n_n(Fg)}{W_f}$$

$$W_f = f\rho_1 V_1 A_1 = (.0698)(.000996)(169.)(8051)$$

$W_f = 94.6$ lbm/sec fuel

$$I_f = \frac{(.95)(85833.22)}{94.6}$$

$$\boxed{I_f = 861.96 \text{ sec}}$$

Overall Efficiency:

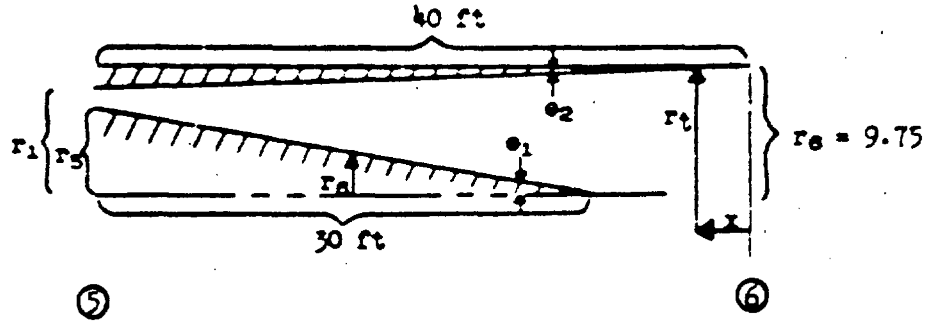
$$n_e = \frac{I_f V_1}{H_f + V_1^2/2g_c J}$$

$$\eta_e = \frac{(861.96)(8050.96)}{\left(19708.5 + \frac{(8050.96)^2}{(2)(32.2)(778)}\right) 778}$$

$$\boxed{\eta_e = .4247}$$

Estimate of Heat Transfer From Nozzle:

Consider the nozzle below: (Note: the values below are not the final but a first estimate)



Flow Area:

$r_6 - r_1 = 9.75 - 7.28 = 2.47$

$\tan \theta_2 = \frac{2.47}{40} = .06175$ $\qquad$ $\tan \theta_1 = \frac{7.11}{30.0} = .237$

$\theta_2 = 3\frac{1}{2}°$

From $x = 0$ to $x = 10$ where $r_t = r_6 - x \tan \theta_2 = 9.75 - x\,(.06175)$

From $x = 10$ to $x = 40$ $A_x = \underbrace{\pi r_t^2}_{A_t} - \underbrace{\pi r_b^2}_{A_b}$ $\qquad$ $r_b = (x - 10)\tan \theta_1 = (x - 10).237$

$x' = 40 - x$

x'	x	r_t	A_t	r_b	A_b	A_x
40	0	9.75	298.8	0	0	298.8
30	10	9.13	262.0	0	0	262.0
20	20	8.52	227.8	2.37	17.6	210.2
10	30	7.90	195.9	4.74	70.6	125.3
5	35	7.60	180.9	5.92	110.3	70.6
4	36	7.53	178.0	6.16	119.3	58.7
3	37	7.47	175.1	6.40	128.6	46.5
2	38	7.40	172.2	6.64	138.3	33.9
1	39	7.34	169.3	6.87	148.4	20.9

Assuming isentropic expansion to each point:

$$(A/A*)_x = \frac{(A/A*)_5 A_x}{A_5} = \frac{1.1}{10.3} = .10967\ A_x \quad (ft^2)$$

This yields a Mach Number from Isentropic Flow Tables.

$$T_x = \frac{(T/T_o)_x}{(T/T_o)_5} T_5 = \frac{(T/T_o)_x\ 5465}{.726} = 7527.5\ (T/T_o)_x \quad (°R)$$

$$P_x = \frac{(P/P_o)_x}{(P/P_o)_5} P_5 = \frac{(P/P_o)_x\ 54}{.323} = 167\ (P/P_o)_x \quad (lb/in^2)$$

$$V_x = M_x 49.1\sqrt{T_x} \quad (ft/sec)$$

$$\rho_x = \frac{P_x\ 144}{53.34\ T_x} = 2.7\ P_x/T_x \quad (lbm/ft^3)$$

x'	$(A/A*)_x$	M	$(P/P_o)_x$	P_x	$(T/T_o)_x$	T_x	V_x	ρ_x	μ
1	2.292	2.35	.074	12.38	.475	3525	6851	.00948	4.4×10^{-5}
2	3.718	2.86	.034	5.68	.379	2815	7451	.00544	3.93
3	5.10	3.20	.020	3.34	.328	2430	7745	.00371	3.68
4	6.44	3.45	.014	2.34	.290	2150	7855	.00294	3.47
5	7.74	3.64	.0108	1.81	.274	2063	8118	.00236	3.40
10	13.74	4.28	.0050	.836	.220	1656	8552	.00136	3.07
20	23.05	4.90	.00213	.356	.172	1294	8654	.00074	2.75
30	28.73	5.10	.00165	.276	.160	1200	8674	.00062	2.66
40	32.89	5.28	.00154	.257	.154	1160	8831	.00060	2.62

Assume the heat transfer relation is turbulent flow flat plate.

$$Nu_x = c(.332(Pr)^{1/3}(Re_x)^{1/2}) = cNu_1$$

$$Re_x = \frac{Vx'\rho}{\mu}$$ c = correction constant for high speed flow (Kays,[14] p. 13.28)

$$h = \frac{Nu_x k}{X'} \quad (Btu/hr\text{-}ft^2\text{-}°F)$$

x'	Re	$Re^{1/2}$	Pr	$Pr^{1/3}$	Nu_1	c	Nu_x	k	h
1	1.475×10^6	1.214×10^3	.83	.94	378.9	.70	265	.065	17.2
2	2.06	1.435	.76	.91	433.5	.63	273	.058	7.9
3	2.34	1.530	.74	.90	457.2	.58	265	.054	4.8

(Continued)

x'	R_e	$R_e^{1/2}$	Pr	$Pr^{1/3}$	Nu'	c	Nu_x	k	h
4	2.66	1.63	.73	.90	487.0	.55	268	.050	3.4
5	2.82	1.68	.73	.90	502.0	.54	271	.049	2.7
10	3.79	1.946	.71	.89	575.0	.45	259	.044	1.1
20	4.66	2.16	.70	.89	638.2	.38	243	.038	.46
30	6.06	2.46	.70	.89	726.9	.37	269	.037	.33
40	8.06	2.84	.696	.89	839.2	.36	302	.036	.27

$$T_{AW} = T_x\left(1 + \frac{r_c}{2}(\gamma - 1)M^2\right)$$

$$\gamma = 1.4$$

$$r_c = Pr^{1/3}$$

$$\Delta t = T_{AW} - T_W = (T_{AW} - 2000°R)$$

$$P = 2\pi r_t + 2\pi r_b$$

x'	T_{AW}	Δt	P	$hP\Delta t$
1	7184.8	5184.8	89.3	7.96×10^6
2	6959.6	4959.6	88.2	3.46
3	6909.0	4909.0	87.1	2.05
4	6756.3	4756.3	86.0	1.39
5	6983.1	4983.1	84.9	1.14
10	7116.3	5116.3	79.4	.447
20	6886.4	4886.4	68.4	.154
30	6818.2	4818.2	57.4	.091
40	6981.0	4981.0	61.3	.082

Then:

$$q_N = \int_{x'=0}^{x'=40} (hP\Delta t)_x dx'$$

Integrating graphically from curve of x' vs $hP\Delta t$ in Figure 76 we get,

$$q_N = 47.8 \times 10^6 \text{ Btu/hr}$$

$$q_N = \frac{47.8 \times 10^6 \text{ Btu/hr}}{4.879 \times 10^6 \frac{\text{lbm air}}{\text{hr}}}$$

q'_N = 9.797 Btu/lbm air

$q'_N = \frac{9.727}{.0698}$ lbm fuel/lbm air

q'_N = 140.4 Btu/lbm fuel

$q'_T = q'_N + q'_c$

q'_T = 1867.4 Btu/lbm fuel

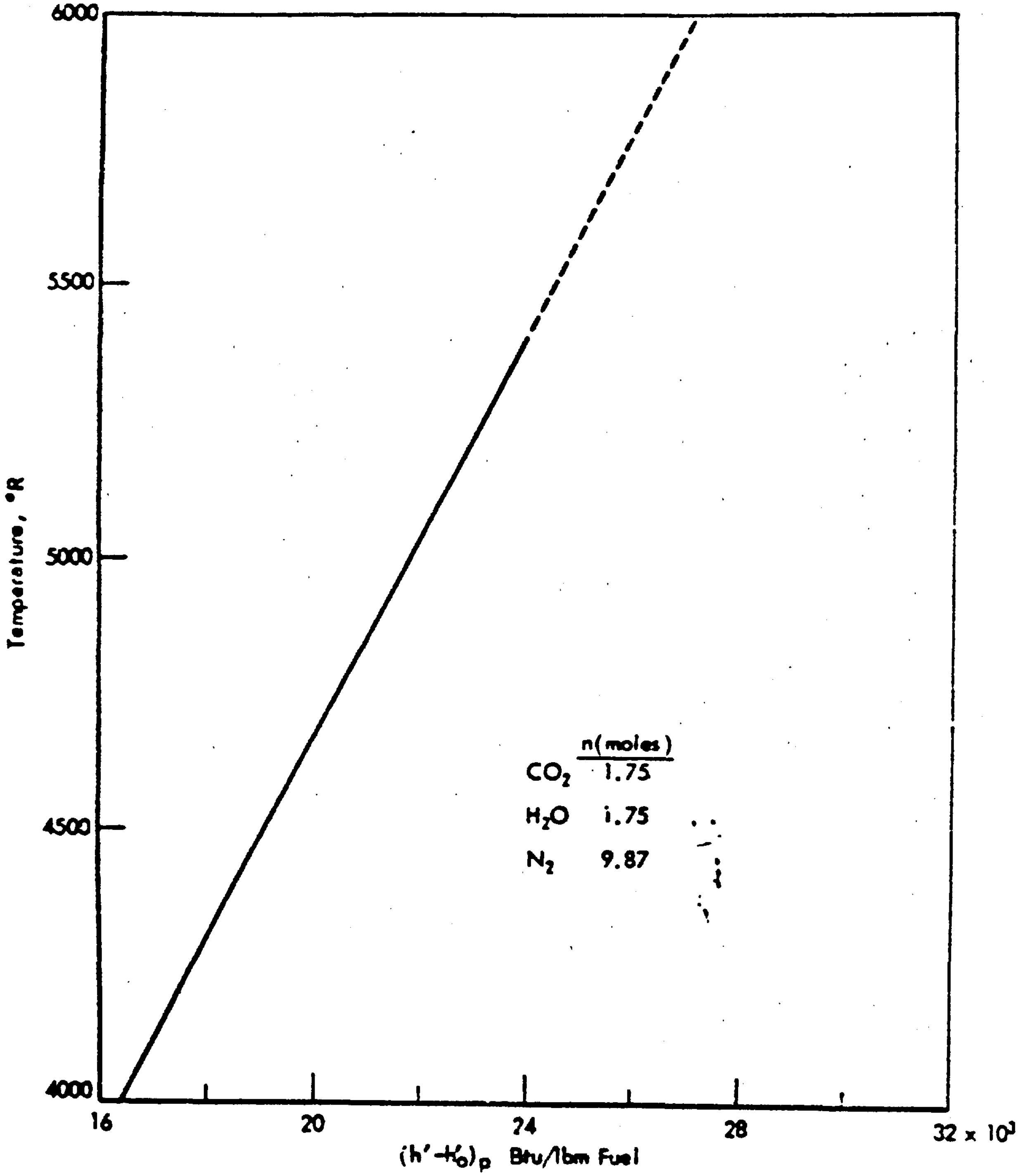


Figure 72. ENTHALPY OF PRODUCTS OF COMBUSTION

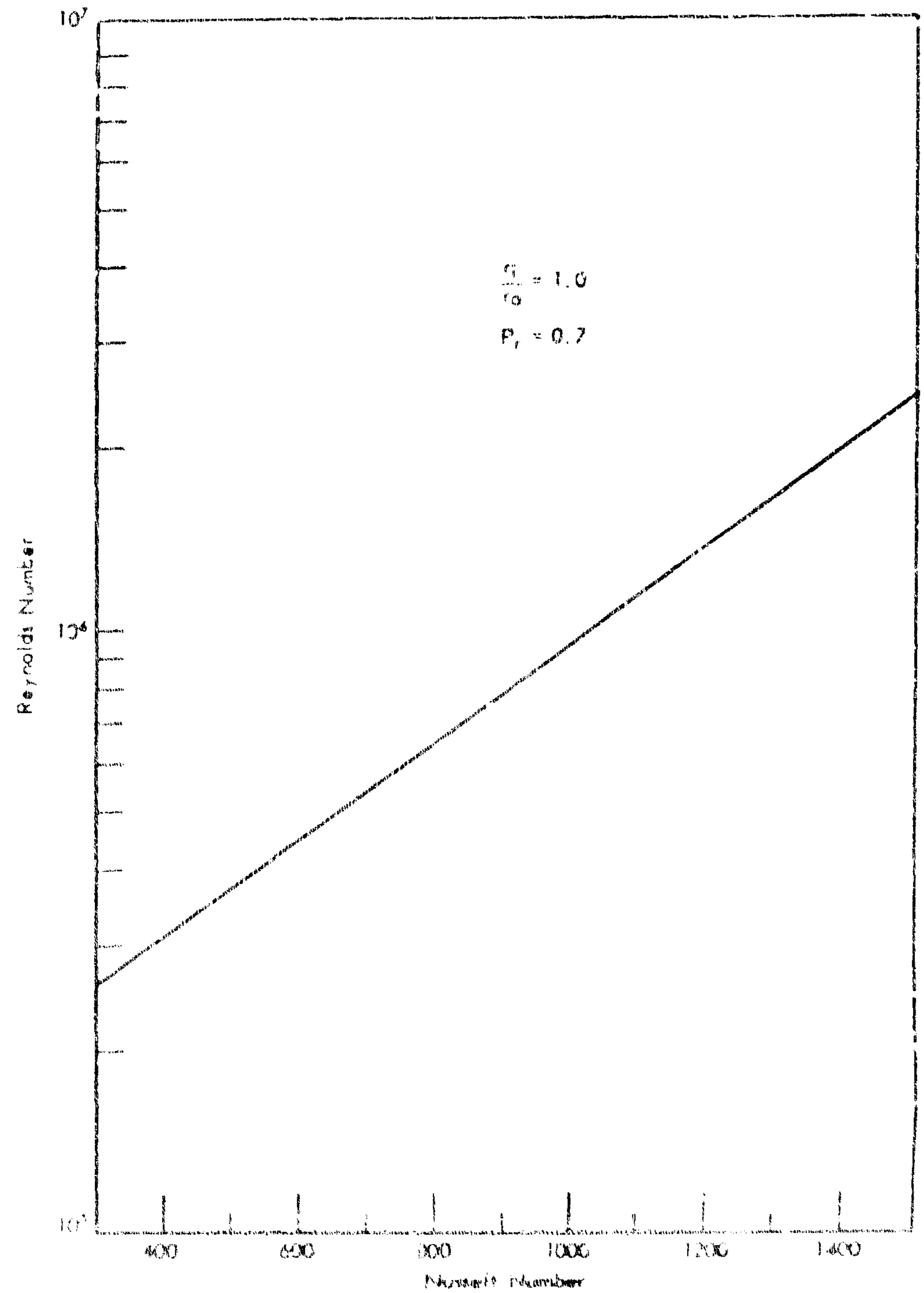


Figure 73. TURBULENT ANNULAR FLOW
From Kays, Table 9-7

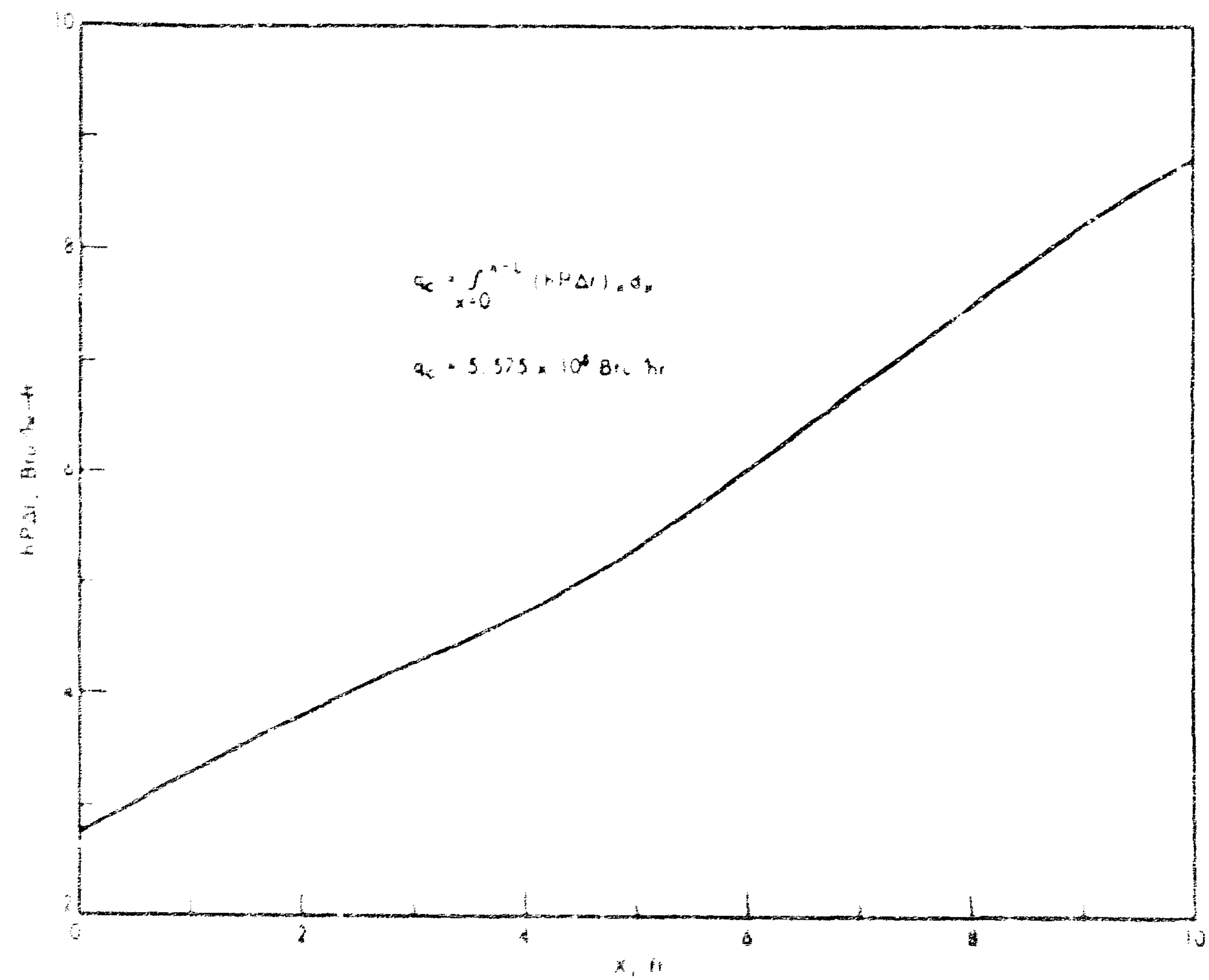


Figure 24. COMBUSTOR HEAT FLUX DISTRIBUTION

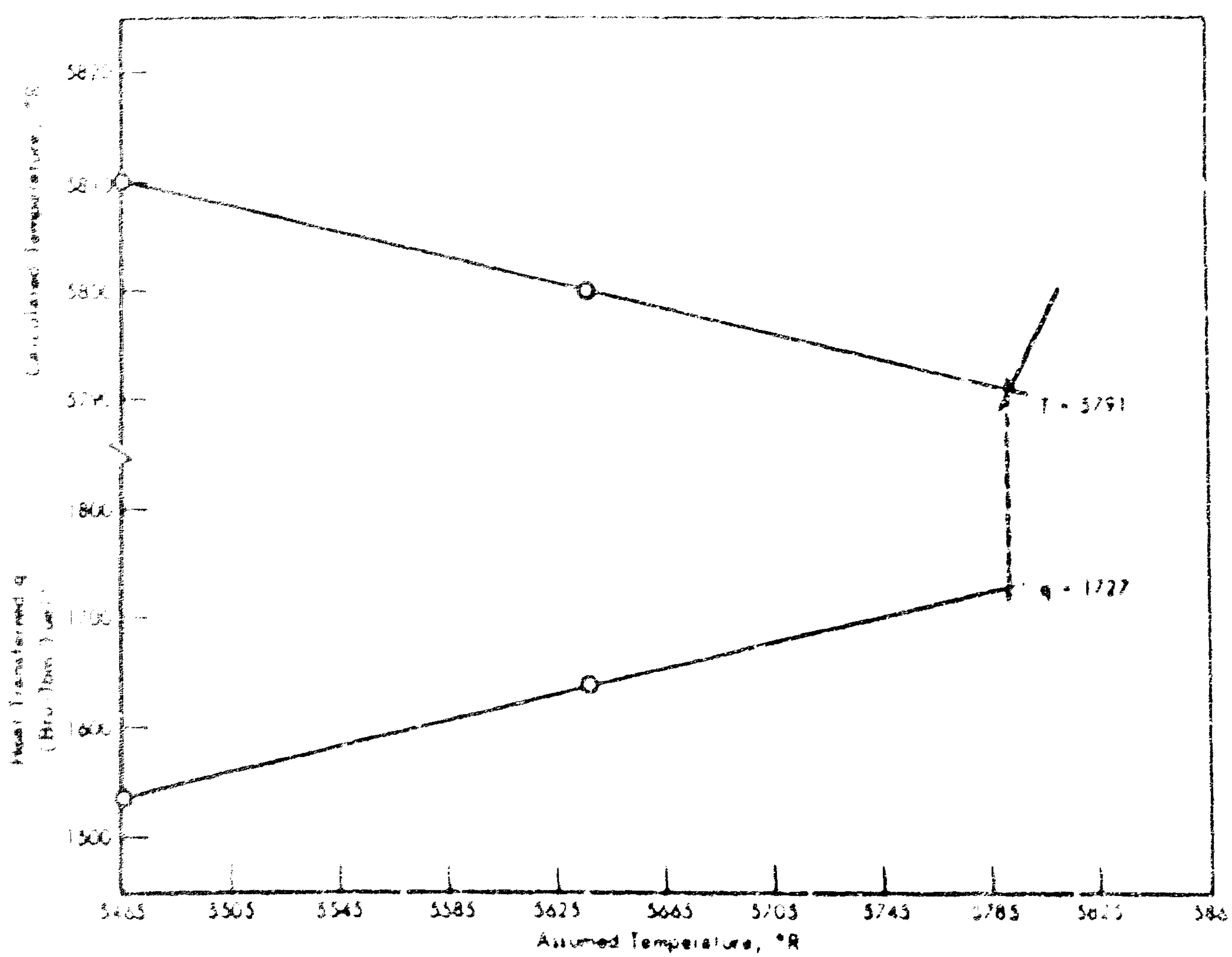


Figure 75. HEAT TRANSFER CONDITIONS

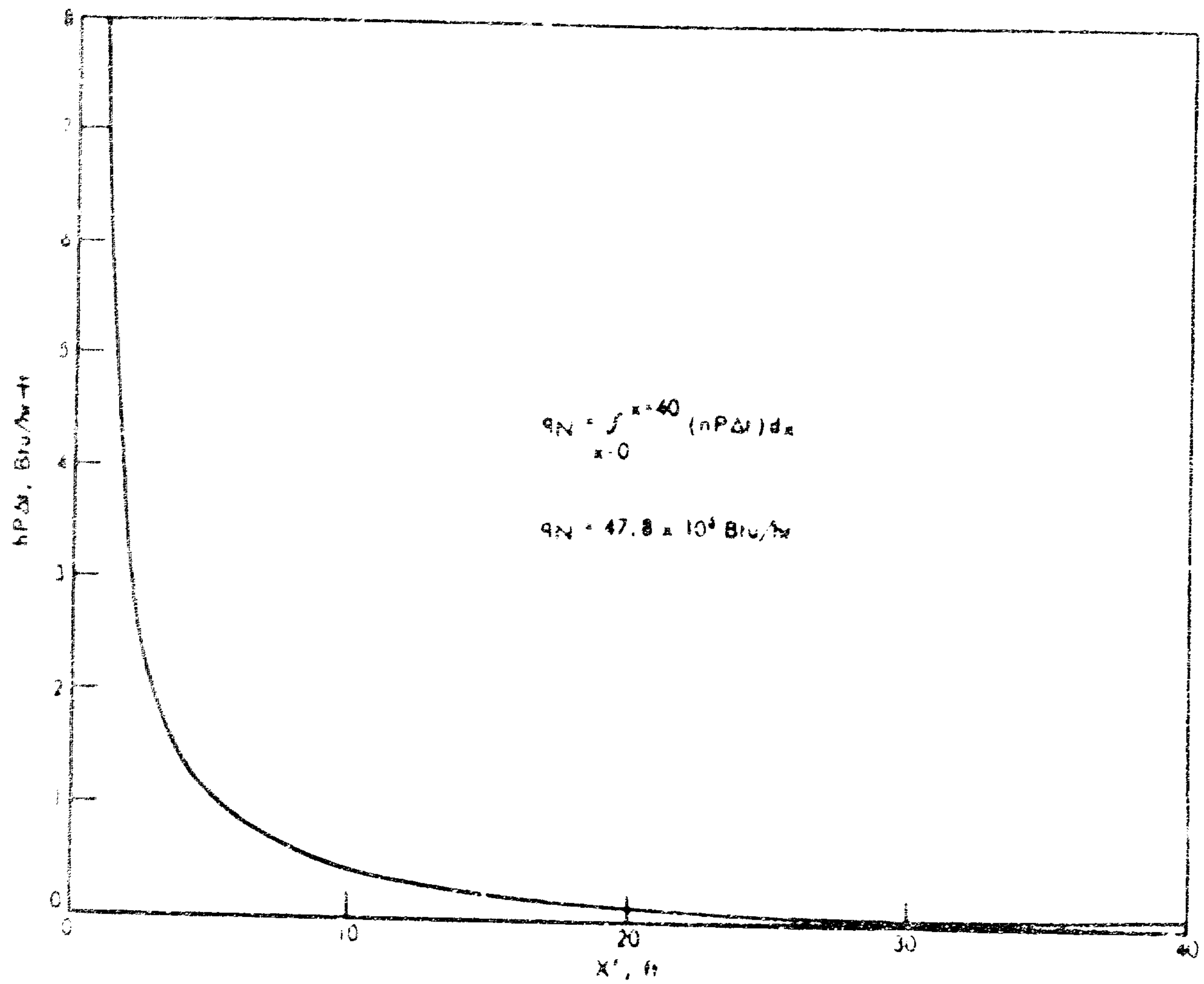


Figure 76. NOZZLE HEAT FLUX DISTRIBUTION

Table 112. DEHYDROGENATION OF MCH OVER AEROFORM PHF-4

Pressure: 1 atm   Catalyst Volume: 7 ml
Block Temperature: 842 °F   Reaction Time: 30 Minutes

Run Number 11018-	35	36-1	36-2	37
LHSV	5	15	30	50
Catalyst Bed Profile, °F	752	655-60	662-777	812-38[d)]
	808-06	680-75	640-759	820-36
	826-24	725-23	658-761	813-35
	835-33	772-66	694-754	808-35
Reactor Wall Temperature, °F	824-22	74-59	730-94	
ΔT max	0	5	135	27[d)]
Product Analysis, %				
Benzene	1.8	0.2	0.0	0.0
U_1[a)]	0.0	0.1	0.4	0.6
MCH	1.0	3.7	41.6	96.1
U_2[b)]	0.0	0.0	0.0	1.0
Toluene	97.1	96.0	58.0	1.2
U_3[c)]	0.1	0.0	0.0	1.1
MCH Conversion, %	99.0	96.3	58.4	3.9

a) Unidentified; emerged after benzene.
b) Unidentified; emerged after MCH.
c) Unidentified; emerged after toluene.
d) Catalyst almost completely deactivated after 10 minutes.

Table 120. DEHYDROGENATION OF MCH OVER SHELL 45

Pressure: 1 atm
Block Temperature: 842 °F

Catalyst Volume: 7 ml
Reaction Time: 30 Minutes
Catalyst No.: 10280-45

Run Number: 11215-	98	99-1	99-2	100-1	100-2	101
LHSV	5	15	30	50	80[a]	100[a]
Catalyst Bed Profile, °F	790-88 824-22 855-53 840-38	671-67 714-07 754-48 795-92	630-22 635-28 651-44 650-73	619 610 617 633	626-30 608 608 617	635-42 608-10 608 614
Reactor Wall Temperature, °F	850	774-70	725-20	705	698	695-91
ΔT max	0	0	0	0	4[a]	7[a]
Product Analysis, %w						
Benzene	9.9	0.9	0.1	0.0	0.0	0.1
MCH	1.1	0.5	19.3	41.3	54.6	60.3
Toluene	89.0	98.6	80.6	58.7	45.4	39.6
MCH Conversion, %w	98.9	999.5	80.7	58.8	47.7	41.8

a) Back pressure was about 15 psig during this run.

Table 121. DEHYDROGENATION OF MCH OVER UOP-R8

Pressure: 1 atm
Block Temperature: 842°F Reaction Time: 30 Minutes

Run Number: 11013-	95-1	95-2	96
LHSV	5	15	30
Catalyst Bed Profile, °F	770-72 789-90 815-19 851-53	709-11 686-82 716-09 759-45	752-858 560-878 671-856 682-856
Reactor Wall Temperature, °F	815-20	775	768-858
ΔT max	4	2	168[d)]
Product Analysis, %w			
Benzene	3.5	0.5	0
U_1[a)]	0.0	0.0	0.3
MCH	1.3	6.1	84.7
U_2[b)]	0.0	0.0	0.5
Toluene	95.0	93.5	12.5
U_3[c)]	0.2	0.0	2.0
MCH Conversion, %w	98.7	93.9	15.3

a) Unidentified; emerged after benzene.
b) Unidentified; emerged after MCH.
c) Unidentified; emerged after toluene.
d) ΔT max = 162 after 17 minutes, catalyst completely deactivated at end of run.

Table 122. DEHYDROGENATION OF MCH OVER STANDARD CATALYST

Pressure: 1 atm Catalyst Volume: 7 ml
Block Temperature: 842°F Reaction Time: 30 Minutes
Catalyst No.: 9874-T

Run Number: 11013-	78	79-1	79-2	80
LHSV	5	15	30	50
Catalyst Bed Profile, °F	779 775 850 857-35	714-16 745 765 788-86	725-76 725-59 754-54 748-59	815-57 797-855 785-833 777-830
Reactor Wall Temperature, °F	826	792	785-97	815-35
ΔT max	0	2	50	52 b)
Product Analysis, %w				
Benzene	1.7	0.4	0.2	0.1
MCH	[illegible]	19.9	62.8	93.1
Toluene	97.2	79.7	37.0	5.6
U_1 a)	0.0	0.0	0.0	1.2
MCH Conversion, %w	98.9	80.1	37.2	6.9

a) Unidentified; emerged after toluene.
b) Catalyst almost completely deactivated at end of run.

Table 123. DEHYDROGENATION OF MCH OVER SHELL 108

Pressure: 1 atm
Block Temperature: 842°F
Catalyst Volume: 7 ml
Reaction Time: 30 Minutes
Catalyst Number: 10280-108

Run Number: 11018-	88-1	89-1	89-2	90-1	90-2	91
LHSV	5	15	30	50	80	100
Catalyst Bed Profile, °F	774-72 817-13 831 837-35	653 689 732-30 775	635-39 637 657-55 687-84	642-53 630-33 637-39 658	669-75 635-39 635-37 648	687-94 644-50 639-42 646-48
Reactor Wall Temperature, °F	826-24	761	727-25	716-18	716	725-29
ΔT max	0	0	4	11	6	7
Product Analysis, %w						
Benzene	2.3	0.2	0.0	0.0	0.0	0.0
MCH	1.4	4.9	30.4	50.8	63.3	68.3
Toluene	96.3	94.9	69.6	49.2	36.7	31.7
MCH Conversion, %w	98.6	95.1	69.6	49.3	36.9	3[illegible].9

Table 124. DEHYDROGENATION OF MCH OVER RD-150

Pressure: 1 atm   Catalyst Volume: 7 ml
Block Temperature: 842 °F   Reaction Time: 30 Minutes

Run Number: 11018-	103-1	103-2	104-1	104-2	105
LHSV	5	15	30	50	80
Catalyst Bed Profile, °F	761-52 806-01 826-24 833	669-65 691-87 729-23 770-68	657-71 639-40 553-55 678-80	700-815 642-761 644-701 657-680	830-33 820-33 806-33 776-83
Reactor Wall Temperature, °F	822-20	763-61	727-29	725-88	824-35
ΔT max	0	0	14	115	-- d)
Product Analysis, %w					
Benzene	1.2	0.0	0.0	0.0	0.0
U_1 a)	0.0	0.1	0.0	0.2	0.2
MCH	1.4	2.2	27.5	56.1	96.6
U_2 b)	0.0	0.0	0.0	0.0	0.6
Toluene	97.4	97.7	72.5	43.7	1.6
U_3 c)	0.0	0.0	0.0	0.0	1.0
MCH Conversion, %w	98.6	97.8	72.5	43.9	3.4 d)

a) Unidentified; emerged after benzene.
b) Unidentified; emerged after MCH.
c) Unidentified; emerged after Toluene.
d) Catalyst about completely deactivated at end of run.

Table 125. DEHYDROGENATION OF MCH OVER UOP-R16E

Pressure: 1 atm
Block Temperature: 842°F
Catalyst Volume: 7 ml
Reaction Time: 30 minutes

Run No. 11325-	85-1	85-2	86-1	86-2	87-1	87-2
LHSV	5	15	30	50	80	100
Catalyst Bed Profile, °F	774-70 813-10 831-29 833	671 705-02 752-50 779-74	655-58 646-57 668-67 689-87	686-729 640-657 644-51 657-55	759-824 673-761 550-89 648-69[a])	824 784-822 705-761 678-720[a])
Reactor Wall Temp, °F	831	779-76	643-47	638-47	750-90	802-28
ΔT_{max}, °F	-4	-5	11	43	88[a])	31[a])
Product Analysis, %w						
Benzene	0.1	0.0	0.0	0.0	0.0	0.0
MCH	7.4	4.8	33.2	54.9	70.9	81.5
Toluene	92.4	95.2	66.8	45.1	29.0	18.0
Others[b])	0.1	0.0	0.0	0.0	0.1	0.5
MCH Conversion, %w	92.6	95.2	66.8	45.1	29.1	18.5

a) Cold spot moved down the catalyst bed.
b) Emerged after MCH and after toluene.

Table 126. DEHYDROGENATION OF MCH OVER 1% Pt on Al_2O_3

Pressure: 1 atm
Block Temperature: 842°F
Catalyst Volume: 7 ml
Reaction Time: 30 minutes
Catalyst No.: 10280-44

Run No. 11325-	81-1	81-2	82-1	82-2	83-1	83-2
LHSV	5	15	30	50	80	100
Catalyst Bed Profile, °F	776-72 817 833 837	686-82 732-27 765-61 795-92	669-76 689 711-09 741-39	685-743 687-707 696-707 718-22	776-815 729-90 716-66 720-54	819-24 806-24 786-819 772-812
Reactor Wall Temp, °F	831-28	781-76	750-52	747-61	770-810	817-831
ΔT_{max}, °F	-4	-5	+7	58	61 b)	40 b)
Product Analysis, %w						
Benzene	2.1	0.3	0.1	0.1	0.1	0.1
MCH	2.2	12.8	44.5	63.7	82.4	92.5
Toluene	95.7	86.9	55.2	35.8	16.7	4.9
Others a)	0.0	0.0	0.2	0.4	0.8	2.5
MCH Conversion, %w	97.8	87.2	55.5	36.3	17.6	7.5
Selectivity for Toluene, %w	97.9	99.7	99.4	99.4	94.5	65.3

a) Emerged after MCH and after toluene.
b) Cold spot moved down the catalyst bed.

Table 127. DEHYDROGENATION OF MCH OVER 10860-114C CATALYST

Pressure: 1 atm
Block Temperature: 842°F
Catalyst Volume: 7 ml
Duration Time: 30 minutes

Run No. 11325-	74-1	74-2	75-1	75-2	76-1	76-2
LHSV	5	15	30	50	80	100
Catalyst Bed Profile, °F	759-61 815 833 837-35	640-35 689-82 750-43 792-84	619 632-30 660-57 691-89	621-26 621 635 658	635-37 619-21 626 644	644-50 621-23 626 637-35
Reactor Wall Temp, °F	831	770-66	730-28	718	711	709
ΔT_{max}, °F	+2	-8	-3	+5	+2	+6
Product Analysis, %w						
Benzene	5.4	0.5	0.1	0.0	0.0	0.0
MCH	2.2	1.7	26.8	47.2	59.6	65.0
Toluene	92.4	97.8	73.1	52.8	40.4	35.0
MCH Conversion, %w	97.8	98.3	73.2	52.8	40.4	35.0

Table 128. DEHYDROGENATION OF MCH OVER 10660-1148 CATALYST

Pressure: 1 atm
Block Temperature, 842°F
Catalyst Volume: 7 ml
Reaction Time: 30 minutes

Run No. 11325-	69	70-1	70-2	71	72-1	72-2
LHSV	5	15	30	50	80	100
Catalyst Bed Profile, °F	761-52 810-04 831-29 835-33	680-75 712-07 752-45 784-79	671-80 676 698-96 727-23	689-707 673-80 696-07 707	727-58 687-709 687-714 690-702	781-806 723-63 700-25 702-16
Reactor Wall Temp, °F	828-26	779-76	752	743-47	747-63	768-95
ΔT_{max}, °F	-9	-7	+9	18	41	40[a)]
Product Analysis, %w						
Benzene	0.8	0.2	0.1	0.1	0.1	0.1
MCH	0.8	10.8	44.3	62.2	73.3	81.3
Toluene	98.4	89.0	55.6	37.7	26.6	18.6
MCH Conversion, %w	99.2	89.2	55.7	37.8	26.7	18.7

a) Cold spot moved down the catalyst bed.

Table 129. DEHYDROGENATION OF MCH OVER 10860-113A AND HOUDRY 200 SR CATALYSTS

Pressure:	1 atm
Block Temperature:	84[illegible]°F
Catalyst Volume:	7
Reaction Time:	30 minutes

Run No. 11325-	89-1	89-2	78-1	78-2	79
Catalyst	Houdry 200 SR		10860-113A		
LHSV	5	15	5	15	30
Catalyst Bed Profile, °F	758-56 801-799 826-24 833	705-833 700-831 741-830 770-828	763-58 804-797 824-19 831-28	725-68 741-50 761-58 784-779	824-37 797-833 774-826 770-817
Reactor Wall Temp, °F	826	783-838	824-21	788-97	820-837
ΔT_{max}, °F	-2	131	-7	43	b)
Product Analysis, %w					
Benzene	1.4	0.2	1.7	0.2	0.1
MCH	1.7	59.3	4.8	35.0	88.3
Toluene	96.9	34.1	93.5	64.8	10.8
Others[a)]	0.0	6.2	0.0	0.0	0.8
MCH Conversion, %w	98.3	40.6	95.2	65.0	11.7
Selectivity for Toluene, %w	98.6	84.0	92.8	99.7	92.3

a) Emerged after MCH, after benzene, after toluene.
b) Catalyst bed temperature about that of reactor wall temperature.

Description of the Pulse Reactor

The pulse reactor was a 1/4-in. OD stainless steel tube (No. 304) 9-1/4 in. long and 0.028 in. wall thickness. Swagelok Tees were fastened at each end and one arm of the Tee served as an injection port. A rubber septum (GLC type) was held in place by the fitting nut and the feed was injected through this septum from a syringe. A five inch length of the reactor tube was surrounded by a secondary furnace liner and the whole was heated by an electric furnace. The secondary liner had seven radial drilled holes for thermocouples, and the holes were located as shown in Figure 79. A schematic diagram of the pulse reactor is shown in Figure 77.

All lines were 1/4-in. OD stainless steel tubing (No. 304). About 28 in. of line just prior to the reactor was wrapped with heating tape and constituted a gas preheater. About 8 in. of the preheater section was filled with quartz chips (10-20 mesh size).

In the pulse reactor system the carrier gas was metered through a rotameter (Figure 77) and passed through the preheater section and into the reactor. The exit gas passed into a manifold and then into the GLC. The purpose of the manifold was to maintain the exit gas pressure slightly greater than the gas pressure in the GLC. This was done by adjusting the pressure control valve and the vent valve. The manifold was wrapped with heating tape and was maintained at 302° to 356°F. The injection port temperature was about 450°F. The pressure control and the vent valves were needle valves (Hoke No. 1315) and the GLC valve was a lever operated valve (Hoke No. 490).

To carry out an experiment the reactor was brought to temperature and the carrier gas flow rate, reactor pressure and manifold pressure were adjusted by means of the appropriate flow control valves. Then with inert gas flowing to the GLC a pulse was injected through the lower injection port and subsequently analyzed. This gave an analysis of the starting material. A pulse was then injected in the top injection port, passed over the catalyst and analyzed.

In this system the space velocity was obtained from the inert gas flow rate. Figure 78 shows the pulse reactor system with the secondary furnace liner in place; Figure 80 shows the GLC analysis system.

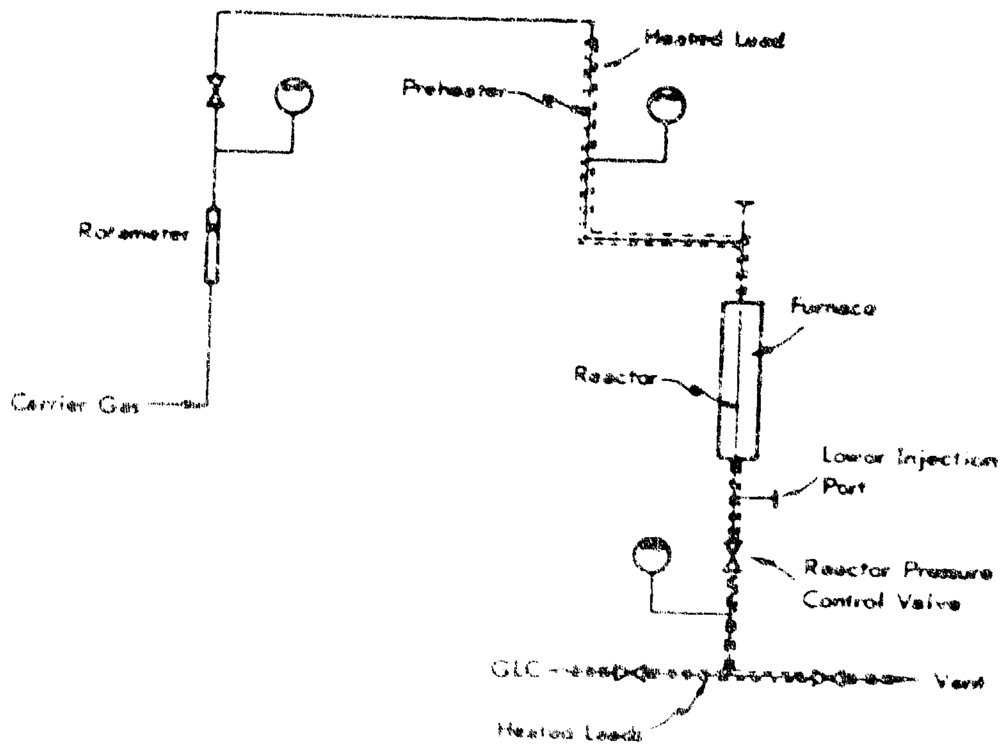


Figure 22. PULSE REACTOR SCHEMATIC

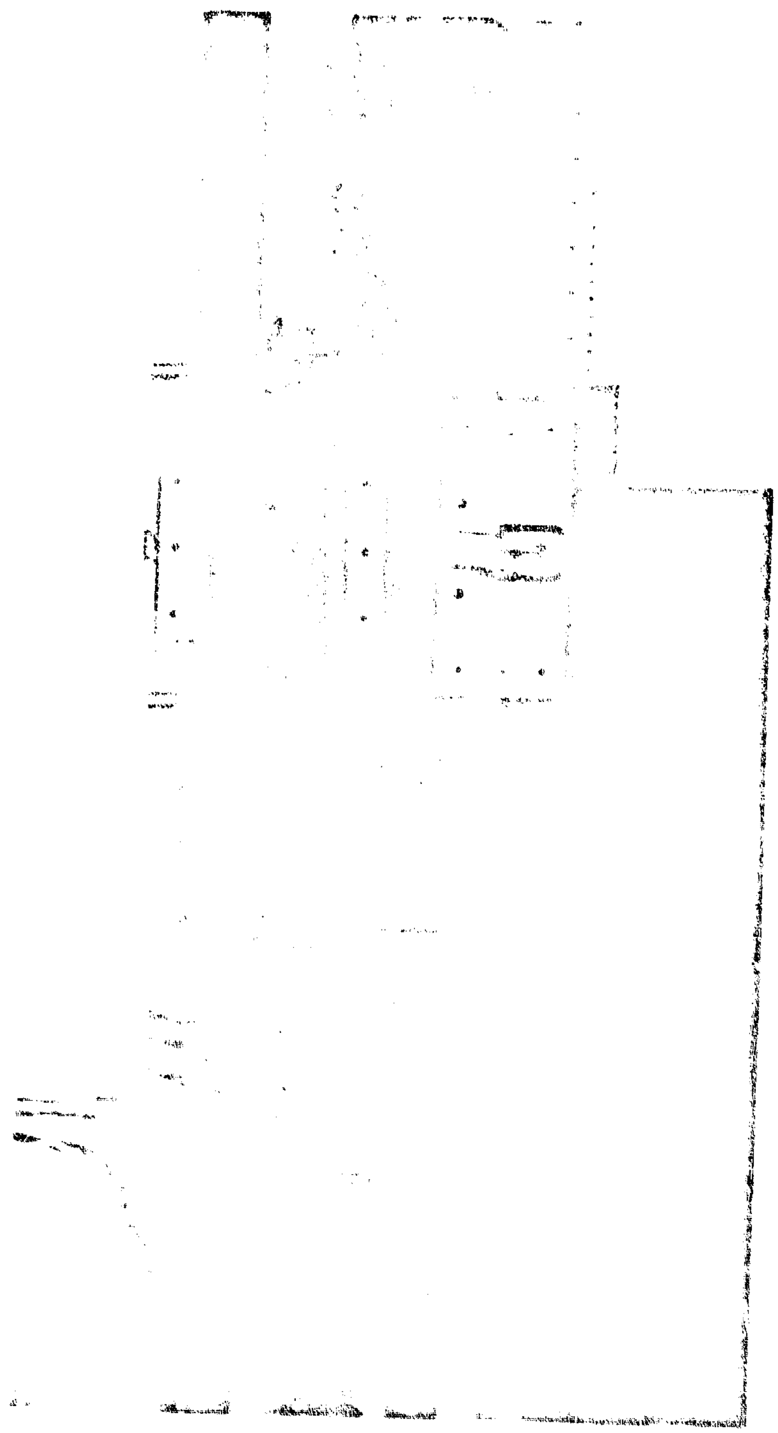


Figure 28. PULSE REACTOR SYSTEM

64786-5

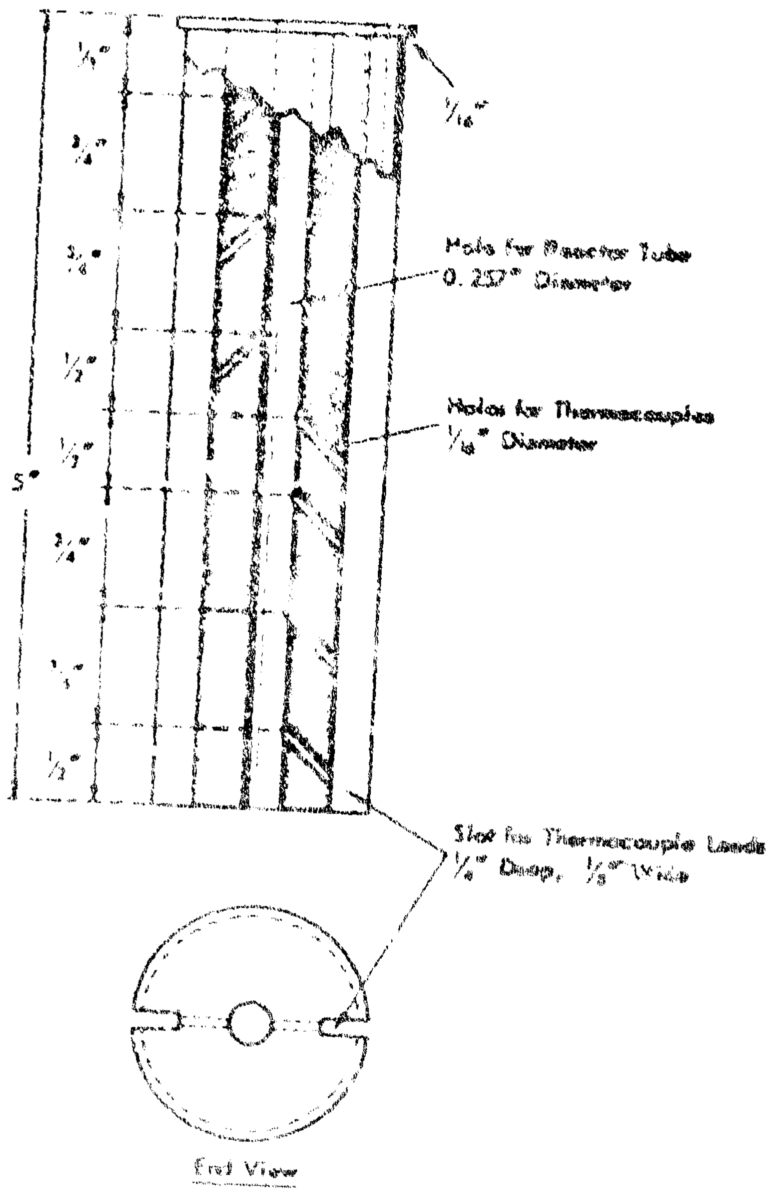


Figure 79. SECONDARY FURNACE LINER FOR PULSE REACTOR

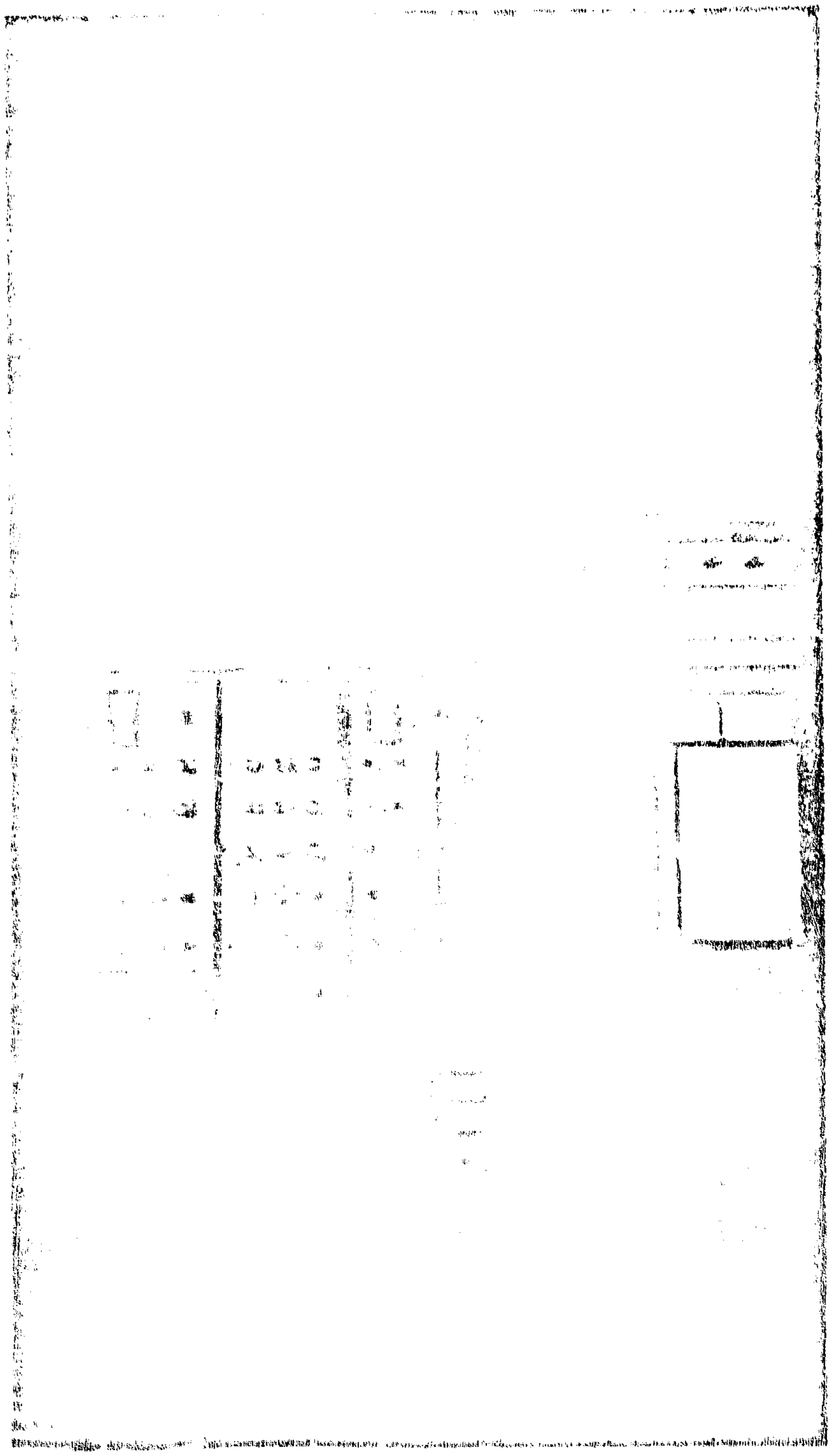


Figure 80. GIC ANALYSIS SYSTEM

64256-3

Description of the 1/4-in. OD Flow Reactor

In order to test candidate fuels that are in short supply one section of our laboratory dual reactor system was modified in the following manner, so that 1/4-in. OD reactor tubes could be used.

In our laboratory reactor system the furnace is 26 in. overall length and contains four heating elements of lengths 4", 8", 8", 4" located from top to bottom in that order. The outer shell of the furnace extends one inch beyond the top and bottom of the heating elements. The furnace consists of two hinged halves and opens lengthwise. Each half contains a heavy Meehanite liner with a groove down the center to hold the reactor tube. When closed the grooves form an opening 7/8 inch in diameter.

To modify the apparatus, a secondary furnace liner was fabricated from a 7/8-in. stainless steel rod (No. 416), 13 inches long. A 0.257-in. diameter hole was drilled down the center to accommodate a 1/4-in. OD reactor tube. Seven holes were drilled radially from the outside to the center hole in which thermocouples were cemented. The thermocouples were 1-1/2 inches apart and the top couple was 1-1/2 inches from the top of the liner. The thermocouples were situated so that they just touched the reactor wall. This secondary liner was placed in the Meehanite liners at the very bottom of the furnace and extended one inch below the bottom heating element. Figure 81 shows the construction of the secondary liner and its position in the furnace.

The reactor was a stainless steel tube (No. 304) 30 inches long, 1/4-inch OD with 0.035" wall thickness. Reaction was carried out in the lower part of the tube and the top part served as a feed preheater. The reactor was furnace-heated and a 13" long secondary furnace liner surrounded the reactor tube at the reaction zone. Figure 81 shows the secondary furnace liner and its position in the furnace.

The reactor wall temperature was measured at seven points along the tube. The points were 1-1/2 inches apart and the top point was one inch below the top of the secondary liner (Figure 81). The temperature of the reactor wall varied down the tube and Figure 82 shows the temperature variation for a furnace block temperature of 1202°F.

The maximum reaction rate will occur in the region of maximum temperature. Presumably the rate in that portion of the tube whose temperature was 18°F (10°C) or more below the maximum temperature, did not contribute appreciably to the overall rate. Thus the "effective" volume of the tube was that portion of the tube whose temperature was within 18°F of the maximum wall temperature, and whose volume was determined from a plot such as Figure 82. The "effective" reactor temperature was taken as 9°F below the maximum temperature.

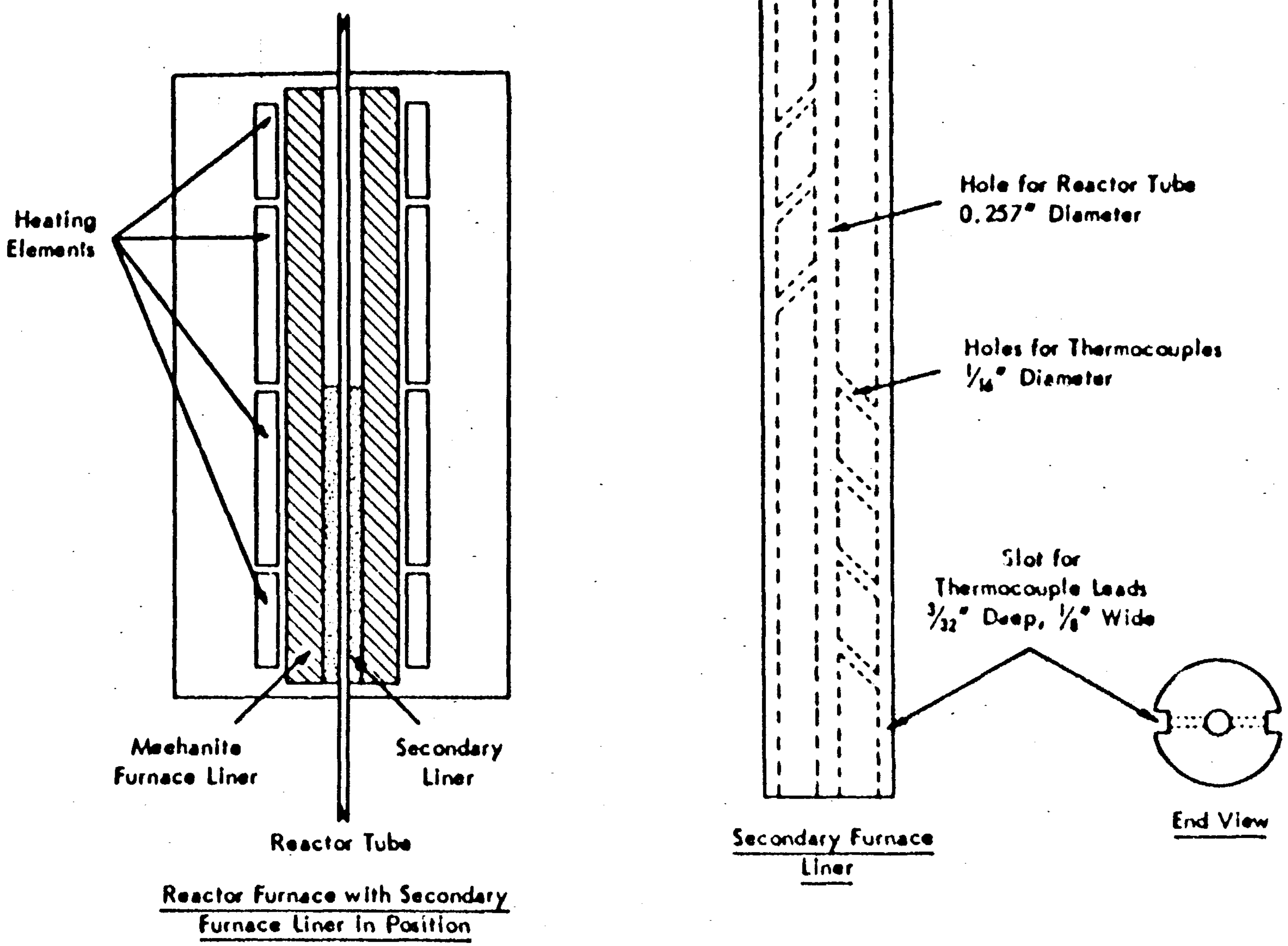


Figure 81. SECONDARY FURNACE LINER FOR 1/4" OD REACTOR TUBE

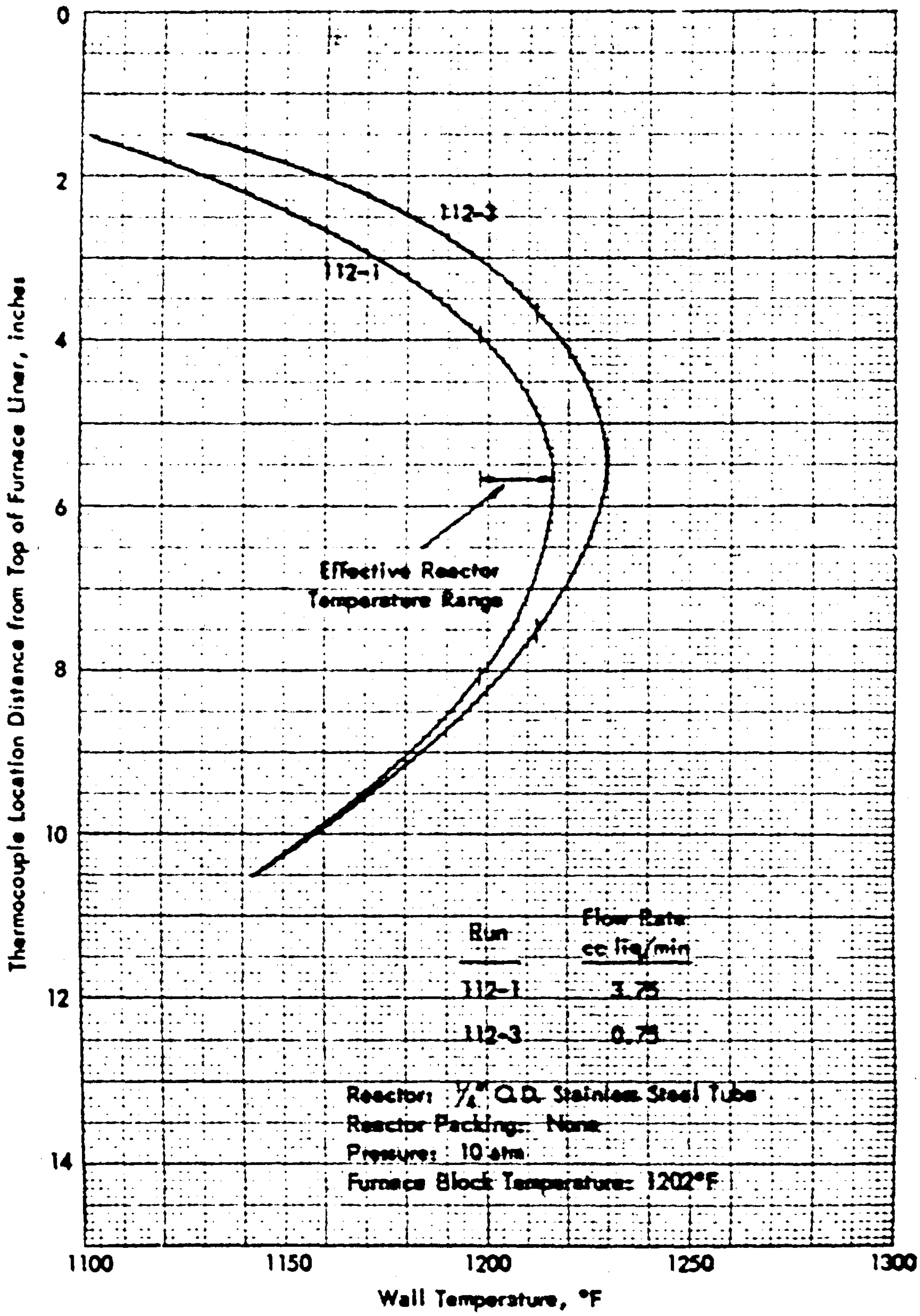


Figure 82. REACTOR TEMPERATURE PROFILE

Micro Catalyst Test Reactor Data

The micro catalyst test reactor (MICTR) and the operational techniques used for screening candidate catalysts have been described in the Appendix of the last Annual Report.[16] No further changes have been made. Catalysts are tested with MCH at LHSV 100 and 662, 752 and 842°F, at 10 atm pressure without added hydrogen. Figures 87 through 89, of reference 18 show the apparatus in detail, except for the changes noted in reference 16. It has been found that more consistent results are obtained if a fresh loading of the reference catalyst 9874-139 is made each week as a base point for calibration, rather than using the same reference catalyst tube over and over again, since the activity gradually declines. Also prepared catalysts have been rescreened to 10-20 mesh to remove fines after impregnation and drying of the supports, and this gives more reproducible results.

Table 130. MCH DEHYDROGENATION WITH VARIOUS CATALYSTS IN MICRO: RUNS 677-813

Period: June-August 1968

Condition: 10 atm pressure; catalysts reduced in H_2 for 20 minutes at 736°F; GLC samples normally taken at 3-, 8-, and 13-minute operation at each block temperature.

Catalyst Volume: 0.9 ml catalyst diluted with 1.1 ml quartz chips; LHSV 100 (catalyst and quartz particles 10-20 mesh unless otherwise noted).

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

([illegible])

[illegible]

64677

[illegible]

[illegible]

Table [illegible]. MCH DEHYDROGENATION WITH VARIOUS CATALYSTS IN [illegible]

Period: September-November 1968

Conditions: 10 atm pressure; catalysts reduced in H_2 for 20 minutes at 7[illegible]°F; GLC samples normally taken at 5, 8, and 15 minute operation at each block temperature.

Catalyst Volume: 0.9 ml catalyst diluted with 1.1 ml quartz chips; LHSV 100 (catalyst and quartz 10-20 mesh unless otherwise noted

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

64987

Table [illegible]. MCH [illegible] WITH VARIOUS CATALYSTS IN [illegible]

Period: December, 1968-February, 1969

Conditions: 10 atm pressure; catalysts reduced in hydrogen at 796°F, GLC samples taken normally at 3-, 8- and 13-minute operation at each temperature.

Volume: 0.9 ml catalyst diluted with 1.1 ml quartz chips (10-20 mesh). LHSV 100 with MCH

Run No.	Catalyst No.	Catalyst Description	Wt, g	MCH Conversion, % [illegible]°F	MCH Conversion, % [illegible]°F	MCH Conversion, % [illegible]°F
[illegible]	[illegible]	1% Pt [illegible] type Al_2O_3 (ref.)	0.[illegible]	20, 25, 26	60, 68, 67	70, 69, 70
[illegible]	[illegible]	1% metal type 1 support[i]	0.[illegible]	0, 0	0, 0	0, 0
[illegible]	[illegible]	Bimetallic 2, 10/type 1 support[i]	0.[illegible]	31, 27, 25	67, [illegible], 67	78, 79, 79
[illegible]	[illegible]	Bimetallic 2, 10/type 1 support[i]	0.[illegible]	16, 14, 14	38, 30, 30	37, 31, 30
[illegible]	[illegible]	Bimetallic 4, 10/type 1 support[i]	[illegible]	2, 2	1, 2, 1	2, 2
[illegible]	[illegible]	Bimetallic 4, 10/type 1 support[i]	0.[illegible]	27, 22, 18	(1), (1), (1)[j] 33, 25, 25	(41), (16), (12)[j] 33, 36, 36
[illegible]	[illegible]	Bimetallic 2, 10 type 1 support[i]	0.[illegible]	3, 8, 9	27, 25, 26	43, 44, 31
[illegible]	[illegible]	Bimetallic 6, 10/type 1 support[i]	0.916	0, 0	0, 0	0, 0
[illegible]	[illegible]	Bimetallic 2, 10 type 1 support[i]	0.[illegible]	31, 30, 25	69, 67, 66	75, 73, 72
[illegible]	[illegible]	Bimetallic 7, 10 type 1 support[i]	0.[illegible]	18, 18, 17	66, 64, 63	71, 70, 69
[illegible]	[illegible]	Bimetallic 6, 10 type 1 support[i]	0.[illegible]	2, 2, 2	2, 2, 1	2, 1, 1
[illegible]	[illegible]	Bimetallic 8, 10 type 1 support[i]	0.[illegible]	9, 9, 9	16, 15, 10	17, 16, 14
[illegible]	[illegible]	1% Pt [illegible] type Al_2O_3 (ref.)	0.[illegible]	25, 25, 26	64, 56, 57	72, 72, 72
[illegible]	[illegible]	4% metal[illegible] type 1 support	0.[illegible]	31, 30, 28	[illegible] [j] 64, 58, 53	(41), (3), (6)[j] 75, 73, 72
[illegible]	[illegible]	4% metal[illegible] type 1 support	0.557	36, 37, 31	[illegible] [j] 59, 57, 52	(26), (21), (12)[j] 78, [illegible], 72
[illegible]	[illegible]	1% Pt [illegible] type Al_2O_3 (ref.)	0.400	21, 25, 25	50, 46, 46	72, 70, 70
[illegible]	[illegible]	4% metal[illegible] type 1 support	0.759	27, 26, 18	(3), (1), (1)[j] 60, 59, 59	(20), (13), (12)[j] 58, 56, 55
[illegible]	[illegible]	4% metal[illegible] type 1 support	0.[illegible]10	22, 22, 20	(7), (2), (2)[j] 56, 57, 55	(28), (20), 20[j] 50, [illegible], [illegible]
[illegible]	[illegible]	4% metal[illegible] type 1 support[e]	0.759	(27)[j] 35, 35, 35	(49), (37), (39)[j] 36, [illegible], [illegible]	(64), (50), (49)[j] 36, 32, 32
[illegible]	[illegible]	4% metal[illegible] type 1 support[e]	0.[illegible]	(31)[j] 36, 35, 35	(61), (61), (57)[j] 32, 30, 36	(53), (60), (58)[j] 32, 31, 35
[illegible]	[illegible]	4% metal[illegible] type 1 support[e]	0.[illegible]	26, 27, 27	(71), (71), (59)[j] 32, [illegible], [illegible]	(61), (56), (56)[j] 31, 37, [illegible]
[illegible]	[illegible]	4% metal[illegible] type 1 support[e]	0.811	28, 27, 26	(45), (45), (42)[j] 33, 32, 35	(51), (52), (45)[j] 36, 37, 37
[illegible]	[illegible]	Tube No. [illegible]; 4% metal on 40% type 1 support (1), 40% type 1 support (2), 20% type 6 binder	0.136	18, 17, 19	(1)[j] 45, 40, 40	(6), (5), (5)[j] 68, 65, 66
[illegible]	[illegible]	Tube No. 25, 4% metal on above support	0.290	26, 26, 26	(2), (1), (2)[j] 37, 32, 31	(14), (13), (11)[j] 72, 75, 72
[illegible]	[illegible]65A	2% metal on 40% type 1 support (1), 40% type 1 support (2); binders, 17% type 6, 4% type 22	0.[illegible]	26, 25, 26	52, 51, 53	79, 79, 78
[illegible]	10960-65B	3% metal on above support	0.396	28, 25, 25	55, 51, 51	79, 79, 79
[illegible]	[illegible]	1% Pt [illegible] type Al_2O_3 (ref.)	0.[illegible]	28, 25, 25	68, 68, 68	72, 78, 70
[illegible]	10960-65C	2% metal on same type support used for catalyst 65A but less type 22 binder	0.413	27, 25, 26	49, 50, 52	79, 79, 77
[illegible]	10960-65D	3% metal on same type support used for catalyst 65A but less type 22 binder	0.400	20, 21, 21	56, 50, 50	81, 80, 79
[illegible]	10960-65E	Bimetallic 2, 3.66/type 1 support[e]	0.609	2, 2, 2	5, 4, 3	10, 0, 0
[illegible]	10960-65F	Bimetallic 2, 3.66/type 1 support[e]	0.721	6, 6, 4	17, 17, 14	26, 22, 22
[illegible]	10960-65G	Bimetallic 2, 3.66/type 1 support[e]	0.609	3, 4, 3	5, 5, -	13, 12, 11
[illegible]	10960-65H	Bimetallic 2, 3.66/type 1 support[e]	0.665	7, 6, 7	10, 12, 11	[illegible], [illegible], 11
[illegible]	[illegible]	4% metal[b] type 1 support	0.7[illegible]	19, 18, 16	(2), (1)[j] 37, 34, 32	(8), (6), (5)[j] 63, 57, 50
[illegible]	10960-62A	Bimetallic 4, 3.66/type 1 support[f]	0.720	24, 22, 22	50, 46, 45	76, 72, 73
[illegible]	10960-62C	Bimetallic 4, 3.66/type 1 support[f]	0.726	20, 21, 22	47, 46, 46	66, 66, 66
[illegible]	10960-65A	4% metal/type 1 support[g]	0.760	2, 1, 1	2, 0, 0	1, 1, 0
[illegible]	10960-65B	4% metal/type 1 support[h]	0.728	<1	0, 0	0, 0
[illegible]	10960-65C	Bimetallic 4, 2/type 1 support[h]	0.719	11, 8, 7	17, 15, 13	39, 38, 39
[illegible]	10960-65D	3.66 metal/type 1 support[h]	0.778	1, 2, 1	4, 2, 2	8, 6, 3
[illegible]	[illegible]-139	1% Pt [illegible] type Al_2O_3 (ref.)	0.452	25, 26, 25	47, 47, 46	70, 70, 66
[illegible]	10960-65E	3.66 metal/type 1 support[h]	0.7[illegible]	0, 0	0, 0	4, 4
[illegible]	10960-65F	Bimetallic 2, 3.66/type 1 support[h]	0.759	17, 17, 16	36, 35, 35	51, 52, 50

a) LHSV 50.
b) Impregnated as 2,2'-dipyridyl chelate.
c) Impregnated as ethylenediamine chelate.
d) Quartz filled.
e) Catalyst muffled 1 hr at 1[illegible]°F in air, before reduction.
f) Catalyst muffled 1 hr at 12[illegible]°F in air, before reduction.
g) Catalyst reduced at 1067°F.
h) Catalyst muffled 1 hr at 1364°F in air, then reduced at 1067°F.
i) Catalyst reduced at [illegible]°F.
j) Calculated from the toluene-benzene-residual methylcyclohexane ratio; % benzene in parenthesis. Considerable cracking to light gases, not determined.

65230

Table 133. MCH DEHYDROGENATION WITH VARIOUS CATALYSTS IN MICRO[illegible] [illegible]

Period: March–August, 1969
Conditions: 10 atm pressure; catalysts reduced in hydrogen at 775°F, GLC samples taken normally at 3-, 8- and 13-minute operation at each temperature
Volume: 0.9 ml catalyst diluted with 1.1 ml quartz chips (10–20 mesh). LHSV 100 with MCH

Run No.	Catalyst Number	Catalyst Description	Wt., g	% MCH Conversion, at [illegible]		
				[illegible]°F	[illegible]°F	[illegible]°F
906	10880-64A	15 Pt/5% [illegible] type 1 support / [illegible] type 1 support [illegible] / [illegible] type [illegible]	0.[illegible]	(28), 29, 26	50, 46, 47	50, 76, 76
907	10880-64B	25 Pt/5% [illegible] type 1 support / [illegible] type 1 support [illegible] / [illegible] type [illegible]	0.[illegible]	29, 26, 25	50, 51, 49	78, 77, 77
908	10880-71	3.6% metal type 1 support	0.[illegible]	0, 0	4, 2	3, 3, 5
909	10880-71A	3.6% metal type 1 support[b]	0.[illegible]	1, 0	<1	4, 3, 3
910	10880-71B	Bimetallic, 2, 3.6%/type 1 support[a]	0.776	29, 28, 26	56, 55, 54	92, 91, 91
911	10880-71C	Bimetallic, 2, 3.6% type 1 support[a]	0.[illegible]	30, 26, 25	55, 51, 51	79, 77, 75
912	10880-71D	Bimetallic, 2, 3.6% type 1 support[a]	0.[illegible]	14, 14, 13	35, 35, 36	56, 56, 56
913	10880-71E	Bimetallic, 2, 3.6%/type 1 support[a]	0.[illegible]	25, 26, 25	50, 47, 46	76, 72, 72
914	10880-71F	Bimetallic, 2, 3.6% type 1 support[a]	0.[illegible]	<1	6, 4, 3	9, 12, 8
915	10880-72A	Bimetallic, 2, 3.6%/type 1 support[a]	0.776	22, 26, 26	53, 52, 52	77, 77, 78
916	10880-72B	Bimetallic, 2, 3.6%/type 1 support[a]	0.775	14, 17, 17	37, 37, 36	57, 57, 55
917	1979-139	15 Pt/DCP B-8 type Al_2O_3 (ref.)	0.433	27, 29, 26	47, 46, 46	70, 70, 70
918	10880-72C	Bimetallic, 2, 3.6%/type 1 support[b]	0.779	11, 11, 12	29, 28, 28	61, 60, 57
919	10880-72D	Bimetallic, 2, 3.6%/type 1 support[b]	0.778	25, 26, 25	52, 44, 46	75, 73, 73
920	10880-72E	Bimetallic, 2, 3.6%/type 1 support[b]	0.775	2, <1	4, 4, 2	10, 4, 2
921	10880-71C	Bimetallic, 2, 3.6% type 1 support[a]	0.815	33, 31, 32	90, 79, 75	(6), (3), (2)[e] 80, 76, 80
922	10880-86	Bimetallic, 2, 3.6% type 1 support[a]	0.760	38, 29, 29	59, 56, 55	84, 83, 83
923	10880-72G	Bimetallic, 2, 3.6%/type 1 support[d]	0.779	22, 23, 26	56, 55, 54	86, 85, 86
924	10880-72H	Bimetallic, 2, 3.6%/type 1 support[d]	0.751	26, 25, 26	52, 51, 51	78, 77, 77
925	10880-72I	Bimetallic, 2, 3.6%/type 1 support[d]	0.760	13, 21, 21	43, 43, 43	65, 64, 63
926	10880-72J	Bimetallic, 2, 3.6% type 1 support[d]	0.762	20, 21, 23	46, 47, 46	71, 70, 64
927	10880-72K	Bimetallic, 2, 3.6% type 1 support[d)(e]	0.761	41, 37, 36	79, 77, 75	(4), (3), (4)[e] 87, 97, 88
928	10880-84B	25 Pt/type 5 support	0.371	19, 21, 21	47, 47, 46	70, 70, 68
929	10880-84G	46 Pt/type 5 support	0.379	15, 14, 13	43, 45, 40	71, 68, 68
930	1979-139	15 Pt/DCP B-8 type Al_2O_3	0.433	30, 28, 26	48, 47, 46	79, 70, 70
931	10880-72E	Bimetallic, 2, 3.6%/type 1 support	0.775	2, 2, 1	6, 6, 6	12, 11, 12
932	10880-88B	Bimetallic, 2, 3.6% type 1 support[f]	0.772	26, 26, 26	55, 55, 55	92, 93, 92
933	10880-88A	25 Pt/type 1 support[f]	0.736	25, 26, 29	55, 55, 55	86, 85, 85
934	10880-88C	25 Pt/type 5 support	0.343	25, 28, 25	53, 46, 48	77, 77, 75
935	10880-87A	Bimetallic, 2, 3.6%/type 1 support[d)(g]	0.739	25, 27, 26	57, 55, 55	95, 95, 95
936	10880-87B	Bimetallic, 2, 3.6%/type 1 support[d]	0.750	(28), 27, 26	56, 52, 52	80, 75, 50
937	10880-87C	Bimetallic, 2, 3.6%/type 1 support[d]	0.718	35, 30, 26	58, 54, 53	79, 78, 78
938	10880-87D	Bimetallic, 2, 3.6%/type 1 support[d]	0.726	19, 20, 19	51, 46, 46	64, 64, 66
939	10880-87E	Bimetallic, 2, 3.6%/type 1 support[d]	0.648	27, 26, 26	47, 48, 46	67, 67, 64
940	10880-89A	25 Pt/40% type 1 support / 40% type 5 support / 20% type 6 binder	0.380	30, 28, 29	50, 49, 46	76, 77, 76
941	10880-89B	35 Pt/40% type 1 support / 40% type 5 support / 20% type 6 binder	0.386	30, 27, 26	50, 50, 49	79, 78, 76
942	10880-89C	25 Pt/37% type 1 support / 37% type 5 support / 30% type 6 binder	0.417	20, 21, 20	54, 53, 49	85, 81, 80
943	10880-89D	35 Pt/37% type 1 support / 37% type 5 support / 30% type 6 binder	0.436	21, 23, 23	51, 48, 47	79, 77, 75
944	1979-139	15 Pt/DCP B-8 type Al_2O_3	0.432	[illegible], [illegible], 25	46, 45, 46	69, 70, 64

(Continued)

65868

Table [illegible] (Cont'd-1). MCH [illegible] WITH VARIOUS CATALYSTS IN [illegible]: RUNS [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(Continued)

65868

Table 133 (Contd-2). MCH DEHYDROGENATION WITH VARIOUS CATALYSTS IN MICTR: RUNS 991-1038

Run No.	Catalyst Number	Catalyst: Description	Wt, g	% MCH Conversion, hr: [illegible]	[illegible]	[illegible]
991	10860-47A	46 Pt[a]/type 1 support	0.7?1	4?, 27, 26	56, 50, 53	84, 80, 79
992	10860-47B	46 Pt/type 1 support	0.717	27, 40, 2?	56, 50, 51	86, 84, 86
993	10860-47C	46 Pt[a]/type 1 support	0.7??	40, 41, 43	5?, 50, ?	88, 86, 89
994	10860-47C	Bimetallic, 2, 3.4%/type 1 support	0.7??	1, 1, 0	2, 2, 2	3, 5, 5
995	10860-47D	Bimetallic, 2, 3.4%/type 1 support	0.770	<1	2	4, 4, 3
996	10860-47E	Harshaw Ni?, 7??	0.?13	2, 3	3	7, 3
997	P??-4	5 46 metal/type 6 support	3.840	3, 0	5, 7	7, 0
998	10860-48A	25 Pt, 5.8 type 1 support , 6.8 type 1 support / 6.8 type 6 binder	0.447	40, 37, 36	57, 50, 49	90, 52, 86
999	MFR-139	15 Pt/TCP ?-? type Al_2O_3	0.493	25, 25, 26	46, 40, 40	79, 78, 78
1000	10860-48B	25 Pt, 7.8 type 1 support , 7.8 type 1 support , 7.8 type 6 binder	0.468	25, 28, 25	37, 37, 36	97, 97, 96
1001	10860-48C	15 Pt/type 1 support	0.442	25, 27, 26	1?, 56, 56	90, 86, 87
1002	10860-48E	46 Pt/type 1 support	0.460	30, 29, 27	34, 36, 36	86, 83, 87
1003	10860-49A	Bimetallic, 4, 4%/type 1 support	0.5??	1, 1, 1	5, 3, 5	6, 4, 5
1004	10860-49B	Bimetallic, 4, 4%/type 1 support	0.8??	(1), (1) 17, 14, 17	(4), (2), (3) 34, 28, 28	(10), (12), (10)[a] 51, 46, 43
1005	10860-49C	Bimetallic, 4, 4%/type 1 support	0.850	3, 3, 3	13, 12, 9	14, 19, 17
1006	10860-49D	Bimetallic, 2, 2%/type 1 support	0.755	23, 21, 19	44, 44, 43	(2), (2), (2)[a] 60, 57, 57
1007	10860-49E	Bimetallic, 2, 2%/type 1 support	0.750	21, 22, 22	42, 40, 39	(6), (4), (4)[a] 58, 57, 55
1008	10860-100A	Bimetallic, 4, 3.6%/type 1 support	0.775	3, 0	0, 0	1, 1
1009	10860-100B	Bimetallic, 2, 2%/type 1 support	0.506	27, 27, 25	41, 41, 41	(7), (2), (2)[a] 55, 53, 46
1010	10860-100C	Bimetallic, 4, 3.6%/type 1 support	0.786	2?, 24, 23	48, 44, 44	(10), (2), (2)[a] 62, 61, 58
1011	10860-109	16 Pt/same support as for 48B	0.500	32, 33, 27	59, 54, 58	90, 87, 91
1012	1776	46 Pt/type 1 support (see shipment 1.35)	0.757	32, 26, 25	56, 55, 54	94, 85, 52
1013	MFR-139	15 Pt/TCP ?-? type Al_2O_3 (ref.)	0.496	28, 26, 26	44, 40, 40	73, 72, 71
1014	10860-100E	Bimetallic, 2, 5%/type 1 support	0.771	17, 14, 19	28, 29, 29	(6), (4) 42, 36
1015	10860-101A	46 metal/type 1 support	0.761	20, 26, 26	(22), (2), (2) 56, 58, 57	(27), (25), (20) 61, 59, 56
1016	10860-101B	Bimetallic, 2, 5%/type 1 support	0.768	17, 26, 26	36, 36, 36	(6), (2), (2) 62, 60, 59
1017	10860-102B	Bimetallic, 2, 5%/type 1 support	0.783	26, 25, 28	46, 44, 46	(6), (4), (3) 63, 62, 62
1018	10860-101B	25 metal/type 1 support	0.722	13, 12, 7	18, 16, 14	23, 27, 25
1019	10860-102A	Bimetallic, 2, 5%/type 1 support	0.780	10, 14, 12	19, 19, 19	23, 25, 23
1020	10860-102B	Bimetallic, 2, 2%/type 1 support	0.772	13, 12, 10	18, 19, 18	(2), (1), (1) 30, 29, 26
1021	10860-102C	Bimetallic, 2, 2%/type 1 support	0.763	11, 9, 9	15, 15, 15	28, 25, 25
1022	10860-102D	Bimetallic, 2, 2%/type 1 support	0.75?	23, 20, 21	43, 43	(5), (2), (2) 54, 54, 53
1023	10860-102E	Bimetallic, 2, 2%/type 1 support	0.784	11, 11, 5	14, 17, 16	25, 25, 26
1024	10860-102F	Bimetallic, 2, 2%/type 1 support	0.759	10, 9, 8	17, 15, 15	20, 21, 19
1025	10860-104	Bimetallic, 2, 3.6%/type 1 support	0.666	30, 30, 28	52, 50, 51	72, 73, 70
1026	10860-104A	25 metal/type 1 support	0.672	20, 23, 22	33, 35, 36	(5), (2), (3) 65, 63, 46
1027	MFR-139	15 Pt/TCP ?-? type Al_2O_3 (ref.)	0.493	25, 29, 27	51, 48, 47	73, 72, 72
1028	10860-104B	Bimetallic, 2, 2%/type 1 support	0.765	12, 8, 9	14, 16, 12	20, 19, 21
1029	10860-105B	Bimetallic, 2, 2%/type 1 support	0.728	34, 32, 29	51, 51, 50	(2), (1), (1) 72, 71, 70
1030	10860-105A	46 Pt[1]/type 1 support	0.648	35, 30, 29	57, 54, 54	89, 85, 91
1031	10860-105B	46 Pt[1,a]/type 1 support	0.698	22, 22, 20	56, 44, 43	68, 64, 60
1032	10860-105C	25 metal[1]/type 1 support	0.741	27, 27, 27	57, 53, 51	76, 77, 75
1033	10860-105D	25 metal[1,a]/type 1 support	0.744	30, 30, 32	55, 53, 57	(13), (1), (1) 80, 75, 76
1034	10860-105E	25 metal[1]/type 1 support	0.721	22, 23, 24	39, 35, 34	(15), (7), (7) 55, 54, 43
1035	10860-105F	25 metal[1,a]/type 1 support	0.761	23, 25, 21	40, 38, 37	(30), (22), (19) 66, 57, 58
1036	10860-106A	10860-105D[a]	0.713	12, 20, 17	33, 29, 28	48, 45, 49
1037	10860-106B	10860-105F[a]	0.718	17, 17, 15	30, 29, 26	(13), (3), (2) 46, 31, 38

(Continued)

65868

Table [illegible] (Cont'd-3). MCH DEHYDROGENATION WITH VARIOUS CATALYSTS IN [illegible]: RUNS [illegible]

Run No.	Catalyst Number	Catalyst: Description	Wt, g	% MCH Conversion, %: [illegible]°F	[illegible]°F	[illegible]°F
[illegible]	[illegible]	[illegible] Pt/[illegible] type Al_2O_3 (ref.)	[illegible]	[illegible]	[illegible]	[illegible], 71
[illegible]	[illegible]	[illegible] Pt/type 1 support	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible] Pt/[illegible] type Al_2O_3 (ref.)	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 1 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 1 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible]	[illegible], 59	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 1 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible], 27	[illegible]	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 1 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible]	51, [illegible]	[illegible]
[illegible]	[illegible]	[illegible] Pt/[illegible] type Al_2O_3 (ref.)	[illegible]	27, [illegible], 25	51, [illegible]	73, 73, [illegible]
[illegible]	10860-	[illegible] Pt/[illegible] type 1 support[illegible] [illegible] type 1 support [illegible] type 6 binder Tube No. 16		[illegible] ([illegible]), 25	[illegible], 57	[illegible]
[illegible]		Above tube No. 16 filled with [illegible] [illegible] in catalyst [illegible]	[illegible]			
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 16 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	25, 25, 23	55, 53, 53	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 16 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible], 27	[illegible]	[illegible], 79
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 16 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible], 21	[illegible]	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 16 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	20, [illegible], 19	55, 55, 53	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 16 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible]	[illegible], 55, 55	[illegible]
[illegible]	10860-1110	[illegible] Pt/[illegible] type 16 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible], 27	[illegible], 55, 55	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 16 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible], 27	57, [illegible]	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt/[illegible] type 16 support [illegible] type 1 support [illegible] type 6 binder	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	10860-7	Tube No. 16 coated with: 5.[illegible] Pt/[illegible] type 1 support[illegible] [illegible] type 1 support [illegible] SiO_2		[illegible]	[illegible], 57	[illegible]
[illegible]	10860-7	Tube No. 16 coated with: 5.[illegible] Pt/[illegible] type 1 support [illegible] type 1 support [illegible] SiO_2 [illegible] in air		17, [illegible]	[illegible]	[illegible]
[illegible]	10860-7	Tube No. 16 coated with 5.[illegible] Pt/[illegible] type 1 support [illegible] type 1 support [illegible] SiO_2 After exp. [illegible] Catalyst chamber filled with equal charge of reference catalyst	[illegible]	[illegible]	65, [illegible], 60	[illegible]
[illegible]	[illegible]	[illegible] Pt/[illegible] type Al_2O_3 (ref.)	[illegible]	[illegible]	[illegible]	73, 73, [illegible]
[illegible]	10860-[illegible]	[illegible] Pt[illegible]/type 1 support	[illegible]	[illegible]	[illegible], 55, 55	[illegible]
[illegible]	10860-[illegible]	[illegible] Pt[illegible]/type 1 support	[illegible]	[illegible]	[illegible]	[illegible]

a) Bracketed numbers % benzene, unbracketed numbers % conversion of MCH to benzene and toluene.
b) Muffled in air at [illegible]°F before reaction in H_2.
c) Support with [illegible] metal dried at [illegible]°F before impregnation with the second metal.
d) Support with [illegible] metal muffled at [illegible]°F in air.
e) [illegible]
f) [illegible] removed from the support.
g) Different [illegible] acid than used for comparable catalysts.
h) Muffled in air at [illegible]°F.
i) Compressed with No. [illegible] salt.
j) Muffled in air at [illegible]°F.
k) Chelated with [illegible].
l) Chelated with ethylene diamine.
m) Chelated metal, neutralized.
n) Muffled in air at [illegible]°F.
o) Rerun of Run No. 730 (Table).
p) [illegible] filled.
q) Originally used in Run 730.
r) Single impregnation.
s) Four successive impregnations, first three thermal decomposition at [illegible]°F, after each impregnation.

65868

Measurement of Deposits on Coker Tubes With Nuclear Radiation[a)]

Presented here is a summary to date of the results and thoughts that have gone into the application of nuclear radiation as a tool for the evaluation of coker tube deposits. Covered are the general principles, electron scattering theory, preliminary experiments, trial apparatus and results, and proposed permanent instrument design. Electron backscatter appears to be the most promising approach and is the method of primary concern in the work presented here.

Thin Film Measurement With Nuclear Radiation General Principles

Thin film measurement with nuclear radiation can be accomplished either by transmission or scatter of the radiation. The problem is to select the best type and energy of radiation and guidelines to such selection that are available.[56)57)] The deposits of interest have a surface density in the neighborhood of 10^{-5} g/cm^2 equivalent to an air path of only .01 cm. This implies an arrangement based on scattering rather than absorption and the probable need of vacuum operation. Possible types of radiation applicable in the present case are summarized in the table below.

Table 134. METHODS OF UTILIZING NUCLEAR RADIATION

Type	Source Radiation	Detected Radiation	Operation	Remarks
1	α	α	alpha backscatter	Low scattering coefficient, requires very high intensity source.
2	α	x	x-ray fluorescence in coker tube	Possible method. Efficiency very dependent on tube metal.
3	β	β	beta backscatter	Preferred method.
4	β	x	x-ray fluorescence	Similar to method 2.
5	x	x	x-ray backscatter	Low efficiency.
6	x	x	x-ray fluorescence	Low efficiency.

The conclusion from this list is that electron scattering is preferred but other factors, not listed, also lead to the same conclusion. Should an alternative method be considered for investigation the use of fluorescence from alpha bombardment is probably the most promising. A transmission type of measurement is possible if radioactivity is introduced, by plating for example, onto the coker tube. This method, suggested by H. Siegel, is

a) Acknowledgement is made to Dr. R. Curtis of the Analytical Department for this work.

preferable from the point of view of measurement to any of those listed above, but the handling of radioactive tubes is a sufficient deterrent to exclude the method.

Electron Backscatter Theory

An approximate description of the relative backscattered electron flux to be expected from a coating of thickness x (g/cm^2) on a base of effectively infinite thickness is given by Tittle[58] as:

$$\frac{I}{I_0} = \frac{\beta_1}{\mu_1 + \lambda_1}\left[1 - e^{-(\mu_1+\lambda_1)x}\right] + \frac{\beta_2}{\mu_1 + \lambda_2}\; e^{-(\mu_1+\lambda_3)x} \qquad (53)$$

The constants μ, λ, and β depend upon the materials involved and the maximum beta energy, subscripts 1 and 2 referring to the coating and base respectively, and 3 to properties of both. From relations given by Tittle equation (53) in the approximation of small x can be expressed as:

$$\frac{I}{I_0} = \left(1 - e^{-Z_2/40}\right) + \frac{35x}{E^{1.14}}\left[\left(\frac{Z_1}{A_1}\right)\left(\frac{331 + Z_1}{106 + Z_1}\right)\left(1 - e^{-Z_1/40}\right) - \left(\frac{Z_1}{A_1} + \frac{50Z_1^{0.31}}{106 + Z_2}\right)\left(1 - e^{-Z_2/40}\right)\right] \qquad (54)$$

in which Z_1 and A_1 are the atomic number and atomic mass of the coating, Z_2 the atomic number of the substrate, and E is the maximum beta energy in Mev. Approximating the deposit composition by $Z_1/A_1 = 0.56$ and $Z_1 = 5.9$ on an aluminum ($Z_2 = 13$) base gives

$$\frac{I}{I_0} = 0.28 - \frac{4.4\,x}{E^{1.14}} \qquad (55)$$

as the ratio of scattered to incident flux. The statistics of counting and the general level of instrumental variables is such that it is not practical to measure a change dI/I_0 of much less than 1%. Equation (55) then predicts a maximum energy of 1.1 Kev in order to detect a thickness change dx of 10^{-6} cm, assuming unit density for the deposit. Some idea of the range of thickness measurable with this energy is obtained by equating (55) to zero with the result $x = 3.10^{-5}$ g/cm^2. This prediction indicates the need of a very low energy source though perhaps not as low as 1 Kev if the expected range of thickness (up to 10^{-4} cm) is to be covered. Possible sources that are available are listed in Table 135. None of these sources is as low in energy as might be desired, but the least energetic sources should provide a useable compromise since even ^{14}C is capable of showing some response to the heavier deposits.

Table 135. LOW ENERGY BETA SOURCES

Isotope	Half Life, Years	Emax., Kev	Range in Air, cm
^{210}Pb	21	17	0.4
^{3}H	12	19	0.5
^{63}Ni	85	67	5.5
^{14}C	5700	155	26.0

Though not immediately apparent, equation (54) dicts that the replacement of aluminum with any metal of higher atomic number will produce an increased response to a given deposit. The method depends on the difference, primarily in atomic number, between coating and base. This difference is not large with aluminum so that a successful measurement in this case assures success with heavier metals.

Preliminary Experiments

Initial tests were aimed at answering three questions: whether operation without a vacuum was feasible, whether to minimize absorption a windowless flow counter was practical, and what magnitude of response would be observed in practice To this end a small counter was constructed (courtesy A. Telfer) from one inch brass tubing with a wedge shaped end opening approximately one mm wide. As a source ^{63}Ni, having a reasonable penetration in air, was utilized in the form of the chloride adsorbed on a strip of filter paper mounted near the counter entrance. Tests were made using a 3/16" aluminum rod covered with various thicknesses of mylar film and mounted 1/2 cm from the counter.

This arrangement was unsatisfactory in several respects. One difficulty, not unexpected, was a large dependence of count rate upon counter gas flow rate. This could be controlled, but drift beyond this factor occurred that could not be accounted for. Stability was sufficient to show a count difference for one mil mylar film but was wholly inadequate for the detection of deposit films. In short, it was concluded that vacuum operation, which would require a thin window counter, was necessary and that a lower energy beta source was essential.

Trial Apparatus and Results

The bell jar and forepump portion of a vacuum deposition apparatus were utilized in the following measurements. Feedthroughs in the base were provided for piping the flow of counter gas, the high voltage lead to the detector, and a slide fitting to which the coker tube could be attached. This slide fitting allowed translation and rotation of the coker tube in front of the source and detector for scanning the deposit area.

A locally constructed thin window flow counter[a] was used as detector. This window is exposed via a 3/32 x 5/8" slot cut in a one inch diameter faceplate. The source was mounted directly on this face about 1/4" from the slot. The source itself was a 1/8 x 1/4" section of a neutron generator target arranged with a rather simple collimator fashioned from aluminum foil. The source-to-scatterer and scatterer-to-detector distance was 2.5 cm.

The associated electronics consisted of a Baird-Atomic Model 530 Spectrometer and Printer which provides the necessary functions of high voltage supply, pulse amplifier, discriminator, counter, and timer. Originally the high voltage was carried into the vacuum to the detector through a shielded cable, but this proved unsatisfactory. Attempts at shielding and insulating were not sufficient to eliminate corona and discharge in the vacuum with resultant spurious counting. A sufficiently hard vacuum to eliminate this problem was not practical. Instead, the high voltage lead and connection to the detector were enclosed in copper tubing and arranged to remain at atmospheric pressure.

The beta source used produces as well, some x-rays. These contribute to the scattered flux which is detected and pr[illegible] a background counting rate even at atmospheric pressure. As the air press[illegible] is reduced, a point is reached where the mean free path of the scattered electrons is sufficient for them to reach the detector and be counted. It was anticipated that a maximum count rate would be reached at some pressure and that this rate would remain constant below this pressure where essentially all electrons that could be scattered toward the detector would reach it. Instead, it was found that the count rate reached a maximum and then decreased with increasing vacuum. This maximum occurred at a pressure of approximately 25 torr while below 1/2 torr the count rate was independent of pressure. Apparently, as the pressure is reduced there is a maximum in count rate when the coker tube, bell jar wall, and residual atmosphere all contribute to the scattering and further evacuation diminishes the air scatter more rapidly than the increased scatter from wall and coker tube. As long as the pressure remains under 1/2 torr this presents no difficulty.

The coker tubes used in this study are of a miniature variety, the section of interest being 2-1/2" long and 1/8" diameter between end sections of 3/16" diameter. The deposit generally covers only a portion of the central tube section, being lightest (visually) near one shoulder, increasing in darkness toward the center of the tube and ending fairly abruptly to leave apparently bare metal beyond this point. The scattered intensity measured along such a tube is shown in Figure 83. Each point in the figure represents a 20 second count. The scatter of these points from a smooth curve is primarily due to [illegible]tistical variations in counting. The rate corresponding to an uncoated tube is about 300 c/s, while on the wider tube section beyond the shoulder it is approximately 350 c/s. While the deposit in this example is a rather heavy one by visual inspection there appears to be ample sensitivity in the backscatter response. This is particularly true considering two simple improvements that could easily be introduced. The first involves better collimation of the incident beta flux to improve resolution of the

a) A. Telfer, "A Flow-Proportional Counter for Soft x-Rays", Emeryville Technical Progress Report 271-64.

deposit profile, the present arrangement viewing about 1/2 cm of tube at a time. The second improvement incorporates a collimator over the detector window the purpose of which is to reduce background scatter from the bell jar. This background involves both x-ray and electron scatter and amounts to about 100 c/s in the absence of a sample tube.

Results with a group of coker tubes are given in Figure 84. Again a 20 sec count was made at each point, but with the limited number of points involved a good approximation to the profile is acquired in roughly 3 min. The two curves for each sample are scans along opposite sides of the tubes. The horizontal line to the right of each curve is an adjusted rate of 300 c/s. This adjustment was necessary because of an unexplained drift, possibly arising from the electronics, which could be corrected for each scan by returning to the starting position, but which is more difficult to correct for in going from tube to tube.

Calibration points for establishing a thickness scale were obtained using mylar film and by coating a tube with films of solution cast nitrocellulose. The mylar film (1/8 mil) is approaching infinite scattering thickness which simply means that the aluminum rod no longer contributes to the scattering. At this point the count rate has dropped from 300 to 200 c/s. Reasonably consistent results were obtained with 1, 2 and 4000A of film. Applied to the five tubes in Figure 84 this gives the following results as shown in Table 136.

$$\frac{I}{I_o} = 1 - e^{-Z_2/40} + \frac{35x}{E^{1.14}}\left[\frac{Z_1}{A_1}\left(\frac{331 + Z_1}{106 + Z_1}\right)\left(1 - e^{-Z_1/40}\right) - \left(\frac{Z_1}{A_1} + \frac{400\ Z_1^{0.31}}{106 + Z_2}\right)\left(1 - e^{-Z_2/40}\right)\right]$$

For Aluminum base $Z_2 = 13$ x = film thickness, g/cm²

$$\frac{I}{I_o} = 0.2775 + \frac{35x}{E^{1.14}}\left[\frac{Z_1}{A_1}\left(\frac{331 + Z_1}{106 + Z_1}\right)\left(1 - e^{-Z_1/40}\right) - \left(\frac{Z_1}{A_1} + 4.195\ Z_1^{0.31}\right)(0.2774)\right]$$

Composition		Z_1	Z_1/A_1	$Z_1^{0.31}$	$1 - e^{-Z_1/40}$	[<0]	% Change[a)]
CH	= 7.74w% H	5.613	.5383	1.707	.1309	1.914	-
CH_2	= 14w% H	5.28	.572	1.675	.1237	1.898	-2.0
$CHO_{.25}$	= 23.5w% O	6.18	.529	1.758	.1432	1.965	+1.5
$CHS_{.05}$	= 11w% S	6.75	.534	1.808	.1553	2.005	+3.5
$CHFe_{.01}$	= 4.1w% Fe	6.46	.535	1.784	.1492	1.985	+2.5
$CHPb_{.001}$	= 1.4w% Pb	6.64	.519	1.798	.1530	1.997	+3.1

a) Scaled with CH as reference.

Z = at. no.

A = Avg at. wt. of coating

w = wt. fraction

E = max energy of source, MEV

$Z_i = \Sigma w_i Z_i$

$\frac{Z_i}{A_i} = \Sigma w_i \frac{Z_i}{A_i}$

Tritium = .019 (must be a very soft source)

Table 136. RESULTS ON FIVE COKER TUBES

Fuel No.	Max Count Rate Decrease	Max Film Thickness, A°	Approx Total[a] Deposit, A° x cm	Visual Ratings	
				Max	Avg
1	85 c/s	5000	6000	7.0	1.3
2	70	4500	7000	6.5	1.5
3	20	1200	1500	4.0	1.6
4	50	3000	4000	6.5	1.8
5	125	8000	6000	6.5	1.0

a) Multiplication by tube circumference (1.0 cm) will give total deposit volume.

There is little agreement with the visual ratings. The scattering results are, of course, reproducible and independent of operator judgment.

The deposit composition in calculations with equation (54) was assumed to be $CH_2O_{.25}$. It can approach $CHO_{.25}$ and may contain up to 5% sulfur. Again the effects of composition changes in the deposit on the scattered intensity can be estimated at least roughly from this equation. The main effect from composition changes is in the average for Z. Starting with $CH_2O_{.25}$ and going to $CH_2O_{.25}S_{.05}$, that is, adding 8% sulfur is equivalent to a 2% change in apparent thickness. The dependence on sulfur or any other heavier element is large, as expected, but film measurement within 2% that does not depend on composition is still far superior to visual estimates.

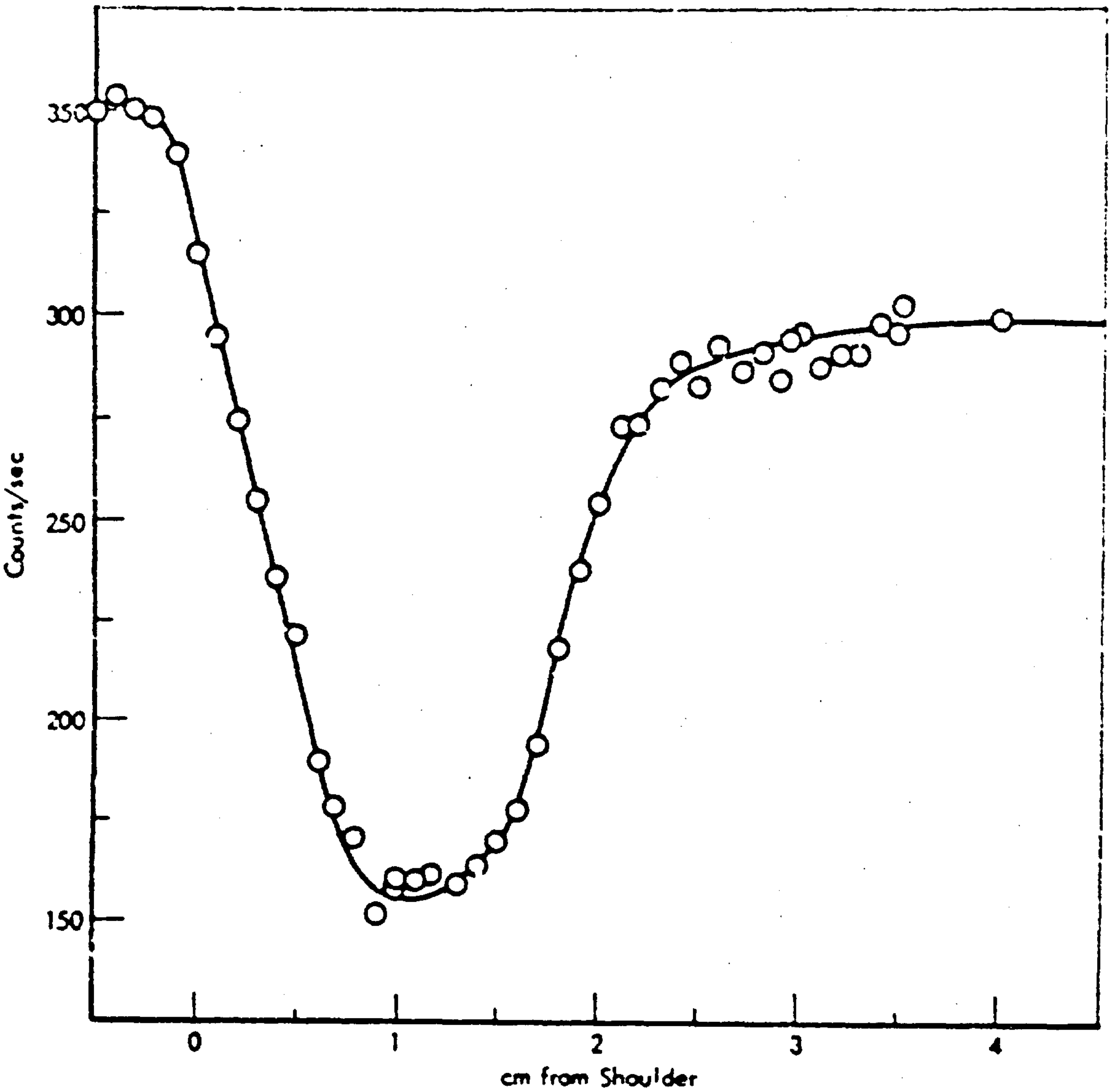


Figure 83. COKER TUBE DEPOSIT PROFILE

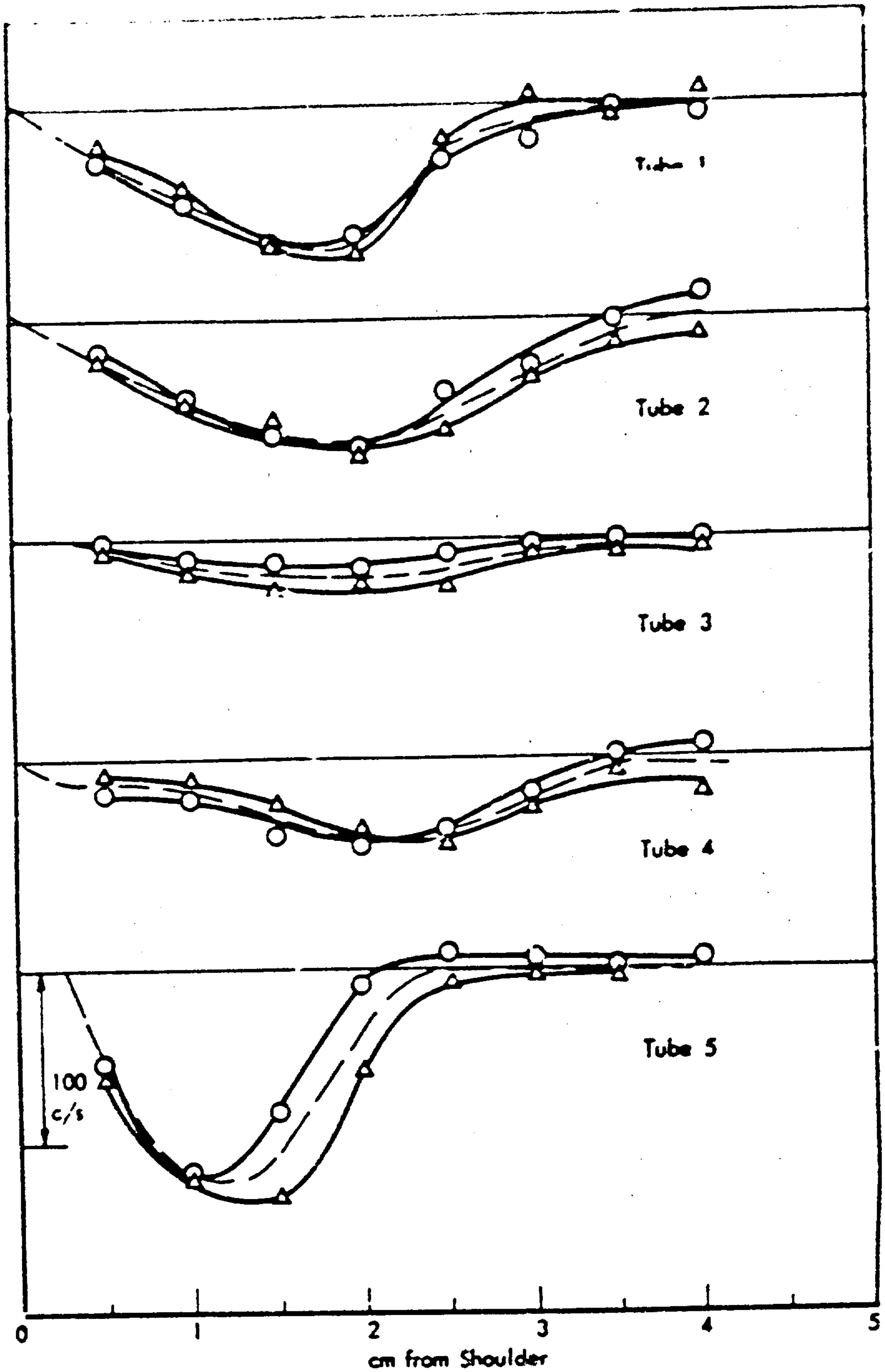


Figure 84. COMPARISON OF DEPOSIT TUBE PROFILES

Proposed Instrument Design

The results observed above demonstrate the feasibility of electron backscatter as a means of quantitative measurement of coker tube deposits. Several conveniences can, however, be incorporated in a practical instrument. These include automatic scanning and recording of the profile and a convenient vacuum assembly.

In respect to scanning it may be convenient to integrate or average readings around the tube circumference so that a one-dimensional average along the tube length is obtained. This can be achieved in either of two ways. With a point source and detector arrangement and a ratemeter output the tube can be rotated with a period less than the time constant of the ratemeter while being translated along its length. A motor driven screw motion would achieve this. The alternative is to arrange both source and cylinder in the form of rings surrounding the rod. Actually, a triangular array would provide a sufficient approximation to a continuous ring. The main cost increase would be in respect to three detectors. The source and electronics cost increase is trivial. In this way only a linear motion need be applied to the sample tube and eccentricity is averaged out.

For the vacuum assembly it may be most convenient to adapt a commercially available apparatus involving a bell jar. But a smaller volume would allow quicker pumping down and would be more compact. This could be in the form of a tube sufficiently long for sample translation and of perhaps 3" ID. An external motor drive would move the sample placed on a suitable carriage. Source and detector would be mounted in the mid-section wall of the tube with collimation on the source and on the detector to reduce extraneous backscatter. Electrical connections would then all be at atmospheric pressure.

TABLE 137 SHELL DEVELOPMENT COMPANY

CHARACTERISTIC PROPERTIES OF DECALIN

(.500 CIS, .500 TRANS)

MOLECULAR WEIGHT	138.2	138.2
ACENTRIC FACTOR	.299	.299
CRITICAL PRESSURE	30.7 ATM	71.8 PSIA
CRITICAL TEMPERATURE	413.8 C	776.8 F
CRITICAL COMPRESSIBILITY FACTOR	.207	.207
CRITICAL DENSITY	.264 GM/CUCM	16.480 LB/CUFT
FREEZING POINT	-44.8 C	-48.6 F
NORMAL BOILING POINT	190.8 C	375.3 F
NORMAL ENTHALPY OF VAPORIZATION	67.8 CAL/GM	122.0 BTU/LB
HEAT OF COMBUSTION	10840. CAL/GM	19509. BTU/LB

TABLE 138 SHELL DEVELOPMENT COMPANY

LIQUID PROPERTIES OF DECALIN AT SATURATION

(.500 CIS, .500 TRANS)

TEMP, C	VAPOR PRESS, ATM	ENTHALPY OF VAP, CAL/GM	ENTHALPY, CAL/GM	ENTROPY, CAL/GM-K	SPEC HEAT AT CONST P, CAL/GM-K	DENSITY, GM/CUCM	VISCOSITY, CP	THERMAL COND, CAL/CM-SEC-K	PRANDTL NUMBER
-43	3.0714-04	8.9630+01	-1.2027+01	-1.0009-01	2.9273-01	9.2780-01	1.5501+01	3.7804-04	1.1823+02
-20	8.1627-04	8.8160+01	-6.0990+00	-4.8790-02	3.2080-01	9.1129-01	7.5713+00	3.7307-04	6.4981+01
0	1.8793-03	8.6477+01	0.0000	0.0000	3.4906-01	8.9809-01	4.2969+00	3.6819-04	4.0629+01
20	3.4898-03	8.5149+01	7.2722+00	4.7147-02	3.7917-01	8.8377-01	2.7019+00	3.6447-04	2.8039+01
40	7.2512-03	8.3567+01	1.5119+01	9.1420-02	4.0794-01	8.6800-01	1.8375+00	3.5974-04	2.6034+01
60	1.5097-02	8.1913+01	2.3948+01	1.3338-01	4.3630-01	8.5370-01	1.3707+00	3.5499-04	1.6461+01
80	3.1284-02	8.0129+01	3.2590+01	1.7394-01	4.6063-01	8.3067-01	1.0070+00	3.5019-04	1.3907+01
100	6.3573-02	7.8213+01	4.2736+01	2.1719-01	5.2115-01	8.2349-01	7.849-01	3.4529-04	1.1932+01
120	1.2647-01	7.6187+01	5.2440+01	2.4934-01	5.3393-01	8.2013-01	6.4449-01	[illegible]	[illegible]
140	2.4480-01	7.4209+01	6.3100+01	2.8939-01	5.6487-01	7.9276-01	5.0018-01	3.3910-04	9.1290+00
160	4.9491-01	7.2244+01	7.4524+01	3.2883-01	6.0020-01	7.7717-01	4.3947-01	3.2999-04	8.3603+00
180	8.0982-01	6.8809+01	8.6439+01	3.5478-01	6.3004-01	7.6137-01	3.0534-01	3.2494-04	7.6982+00
200	1.3530+00	6.6301+01	9.8744+01	3.8843-01	6.6903-01	7.4943-01	3.4009-01	3.1867-04	7.1075+00
220	2.1549+00	6.3222+01	1.1196+02	4.2996-01	7.0974-01	7.2844-01	2.9023-01	3.1749-04	6.6487+00
240	3.2559+00	5.9749+01	1.2409+02	4.5247-01	7.4149-01	7.1530-01	2.5470-01	3.0927-04	6.1229+00
260	4.6871+00	5.5199+01	1.3458+02	4.8361-01	7.7030-01	6.9187-01	2.1189-01	2.9714-04	5.9704+00
280	6.5028+00	5.2401+01	1.5271+02	5.1412-01	8.1483-01	6.7919-01	1.7733-01	2.8804-04	5.0185+00
300	8.6907+00	4.8933+01	1.6710+02	5.4369-01	8.7490-01	6.5734-01	1.4099-01	2.7070-04	4.5099+00
320	1.1271+01	4.4228+01	1.8239+02	5.7323-01	9.0917-01	6.2100-01	1.2913-01	2.6904-04	4.2143+00
340	1.4291+01	3.9430+01	1.9754+02	6.0729-01	9.7100-01	5.9903-01	1.0400-01	2.6311-04	3.8944+00
360	1.7630+01	3.3099+01	2.1300+02	6.3124-01	1.0799+00	5.5420-01	8.7450-02	2.4621-04	3.8203+00
380	2.1427+01	2.6099+01	2.3087+02	6.6074-01	1.2400+00	5.1068-01	7.1709-02	2.4634-04	3.4783+00
400	2.5034+01	1.6912+01	2.4988+02	6.9104-01	1.8211+00	4.4914-01	5.5449-02	3.8399-04	3.3221+00

LIQUID PROPERTIES OF DECALIN AT SATURATION

(.500 CIS, .500 TRANS)

TEMP, F	VAPOR PRESS, PSIA	ENTHALPY OF VAP, BTU/LB	ENTHALPY, BTU/LB	ENTROPY, BTU/LB-R	SPEC HEAT AT CONST P, BTU/LB-R	DENSITY, LB/CUFT	VISCOSITY, LB/FT-HR	THERMAL COND, BTU/FT-HR-R	PRANDTL NUMBER
-45	4.7692-03	1.6208+02	-1.5181+01	-7.7409-02	2.8512-01	5.8180+01	4.4403+01	9.1997-02	1.4367+02
32	1.2993-02	1.5849+02	0.0000	0.0000	3.2379-01	5.6913+01	1.7099+01	9.3334-02	6.1290+01
50	3.5499-02	1.5464+02	1.7187+01	6.8480-02	3.6193-01	5.5034+01	8.1913+00	8.8730-02	3.3374+01
100	9.8211-02	1.5374+02	3.6366+01	1.3193-01	4.2494-01	5.4343+01	4.0747+00	8.7191-02	2.1440+01
150	2.7172-01	1.4698+02	5.7909+01	1.8900-01	4.4497-01	5.3800+01	2.9629+00	8.5592-02	1.5470+01
200	7.3450-01	1.4199+02	8.0900+01	2.4437-01	4.9059-01	5.1729+01	2.0779+00	8.3922-02	1.2113+01
250	1.9358+00	1.3692+02	1.0619+02	2.9820-01	5.3934-01	5.0390+01	1.5477+00	8.2758-02	1.0074+01
300	4.7640+00	1.3133+02	1.3341+02	3.4909-01	5.8140-01	4.9098+01	1.2147+00	8.0922-02	8.7715+00
350	1.0009+01	1.2401+02	1.6273+02	3.9409-01	6.2087-01	4.7780+01	9.7599-01	7.8730-02	7.7919+00
400	2.2162+01	1.1777+02	1.9356+02	4.4022-01	6.7749-01	4.6307+01	7.9739-01	7.6813-02	7.0327+00
450	4.0994+01	1.6909+02	2.2011+02	4.8504-01	7.2732-01	4.4797+01	6.9327-01	7.4530-02	6.3400+00
500	6.9029+01	1.0119+02	2.6022+02	5.2091-01	7.7430-01	4.3144+01	5.1593-01	7.1079-02	5.5286+00
550	1.0739+02	9.1717+01	2.9979+02	5.7308-01	8.3077-01	4.1382+01	4.8900-01	6.8744-02	4.8444+00
600	1.5671+02	8.1395+01	3.3249+02	6.1169-01	8.9609-01	3.9174+01	3.1400-01	6.5741-02	4.2927+00
650	2.1731+02	6.9423+01	3.7159+02	6.5190-01	9.9209-01	3.6679+01	2.4430-01	6.3999-02	3.8497+00
700	2.8040+02	5.4363+01	4.1229+02	6.9243-01	1.1873+00	3.3424+01	1.9017-01	6.3371-02	3.9837+00
750	3.7222+02	3.6470+01	4.9094+02	7.3409-01	1.7084+00	2.8125+01	1.3604-01	7.2303-02	3.3279+00

TABLE 130 — SHELL DEVELOPMENT COMPANY

GAS PROPERTIES OF DECALIN AT SATURATION
(.500 CIS, .500 TRANS)

TEMP., C	VAPOR PRESS., ATM	COMP FACTOR	DENSITY, GMOL/CC	FUGACITY, ATM	ENTHALPY, CAL/GM	ENTROPY, CAL/GM-K	FREE ENERGY, CAL/GM	SPEC HEAT AT CONST P, CAL/GM-K
-40	3.8714-04	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
-20	8.1627-04	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0	1.6765-03	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	3.4460-03	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
40	7.2913-03	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
60	1.5007-02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
80	3.1294-02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	6.3973-02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
120	1.2069-01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
140	2.4460-01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
160	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
180	8.0902-01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
200	1.3538+00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
220	2.1565+00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
240	3.2765+00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
260	4.6971+00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
280	6.5020+00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
300	8.6907+00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
320	1.1271+01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
340	1.4751+01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
360	1.7636+01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
380	2.1079+01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
400	2.5634+01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF DECALIN AT SATURATION
(.500 CIS, .500 TRANS)

TEMP., C	VAPOR PRESS., ATM	SPEC HEAT AT CONST V, CAL/GM-K	RATIO OF SPEC HEATS	SONIC VEL., CM/SEC	J-T COEF, K/ATM	VISCOSITY, CP	THERMAL COND., CAL/CM-SEC-K	PRANDTL NUMBER
-40	3.8714-04	2.3414-01	1.2704+00	1.2291+04	2.0297+01	4.5714-03	1.2713-05	7.8976-01
-20	8.1627-04	2.3229-01	1.2010+00	1.2714+04	2.1576+01	4.9104-03	1.5440-05	7.8005-01
0	1.6765-03	2.5974-01	1.0754+00	1.3104+04	1.8104+01	5.3357-03	1.8777-05	7.9565-01
20	3.4460-03	2.8056-01	1.3507+00	1.3602+04	1.2570+01	5.6477-03	2.1490-05	7.9160-01
40	7.2913-03	3.1771-01	1.0601+00	1.4027+04	8.9790+00	6.2530-03	2.4605-05	7.9960-01
60	1.5007-02	3.3420-01	1.0427+00	1.4430+04	8.2232+00	6.3950-03	2.8207-05	7.9760-01
80	3.1294-02	3.6125-01	1.0300+00	1.4070+04	6.5750+00	6.7773-03	3.1339-05	7.9910-01
100	6.3973-02	3.8773-01	1.0370+00	1.5107+04	5.3636+00	7.1197-03	3.5757-05	8.3117-01
120	1.2069-01	4.2170-01	1.0357+00	1.5037+04	4.6935+00	7.4610-03	3.0722-05	8.2755-01
140	2.4460-01	4.3554-01	1.0363+00	1.5035+04	3.7380+00	7.8019-03	4.3840-05	8.3475-01
160	[illegible]	[illegible]	[illegible]	[illegible]	3.1090+00	8.2272-03	4.8117-05	8.1124-01
180	8.0902-01	4.8765-01	1.0271+00	1.0752+04	2.7210+00	8.6142-03	5.2560-05	8.1756-01
200	1.3538+00	5.0096-01	1.0772+00	1.0291+04	2.3763+00	9.2173-03	5.7150-05	8.2599-01
220	2.1565+00	5.2979-01	1.0349+00	1.0723+04	2.0960+00	9.4429-03	6.1960-05	8.3615-01
240	3.2765+00	5.5119-01	1.0300+00	1.0644+04	1.0076+00	9.4974-03	6.0473-05	8.4957-01
260	4.6971+00	5.7451-01	1.0190+00	1.5713+04	1.7328+00	1.0360-02	7.1147-05	8.6419-01
280	6.5020+00	5.9750-01	1.0440+00	1.5234+04	1.6342+00	1.2927-02	7.7170-05	8.8107-01
300	8.6907+00	6.1907-01	1.0772+00	1.4991+04	1.9066+00	1.1527-02	8.2602-05	9.0077-01
320	1.1271+01	6.4260-01	1.0430+00	1.3967+04	1.5070+00	1.2215-02	8.8176-05	9.4491-01
340	1.4751+01	6.6441-01	1.0917+00	1.2739+04	1.6493+00	1.3022-02	9.4566-05	9.6477-01
360	1.7636+01	6.9379-01	1.1450+00	1.1014+04	1.0750+00	1.4704-02	1.0777-04	1.0657+00
380	2.1079+01	7.2025-01	1.1773+00	9.7563+03	2.1532+00	1.3667-02	1.0795-04	1.2614+00
400	2.5634+01	8.1732-01	1.4986+00	7.1002+03	3.8033+00	1.5309-02	1.1693-04	1.0047+00

GAS PROPERTIES OF DECALIN AT SATURATION
(.500 CIS, .500 TRANS)

TEMP., F	VAPOR PRESS., PSIA	COMP FACTOR	DENSITY, LB/CUFT	FUGACITY, PSIA	ENTHALPY, BTU/LB	ENTROPY, BTU/LB-R	FREE ENERGY, BTU/LB	SPEC HEAT AT CONST P, BTU/LB-R
-40	4.7062-03	9.9513-01	1.4909-04	4.7060-03	1.0600+02	3.1013-01	-3.1700+02	2.1750-01
0	1.2993-02	9.9909-01	3.6410-04	1.2991-02	1.3900+02	3.4490-01	-2.9610+02	2.4975-01
50	3.5400-02	9.9969-01	8.9757-04	3.5400-02	1.7183+02	3.7779-01	-2.7361+02	2.8761-01
100	9.0211-02	9.9931-01	2.2021-03	9.0144-02	1.8711+02	4.2900-01	-2.5720+02	3.2824-01
150	2.7172-01	9.9840-01	5.7902-03	2.7131-01	2.0419+02	4.3992-01	-2.3330+02	3.5070-01
200	7.3054-01	9.9461-01	1.4470-02	7.3405-01	2.2200+02	4.5954-01	-2.1530+02	3.9415-01
250	1.9730+00	9.9261-01	3.5310-02	1.9500+00	2.4311+02	4.9227-01	-1.9941+02	4.2743-01
300	4.7900+00	9.8460-01	8.2750-02	4.6923+00	2.6470+02	5.1603-01	-1.8391+02	4.6114-01
350	1.0005+01	9.7700-01	1.7722-01	1.0400+01	2.8750+02	5.4021-01	-1.7563+02	4.9497-01
400	2.2162+01	9.6440-01	2.5081-01	2.1350+01	3.1133+02	5.7721-01	-1.5097+02	5.2857-01
450	4.0990+01	9.1237-01	6.3427-01	3.7960+01	3.3590+02	6.0570-01	-1.4007+02	5.6166-01
500	6.9020+01	8.6763-01	1.0600+00	6.0960+01	3.6137+02	6.3391-01	-1.3644+02	5.9874-01
550	1.0730+02	8.1274-01	1.6450+00	9.0331+01	3.8747+02	6.6133-01	-1.3375+02	6.3497-01
600	1.5071+02	7.0010-01	2.5460+00	1.2909+02	4.1300+02	6.9660-01	-1.2960+02	6.7610-01
650	2.1731+02	6.7334-01	3.7460+00	1.6420+02	4.0091+02	7.1094-01	-1.2917+02	7.2811-01
700	2.8040+02	5.8479-01	5.4777+00	2.0609+02	4.6605+02	7.3930-01	-1.2715+02	8.1710-01
750	3.7713+02	4.6307-01	8.5693+00	2.3260+02	4.9022+02	7.6116-01	-1.2760+02	1.1510+00

GAS PROPERTIES OF DECALIN AT SATURATION
(.500 CIS, .500 TRANS)

TEMP., F	VAPOR PRESS., PSIA	SPEC HEAT AT CONST V, BTU/LB-R	RATIO OF SPEC HEATS	SONIC VEL., FT/SEC	J-T COEF, F/PSI	VISCOSITY, LB/FT-HR	THERMAL COND., BTU/FT-HR-F	PRANDTL NUMBER
-40	4.7062-03	1.9421-01	1.0733+00	3.7960+02	3.7730+00	1.0815-02	2.9011-03	7.6471-01
0	1.2993-02	2.3937-01	1.0411+00	4.1870+02	2.9020+00	1.2740-02	3.0113-03	7.0031-01
50	3.5400-02	2.7772-01	1.0927+00	4.3019+02	1.7360+00	1.3279-02	4.0150-03	7.9277-01
100	9.0211-02	3.0003-01	1.0465+00	4.9667+02	1.2533+00	1.4400-02	5.9067-03	7.9540-01
150	2.7172-01	3.4420-01	1.0416+00	4.7720+02	9.2609-01	1.5716-02	7.5600-03	7.9790-01
200	7.3053-01	3.7902-01	1.0363+00	4.9600+02	7.0091-01	1.6930-02	8.3300-03	8.3065-01
250	1.9730+00	4.1311-01	1.0356+00	5.1234+02	5.4000-01	1.8157-02	9.4631-03	8.8779-01
300	4.7600+00	4.4603-01	1.0339+00	5.2727+02	4.2000-01	1.9395-02	1.1491-02	8.5058-01
350	1.0009+01	4.7871-01	1.0311+00	5.3160+02	3.4159-01	2.0670-02	1.2930-02	8.1020-01
400	2.2162+01	5.1139-01	1.0356+00	5.3000+02	2.6212-01	2.2530-02	1.4073-02	8.2760-01
450	4.0990+01	5.4400-01	1.0397+00	5.2031+02	2.4092-01	2.3900-02	1.5607-02	8.4457-01
500	6.9020+01	5.7691-01	1.0300+00	5.1993+02	2.1224-01	2.5130-02	1.7109-02	8.6011-01
550	1.0730+02	6.0121-01	1.0476+00	5.0220+02	1.9720-01	2.6977-02	1.9170-02	8.9715-01
600	1.5071+02	6.3796-01	1.0489+00	4.9073+02	1.9304-01	2.9157-02	2.1560-02	9.3970-01
650	2.1731+02	6.7997-01	1.0894+00	4.1117+02	2.0023-01	3.1960-02	2.3074-02	1.3794+00
700	2.8040+02	7.1163-01	1.1909+00	3.6430+02	2.4640-01	3.0704-02	2.5273-02	1.1037+00
750	3.7913+02	8.8739-01	1.4200+00	2.4954+02	3.4491-01	4.3000-02	2.7926-02	1.0070+00

TABLE [illegible]

GAS PROPERTIES OF DECALIN (.900 CIS, .100 TRANS) SHELL DEVELOPMENT COMPANY

COMPRESSIBILITY FACTOR

PRESSURE, ATM

TEMP, C	0	5	10	15	20	25	30	35	40	45	50
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF DECALIN (.900 CIS, .100 TRANS)

COMPRESSIBILITY FACTOR

PRESSURE, ATM

TEMP, C	50	55	60	65	70	75	80	85	90	95	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF [illegible]

DENSITY, GM/CC

PRESSURE, ATM

TEMP, C	0	5	10	15	20	25	30	35	40	45	50
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF [illegible]

DENSITY, GM/CC

PRESSURE, ATM

TEMP, C	50	55	60	65	70	75	80	85	90	95	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE [illegible] (CONTINUED) SHELL DEVELOPMENT COMPANY

GAS PROPERTIES OF DECALIN (.[illegible] CIS, .[illegible] TRANS)

ENTHALPY, CAL/GM
PRESSURE, ATM

TEMP. C	[illegible]	5	10	15	20	25	30	35	40	45	50
-40	[illegible]										
-20	[illegible]										
0	[illegible]										
20	[illegible]										
40	[illegible]										
60	[illegible]										
80	[illegible]										
100	[illegible]										
120	[illegible]										
140	[illegible]										
160	[illegible]										
180	[illegible]										
200	[illegible]										
220	[illegible]										
240	[illegible]										
260	[illegible]										
280	[illegible]	[illegible]									
300	[illegible]	[illegible]									
320	[illegible]	[illegible]	[illegible]								
340	[illegible]	[illegible]	[illegible]								
360	[illegible]	[illegible]	[illegible]	[illegible]							
380	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
420	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
440	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
460	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
480	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
520	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
540	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
560	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
580	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
600	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
620	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
640	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
660	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
680	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
720	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
740	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
760	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
780	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
800	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
820	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
840	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
860	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
880	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
920	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
940	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF DECALIN (.[illegible] CIS, .[illegible] TRANS)

ENTHALPY, CAL/GM
PRESSURE, ATM

TEMP. C	55	[illegible]	60	65	[illegible]	[illegible]	80	85	90	95	100
420	2.9830+02	2.9796+02	2.9713+02	2.9664+02	2.9626+02	2.9599+02	2.9564+02	2.9547+02	2.9520+02	2.9513+02	2.9500+02
440	2.7607+02	2.7580+02	2.7499+02	2.7436+02	2.7384+02	2.7342+02	2.7307+02	2.7275+02	2.7253+02	2.7232+02	2.7215+02
460	2.9509+02	2.9435+02	2.9321+02	2.9234+02	2.9164+02	2.9111+02	2.9064+02	2.9027+02	2.8999+02	2.8966+02	2.8948+02
480	3.1554+02	3.1333+02	3.1179+02	3.1250+02	3.0971+02	3.0900+02	3.0843+02	3.0796+02	3.0759+02	3.0771+02	3.0693+02
500	3.3510+02	3.3245+02	3.3051+02	3.2907+02	3.2796+02	3.2709+02	3.2638+02	3.2580+02	3.2531+02	3.2490+02	3.2454+02
520	3.5428+02	3.5145+02	3.4937+02	3.4767+02	3.4637+02	3.4533+02	3.4448+02	3.4380+02	3.4322+02	3.4274+02	3.4232+02
540	3.7240+02	3.7010+02	3.6801+02	3.6626+02	3.6484+02	3.6368+02	3.6273+02	3.6194+02	3.6128+02	3.6073+02	3.6026+02
560	3.9053+02	3.8843+02	3.8648+02	3.8477+02	3.8331+02	3.8207+02	3.8134+02	3.8018+02	3.7946+02	3.7883+02	3.7828+02
580	4.0841+02	4.0695+02	4.0479+02	4.0316+02	4.0178+02	4.0046+02	3.9949+02	3.9846+02	3.9779+02	3.9702+02	3.9646+02
600	4.2622+02	4.2496+02	4.2296+02	4.2146+02	4.2009+02	4.1886+02	4.1779+02	4.1685+02	4.1603+02	4.1531+02	4.1469+02
620	4.4404+02	4.4294+02	4.4109+02	4.3975+02	4.3842+02	4.3724+02	4.3619+02	4.3526+02	4.3441+02	4.3366+02	4.3303+02
640	4.6191+02	4.6099+02	4.5927+02	4.5796+02	4.5676+02	4.5532+02	4.5461+02	4.5368+02	4.5286+02	4.5212+02	4.5146+02
660	4.7985+02	4.7901+02	4.7738+02	4.7621+02	4.7505+02	4.7406+02	4.7308+02	4.7217+02	4.7130+02	4.7063+02	4.6996+02
680	4.9789+02	4.9675+02	4.9562+02	4.9453+02	4.9346+02	4.9246+02	4.9150+02	4.9070+02	4.8991+02	4.8918+02	4.8846+02
700	5.1604+02	5.1497+02	5.1393+02	5.1291+02	5.1193+02	5.1100+02	[illegible]	5.0928+02	5.0853+02	5.0785+02	5.0714+02
720	5.3430+02	5.3331+02	5.3233+02	5.3137+02	5.3046+02	5.2957+02	5.2876+02	5.2799+02	5.2722+02	5.2653+02	5.2586+02
740	5.5260+02	5.5175+02	5.5083+02	5.4996+02	5.4907+02	5.4824+02	5.4749+02	5.4673+02	5.4596+02	5.4533+02	5.4471+02
760	5.7128+02	5.7032+02	5.6969+02	5.6861+02	5.6778+02	5.6700+02	5.6625+02	5.6551+02	5.6480+02	5.6412+02	5.6348+02
780	5.8966+02	5.8891+02	5.8819+02	5.8749+02	5.8662+02	5.8587+02	5.8518+02	5.8447+02	5.8382+02	5.8321+02	5.8261+02
800	6.0809+02	6.0783+02	6.0706+02	6.0630+02	6.0556+02	6.0489+02	6.0417+02	6.0350+02	6.0286+02	6.0230+02	6.0175+02
820	6.2753+02	6.2678+02	6.2604+02	6.2532+02	6.2462+02	6.2395+02	6.2329+02	6.2267+02	6.2207+02	6.2150+02	6.2097+02
840	6.4657+02	6.4584+02	6.4515+02	6.4447+02	6.4380+02	6.4316+02	6.4254+02	6.4194+02	6.4137+02	6.4083+02	6.4030+02
860	6.6575+02	6.6505+02	6.6438+02	6.6376+02	6.6310+02	6.6248+02	6.6188+02	6.6132+02	6.6077+02	6.6025+02	6.5975+02
880	6.8503+02	6.8434+02	6.8376+02	6.8312+02	6.8252+02	6.8193+02	6.8136+02	6.8082+02	6.8030+02	6.7979+02	6.7931+02
900	7.0444+02	7.0382+02	7.0322+02	7.0262+02	7.0203+02	7.0146+02	7.0094+02	7.0042+02	6.9992+02	6.9943+02	6.9897+02
920	7.2390+02	7.2330+02	7.2281+02	7.2224+02	7.2169+02	7.2115+02	7.2063+02	7.2013+02	7.1966+02	7.1920+02	7.1876+02
940	7.4365+02	7.4307+02	7.4251+02	7.4197+02	7.4144+02	7.4093+02	7.4043+02	7.3995+02	7.3950+02	7.3906+02	7.3864+02
960	7.6340+02	7.6286+02	7.6233+02	7.6181+02	7.6131+02	7.6082+02	7.6034+02	7.5988+02	7.5944+02	7.5901+02	7.5860+02
980	7.8329+02	7.8277+02	7.8226+02	7.8177+02	7.8128+02	7.8081+02	7.8036+02	7.7992+02	7.7949+02	7.7908+02	7.7868+02
1000	8.0320+02	8.0270+02	8.0230+02	8.0183+02	8.0137+02	8.0093+02	8.0049+02	8.0006+02	7.9964+02	7.9924+02	7.9885+02

[illegible]

[illegible]

GAS PROPERTIES OF DECALIN [illegible]

SPECIFIC HEAT AT CONSTANT PRESSURE, CAL/GM [illegible]
PRESSURE, ATM

[illegible]

GAS PROPERTIES OF DECALIN [illegible]

SPECIFIC HEAT AT CONSTANT PRESSURE, CAL/GM [illegible]
PRESSURE, ATM

[illegible]

[illegible]

[illegible]

RATIO OF SPECIFIC HEATS

PRESSURE, ATM

RATIO OF SPECIFIC HEATS

PRESSURE, ATM

GAS PROPERTIES OF DECALIN [illegible]

SONIC VELOCITY, CM/SEC
PRESSURE, ATM

TEMP., C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF DECALIN [illegible]

SONIC VELOCITY, CM/SEC
PRESSURE, ATM

TEMP., C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE (CONTINUED)
GAS PROPERTIES OF DECALIN

JOULE-THOMSON COEFFICIENT, K/ATM
PRESSURE, ATM

TEMP. C — 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

GAS PROPERTIES OF DECALIN

JOULE-THOMSON COEFFICIENT, K/ATM
PRESSURE, ATM

TEMP. C — 55, 60, 65, 70, 75, 80, 85, 90, 95, 100

TABLE [illegible] (CONTINUED)

GAS PROPERTIES OF [illegible] Vulcan [illegible] [illegible] Propellant Company

VISCOSITY, [illegible]

PRESSURE, ATM

TEMP											
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF [illegible]

VISCOSITY, [illegible]

PRESSURE, ATM

TEMP											
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] PROPERTIES OF [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

TABLE [illegible] (CONTINUED)

GAS PROPERTIES OF [illegible]

[illegible]

GAS PROPERTIES OF [illegible]

[illegible]

[illegible]

TEMP.	1	10	20	30	40	50	60	70	80	90	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TEMP.	1	10	20	30	40	50	60	70	80	90	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF JP-4

SPECIFIC HEAT AT CONSTANT PRESSURE, CAL/GM-K

PRESSURE, ATM

TEMP. C	0	10	20	30	40	50	60	70	80	90	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF JP-4

SPECIFIC HEAT AT CONSTANT VOLUME, CAL/GM-K

PRESSURE, ATM

TEMP. C	0	10	20	30	40	50	60	70	80	90	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

TABLE [illegible] (CONTINUED) [illegible]

GAS PROPERTIES OF [illegible]

[illegible]
PRESSURE, ATM

TEMP. [illegible]	1	10	20	30	40	50	60	70	80	90	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GAS PROPERTIES OF [illegible]

VISCOSITY, CP
PRESSURE, ATM

TEMP. [illegible]	1	10	20	30	40	50	60	70	80	90	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

TEMP	0	100	200	300	400	500	600	700	800	900	1000	1200
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

TEMP	0	100	200	300	400	500	600	700	800	900	1000	1200
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

SHELLDYNE-H (RJ-5)

Preliminary Analytical and Physical Property Data

Following are typical analytical data and calculated physical property information based on a variety of methods. Since only a limited number of samples of SHELLDYNE-H have been prepared, the consistency of the data from batch to batch has not been established. Also, pending larger scale preparations, we have not independently calculated the effect of temperature and pressure, outside the normal range, on various liquid and gaseous properties of interest. Instead we have applied corrections to the values calculated for SHELLDYNE itself, as given in the citation above, as deemed advisable.

The magnitudes of the correction factors involved are generally not large and we believe the data can be used without serious error. Improved information will be supplied as soon as it is available.

Table [illegible]

[illegible] Chemical and Physical Properties and Test Methods

	Typical Values	Test Method
Gravity, deg API	[illegible]	ASTM [illegible]
Specific [illegible]	[illegible]	
Refractive Index, [illegible]	[illegible]	[illegible]
Color	water white	
Distillation temperature, °F		ASTM [illegible]
Initial boiling point	[illegible]	
10% Evaporated	[illegible]	
20% Evaporated	[illegible]	
50% Evaporated	[illegible]	
90% Evaporated	[illegible]	
End Point	[illegible]	
Loss, %	[illegible]	
Residue, %	0.9	
Sulfur, %w	0.0001	ASTM [illegible]
Mercaptan sulfur, %w	<0.001	ASTM [illegible] or [illegible]
Existent Gum, mg per 100 ml	1	ASTM [illegible]
Freezing point, F	[illegible] a)	ASTM [illegible] or [illegible]
Boiling point, °F	[illegible] c)	ASTM [illegible]
Net heat of combustion		ASTM [illegible]
Btu/lb	[illegible]	
Btu/gal	[illegible]	
Aromatic content, %v	<0.1	ASTM [illegible]
Olefin content, %w	1	[illegible]
Copper strip corrosion	1A	ASTM [illegible]-65
Viscosity, cs, at 100°F	[illegible]	ASTM [illegible]-65
0°F	[illegible]	
-30°F	[illegible]	
Flash point, F	[illegible]	ASTM [illegible]
Vapor pressure, psia at 300°F	[illegible]	
psia at 500°F	[illegible]	
Thermal stability, 5 hr	[illegible] b)	CRC Modified
Pressure change, in. Hg	[illegible] b)	Standard Coker
Preheater deposit rating	2-1/2 b)	
Smoke point	[illegible]	[illegible]
Carbon/hydrogen ratio	[illegible]	Calculated
Critical temperature, F	[illegible]	API [illegible]
Critical pressure, psia	[illegible]	API [illegible]
Heat of formation, [illegible] Btu/lb	[illegible]	
Molecular weight	[illegible]	

a) Generally fluid becomes [illegible], [illegible] some samples have formed crystals at temperatures of about [illegible]°F and below.
b) [illegible] recycle coker.
c) ASTM [illegible]% point corrected as per API Figure [illegible].

Table 146. LIQUID PROPERTIES OF [illegible] AT SATURATION PRESSURE

Temp, °F	Density, lb/ft³	Viscosity,[a] lb/ft-hr	Thermal Conductivity, Btu/ft-hr-°F	Heat Capacity, Btu/lb-°F	Enthalpy, Btu/lb	Heat of Vaporization, Btu/lb	Vapor Pressure, psia
-60	70.8	22000.	0.098	0.217	-14.5	151.9	0.0000
0	69.5	532.	0.096	0.257	0.0	146.5	0.0000
100	66.6	35.7	0.093	0.302	29.0	142.3	[illegible]
200	63.8	8.78	0.090	0.367	64.5	135.7	[illegible]
300	60.9	3.12	0.085	0.452	106.4	128.4	[illegible]
400	57.8	1.41	0.079	0.507	154.6	120.4	2.97
500	54.5	0.752	0.072	0.559	207.7	111.5	11.50
600	50.9	0.492	0.064	0.606	266.0	101.3	32.9
700	46.7	0.341	0.057	0.651	328.8	88.9	76.2
800	41.7	0.258	0.048	0.702	396.3	72.9	155.0
900	34.2	0.155	0.040	0.818	470.9	46.8	278.8

a) To convert to cs multiply by $\frac{25.8}{\text{density}}$.

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Thermal [illegible]											
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Heat [illegible]											
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(Continued)

66157

Table [illegible] [illegible] [illegible]

Temp., °F	Pressure, psia										
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Heat capacity ratio, [illegible]										
[illegible]			[illegible]								
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible] coefficient, [illegible]										
[illegible]			[illegible]								
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Sound velocity, [illegible]										
[illegible]			[illegible]								
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Enthalpy, a) Btu/lb										
-400	[illegible]										
0	[illegible]										
[illegible]	[illegible]										
[illegible]	[illegible]										
[illegible]	[illegible]										
[illegible]	[illegible]										
[illegible]	[illegible]										
[illegible]	[illegible]										
[illegible]	[illegible]										
[illegible]	[illegible]	[illegible]									
[illegible]	[illegible]	[illegible]	[illegible]								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

a) The reference state is the liquid at [illegible] pressure and 0°F

[illegible]

[illegible]
[illegible]

[illegible]
[illegible], 1409, [illegible], 1450, [illegible], [illegible]

[illegible]
[illegible], 667, 671, 684, 734, 929, 1250, 1256, 1351

[illegible]
[illegible], 50, 51, 67, 72, 72, 73, [illegible], 76, [illegible], [illegible], [illegible], 110, [illegible], 123, [illegible], [illegible], 451, 452, 456, [illegible], 513, [illegible], 535, 537, [illegible], 543, 544, [illegible], 564, [illegible], 602, [illegible], 615, [illegible], 654, [illegible], 661, [illegible], 675, [illegible], 713, 716, 719, [illegible], 733, [illegible], 763, [illegible], 773, [illegible], 856, 857, [illegible], 900, [illegible], 916, [illegible], 972, 972, [illegible], 974, 975, [illegible], 993, [illegible], 1016, [illegible], 1075, [illegible], 1086, [illegible], 1106, 1118, 1129, [illegible], 1147, 1155, [illegible], 1167, [illegible], 1159, [illegible], 1200, 1211, 1211, 1226, 1227, [illegible], 1249, 1255, 1256, [illegible], 1279, [illegible], 1291, [illegible], 1351, 1361, 1375, [illegible], 1395, 1396, 1397, 1405, 1406, 1407

High Temperature Stability
[illegible], 55, [illegible], 125, [illegible], 405, [illegible], 505, 573, 574, [illegible], 745, [illegible], 906, 1001, [illegible], 1261, [illegible], 1265, [illegible], 1411, 1450, 1467, 1472, [illegible], 1475, 1476, [illegible], 1479

[illegible] (Cont'd)

[illegible]

[illegible], [illegible], [illegible], [illegible], 112, 113, 114, 115, 116, 117, 121, 129, 133, 139, 144, [illegible], 571, 579, [illegible], [illegible], 603, 631, 641, [illegible], [illegible], 644, [illegible], [illegible], [illegible], 732, 760, 761, 765, 777, [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], 1035, 1042, 1052, [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], 1136, 1217, 1229, 1257, [illegible], [illegible], 1359, 1370, [illegible], 1412, 1415, 1416, [illegible], 1469, 1471, 1475, 1479

Fuel Additives

[illegible], [illegible], [illegible], 90, 91, 92, 94, 95, 115, 116, 144, 160, 163, 179, 204, 244, [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], 306, 327, 475, 558, 554, 555, 556, [illegible], 664, [illegible], 676, 682, 723, [illegible], [illegible], 773, 797, 827, 839, 881, [illegible], 931, [illegible], [illegible], [illegible], [illegible], 1022, 1068, 1112, 1159, 1169, 1203, 1274, 1275, [illegible], [illegible], [illegible], 1410

Combustion Characteristics

[illegible], [illegible], [illegible], [illegible], [illegible], [illegible], 30, 33, 35, 43, 52, 53, 55, 56, 59, 61, 63, 69, 82, [illegible], [illegible], [illegible], [illegible], [illegible], 129, 132, 137, 138, 140, 141, 159, 168, [illegible], [illegible], [illegible], [illegible], 203, [illegible], 206, 209, 221, 224, [illegible], 226, 229, 231, 232, 233, 234, [illegible], 246, 250, [illegible], 261, 265, [illegible], 275, [illegible], 283, 287, 291, 292, [illegible], [illegible], [illegible], [illegible], [illegible], 311, [illegible], [illegible], [illegible], 322, 324, 341, 347, 353, 354, [illegible], [illegible], [illegible], [illegible], 366, [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], 406, 410, 415, 418, [illegible], [illegible], [illegible], 425, 431, [illegible], 433, [illegible], [illegible], [illegible], [illegible], 457, 462, 467, 479, [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], 500, 504, 515, 516, [illegible], [illegible], 525, 529, 531, [illegible], [illegible], [illegible], 563, 565, 573, 580, 581, [illegible], 583, 586, 595, 598, 599, 600, 604, 605, 607, 609, 614, 625, 626, 627, 633, 635, 636, 640, 649, 657, 660, 661, 663, 666, 668, 669, 670, 671, 677, 681, 683, 687, 693, 696, 703, 707, 709, 711, 712, 714, 720, 724, 727, 728, 729, 731, 736, 744, 750, 751, 754, 756, 757, 759, 760, 769, 771, 779, 781, 790, 793, 796, 798, 806, 809, 813, 823, 828, 829, 836, 843, 846, 848, 849, 850, 852, 859, 866, 867, 868, 869, 871, 884, 885, 892, 896, 901, 904, 909, 910, 913, 920, 921, 922, 923, 929, 946, 958, 977, 978, 979, 983, 984, 991, 992, 994, 995, 996, 997, 998, 1007, 1018, 1019, 1025, 1032, 1033, 1037, [illegible], 1043, 1044, 1050, 1057, 1058, 1059, 1060, 1061, 1062, 1067, 1072, 1073, 1074, 1084, 1085, 1090, 1095, 1096, 1097, 1098, 1102, 1103, 1104, 1108, 1109, 1111, 1116, 1118, 1119, 1120, 1121, 1122, 1126, 1128, 1131, 1140, 1141, 1144, 1145, 1148, 1149, 1154, 1157, 1160, 1161, 1182, 1183, 1185, 1190, 1192, 1197, 1199, 1201, 1205, 1206, 1210, 1219, 1222, 1234, 1236, 1237, 1239, 1244, 1245, 1246, 1247, 1253, 1254, 1263, 1264, 1271, 1272, 1277, 1280, 1284, 1288, 1289, 1309, 1310, 1311, 1312, 1313, 1314, 1315, 1317, 1322, 1323, 1326, 1331, 1343, 1350, 1366, 1367, 1368, 1372, 1374, 1376, 1378, 1381, 1384, 1387, 1389, 1390, 1394, 1398, 1399, 1400, 1401, 1404, 1452, 1452, 1453, 1454, 1455, 1456, 1457, 1458, 1502

Physical Chemical Properties

[illegible], 12, 13, 127, 130, 132, 135, 205, 206, 209, 256, 257, 286, 290, 291, [illegible], 298, 310, 312, 314, 329, 341, 352, 353, 368, 369, 377, 389, 396, [illegible], [illegible], 467, 625, 600, 720, [illegible], 917, 962, 1020, 1031, 1080, 1132, 1137, 1135, 1182, 1251, 1320, 1332, 1376, 1383, 1459, 1461, 1462, 1470, 1477

[illegible]

[illegible]

[illegible]

[illegible] [illegible], 1501

[illegible]

[illegible] 46, [illegible] 101, [illegible] 325, [illegible] 453, [illegible] 459, [illegible] 517, [illegible] 521, [illegible] 557, [illegible] 615, 616, [illegible] 656, [illegible] 714, 715, [illegible] 761, 770, [illegible] 781, [illegible] 795, 796, [illegible] 817, 819, 821, [illegible] 841, 853, [illegible] 861, [illegible] 904, [illegible] 915, [illegible] 956, [illegible] 1047, 1051, [illegible] 1079, [illegible] 1085, [illegible] 1169, 1170, 1171, 1172, 1174, 1176, 1177, [illegible] 1179, [illegible] 1216, [illegible] 1233, [illegible] 1276, [illegible] 1354, 1364, 1365, [illegible] 1391, 1411, [illegible] 1442, 1443, 1444, 1445, 1446, 1447, [illegible] 1457, [illegible]

[illegible] (a)

1. American Cyanamid Co., CATALYSTS FOR CRACKING OF HYDROCARBONS. Neth. Appl. [illegible], February 2, 1965, U.S. Appl. August [illegible], 1963, 9 pp. C.A. 63, 5825 (1965).

2. American Cyanamid Co., ALUMINO SILICATE CRACKING CATALYSTS. Neth. Appl. 6, 511, 290 (Cl. B 01j), March 29, 1966, U.S. Appl. September 23, 1964, 15 pp. C.A. 65, 8635 (1966).

3. Abell, J. B., Jr., Fannin, L. W., Roth, J. F. (to Monsanto Co.), DEHYDROGENATION CATALYSTS FOR SATURATED HYDROCARBONS. U.S. 3, 315, 008 [illegible], April 18, 1967, Appl. December 28, 1964, 4 pp.; C.A. 67, 21583

4. Abell, J. B. Jr., Fannin, L. W., Roth, J. F. (to Monsanto Co.), DEHYDROGENATION CATALYSTS FOR SATURATED HYDROCARBONS. U.S. 3, 315, 007 (Cl. 260-[illegible]), April 18, 1967, Appl. December 28, 1964, 4 pp.; C.A. 67, 13582.

5. Abramovich, G. N., THE THEORY OF TURBULENT JETS. Cambridge, Mass., The M.I.T. Press, 1963 (English Trans.).

6. Adams, D. M. (Lockheed Aircraft Corp.), PERFORMANCE ANALYSIS OF HYPERSONIC AIR-AUGMENTED SUPERSONIC COMBUSTION PROPULSION VEHICLES. AIAA Aerospace Sciences Meeting, 5th, New York, January 23-26, 1967, Paper [illegible], 12 pp.

7. Adams, H. W. (McDonnell Douglas Corp.), RELIABILITY AND OPERATIONAL ECONOMICS OF THE NEXT DECADE OF JET TRANSPORTS. Journal of Aircraft 5(6), 570-5 (1968).

8. Adams, J. M. (Aerojet-General Corp.), THE MEASUREMENT OF GAS AND PARTICLE TEMPERATURES IN ROCKET MOTOR CHAMBERS AND EXHAUST PLUMES. Pyrodynamics 6, 1-28 (1968).

9. Adler, J. (Imperial College, London), DOWNSTREAM BOUNDARY CONDITIONS OF NONADIABATIC ONE-DIMENSIONAL LAMINAR FLAMES. Combust. Flame 11(1), 85-6 (1967); C.A. 67, 15441.

10. Adler, J. and Zaturska, M. B. (University of London), THE DEPENDENCE OF FLAME IGNITION ON TRANSPORT PROPERTIES AND CHEMICAL KINETIC PARAMETERS. Combustion and Flame 10, 273-8 (September 1966).

11. Advisory Group for Aerospace Research and Development, GAS TURBINES. Conference Proceedings 27th Meeting of the Propulsion and Energetics Panel, Paris, France, April 4-7, 1966, Report No. AGARD-CP-Ser-9-Pt-1, 1966, 448 pp. (AD 815 605).

a/ This extends the survey of the literature presented in reference 19.

[illegible]

12. Affens, W. A. and [illegible], H. W., [illegible] POINT AND LOWER FLAMMABILITY LIMIT [illegible] U.S. Naval Research Laboratory Memorandum Report No. [illegible], November [illegible], [illegible] pp. [illegible]

13. Affens, W. A., FLAMMABILITY PROPERTIES [illegible] IN AIR [illegible] Am. Chem. Soc. [illegible] Mtg., Detroit [illegible], Am. Chem. [illegible] Petrol. Chem. [illegible] Preprints [illegible]

14. A[illegible]sta, V. ([illegible] Polytechnic), [illegible] FLOW. The Combustion Inst. [illegible] Technical Meeting [illegible], October [illegible], Paper.

15. Ahern, J. E., Nagy, A. R., Jr., Yamamura, [illegible] A., [illegible] U.S. Air Force AFAPL-[illegible], Contract No. [illegible]

16. Aihara, Y., OPTIMUM [illegible] GEOMETRIES [illegible] SONIC [illegible]. AIAA Journal [illegible]

17. Aihara, Y. and N[illegible], [illegible] TRANSFER WITH RADIATIVE HEATING. [illegible] National Congress [illegible] Mechanics, [illegible] University, [illegible], Proceedings, Tokyo, [illegible]

18. Air Products and Chemicals, Inc. [illegible] and [illegible], Jr.), [illegible] June 1, [illegible], [illegible] April [illegible] pp. [illegible]

19. Aldred, J. W. and Williams, A. [illegible] OF [illegible]-ALKANES. Combust. Flame [illegible]

20. Allen, [illegible], [illegible] Diss. ([illegible]) [illegible] pp.; Diss. Abstr. [illegible], October [illegible]

21. Allgood, M. A., MICROBES IN AIRCRAFT [illegible] INHIBIT MICROBIAL GROWTH. Mater Protect [illegible], No. [illegible]

22. Altis, H. P. and Helt, R. H. (McDonnell [illegible] Corp.), [illegible] CHALLENGE OF A HYPERSONIC CRUISE. AIAA, [illegible] Meeting and [illegible] Display, 5th, Philadelphia, Pa., October [illegible], Paper [illegible] pp.

23. Alvarez, J. [illegible] and [illegible] (Inst. [illegible]), KINETICS OF THE CATALYTIC DEHYDROGENATION [illegible] Am. [illegible] Soc. Paper [illegible]

BIBLIOGRAPHY (Cont'd)

24. Ambrose, M. J., De[illegible], S. M., and Hussey, C. E., SMOKELESS COMBUSTION IN OIL-BURNING GAS TURBINES. Am. Soc. Mech. Engrs. Inst. Elec. Electron Engrs. Power Generation Conference (9/24-28/67) Paper No. 67-PWR-5 (Abstr).

25. Amin, N. F. and Molder, S. (McGill Univ.), PERFORMANCE COMPARISON OF GUN-LAUNCHED SCRAMJETS FOR VARIOUS FUELS. J. Spacecraft Rockets 4 ([illegible]), 1[illegible]-91 (1967); C.A. [illegible], [illegible].

26. Amos, R., ESTIMATION OF 2,4-DIMETHYL, 6-TERTIARY BUTYL PHENOL IN AVIATION TURBINE FUEL BY THIN LAYER CHROMATOGRAPHY. J. Inst. Petrol. V54 No. 529, 9-15 (Jan 1968).

27. Anand, D. K. and Jenkins, R. W. (Johns Hopkins Univ.), EFFECTS OF CONDENSER PARAMETERS ON HEAT PIPE OPTIMIZATION. Journal of Spacecraft and Rockets 4, 695, 6[illegible] (May 1967); NASA-supported research; U.S. Navy Contract NOw-62-0604-C.

28. Andersen, R. H., ADVANCED HIGH TEMPERATURE COMBUSTOR RESEARCH FOR SMALL GAS TURBINE ENGINES. Curtiss-Wright Corp., October 196[illegible], 1[illegible] pp. (AD [illegible]).

29. Anderson, J. D., Jr., (U.S. Naval Ordnance Lab.), AN EQUATION FOR STAGNATION-POINT RADIATIVE HEAT TRANSFER. AIAA Journal 6 (11), 22[illegible]-9 (November 1968).

30. Anderson, R. C. (University of Texas), COMBUSTION AND FLAME. Journal of Chemical Education 44, No. 5, 248-60 (May 1967).

31. Anderson, R. D., Davis, W. C., McLoed, R. N., Rakowski, C. J., HIGH TEMPERATURE COOLED TURBINE BLADES. General Motors Corp., Allison Div. Design Report No. 2, Report No. EDR-5068, U.S. Air Force Contract AF33(615)-2[illegible]85, February 196[illegible], 54 pp. (AD 380 5[illegible]L) (REPORT CLASSIFIED CONFIDENTIAL).

32. Anderson, R. E. and Graham, P. A., A STUDY OF THE EFFECTS OF AN ORIFICE INLET ON THE PERFORMANCE OF A STRAIGHT CYLINDRICAL DIFFUSER. U.S. Naval Air Propulsion Test Center, Aeronautical Turbine Dept. Report No. NAPTC-ATD-1[illegible], December 1967, 20 pp. (AD 665 670).

33. Ando, N., COMBUSTION AND ITS EXTINGUISHMENT, ESPECIALLY IN CHAIN REACTIONS. Kairyo 16 (1[illegible]), 600-4 (19[illegible]) (Japan); C.A. [illegible], [illegible].

34. Anon., A HEAT PIPE OVEN HAS BEEN DESIGNED TO CONTINUOUSLY GENERATE A HOMOGENEOUS METAL VAPOR HAVING A WELL-DEFINED TEMPERATURE, PRESSURE, AND OPTICAL PATH LENGTH. Chemical and Engineering News, June 1[illegible], 19[illegible], p. [illegible].

35. Anon., A NEW PROCESS FOR IMPROVING COMBUSTION PROPERTIES OF KEROSENE AND JET FUELS. Chemical and Engineering News, April [illegible], 19[illegible], p. [illegible].

BIBLIOGRAPHY (Cont'd)

36. Anon., [illegible] & ENGINEERING [illegible] JET FUEL [illegible] Chem. Eng. News [illegible] No. [illegible]

37. Anon., [illegible] FUELANT. Aviation Week and Space Technology, Nov. [illegible], 19[illegible], p. [illegible].

38. Anon., AN ALUMINA-BASED [illegible] CATALYST. Petrol. Times [illegible] No. [illegible]

39. Anon., CATALYST ACTIVITY CONTINUES. [illegible] No. [illegible].

40. Anon., INLETS FOR SUPERSONIC AIRCRAFT. Space Aeronautics [illegible], [illegible] (May 19[illegible]).

41. Anon., JET FUELS - TAKING OFF WITH NEW PLANES. Chem. Eng. [illegible], p. [illegible], 40 (Jan. 2[illegible], 19[illegible]).

42. Anon., MAKING AIRCRAFT FUELS SAFE FOR [illegible] FLIGHT. Instr. Pract. [illegible] (19[illegible]) (ABSTR.) J. Inst. Petrol. [illegible] (Aug. 19[illegible]).

43. Anstus, [illegible], Nixon, A. C., [illegible] BACK [illegible] OF THE OXIDATION OF [illegible] Am. Chem. Soc., Div. Petrol. Chem. Preprints [illegible]

44. Antar [illegible] les de l'Atlantique [illegible] Fr. 111, [illegible], June [illegible], 19[illegible].

45. Armstrong, [illegible], THE [illegible] International Journal of Heat and Mass Transfer [illegible] (October 19[illegible]).

46. Armstrong, R. C. and Miller, [illegible] NAMIC PROBLEMS [illegible] INSTALLATION IN [illegible] J. Aircraft [illegible], [illegible] (May - June 19[illegible]).

47. A[illegible], [illegible] Inv. Vyssh. [illegible] Air Force Translation [illegible] (AD [illegible])

48. Argand, [illegible] and [illegible] AIAA Journal [illegible] (April 19[illegible]).

49. Ashland [illegible] April [illegible], 19[illegible] [illegible]

BIBLIOGRAPHY

50. Ashley, [illegible] and [illegible], I. A., Jr. [illegible] ELECTRO-[illegible]LATION CATALYST AND PROCESS. [illegible], January 17, 19[illegible], April [illegible] 21, 19[illegible]; [illegible] Brit. [illegible], February 12, 19[illegible]; C. A. [illegible] (19[illegible]).

51. Ashwill, [illegible], [illegible], I. A. (Houdry Process and Chem [illegible]), [illegible] NEW [illegible] CATALYST [illegible] [illegible] [illegible]. [illegible], C.A. [illegible].

52. Aslanov, [illegible] K., INSTABILITY CRITERION OF TURBULENT COMBUSTION. Fizika Gorinija i Vzryva [illegible], No. 4, [illegible] (in Russian).

53. Aslanov, [illegible] K., INSTABILITY CRITERION FOR SLOW COMBUSTION OF MIXTURES. Fizika Gorinija i Vzryva [illegible], [illegible] July - September 19[illegible]; Combustion, Explosion, and Shock Waves [illegible], [illegible] (July - September 19[illegible]).

54. Atallah, A. [illegible], EVALUATION OF EXPERIMENTAL SAFETY [illegible] IN A [illegible] [illegible] NAL [illegible] [illegible] SYSTEM, U. S. Naval Air Propulsion Test Center, Aeronautical Engine Dept., April 19[illegible], [illegible] p. (AD [illegible]).

55. [illegible]ovskii, [illegible] and Medvedev, [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] BOUNDARY [illegible] WITH [illegible] Izv. Akad. Nauk [illegible], Mekh. [illegible] 19[illegible] ([illegible]), [illegible] (Russ); C. A. [illegible], [illegible].

56. Averson, A. [illegible] and [illegible], [illegible], APPROXIMATE METHOD OF CALCULATING THE CRITICAL CONDITIONS OF IGNITION. Fizika Gorinija i Vzryva 19[illegible] (4), [illegible]-25 (December).

57. Avery, W. H. (Johns Hopkins University), BEYOND THE [illegible] TRANS-PORT. Science and [illegible], 19[illegible], [illegible] (February).

[illegible]

58. [illegible], A. F., FORMATION OF VAP[illegible] IN [illegible] In Heat Transfer and Hydrodynamics in Two-Phase Media, ed. by [illegible], Kiev, Izdatel'stvo Naukova Dumka, 19[illegible], p. [illegible] (In Russian).

59. [illegible] and [illegible], [illegible] Fizika [illegible] Vypuva [illegible] (In Russian).

60. Bat[illegible] and [illegible], A. A., APPROXIMATE METHOD FOR ESTIMATING THE MAXIMUM [illegible] A POLY-[illegible] MATERIAL IN A VERTICAL TWO-PHASE FLOW. In Heat Transfer and Hydrodynamics in Two-Phase Media, ed. by [illegible], Kiev, Izdatel'stvo Naukova Dumka, 19[illegible], p. [illegible] (In Russian).

61. Baren[illegible], [illegible] and Melamed, V. [illegible] ON NON[illegible] OF THE STATIONARY SOLUTION OF THE SYSTEM OF EQUATIONS IN THE [illegible]. Prikladnaia Matematika i Mekhanika [illegible], March - April 19[illegible]; PMM - Journal of Applied Mathematics and Mechanics [illegible] (19[illegible]); C. A. [illegible].

62 Back, L. H., Cuffel, R. F., Massier, P. F. (Jet Propulsion Lab., California Inst. of Technology), LAMINARIZATION OF A TURBULENT BOUNDARY LAYER IN NOZZLE FLOW. AIAA Journal 7 [illegible]), 730-3 (April 19[illegible]).

63. Back, L. H., Massier, P. F., Cuffel, R. F. (California Institute of Technology), SOME OBSERVATIONS ON REDUCTION OF TURBULENT BOUNDARY-LAYER HEAT TRANSFER IN NOZZLES. AIAA Journal [illegible], 222[illegible] (December 19[illegible]).

64. Back, L. H., Massier, P. F., Gier, H.L. (California Inst. of Technol.), CONVECTIVE HEAT TRANSFER IN A CONVERGENT-DIVERGENT NOZZLE. NASA Accession No. [illegible], National Aeronautics and Space Administration Report No. NASA-CR-67225, 19[illegible], [illegible] pp.; C.A. [illegible].

65. Bader, F. and Hunt, E. A., RAMJET TECHNOLOGY, [illegible] ON FLOW [illegible] AND ENGINE PERFORMANCE. CHAPTER 5. COMBUSTOR FLOW AND ENGINE PERFORMANCE. Johns Hopkins Univ., Applied Physics Lab. Technical Memo TG-610-5-Rev., November 19[illegible], [illegible]pp. (PB 177 263).

66. Badische Anilin - und Soda - Fabrik A.-G. (by H. Mueller), as - HYDRINDACENE AND ACENAPHTHENE. Ger. 1, 250, [illegible] (Cl. C [illegible]), December [illegible], 19[illegible], Appl. January 5, 19[illegible]1, 2pp.; C. A. [illegible], 21793.

67. Badische Anilin - und Soda - Fabrik A. G., NICKEL CATALYST FOR HYDROCARBON CRACKING. Neth. Appl. 6, 510, 823 (Cl. C [illegible]), Feb. 21, 19[illegible], Ger. Appl. August 19, 19[illegible]; [illegible]pp.; C. A. [illegible], [illegible].

BIBLIOGRAPHY (Cont'd)

68. Beer, A. L. and Lucas, E. J., WIND TUNNEL TESTS OF DUAL MODE SCRAMJET INLET CONFIGURATIONS AT MACH NUMBERS FROM 2.5 to 6. Arnold Engineering Development Center, Arnold Air Force Station Technical Report no. AEDC-TR-67-60, prepared in cooperation with ARO, Inc., U. S. Air Force Contract AF [illegible] - 1200, April [illegible], 27pp. (AD 380 703L) (REPORT CLASSIFIED CONFIDENTIAL).

69. Bahn, G. S. (Marquardt Corp.), EVOLUTION OF A FIRST-ROUND REACTION KINETICS PACKAGE FOR PYROLYSIS/OXIDATION OF A LARGE ALIPHATIC HYDROCARBON MOLECULE. Western States Section/ The Combustion Inst. 1968 Fall Meeting, October 28-29, 1968, Paper 68-37.

70. Baiburskii, L. A. et al., FUELS FOR STATIONARY AND TRANSPORT GAS TURBINE ENGINES. 7th World Petrol. Congr. (Mexico City 4/2-8/67) Paper N.PD-29(6).

71. Bajars, L. (to Petro-Tex Chemical Corp.), DEHYDROGENATION OF ALIPHATIC HYDROCARBONS. U. S. 3, 277, 207 (Cl. 260-680), October 4, 1966, Appl. June 11, 1965; 4pp.; C. A. 66, 10558 (1967).

72. Bajars, L. (to Petro-Tex Chemical Corp.), DEHYDROGENATING HYDROCARBONS. U. S. 3, 291, 854, (Cl. 260-680), December 13, 1966, Appl. June 11,1965; 5pp. Continuation-in-part of U. S. 3, 207, 811; C. A. 66, 39622 (1967).

73. Bajars, L. (Petro-Tex Chemical Corp.), DEHYDROGENATION OF HYDROCARBONS. U. S. 3, 306, 950 (Cl. 260-680), February 28, 1967, Appl. June 11, 1965 5pp. Continuation-in-part of U. S. 3, 207, 811; C. A. 66, 115262 (1967).

74. Baker, P. J. and Martin, B. W. (University of London (England), HEAT TRANSFER IN SUPERSONIC SEPARATED FLOW OVER A TWO-DIMENSIONAL BACKWARD-FACING STEP. International Journal of Heat and Mass Transfer 9, 1081-8 (October 1966).

75. Balandin, A. A., Kazanskii, B. A., Vasserberg, V. E. Isagulyants, G. V., Levi, G. I., SCIENTIFIC SELECTION OF CATALYSTS. Trans. by A. Aladjem, S. Monson, Jerusalem, 1968.

76. Balandin, A. A., OSMIUM AS A DEHYDROGENATION CATALYST FOR DECAHYDRONAPHTHALENE. Z. physik Chem B9, 49-72 (1930); C. A. 24, 4984.

77. Balandin, A. A., Spitsyn, V. I. et al., STUDY OF THE ADSORPTION AND ENERGY PROPERTIES OF METALLIC CATALYSTS. 1. THE SPECIFIC SURFACES OF CATALYSTS. Zh. Fiz. Khim. 41, No. 10, 2683-8 (October 1967).

78. Balandin, A. A., Tolstopyatova A. A., Yakushina, M. Ya., SOME CATALYTIC PROPERTIES OF BINARY CHROMIUM-CERIUM AND CHROMIUM-ZIRCONIUM OXIDE CATALYSTS. Dokl. Akad. Nauk SSSR 174(4), 835-8 (1967) (Russ); C. A. 67, 90242.

[illegible]

79. Walker, J. R. and Petersen, E. E. (Univ. Calif., Berkeley), [illegible] IN A [illegible] REACTOR. [illegible] (October 196[illegible]).

80. Barrimer, [illegible] and [illegible], [illegible] [illegible] FACIAL PHENOMENA. AIAA, Meeting, [illegible], New York, January [illegible], 196[illegible], Paper [illegible], [illegible]pp.

81. Barker, R. F. and [illegible], M. [illegible], [illegible] [illegible] [illegible] Aviation Final Report, 1 May 196[illegible] - 1 May 196[illegible], Report No. [illegible] [illegible], U. S. Navy Contract NOOO1[illegible], May 196[illegible], [illegible] pp. [illegible].

82. Barthel, H. O. and Strehlow, R. A. (Univ. of Illinois, Urbana), WAVE PROPAGATION IN ONE-DIMENSIONAL REACTIVE FLOWS. Phys. Fluids [illegible], [illegible]-[illegible] (196[illegible]); C. A. [illegible], [illegible] (196[illegible]).

83. Baryzkin, V. V., Antarovskaia, V. I., Merzhanov, A. G., CONTRIBUTION TO THE THERMAL EXPLOSION THEORY OF SELF-ACCELERATING REACTIONS. Fizika Goreniia i Vzryva 196[illegible], No. 4, 18-23 (In Russian).

84. Basmatov, V. A., GENERALIZED HYDRODYNAMIC EQUATION FOR DETERMINING THE [illegible] OF AN [illegible] RAM-JET ENGINE. Akademiia Nauk SSSR, [illegible] Otdelenie, Izvestiia, Seriia Tekhnicheskikh Nauk, 196[illegible], No. 2, 5-11 (In Russian).

85. Baskakova, V. [illegible], RELATION BETWEEN THERMODYNAMIC STABILITY AND THE [illegible] CHARACTERISTICS OF A LIQUID. Zh. Fiz. Khim. 4[illegible]([illegible]), 2922-4 (196[illegible]) (Russ.); C. A. [illegible], 32450 (196[illegible]).

86. Bauer, [illegible] E. and Pisotell, M. A. (Boeing Co.), NEW MATERIALS IN THE AEROSPACE INDUSTRY. Industrial Research 196[illegible], 40-6 (November).

87. Bauer, S. H. (Cornell University), TRANSIENT SPECIES GENERATED DURING THE PYROLYSIS OF HYDROCARBONS. In Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., August 14-20, 1966, Proceedings, Pittsburgh, Pa., Combustion Institute, 1967, p. 105-14, 114,115.

88. Beek, J. and Hassell, H. L. (Shell Development Co.), CALCULATION OF DIFFERENTIAL RATES FROM EXPERIMENTS WITH PACKED TUBULAR REACTORS. Eur. Chem. Reaction Eng. Symp., 4th, "Chem. Kinet. and Reactor Des." Session, Brussels, September 9-11, 1968, Paper No. 4.1, 7pp.

89. Beer, J. M. and Chigier, N. A., IMPINGING JET FLAMES. Combustion and Flame 12, 575-86 (December 1968).

BIBLIOGRAPHY (Contd)

90. Beerbower, A., Nixon, J., Wallace, T. J. (Esso Research and Engineering Co.), NON-NEWTONIAN FUELS FOR AIRCRAFT SAFETY. AIAA, Propulsion Joint Specialist Conference, 3rd, Washington, D. C. July 17-21, 1967, Paper 67-505; Journal of Aircraft 5, 367-72 (July - August 1968).

91. Beerbower, A., Nixon, J., Phillippoff, W., Wallace, T. J. (Esso Research and Engineering Co.), THICKENED FUELS FOR AIRCRAFT SAFETY. Society of Automotive Engineers, National Aeronautic Meeting, New York, N. Y., April 24-27, 1967, Paper 670364, 10pp.

92. Beerbower, A. and Phillippoff, W. (Esso Research and Engineering Co.), HISTORY OF GELLED FUELS - THEIR CHEMISTRY AND RHEOLOGY. Aircraft Fluids Fire Hazard Symposium, Fort Monroe, Va., June 7,8, 1966, Paper, Esso Air World 19, 93-7 (January - February 1967).

93. Beeton, A. B. P. (Great Britain Ministry of Aviation), MATERIALS REQUIREMENTS FOR AIRCRAFT TURBOJET AND RAMJET ENGINES. In Advances in Materials; Proceedings of a Symposium, Manchester College of Science and Technology, Manchester, England, April 6-9, 1964, Oxford, Pergamon Press, Ltd., 1966, pp. 57-60.

94. Bell Helicopter Co., A NEW EMULSIFIED, FIRE-RESISTANT AVIATION FUEL. Chem Week V99 N.25.58 (12 17 66).

95 Bellamy, L., Barton, J. H., O'Loughlin, J. R. (Tulane Univ), THE INFLUENCE OF CHEMICAL INHIBITOR ADDITION ON REVERSE-JET FLAME STABILIZATION. ASME Publication 68-GT-39, p. 1-4 (1968); prepared for presentation at the Gas Turbine Conference and Products Show, Washington, D. C., March 17-21, 1968 U. S. Army ARO - 4981:2, U. S. Army Contract DA 31-124-ARO(D)-240, 1968, 8pp. (AD 666 878).

96. Benesi, H. A. and Studer, H. P. (Shell Development Co.), PREPARATION OF HIGHLY DISPERSED CATALYTIC METALS. PLATINUM SUPPORTED ON SILICA GEL. Journal of Catalysis 10(4), 328-35 (April 1968).

97. Benson, J. L., Miller, L. D., Santman, D. M. (Lockheed-California Co.), Meckley, E. A. (NASA, Langley Research Center), Pearson, L. W. (AiResearch Manufacturing Co.), HYPERSONIC RESEARCH ENGINE INLET DEVELOPMENT PROGRAM. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colorado, June 9-13, 1969 Paper (Classified).

98 Benth, S., Babitz, M., Stern, A. B., EFFECT OF ORGANIC PEROXIDES ON THE CORROSIVENESS OF AVIATION FUELS AND PURE HYDROCARBONS, J. Chem. Eng. Data V9 N.1.115-18 (January 1964).

99. Berezin, B. D. and Lomchilova A. V., CATALYTIC PROPERTIES OF PLATINUM GROUP METAL PHTHALOCYANINES, Kinetika i Katalis 8, No. 3, 592-8 (1967).

100. Bergendorf, H. W. and Likus, A. G. (to Universal Oil Products Co.), LOW PRESSURE REFORMING. U. S. 3, 364, 137, January 16, 1968.

101. Bergman, [illegible] A., [illegible] Conf. (Los Angeles, [illegible]) [illegible] 72-81 (March 1967).

102. Berlin, A. A., [illegible] A. [illegible] ACTIVITY OF [illegible] Ser. Khim. [illegible] (Russ); C. A. [illegible]

103. Berrier, B. L., EFFECT OF [illegible] GEOMETRY VARIATIONS ON [illegible] NOZZLE PERFORMANCE AT TRANSONIC SPEEDS. National Aeronautics and Space Administration, Langley Research Center, March [illegible]

104. [illegible] A. [illegible] and Ivanov, [illegible] FINITE [illegible] CYLINDER. Inzhenerno-Fizicheskii Zhurnal [illegible] (March 1967) (In Russia).

105. Beshkhanova, Tsv. and Dimitrov, Khr., THERMODYNAMIC CALCULATIONS OF THE REACTIONS WHICH DIALKYLBENZENES UNDERGO ON AN ALUMINOSILICATE CATALYST IN THE GAS PHASE. God. Sofii. Univ., Khim. Fak. [illegible] 1965), 345-59 (Pub. 1966) (Bulg); C. A. [illegible] 6550d.

106. Bicknell, J. L. (Bendix Corp.), [illegible] - A GROWTH CONTAMINANT IN HYDROCARBON SYSTEMS. in Society of Automotive Engineers, Aerospace Systems Conference, Los Angeles, Calif., June 27-30, 1967, Proceedings, New York, Society of Automotive Engineers, Inc., 1967, p. [illegible]

107. Billig, F. S. (John Hopkins), [illegible] ON [illegible] PRESSURE - AREA FIELDS. In Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif. August 14-20, 1966, Proceedings. Pittsburgh, Pa., Combustion Institute, 1967, p. [illegible] NASA Contract No. NC-R-76-21-09-001; U. S. Navy Contract No. N[illegible]-0604-c.

108. Billig, F. S., EXTERNAL BURNING IN SUPERSONIC STREAMS. International Astronautical Federation, International Astronautical Congress, 18th, Belgrade, Yugoslavia, September 24-30, 1967, Proc. Vol 3., Pergamon Press, Ltd., 1968, p. 23-54.

109. Billig, F. S. and Dugger, G. L. (Johns Hopkins Univ.), EXTERNAL BURNING IN SUPERSONIC STREAMS. APL Technical Digest 8, 2-10 (November - December 1968).

110. Billig, F. S. and Grenleski, S. E. (Johns Hopkins Univ), DIRECT-CONNECT AND FREE JET TEST OF SCRAM ENGINE. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper (Classified).

111. Billig, F. S., Orth, R. C., Lasky, M. (Johns Hopkins Univ.), EFFECTS OF THERMAL COMPRESSION ON THE PERFORMANCE ESTIMATES OF HYPERSONIC RAMJETS. Journal of Spacecraft and Rockets 5, 1076-81 (September 1968).

BIBLIOGRAPHY (Cont'd)

112. Ritten, J. F., STUDY OF AVIATION - FUEL FILTER/SEPARATORS. IIT Research Inst. Annual Summary Report 20 April 1966 - 19 April 1967, Report No. IITRI-[illegible], U. S. Navy Contract NOw-66-[illegible], May 1967, 122pp. (AD 815 042).

113. Ritten, J. F., STUDY OF AVIATION - FUEL FILTER/SEPARATORS. IIT Research Inst. Quarterly Progress Report, 20 October 1966 - 19 January 1967, Report No. IITRI-C6088-3, U. S. Navy Contract NOw-66-0468, Feb. 1967, 30pp. (AD 808 047).

114. Ritten, J. F., STUDY OF AVIATION - FUEL FILTER/SEPARATORS. IIT Research Institute Quarterly Progress Report 20 July - 19 October 1966, Report No. IITRI-C6088-2, U. S. Navy Contract NOw-66-0468, November 1966, 24pp. (AD 805087).

115. Blade, O. C., AVIATION TURBINE FUELS, 1966. U. S. Bur Mines Mineral Ind. Surve (Petrol Prod. Surv. N.49) (March 1967) 13p.

116. Blade, O. C., AVIATION TURBINE FUELS, 1965. U. S. Bur Mines Mineral Ind. Surve. , (Petrol. Prod. Surv. N.44) (April 1966) 13 p.

117. Blanchard, G. C. and Goucher, C. R. (Melpar, Inc.), ALUMINUM CORROSION PROCESSES IN MICROBIAL CULTURES. Electrochem. Technol. 5(3-4), 79-85 (1967); C. A. 66, 101010 (1967).

118. Blanco, J. A. and Gill, W. N., ANALYSIS OF MULTISTREAM TURBULENT FORCED CONVECTION SYSTEMS. Chemical Engineering Progress Symposium Series 63 (77), 60-79 (1967).

119. Bloch, H. S., (Universal Oil Products Co.), CATALYTIC DEHYDROGENATION OF PARAFFINIC HYDROCARBONS ENHANCED BY BENZENE. U. S. 3,391,218, July 2, 1968.

120. Bocarely, S. I. (Lockheed Corp., Lockheed California Co.), REFRACTORY METALS. Chem Eng. Progress 60(2), 58-60 (1964).

121. Boggs, W. A., A FIVE-POINT PROGRAM DESIGNED TO ELIMINATE CONTAMINATION AND CORROSION OF FUEL TANKS ON AIRCRAFT USING JET TURBINE FUEL. Soc. Automotive Engrs. Mtg. Paper N.650364 (1965); SAE (Soc. Automotive Engrs.) Trans. V74 (Pt. 2) .223-31 (1966).

122. Bogolepov, V. V. and Neiland, V. Ia., CONVECTIVE AND RADIATION HEAT TRANSFER IN A RADIATING GAS. International Astronautical Federation, International Astronautical Congress, 17th, Madrid, Spain, October 9-15, 1966. Paper, 24pp. (In Russian).

123. Bol'shakov, G. F., EFFECT OF SULFUR-ORGANIC COMPOUNDS ON THE COMPOSITION OF THE SOLID PHASE WHICH FORMS DURING THE OXIDATION OF JET FUEL. Khim. i Tekh. Topliv i Masel 13(10), 41-7, (1968).

[illegible]

144. [illegible]akov, [illegible], [illegible] [illegible], Neft [illegible] [illegible], C. A. [illegible] [illegible]

145. [illegible]akov, G. F., AN [illegible] [illegible] Khim. i. Tekhnol. [illegible] [illegible]

146. [illegible]akov, [illegible], [illegible] [illegible] [illegible]

147. [illegible]akov, G. F., Galin, F. I., [illegible], N. N., [illegible] AND [illegible] [illegible] IN THE [illegible] [illegible] TT-[illegible], CFSTI, Springfield, Va., 1966 [illegible] pp. Translated from Russian; C. A. [illegible] [illegible]

148. [illegible]akov, G. F., [illegible], A. I., [illegible], N. I., [illegible], G. F., DETERMINATION OF MERCAPTANS IN [illegible] Neftepererab. i Neftekhim. [illegible] [illegible] (Russ), C. A. [illegible] [illegible]

149. [illegible], L. F. and [illegible], R., FORMATION OF DETONATION WAVES IN FLOWING [illegible] Ohio State Univ., 196[illegible], [illegible] pp. AD [illegible], C. A. [illegible] [illegible]

150. [illegible], [illegible], A [illegible] PROGRAM OF FUNDAMENTAL RESEARCH [illegible] TO JET PROPULSION [illegible] OF NAVAL [illegible], DEPARTMENT OF THE NAVY. University of Virginia Semi-annual Progress Report, April 1-[illegible] September 196[illegible], [illegible] Navy Contract [illegible], October 196[illegible], [illegible] pp. [illegible]

151. [illegible], [illegible] (Johnson Matthey and Co. Ltd.), [illegible] AND CATALYTIC PROPERTIES OF [illegible] [illegible] Congress Catalysis (4th), Moscow June 23-29, 196[illegible], Preprint No. [illegible], [illegible] pp.

152. [illegible], A. A., [illegible], G. M., [illegible], [illegible], IGNITION OF FUEL FILM [illegible] WAVES IN AIR AND OXYGEN. Combustion and Flame 12, [illegible] (October 196[illegible]).

153. [illegible], I. [illegible], [illegible] OF HEAT TRANSFER IN A CONVERGING-DIVERGING NOZZLE. Journal of Spacecraft and Rockets 4, [illegible], [illegible] (March 196[illegible]).

154. Boudart, M., [illegible], J. [illegible] et al., ON THE [illegible] OF PLATINUM CATALYSTS. J. Catal. [illegible] (1), [illegible] (May 196[illegible]).

155. [illegible], J. and [illegible], F., SOME [illegible] PROBLEMS RELATED TO THE PROPULSION OF A HYPERSONIC AIRCRAFT. Association Francaise des Ingenieurs et Techniciens de l'Aeronautique et de l'Espace, Colloque d'Aerodynamique Appliquee, 3rd, Marseille and Istres, France, Nov. 8-10, 1966, Communication; ONERA, TP No. 4[illegible], 196[illegible], p. 1-[illegible] (in French).

BIBLIOGRAPHY (Cont'd)

136. [illegible], [illegible] M. and Hart, F. D. (Socony Mobil Oil Co., Inc.), RARE EARTH METAL ALUMINOSILICATE CRACKING CATALYSTS CONTAINING BERYLLIUM. U. S. [illegible] (Cl. [illegible]), July 6, 1965, Appl. Oct. 17, 1960; 8pp.; C. A. [illegible] (1965).

137. Bowden, F. P., Field, J. E., Fox, P. [illegible], Chaudhri, M. M., GROWTH OF BURNING TO DETONATION IN LIQUIDS AND SOLIDS. Carrier Corp Annual Summary Rept. November 1966-1967, U. S. Air Force AFO [illegible], Grant AF [illegible], December 1967, 20pp. (AD [illegible]).

138. Bowden, F. P. and McOnie, M. P. (Cambridge Univ., England), FORMATION OF CAVITIES AND MICROJETS IN LIQUIDS AND THEIR ROLE IN INITIATION AND GROWTH OF EXPLOSION. Royal Society (London), Proceedings, Series A 298 [illegible] (March 28, 1967).

139. Bowlus, D. A. (Pennsylvania State Univ.) and Hayday, A. A., INTEGRATION OF COUPLED NONLINEAR EQUATIONS IN BOUNDARY-LAYER THEORY WITH SPECIFIC REFERENCE TO HEAT TRANSFER NEAR THE STAGNATION POINT IN THREE-DIMENSIONAL FLOW. International Journal of Heat and Mass Transfer 10, 415-26 (April 1967).

140. Bowman, C. T. and Seery, D. J., CHEMILUMINESCENCE IN THE HIGH-TEMPERATURE OXIDATION OF METHANE. Combustion and Flame 12, 611-4 (Dec. 1968).

141. Bowman, C. T. and Seery, D. J. (United Aircraft Research Labs.), IGNITION MECHANISMS OF HYDROCARBON FUELS - METHANE AND ACETYLENE. Western States Section / The Combustion Inst. 1968 Fall Meeting, October 28-29, 1968, Paper 68-41.

142. Bowman, R. S. (to Baugh Chemical Co.), CATALYTIC HYDROGENATION WITH COBALTOUS FERRITE. U. S. 3,291,750 (Cl. 252-474), December 13, 1966, Appl. January 9, 1964; 3pp., C. A. 66, 55206 (1967).

143. Bradbrooke, J. (ed.), AEROSPACE PROCEEDINGS 1966: Royal Aeronautical Society, Centenary Congress and International Council of the Aeronautical Sciences, Congress 5th London, England, September 12-16, 1966. Vol. 1 and Vol. 2, London, Macmillan, 1967, 606 pp., 565pp. Partial Contents: Jamieson, R. R., POWER UNITS FOR VERY HIGH SPEED WINGED VEHICLES. p. 487-513, Dupin, J., AIR-BREATHING PROPULSION SYSTEM FOR THE FIRST STAGE OF THE SPACE TRANSPORT. p. 515-53. Heldenfels, R. R., STRUCTURAL PROSPECTS FOR HYPERSONIC AIR VEHICLES. p. 553-85 Silverstein, A., PROGRESS IN AIRCRAFT GAS TURBINE ENGINE DEVELOPMENT. p. 587-605, Linan, A., Urrutia, J. L., Fraga, E., ON DIFFUSIVE SUPERSONIC COMBUSTION. p. 607-18.

144. Bradshaw, R., Kesslin, G., ORTHO ESTERS AS WATER SCAVENGERS. Ind. Eng. Chem. Prod. Res. Develop. V5 N.1.27-29 (March 1966).

145. Bragg, K. R., Kimmel, C. C., Jones, P. H., NITROGEN INERTING OF AIRCRAFT FUEL TANKS PROTECTS AGAINST FIRES. SAE Journal 77( ), 49-51 (June 1969).

146. [illegible], [illegible] and [illegible] Stachalek, H. [illegible] ... 15 1,), August [illegible], [illegible].

147. [illegible], H. and Herrin, [illegible], VARIABLE [illegible] ACTIVITY [illegible] CATALYST [illegible] CRYSTALLIZATION [illegible]. Z. [illegible] (Ger); C. A. [illegible], 32279 ([illegible]).

148. [illegible], L. L., EXPERIMENTAL INVESTIGATION OF A [illegible] NOZZLE WITH TRANSLATING PRIMARY AND [illegible] AT MACH NUMBERS FROM 0 TO 2.0. National Aeronautics and Space Administration, Lewis Research Center, April [illegible], 34pp. ([illegible]).

149. Bressan, A., ON RELATIVISTIC THERMODYNAMICS. Nuovo Cimento [illegible], [illegible] (April 11, 1967).

150. Breugelmans, F., INVESTIGATION OF A ONE STAGE AXIAL FLOW [illegible] COMPRESSOR, PART 1. GLOBAL PERFORMANCE OF THE [illegible] TRAILING EDGE BLADE ROTOR R 32. Von Karman Inst. for Fluid Dynamics ([illegible]) Report No. VKI-TR-12-Pt-1, U. S. Air Force Grant AF-EOAR-[illegible], March 1965, 48pp. (AD [illegible] 591).

151. Breugelmans, F., ON THE USE OF A [illegible] SYSTEM IN [illegible] COMPRESSORS. Yearbook 1965; Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, European Aeronautical Congress, [illegible], [illegible], West Germany, September [illegible], 1965, Reports, ed. by H. [illegible], [illegible], West Germany, Friedrich Vieweg und Sohn GmbH, 1966, p. [illegible].

152. Breugelmans, F., PRELIMINARY INVESTIGATION OF A [illegible] TRAILING EDGE BLADE CASCADE IN THE S-3 SUPERSONIC CASCADE TUNNEL. Von Karman Inst. for Fluid Dynamics (Belgium) Report No. VKI-IN-3, U. S. Air Force Grant AF-EOAR-64-[illegible], January 196[illegible], 56pp. (AD [illegible] 589).

153. Breugelmans, F. and Klock, R., INVESTIGATION OF A ONE STAGE AXIAL FLOW SUPERSONIC COMPRESSOR, PART 2. BLADE SECTION PERFORMANCE OF THE [illegible] TRAILING EDGE ROTOR R-32. Von Karman Inst. for Fluid Dynamics ([illegible]) Report No. VKI-TR-12-Pt-2, U. S. Air Force Grant AF-EOAR-[illegible], April 1965, 85 pp. (AD [illegible] 592).

154. Brevig, O. (General Dynamics Corp., General Dynamics/Convair), A COMPARISON BETWEEN THE EJECTOR RAMJET AND [illegible]. AIAA Propulsion Joint Specialist Conference, 3rd, Washington, D. C., July 17-21, 1967, Paper 67-457, 11pp.

155. Brewer, G. D. (Lockheed Aircraft Corp.), [illegible]. Lockheed Horizons, First Quarter 19[illegible], p. [illegible].

156. Brinkman, [illegible] H. and Dodak, [illegible] A. (General Dynamics Corp.), [illegible] OF PARTITION FUNCTIONS AT HIGH TEMPERATURES. AIAA [illegible] (June 1967).

[illegible]

[illegible] [illegible], J. C. and [illegible], C. R. ([illegible] Aircraft Co.), THE FUTURE [illegible] WORLD. Journal of Aircraft 4(6), [illegible] (19[illegible]).

[illegible]. [illegible]dsall, A. M., KINETICS OF ETHANE CRACKING. Vestn. Akad. Nauk SSSR [illegible], 40-5 (19[illegible]5) (Russ.); C. A. [illegible], 494 (1966).

[illegible]. [illegible]okaw, R. [illegible], [illegible]elles, F. E., Cla[illegible]k, P. J., Zeleznik, F. J., COMBUSTION. U. S. National Aeronautics and Space Administration Report No. NASA-[illegible], NASA Accession No. N66-33667, 1966, 5-25 pp.; C. A. 66, 117500 (1967).

100. Brown, F. (Shell International Petroleum Co., Ltd.), SHELL ACA-5. Shell Aviation News, No. 340, 14-21 (1966).

101. Brown, [illegible] and Tipper, C. F. H., SOME ASPECTS OF THE COOL FLAME COMBUSTION OF PROPANE, CYCLOHEXANE AND THEIR CONJUGATE OLEFINS. Combustion and Flame 12, p. 79, 80 (February 1968).

102. Brown, P. F., X-7A HIGH ENERGY FUEL STUDY REPORT. Lockheed Missile and Space Co. Report No. LMSC-4008, U. S. Air Force Contract AF 33(600)-28 692, December 1957, 38pp. (AD 802 206).

[illegible]. Brown, R. N., EVALUATION OF FILTER/SEPARATOR ELEMENT PERFORMANCE IN THE PRESENCE OF SURFACE ACTIVE FUEL ADDITIVES (FAUDI FEINBAU AND FILTERS, INC., ELEMENTS). U. S. Army Engineer Research and Development Labs. Final Report April - November 1966, Report No. AERDL-1888, [illegible]nuary 1967, 32pp. (AD 815 378L).

104 [illegible], R. N. and Blakeney, S. A., COMPARATIVE EVALUATION OF FOUR [illegible]THODS FOR DETECTING MINUTE QUANTITIES OF FREE WATER IN HYDROCARBON F[illegible]. U. S. Army Engineer and Development Labs. Report No. AERDL-18[illegible] [illegible]ay 1967, 26pp. (AD 816 049L).

105. Brow[illegible] R. N. and Gariepy, G. A., EVALUATION OF FUEL CONTAMINANT MONITORS: [illegible]ENDIX 'GO-NO GO GAGE', AEL WATER DETECTOR, BP AQUASCAN. Army Engineers Research and Development Laboratories Final Report April 1965-January 1966, AERDL 1863, June 1966, 89pp. (AD 803 363L).

106. Brundrett, E. and Baines, W. D., A TEMPERATURE PROBE FOR THE DETERMINATION OF HEAT TRANSFER AT A WALL IN TURBULENT FLOW. International Journal of Heat and Mass Transfer 10, 973-81 (July 1967).

107. Bruno, C., LIMITATIONS OF PRESENT AIR-BREATHING JETS AND THEIR FUTURE POSSIBILITIES - THE SCRJ [SCRAMJET]. Rivista Aeronautica, Supplemento Tecnico 1968, p. 133-44 (In Italian).

108. Brzutowski, T. A., McDonald, A. G., [illegible]man, J. A., Keshavan, R., HEAT TRANSFER FROM A PROPANE-OXYGEN-ALUMINUM FLAME. Combustion Institute, Western States Section, Spring Meeting, University of Denver, Denver, Colo., April 25-27, 1966, Paper WSCI 66-2; Pyrodynamics 5, 205-15 July 1967.

BIBLIOGRAPHY (Cont'd)

169. [illegible] and [illegible] (U. S. Air Force, Aero Propulsion Lab.), [illegible] OF MARCH 19[illegible] AIRBREATHING PROPULSION FOR ADVANCED MISSILES AND [illegible], AIAA Propulsion Joint Specialist Conference, [illegible], Colorado Springs, Colo., June [illegible], 19[illegible], Paper. (Classified).

170. [illegible], [illegible] A., EXPLORATORY [illegible] OF HIGH-TEMPERATURE HEAT [illegible]. Garrett Corp., AiResearch Mfg. Div. Interim Engineering Progress Report No. 6, 1 October - 31 December 19[illegible], Report No. [illegible], RTD [illegible](VI), U. S. Air Force Contract AF 33(615)-2755, Dec. 19[illegible], 29pp. (AD 813 [illegible]).

171. Buckeam, W., Schlegel, W., Smith, I. R., DESIGN, DEVELOPMENT AND EVALUATION OF A CRASH-RESISTANT FUEL SYSTEM INSTALLATION. All American Engineering Co. Technical Report, U. S. Federal Aviation Agency FAA-ADS-27, U. S. Federal Aviation Agency Contract FA-WA-4560, Dec. 1965, 202pp. (AD 654 746).

172. Buechner, E., Erlmeier, R., Spengler, G., THERMODYNAMIC CALCULATION OF EFFICIENCY DATA FOR ROCKET FUELS -- 6. FURTHER APPLICATION. . . (Solid) LITHERGOLIC SYSTEMS. Brennstoff-Chem V49 N.2 40-43 (Feb. 1968).

173. Buekens, A. G. and Froment, G. F., FUNDAMENTAL ASPECTS OF THE DESIGN OF TUBULAR CRACKING UNITS. Eur. Chem. Reaction Eng. Symp , 4th, "Chem. Kinet. and Reaction Des." Session, Brussels, Sept. 9-11, 1968, Paper No. 4.6, 8pp.

174. Bulewicz, E. M., CHEMI-IONIZATION IN FLAMES AND THE HEAT OF OXIDATION OF ORGANIC COMPOUNDS. Combustion and Flame 13(2), 214-6 (April 1969).

175. Bulewicz, E. M., SOME OBSERVATIONS ON CHEMILUMINESCENCE AND CHEMI-IONIZATION IN FLAMES. Combust. Flame 11(4), 297-308 (1967); C. A. 67, 75031.

176. Bunt, E. A., RAMJET TECHNOLOGY. CHAPTER 2. BASIC ADIABATIC THEORY. Johns Hopkins Univ., Applied Physic Lab. Technical Memo TG-610-2-Rev., November 1957, 93pp. (PB 177 251).

177. Burge, H. L., Roberts, R. W., Zettle, E. V. (Rocketdyne), TRANSPORT OF POWDERED METALS. Chem. Eng. Progress 60(2), 45-6 (1964).

178. Burger, J., Meyer, C., Clement, G., Balaceanu, J., HETEROGENEOUS INITIATION OF CHAIN REACTIONS; AUTOXIDATIONS IN THE LIQUID PHASE. Compt. rend. 252, 2235-7 (1961); C. A. 55, 18623.

179. Burk, W. J., AN INVESTIGATION OF THE COMPATIBILITY OF FAA 1069-1 KEROSINE FUEL GEL WITH COMMERCIAL JET TRANSPORT FUEL SYSTEMS. Boeing Co., Commercial Airplane Div., February 1969, 84pp. (AD 686 522).

BIBLIOGRAPHY (Continued)

180. Burke, J. J., Reed, N. L., Weiss, V. (ed.), SURFACES AND INTERFACES, I. CHEMICAL AND PHYSICAL CHARACTERISTICS. Proc. 13th Sagamore Army Materials Research Conference, August 23-26, 1966, Syracuse University Press.

181. Bursian, N. R., Kogan, S. B., Davydova, Z. A., THE STATE OF PLATINUM IN [SILICA-OR ALUMINA - SUPPORTED ALKALI METAL OXIDE] PROMOTED PLATINUM CATALYSTS AND THE NATURE OF THE ACTIVITY OF METAL CATALYSTS FOR DEHYDROCYCLIZATION OF PARAFFINIC HYDROCARBONS. Kinet. i Katal. 9(3), 661-7 (May - June 1968).

182. Bursian, N. R., Kogan, S. B., Davydova, Z. A., A STUDY OF THE STATE OF PLATINUM IN PLATINUM DEHYDROCYCLIZATION CATLYSTS BY THE EXTRACTION METHOD. Kinetika i Kataliz 8, No. 6, 1283-9 (November - December 1967).

183. Bursian, N. R., Kogan, S. B., Davydova, Z. A., EFFECT OF SODIUM ON THE ACTIVITY OF A PLATINUM-ALUMINA CATALYST. Kinetka i Kataliz 6(4), 744-6 (1965) (Russ); C. A. 63, 14717 (1965).

184. Bursian, N., Kogan, S., Davydova, Z., INVESTIGATION OF THE STATE OF THE PLATINUM IN PLATINUM DEHYDROCYCLIZATION CATALYSTS BY THE EXTRACTION METHOD. Kinet. i Katal. 7, 1085 (1966).

185. Bursian, N. R., et al., THE STATE OF PLATINUM IN PLATINUM CATALYSTS OF DEHYDROCYCLIZATION PROMOTED BY ALKALI METALS. Metody Issled. Katal i Katal. Reakts. Akad. Nauk SSSR, sib. Otdel., Inst. Katal No. 2, 144-51 (1965) (Russ); C. A. 67, 53786.

186. Butler, R. J. and Ziegenhain, W. C. (Continental Oil Co.), PRODUCTION OF HIGH PURITY ALUMINA [AND ALFOL ALCOHOLS] BY THE HYDROLYSIS OF ALUMINUM ALKOXIDES. AIChE Nat. Mtg. (64th), New Orleans, March 16-20, 1969, Preprint No. 8D, 12pp.

187. Butze, H. F., Moyer, H. M., Trout, A. M., PERFORMANCE OF SWIRL-CAN TURBOJET COMBUSTORS AT SIMULATED SUPERSONIC COMBUSTOR-INLET CONDITIONS. U. S. National Aeronautics and Space Administration, Lewis Research Center, January 1969, 28pp. (N69-16154).

BIBLIOGRAPHY (Contd)

188. Calmon, J. and Menioux, C., THE TRANSITION PHASE OF THE TURBORAMJET ENGINE. Entropie 1967, 07-16 (January-February) (in French).

189. Campbell, J. B., THE HYPERSONIC ERA. Space/Aeronautics 1966, 53 (Nov.).

190. Cannell, L. G. (Shell Development Co.), FOUR $C_{16}H_{12}$ POLYCYCLIC OLEFINS. Tetrahedron Letters No. 48, 5967-72 (1966).

191. Canetti, G. S. and Cheung, H. (North American Aviation, Inc.), ATMOSPHERIC CHEMISTRY AND AERODYNAMIC FLOW. Chem. Eng. Progress 60 (2), 36-8 (1964).

192. Cantone, B., Grasso, F., and Lindemann, L., MASS SPECTROMETRIC ANALYSIS OF PETROLEUM FRACTIONS IN THE C10-C13 RANGE. Riv. Combust. V18. 177-82 (1964); (Abstr, J. Inst. Petrol. V51 N.500.120A (Aug. 1965).

193. Canright, R. B. (Mc Donnell Douglas Corp.), PROPULSION. Space Systems Technology, ed. by R. D. Heitchue, Jr., New York, Reinhold, 1968, pp. 89-138.

194. Capell, R. G. (Gulf Research and Development Co.) and Granquist, W. T. (National Lead Co.), CRYSTALLINE SYNTHETIC ALUMINOSILICATE CRACKING CATALYSTS. U. S. 3,252,889 (Cl. 208-120), May 24, 1966, Appl. July 16, 1963; 9 pp.; C.A. 65, 5284 (1966).

195. Caney, C., Carnevale E. H., Lym, S., Marshall, T., EXPERIMENTAL DETERMINATION OF GAS PROPERTIES AT HIGH TEMPERATURES AND/OR PRESSURES. Parametrics Inc., March 1969, 62 pp. (AD 684 530).

196. Carlson, L. W. and Seader, J. D. (North American Aviation, Rocketdyne Div.), HEAT-TRANSFER CHARACTERISTICS OF HOT-GAS IGNITION. American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 3rd, New York, January 24-26, 1966, Paper 66-67; AIAA Journal 5, 1272-9 (July 1967).

197. Carpenter, J. E., Klavins, A., Tate, S. E., Graves, K. W., AN EXISTING FACILITY FOR SCRAMJET TESTING THE WAVE SUPERHEATER HYPERSONIC TUNNEL. AIAA, Aerospace Sciences Meeting, 5th, New York, January 23-26, 1967, Paper 67-132, 6pp.

198. Carra, S., Forni, L., and Vintani, C., THE KINETICS AND MECHANISM IN CATALYTIC DEHYDROGENATION OF n-BUTANE OVER CHROMIA-ALUMINA. Catalysis 9, No. 2, 154-65 (October 1967).

199. Carriere, P., REMARKS CONCERNING THE METHODS OF CALCULATING VISCOSITY EFFECTS IN PROPULSION NOZZLES. ONERA, TP No. 408, 1966; Wissenschaftliche Gesellschaft für Luft-und Raumfahrt and Deutsche Gesellschaft für Raketentechnik und Raumfahrt, Jahrestagung 1966, Bad Godesberg, West Germany, Oct. 4-8, 1966, Paper, 45 pp. (in French).

BIBLIOGRAPHY (Cont'd)

200. Cassi, C. and Ghezzi, U., COMBUSTION EFFICIENCY OF A SUPERSONIC RAMJET. L'Aerotecnica 46, 18-27 (February 1966).

201. Cassi, C., and Ghezzi, U., COMBUSTION EFFICIENCY OF A SUPERSONIC RAMJET ENGINE. Associazione Italiana di Aerotecnica and Associazione Italiana Razzi, National AIDA-AIR Convention, Universita di Napoli, Naples, Italy, October 25-28, 1965, Proceedings. Rome, Associazione Italiana di Aerotecnica, 1967, p. 144-62 (in Italian).

202. Cassel, H. M., ON THE GROWTH OF SOOT PRECIPITATES IN FLAMES. Eastern Section of the Combustion Inst. 1968 Technical Meeting, October 21, 22, 1968, Paper.

203. Cato, R. J., Gilbert, W. H., and Kuchta, J. M., EFFECT OF TEMPERATURE ON UPPER FLAMMABILITY LIMITS OF HYDROCARBON FUEL VAPORS IN AIR. Fire Technol. 3 (1), 14-19 (1967).

204. Cato, R. J., Furno, A. L., Bartkowiak, A., Kuchta, J. M., EVALUATION OF FLAME ARRESTOR MATERIALS FOR AIRCRAFT FUEL SYSTEMS. U. S. Bureau of Mines, Explosives Research Center Annual Report, Jan. 31-Dec. 1966. U. S. Air Force AFAPL TR-67-36, March 1967, 36 pp. (AD 380 877L) (REPORT CLASSIFIED SECRET).

205. Cato, R. J. and Kuchta, J. M., HOT-GAS IGNITION TEMPERATURES OF HYDROCARBON FUEL VAPOR-AIR MIXTURES. U. S. Bur. Mines Rept. Invest. No. 6857 (1966) 14 p.

206. Cato, R. J. and Kuchta, J. M. (U. S. Bur. of Mines), HOT GAS IGNITION TEMPERATURES OF HYDROCARBON FUEL VAPOR-AIR MIXTURES. Amer. Chem. Soc., Div. Fuel Chem., Preprints 9 (4), 28-42 (1965); C.A. 66, 67 597 (1967).

207. Catton, I., Hill, D. E., McRae, R. P. (Douglas Missile and Space Systems Div.), STUDY OF LIQUID JET PENETRATION IN A HYPERSONIC STREAM. AIAA Journal 6 (11), 2084-9 (1968).

208. Ceresuela, R., AERODYNAMICS OF A MACH 7 POWERED AIRCRAFT. Afitae Colloq. on Appl. Aerodyn. (5th), Poitiers, France, 6-8 November 1968, 25 pp. (in French, English Summary) (N 69-20784).

209. Chaiken, R. F., EXTINCTION OF OPPOSED-JET DIFFUSION FLAMES: A PHYSICAL CRITERION FOR EXTINCTION. Aerojet Gen. Corp. 1965, 32 pp. (AD 625 859); C. A. 66, 106744 (1967).

210. Chambadal, P., APPLICATION OF THE ENTROPY CONCEPT TO ANALYSIS OF GAS TURBINE FUNCTIONING. Entropie 1966, 28-35 (Sept.-Oct.) (in French).

211. Chambers, H. F., Jr. (Wright-Patterson A. F. B.), ANALYTICAL STUDY OF SHOCK-TUNNEL SIMULATION OF COMBUSTOR ENTRANCE CONDITIONS. U. S. Clearinghouse Fed. Sci. Tech. Inform., AD 646 599, 40 pp. (1966); C. A. 67, 66855.

BIBLIOGRAPHY (Cont'd)

212. Chan, A. S., SIMULATION OF RADIANT HEAT TRANSFER. ASME, Transactions, Series C-Heat Transfer 89, 195, 196 (May 1967).

213. Chang, J., SUPERSONIC MOLECULAR BEAM SAMPLING SYSTEM FOR MASS SPECTROMETRIC STUDIES OF HIGH PRESSURE FLOW SYSTEMS. Avco Everett Research Lab., April 1969, 74 pp. (AD 687 098).

214. Chapman, A. J., HEAT TRANSFER (2nd Edition). New York, Macmillan Co.; London, Collier-Macmillan, Ltd., 1967, 6[illegible]4 p.

215. Chauvin, J., FUTURE DEVELOPMENT OF GAS TURBINES AND HIGH PERFORMANCE COMPRESSORS. Von Karman Inst. for Fluid Dynamics (Belgium) Report no. VKI-TM-18, July 1966, 98 pp. (AD 812 213) (in French).

216. Chauvin, J. and Breugelmans, F., APPLICATION OF BLUNT TRAILING EDGE BLADINGS TO SUPERSONIC COMPRESSOR STAGES. Von Karman Inst. for Fluid Dynamics (Belgium) Final Scientific Report No. VKI-TN-22, U.S. Air Force ARL67-0120, U. S. Air Force Contract AF-EOAR-65-65, May 1967, 73 pp. (AD 653 595).

217. Chen, S. Y., Baron, J., Mobley, R. (Rand Corp.), STAGNATION-REGION GAS INJECTION IN LOW REYNOLDS NUMBER HYPERSONIC FLOW. Proc. Heat Transfer Fluid Mech. Inst. 1967, 34-57; C.A. 67, 101440.

218. Chen, S. Y., Baron, J., Mobley, R., STAGNATION REGION GAS INJECTION IN LOW REYNOLDS NUMBER HYPERSONIC FLOW. Rand Corp. Report No. RM-5[illegible]-PR, Contract F 44620-67-C-0045, February 1967, 45 pp. (AD 647 769).

219. Chen, Y. M. and Tien, C. L., PENETRATION OF TEMPERATURE WAVES IN A RANDOM MEDIUM. Journal of Mathematics and Physics 46, 188-94 (June 1967).

220. Cheng, D. C.-H., CERTAIN THEORETICAL ASPECTS OF POWDER BEHAVIOR. Warren Spring Laboratory, Chem. Eng. Div., Report LR 48(CE), Stevenage, Herts, England, May 1967.

221. Cherepanov, G. P., ON THE THEORY OF THE NORMAL COMBUSTION VELOCITY. Prikladnaia Matematika; Mekhanika 29, 794, 795 (July-August, 1965); PMM-Journal of Applied Mathematics and Mechanics 29, No. 4, p. 941, 942 (1965) (Translation).

222. Chernov, V. A. and Antipina, T. V., ALUMINUM FLUORIDE AS A HYDROCARBON CRACKING CATALYST. Kinetika i Kataliz 6 (6), 1114-5 (1965) (Russ.); C.A. 64, 6359 (1966).

223. Chernov, V. A. and Antipina, T. V., THE CATALYTIC ACTIVITY OF PROMOTED ALUMINUM OXIDE CATALYSTS IN CRACKING AND ISOMERIZATION REACTIONS. Neftekhimiya 5, (5), 688-92 (1965) (Russ). C.A. 64, 3257 (1966).

224. Chernyi, G. G., SUPERSONIC FLOW AROUND BODIES WITH THE FORMATION OF DETONATION AND SLOW-COMBUSTION FRONTS. Astronautica Acta 14, 467-80 (August 1968) (in Russian).

BIBLIOGRAPHY (Cont'd)

225. Chernyi, G. G., ASYMPTOTIC LAW OF PROPAGATION OF A PLANE DETONATION. Dokl. Akad. Nauk SSSR 172 (4), 556-60 (1967) (Russ.); C.A. 66, 79700 (1967).

226. Chernyi, G. G., SELF-MODELING PROBLEMS OF FLOW OF A COMBUSTIBLE GAS MIXTURE AROUND BODIES. Izv. Akad. Nauk SSSR, Mekhanika Zhidkosti i Gaza 1966 (6), 10-24; U.S. Air Force Translation FTD-MT-24-279-67, October 1967, 29 pp. (AD 666 149).

227. Chertkov, Ya. B., CURRENTLY USED AND PROSPECTIVE JET AND DIESEL HYDROCARBON FUELS. Moscow, Izdatel' stvo Khimiia. 1968. 356 pp. (Russ.).

228. Chertkov, Ya. B., Spirkin, V. G., Ignatov, V. M., JET FUELS IN THE U.S. AND GREAT BRITAIN. Khimiia i Tekhnologiia Topliv i Masel 12, 49-52 (April 1967) (in Russian).

229. Chervinsky, A. and Manheimer-Timnat, Y., A STUDY OF AXISYMMETRICAL TURBULENT JET DIFFUSION FLAMES. Combustion and Flame 13 (2), 157-65 (April 1969).

230. Chervinsky, A. and Timnat, Y. M., XPERIMENTAL INVESTIGATION OF TURBULENT SWIRLING FLAMES. Israel Annual Conference on Aviation and Astronautics, 9th, February 22, 23, 1967, Paper; Israel Journal of Technology 5 (1-2), 39-46 (1967); C.A. 67, 47187.

231. Chigier, N. A., FLAME STABILIZATION WITH SWIRLING AIR JETS. Israel J. Technol. 3 (1), 31-7 (1965); C.A. 66, 117549 (1967).

232. Chigier, N. A. and Chervinsky, A. (Israel Inst. Technol.), AERODYNAMIC STUDY OF TURBULENT BURNING FREE JETS WITH SWIRL. NASA Accession No. N66-30804, Report No. TAE-49, 36 pp. 1966; C.A. 67, 4499.

233. Chiappetta, L., Kay, I. W., Kennedy, J. B., McVey, J. B., Rubins, P. M., HYDROCARBON FUELED SCRAM-JET. VOLUME VI. LITERATURE SURVEY OF COMBUSTION TECHNOLOGY. United Aircraft Corp., United Aircraft Research Labs. Final Report, November 1, 1968 - March 31, 1969, Report No. H910755-11, U.S. Air Force AFAPL-TR-68-146, Volume VI, Contract No. AF 33(615)-5153. June 1969, 86 pp.

234. Chinitz, W. and Baurer, T. (General Applied Science Labs., Inc.), AN ANALYSIS OF NON-EQUILIBRIUM HYDROCARBON/AIR COMBUSTION. Pyrodynamics 4 (2), 119-54 (1966); C.A. 67, 92525.

235. Chisholm, D., PRESSURE GRADIENTS DURING THE FLOW OF INCOMPRESSIBLE TWO-PHASE MIXTURES THROUGH PIPES, VENTURIS AND ORIFICE PLATES. Brit. Chem. Eng. 12 (9), 111 (1967); C.A. 67, 101 439.

236. Chiu, H. H., THEORY OF ACCELERATED ROCKET NOZZLES. New York University Department of Aeronautics and Astronautics, August 1968, 34 pp. (AD 686 161).

BIBLIOGRAPHY (Contd)

237. Ch[illegible], [illegible] and [illegible], Y. [illegible], COMBUSTION AND DISSOCIATION ANALYSIS OF EQUILIBRIUM [illegible] OF HYDROCARBON-AIR MIXTURES. Inst. of Engineers (India), Journal, Mechanical Engineering Div. [illegible], [illegible]79-86 (March, 19[illegible]).

238. Christiansen, E. B., Jensen, G. E., Tao, F. (University of Utah), LAMINAR FLOW HEAT TRANSFER. A. I. Ch. E. Journal 1[illegible], 1196-1202 (November 1966).

239. Christiansen, E. B., Jensen, G. E., Tao, F., LAMINAR FLOW HEAT TRANSFER. Research on Heat and Mass Transfer. Part 2 - American Inst. of Chemical Engineers, Annual Meeting, 59th, Symposium 17, Detroit, Mich., Dec. 4-8, 1966, Papers, New York, American Institute of Chemical Engineers, 1966, 11 pp.

240. Chen, C. H., et al., THE ONSET OF INTERFACIAL WAVE FORMATION IN CO-CURRENT GAS-LIQUID STRATIFIED FLOW. Canadian J. Chem. Eng. 46, 143-4 (April 1968).

241. Chow, R., HEAT TRANSFER OF AN INCOMPRESSIBLE FLUID AT A THREE DIMENSIONAL STAGNATION POINT. Grumman Aircraft Engineering Corp., Research Dept. Report RE-316, January 1968, 28 pp. (N68-16600).

242. Chomitz, N. and Cullo, L. A. (American Cyanamid Co.), HYDROCARBON CRACKING CATALYSTS. U. S. 3,210,294 (Cl. 252-453), October 5, 1965, Appl. August 14, 1963; 3 pp.; C.A. 63, 17765-6 (1965).

243. Churchill, A. V., Hager, J. A., Zengel, A. E., FUELS FOR ADVANCED AIR-BREATHING WEAPON SYSTEMS. Society of Automotive Engineers, National Aeronautic and Space Engineering and Manufacturing Meeting, Los Angeles, October [illegible]-8, 1963, Paper 650004, 19 pp.

244. Chursirikov, E. S., Gureev, A. A., Rozhkov, I. V., Shirokova, G. E., EVALUATION OF CORROSIVE PROPERTIES OF FUELS AND THE EFFECTIVENESS OF ANTICORROSION ADDITIVES. Khim. Tekhnol. Topl. Masel. 11 (12), 54-6 (1966) (Russ); C.A. 66, 57550 (1967).

245. Clarke, J. F., THE REFLECTION OF A PLANE SHOCK WAVE FROM A HEAT-CONDUCTING WALL. Proc. Roy. Soc., Ser. A 299 (1457), 221-37 (1967); C.A. 67, 13125.

246. Clarke, J. F., THE LAMINAR DIFFUSION FLAME IN OSEEN FLOW - THE STOICHIOMETRIC BURKE-SCHUMANN FLAME AND FROZEN FLOW. Royal Society (London), Proceedings, Series A 296, 519-45 (Feb. 14, 1967).

247. Clay, E. C., THE B-70'S NEW STRUCTURAL DESIGN CONCEPTS FOR MACH 3 TEMPERATURES. North American Aviation Inc., Los Angeles Div. Report No. NA-62-655, 1962, 25 pp. (AD 814 123).

BIBLIOGRAPHY (Cont.)

248. Click, J. D. and Safford, D. L., INTEGRATED ENGINEERING AND SERVICE TEST OF FILTER/SEPARATOR, LIGHTWEIGHT, 50-GPM, TEMPERATE CLIMATE. U.S. Army General Equipment Test Activity, Fort Lee, Va. Final Report, 7 January 1966 - 1[illegible] March 1967, May 1967, 55 pp. (AD 819 065L).

249. Cluchet, P., CATALYSIS BY PLATINUM—MECHANISMS AND APPLICATIONS. Chim. mod. 1, 381-94 (19[illegible]); C.A. [illegible], 6[illegible].

250. Cohen, J. J., ANALYTICAL INVESTIGATION OF FLOW DURATION IN THE CONVAIR HYPERSONIC SHOCK TUNNEL. General Dynamics/Convair, June 1960, 24 pp. (AD 621 750).

251. Cockshutt, E. P., GAS TURBINE CYCLE CALCULATIONS: DIFFERENTIAL METHODS IN THE ANALYSIS OF EQUILIBRIUM OPERATION. National Res. Council of Canada Report NRC-9606, NAE-LR-481, March 1967, 61 pp. (AD 820 539).

252. Cockshutt, E. P. (Canadian National Research Council), GAS TURBINE CYCLE CALCULATIONS - DIFFERENTIAL METHODS IN THE ANALYSIS OF EQUILIBRIUM OPERATION. CASI Transactions 1, 21-38 (March 1968).

253. Cohen, L. A., Power, W. H., Fabel, D. A. (Monsanto Co.), NEW METAL FOAMS ARE HIGHLY POROUS AND UNIFORM. Mat. Eng. 67, 44-6 (1968).

254. Cohn, J. G., PRECIOUS METALS CATALYSTS IN SPACE OR AEROSPACE APPLICATIONS. Englehard Ind. Tech. Bull. 9, 5-9 (June 5, 1968).

255. Cole, J. D. and Zien, T. (California Inst. of Technology), A CLASS OF THREE-DIMENSIONAL, OPTIMUM HYPERSONIC WINGS. AIAA Journal 7, (2), 264-71 (February 1969).

256. Coleman, B. D. and Mizel, V. J. (Mellon Inst.; Carnegie Institute of Technology), EXISTENCE OF ENTROPY AS A CONSEQUENCE OF ASYMPTOTIC STABILITY. Archive for Rational Mechanics and Analysis 25 (4), 243-70 (1967) NSF Grant No. GP-6173; U.S. Air Force Grant No. AF AFOSR 728-66.

257. Collison, E. S., Gleason, C. C., Kutzko, G. G., TURBO-PROPULSION COMBUSTION SYSTEM EXPLORATORY DEVELOPMENT PROGRAM. General Electric Co., Flight Propulsion Div. Final Report 1 April 1964 - 30 September 1966 on phase 3, Report No. R66FPD 271, AFAPL TR-66-113, U.S. Air Force Contract AF 33(615)-1304, Nov. 1966, 340 pp. (AD 379 186) (REPORT CLASSIFIED CONFIDENTIAL).

258. Condon, S. P. (Wright-Patterson A.F.B.), MIXING OF PERPENDICULAR GAS JETS AS APPLIED TO SUPERSONIC COMBUSTION. AD 635 230, Avail. CFSTI, 83 pp. 1966; C.A. 61, 23690.

259. Conrad, O., STATISTICAL RESEARCH FOR SUPERSONIC COMPRESSORS. Yearbook 1965; Wissenschaftliche Gesellschaft für Luft-und Raumfahrt, European Aeronautical Congress, 6th, Munich, West Germany, Sept. 4-6, 1965, Reports ed. by H. Blenk, Braunschweig, West Germany, Friedrich Vieweg und Sohn GmbH, 1966, 374-84 (in German).

BIBLIOGRAPHY (Contd)

260. C[illegible]k, [illegible].A., et al., A SYMPOSIUM ON FUEL CONTAMINANT MONITORING DEVICES. [illegible]th [illegible] Ann. Mtg. (Chicago June 21-26, 1964); (Abstr) Mater. Res. Std. [illegible] N. [illegible]40 (May 1964).

261. [illegible]k, F. and [illegible]el, R. TECHNIQUE FOR TRAPPING INTERMEDIATE SPECIES OF HIGH-TEMPERATURE REACTIONS. Aerospace Corp., Nov. 1968, 26 pp. (AD 685 [illegible]).

262. Co[illegible], J. J., [illegible], P., [illegible] (University of Dayton Res. Inst.), GROWTH AND SURVIVAL OF [illegible] IN JP-4 EMULSIONS AND NON-EMULSIFIED FUEL SYSTEMS. Appl. Microbiol. 16, 56[illegible]-71 (1968).

263. Cooper, C. W., Kemp, H. T., Fell, R. M., ELASTOMERS FOR FUEL SYSTEMS CONTAINING MICRO[illegible] ADDITIVES REPT. FOR OCT. 1, 1962-AUG. 31, 19[illegible]. U.S. Dept. Com. Office Tech. Serv., AD N. 408,806 ([illegible]) TOP.; (Abstr) Corrosion Abstr. V3 N.5.333 (Sept 1964).

264. Cooper, [illegible] J., TECHNOLOGY OF ADVANCED PROPULSION SYSTEMS WITH REGARD TO INSTALLATION AND PERFORMANCE IN AEROSPACE VEHICLES. British Interplanetary Society, Technical Meeting on Research and Development in Propulsion Technology, London, England, Oct. 31- Nov. 1, 1967, Paper, 19 pp.

265. Copper, J. A., Griffith, W. R., Hameetman, F. J., Shaw, W. J., Smith, N. [illegible], TECHNIQUES USED TO CONDUCT EXTERNAL BURNING EXPERIMENTS IN THE SHOCK TUNNEL. IAA Accession No. A66-40631, Avail. AIAA, 1966, 12 pp.; C.A. 67, 44[illegible].

266. Cornelius, W., Stivender, D. L., Sullivan, R. E., A COMBUSTION SYSTEM FOR A VEHICULAR REGENERATIVE GAS TURBINE FEATURING LOW AIR POLLUTANT EMISSIONS. SAE Combined Fuels and Lubricant Powerplant + Transp. Mtgs. (Pittsburgh 10/30-11/3/67) Paper No. 670936 20 pp.

267. Cotton, F. A. (Massachusetts Inst. Technol.), FLUXIONAL ORGANOMETALLIC MOLECULES. Chem. in Britian 1968, 345-7, 355 (August).

268. Coulbert, C. D. (Marquardt Co.), RADIATION COOLING. Chem. Eng. Progress 60 ([illegible]), [illegible] (1964).

269. Covini, R., Fattore, V., Giordano, N., ACIDITY OF FLUORINATED ALUMINAS, AND THEIR CATALYTIC ACTIVITY IN CUMENE HYDRODEALKYLATION. J. Catal. 7 (2), 126-34 (1967); C.A. 66, 85 784 (1967).

270. Cozzarelli, F. A. and Vito, R. P., CREEP OF CONICAL MEMBRANE SHELLS UNDER AERODYNAMIC HEATING AND LOADING. AIAA Journal 7 (3), 412-8 (March 1969).

271. Crabtree, D. L. and Warner, C. F., AN EXPERIMENTAL INVESTIGATION OF THE VELOCITY AND TEMPERATURE PROFILES AN THE BOUNDARY LAYER ABOVE AN UNSTABLE EVAPORATING FILM OF LIQUID UNDER THE INFLUENCE OF A MOVING STREAM OF HOT GAS. Purdue Univ., Jet Propulsion Center Technical Memo, Report No. TM-66-9, JPC-429, U.S. Navy Contract Nonr-1100 (21), Sept. 1966, 229 pp. (AD 645 214).

BIBLIOGRAPHY (Cont'd)

272. Cramer, R. H., [illegible], A. F., [illegible], K. I. (Mobil Oil Corp.), CATALYST COMPOSITION CONTAINING A CRYSTALLINE ALUMINOSILICATE, A SILICEOUS MATRIX, AND INERTS FOR THE CONVERSION OF HYDROCARBONS. U.S. 3,[illegible] (Cl. [illegible]), April 4, 1967, Appl. May 24, 196[illegible] and April 9, 1965, 17 pp.; C.A. 67, [illegible]51.

273. Crane, C. R. and Sanders, D. C., EVALUATION OF A BIOCIDAL TURBINE-FUEL ADDITIVE. U.S. Federal Aviation Agency Civil Aeromedical Inst. Report FAA-AM-67-21, August 1967, 16 pp. (AD 665 661).

274. Crawford, W. J. (General Electric Co.), OPERATION OF THE GE T54 ON EMULSIFIED FUEL. Society of Automotive Engineers, National Aeronautic Meeting, New York, N. Y., April 24-27, 1967 Paper 670364, 6 pp.

275. Croomes, E. F., THE COMBUSTION OF HYDROCARBONS AND FLUOROSUBSTITUTED HYDROCARBONS WITH NITROGEN TRIFLUORIDE AND NITROGEN TRIFLUORIDE-OXYGEN MIXTURES. Combust. Flame V10 N.1., 71-77 (March 1966).

276. Cross, W. G. and Edwards, N. B. (Rolls-Royce, Ltd.), SOME ASPECTS OF THE CONTROL OF MULTISHAFT JET ENGINES. Society of Automotive Engineers, Automotive Engineering Congress, Detroit, Mich., January 9-13, 1967, Paper 670139, 13 pp.

277. Crosthwait, E. L., Kennon, I. G., Jr., Roland, H. L., PRELIMINARY DESIGN METHODOLOGY FOR AIR-INDUCTION SYSTEMS. General Dynamics Final Report July 1965-June 1966, U.S. Air Force SEG TR-67-1, U.S. Air Force Contract AF 33(615)-3125, January 1967, 435 pp. (AD 811 569).

278. Crum, M. G., Reynolds, R. J., Hedrick, H. G., MICROBIAL PENETRATION AND UTILIZATION OF ORGANIC AIRCRAFT FUEL-TANK COATINGS. Appl. Microbiol. 15, 1325-55 (1967).

279. Crum, M. G., Reynolds, R. J., Hedrick, H. G., EFFECT OF SURFACTANTS AND ADDITIVES ON THE PROGRESS OF MICROBIOLOGICAL CORROSION ON ALUMINUM ALLOYS. Develop. Ind. Microbiol. 8, 253-9 (1966); C.A. 67, 67153.

280. Csicsery, S. M. (to Chevron Research Co.), DEHYDROCYCLODIMERIZATION OF LOW-MOLECULAR-WEIGHT PARAFFINS. U.S. 3,296,324 (Cl. 260-673), Jan. 3, 1967, Appl. April 5, 1966; 4 pp.; C.A. 66, 48142 (1967).

281. Csicsery, S. M., and Burnett, R. L., ISOMERISATION AND TRANSMETHYLATION OVER PLATINUM-ON-SILICA CATALYST. J. Catalysis, 1967, 8, (1), 75-81.

282. Cullis, C. F., RECENT DEVELOPMENTS IN THE CONTROLLED OXIDATION OF HYDROCARBONS. Chem. and Industry 1968, 961-5 (July 20).

283. Cullis, C. F., Saeed, M., Trimm, D. L., QUANTITATIVE ASPECTS OF ALKYLPEROXY RADICAL ISOMERIZATION DURING HYDROCARBON COMBUSTION. Proc. Roy. Soc., Ser. A 300 (1463), 455-67 (1967); C.A. 67, 90221.

BIBLIOGRAPHY [illegible]

284. [illegible] and Geankoplis, C. J. (Ohio State Univ.), THE EFFECTS [illegible] OF POROUS SOLIDS ON DIFFUSION OF GASES IN THE TRANSITION [illegible] FROM KNUDSEN TO MOLECULAR DIFFUSION. Ind. Eng. Chem., [illegible] November 196[illegible].

28[illegible]. [illegible], A VULNERABILITY EVALUATION OF EMULSIFIED FUELS FOR THE [illegible]. Falcon Research and Development Co., April 19[illegible], [illegible] (AD [illegible]).

[illegible] [illegible], J. and [illegible]k, C., HIGH TEMPERATURE VAPORIZATION STUDIES BY MASS [illegible] 3: CALCULATIONS AND COMPUTER PROGRAMMES. United Kingdom Atomic Energy Authority Report AERE-R-5424, October 1967, 27 pp. (N68-15375).

BIBLIOGRAPHY (Cont'd)

287. Dabora, E.K., PRODUCTION OF MONODISPERSE SPRAYS. Rev. Sci. Instr. 738 N. 4, 502-6 (April 1967).

288. Daido Steel Co. Ltd. and Okaya and Co. Ltd., A HIGHLY ACTIVE CATALYST. Brit. 1, 105, 442. Publ. 2/14/68 f. Japan 1/28/64, 2/26/64.

289. Daily, J. W., SOME ASPECTS OF FLOWING SUSPENSIONS. Developments in Mechanics, Vol. 3; Part 2, Dynamics and Fluid Mechanics (Proceedings of the Ninth Midwestern Mechanics Conference, Univ. of Wisconsin, Madison, August 16-18, 1965); New York, John Wiley and Sons, pp. 17-36, 1967.

290. Dalla Valle, J. M., et al., APPLICATION OF HINDERED SETTLING TO PARTICLE-SIZE MEASUREMENT. U.S. Atomic Energy Comm. Report ORNL-2565, 1958, 21 pp.; C.A. 53, 7720.

291. Dalzell, W. H. and Sarofim, A. F. (Massachusetts Inst. of Technol.), OPTICAL CONSTANTS OF SOOT AND THEIR APPLICATION TO HEAT-FLUX CALCULATIONS. American Inst. of Chem. Engineers and American Society of Mechanical Engineers, Heat Transfer Conference and Exhibit, Philadelphia, Pa., August 11-14, 1968, ASME Paper 68-HT-13, 5 pp.

292. Daniel and Florence Guggenheim Aviation Safety Center at Cornell Univ., Aircraft Fluids Fire Hazard Symposium, Fort Monroe, Va., June 7,8, 1966, Proceeding. New York, Daniel and Florence Guggenheim Aviation Safety Center, 1966, 203 pp.
Partial Contents: Beerbower, A. and Philippoff, W. (Esso Research and Engineering Co.), HISTORY OF GELLED FUELS - THEIR CHEMISTRY AND RHEOLOGY. p. 86-109; Brown, W. E. (Western Company of North America), SAFETY FUELS-FROM THEORY TO PRACTICE. p. 110-138; Chute, R. (Continental Aviation and Engineering Corp.), FEASIBILITY INVESTIGATION FOR BURNING GELLED AND EMULSIFIED FUELS IN A GAS TURBINE. p. 139-164; Lissant, K. J. (Petrolite Corp.), EMULSIFIED FUEL STUDIES. p. 165-176.

293. Da-Riva, I. and Urrutia, J. L., IGNITION DELAY IN DIFFUSIVE SUPERSONIC COMBUSTION. AIAA, Propulsion Joint Specialist Conference, 3rd, Washington, D. C., July 17-21, 1967, Paper 67-496; AIAA Journal 6 (11), 2095-2101 (November 1968).

294. Das Gupta, N. C., AN EXPERIMENTAL TECHNIQUE FOR HIGH TEMPERATURE COMBUSTION RESEARCH. Inst. of Eng. (India), Journal, Mechanical Engineering Division 48, 565-78 (March 1968).

295. David, E., Koch, B., Pfeifer, H. J., Vom Stein, H. D., STUDY OF SHOCK PHENOMENA BY A LASER INTERFEROMETER. Inst. Franco-allemand de Recherches (France), Dec. 1967, 32 pp. (in German) (N69-17309).

296. Davies, P.O.A.L., TURBULENCE STRUCTURE IN FREE SHEAR LAYERS. AIAA Journal 4, 1971-8 (November 1966).

BIBLIOGRAPHY (Cont'd)

297. Davies, R. G. and Attendu, M. C., ELECTROSTATIC HAZARDS IN AIRCRAFT FUELING. 1st Can. Fuel Technol. Conf. (Montreal, May 1965); (Abstr) Combust. Flame V 7 N. 4, [illegible]-82 (Dec. 1963).

298. Davies, R. M. and Toth, H. E., THERMODYNAMIC AND TRANSPORT PROPERTIES OF FUEL-OXYGEN COMBUSTION SYSTEMS. ASME Symposium on Thermophysical Properties, 4th Proc., April 1-4, [illegible]. p. 350-[illegible].

299. Davis, J. D. and Eden, R. Q. E. (Shell International Petroleum Co., Ltd.), FUEL FOR CONCORDE. II. World Petroleum Congress, Quadrennial, 7th, Mexico City, Mexico, April 2-9, 1967, Paper; Shell Aviation News, No. 348, 8-11 (1967).

300. Dawson, D. B., CONDENSATION OF SUPERSATURATED ORGANIC VAPORS IN A SUPERSONIC NOZZLE. Mass. Inst. of Technol., Gas Turbine Lab. Report No. 90, U.S. Navy Contract Nonr-3963 (07), April 1967, 174 pp. (AD 655 473).

301. Dawson, L. G. and Holliday, J. B., LOOKING AHEAD IN AERONAUTICS: PROPULSION. Aeronautical Journal 72, 739-47 (Sept. 1968).

302. Degrace, L. G. (Bendix Corp.); DEVELOPMENT OF A SPARK IGNITION SYSTEM FOR A RAMJET MISSILE. American Inst. of Aeronautics and Astronautics, Propulsion Joint Specialists Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-645, 9 pp.

303. De Gray, R. J. and Belden, S. H. (Standard Oil Co., Ohio), GLYCOL BORATE AMINE SALTS. U.S. 3,311 653 (Cl. 260-462), March 28, 1967, Appl. Aug. 1, 1963, 3 pp.; C.A. 67, 11269.

304. De Rosset, A. J. (To Universal Oil Products Co.) DEHYDROGENATION OF HYDROCARBONS AT HIGH CONVERSION LEVELS. U.S. 3,375,288, March 26, 1968.

305. Deich, M. E. and Likherzak, E. E., VORTEX EFFECTS IN A TURBINE STAGE. Izv. Akad. Nauk SSSR. Energetika i Transport 1964 (1), 109-15; U.S. Air Force Translation FTD-MT-67-47, June 1967. 18 pp. (AD 668511).

306. Dekhovich, P. A., TURBINE STAGE CHARACTERISTICS. Izv. Vyssh. Ucheb. Zaved., Energ. (Minsk) 1965 (8), 67-75; U.S. Air Force Translation FTD-HT-66-537, August 1967, 21 pp. (AD 662 459) (N68-15417).

307. Delery, J. and Masure, B. (Office National d' Etudes et de Recherches Aerospatiales, France), INFLUENCE OF A SHARP PRESSURE VARIATION ON A TURBULENT BOUNDARY LAYER AND APPLICATION TO HYPERSONIC AIR INTAKES. Intern. Congr. of Aeron. Sci. (6th), Munich, Sept. 9-13, 1968, 10 pp. (N69-18226).

308. Del Notario, P. P., Tarifa, C. S., Torralbo, A. M., COMBUSTION AND FLAME PROPAGATION IN HETEROGENEOUS SYSTEMS. FINAL REPORT. Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain), Nov. 1968, 33 pp. (N69-21885).

BIBLIOGRAPHY (Cont'd)

309. Den Hartog, H. J. and Beek, W. J., LOCAL MASS TRANSFER WITH CHEMICAL REACTION. I. HOMOGENEOUS REACTIONS. II. HETEROGENEOUS REACTIONS. Appl. Sci. Res. 17, 311-37, 338-51 (1968).

310. Desikan, P. and Venkatesh, A. V., SMOKE POINTS OF HYDROCARBON FUELS-CORRELATION WITH PHYSICOCHEMICAL PROPERTIES. Petrol. Hydrocarbons 1 (4), 450-5 (1967); Chem. Age India 19 (1); C.A. 66, 117640 (1967).

311. Destriau, M. and Heleschewitz, H., HETEROGENEOUS PROCESSES IN THE COMBUSTION OF GASEOUS MIXTURES. In Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., Aug. 14-20, 1966, Proceedings. Pittsburgh, Pa., Combustion Institute, 1967, p. 1075-79.

312. Deutch, J. M. and Zwanzig, R. (National Bureau of Standards), ANOMALOUS SPECIFIC HEAT AND VISCOSITY OF BINARY VAN DER WAALS MIXTURES. Journal of Chemical Physics 46, 1612-20 (March 1, 1967).

313. Deverall, J. E., THE EFFECT OF VIBRATION ON HEAT PIPE PERFORMANCE. Los Alamos Scientific Lab. Report LA-3798, Nov. 1967, 7 pp. (N68-16650).

314. Diamond, J. J., BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS, OCTOBER, NOVEMBER, DECEMBER 1968. U. S. National Bureau of Standards, Inst. for Materials Research, NBS-SP-315, January 1969, 78 pp.

315. Diazy, A. M., Ben-Aim, R., Laffitte, P., THERMAL ANALYSIS OF A COMBUSTION REACTION. Bull. Soc. Chim. Fr. 1967 (4), 1281-8 (Fr.); C.A. 67, 103333.

316. Diatlov, I. N., FLAME STABILIZATION IN GAS-TURBINE-ENGINE AFTERBURNERS. Kazanskii Aviatsionnyi Institut, Trudy, Seriia Aviatsionnye Dvigateli, 1965, No. 88, 104-13 (in Russian).

317. Diederichsen, J. and Gould, R. D., COMBUSTION INSTABILITY MEASUREMENTS OF THE VISIBLE AND ULTRAVIOLET RADIATION FROM PREMIXED FLAMES OF VARIABLE BURNING VELOCITY. Combust. Flame V9 N.1.25-31 (March 1965).

318. Digman, W. J., EFFECTS OF FUEL CONTAMINATION ON CORROSION OF AIRCRAFT FUEL SYSTEMS. Esso Air World V 15. 92-96 (1963); (Abstr.) J. Inst. Petrol. V50 N.485.89A (May 1964).

319. Dill, T. (Kathleen E. Dill, administratrix) (to Mobil Oil Corp.), CATALYTIC CRACKING OF HYDROCARBONS. U.S. 3,291,719 (Cl. 208-72), Dec. 13, 1966, Appl. May 23, 1963, and March 22, 1966; 4 pp.; C.A. 66, 87339 (1967).

320. Dimitrov, Khr. and Ignatiev, P., DEALKYLATION, FRAGMENTATION, AND C_5 DEHYDROCYCLIZATION OF 3-PHENYLPENTANE ON SILICA-ALUMINA CATALYST. J. Catal. 7 (2), 103-9 (1967); C.A. 66, 64892 (1967).

BIBLIOGRAPHY (Contd)

321. Dini, D., COMPUTATION OF PEAK TRANSIENT STRESSES IN JET ENGINE EXHAUST NOZZLES. L'Aerotecnica 46, 28-35 (February 1966) (in Italian).

322. Dieseraky, D., THEORETICAL AND PRACTICAL DEVELOPMENT OF GAS-FLAME RESEARCH. Freiberg Forschungsh., B No. 120, 15-200 (1967) (Ger.); C.A. 67, 101 567.

323. Disegna, W. L. and Foster, R. L. (Sinclair Research, Inc.), CRACKING-CATALYST DEMETALLIZATION. U.S. 3,[illegible] (Cl. [illegible]-415), May 24, 1966, Appl. Dec. 27, 1962; 7 pp.; C.A. 65, [illegible] (1966).

324. Dixon-Lewis, G., FLAME STRUCTURE AND FLAME REACTION KINETICS.I. Royal Society (London), Proceedings, Series A, 2[illegible], 4[illegible]5-513 (May 16, 1967).

325. Djordjevic, B. D., AERODYNAMIC FORCE ANALYSIS. VOLUME I. Auburn Univ., U.S. Army Contract DA-01-009-506-ORD-851 (Z), June 1966, 515 pp. (AD 802 293).

326. Djordjevic, B. D., AERODYNAMIC FORCE ANALYSIS, VOLUME II. Auburn Univ., U.S. Army Contract DA-01-009-506-ORD-851 (Z), June 1966, 343 pp. (AD 802 294).

327. Dobres, R. M., Rheaume, L., Cirpetta, F. G., (Davison Chem. Div., W. R. Grace and Co.) PORE STRUCTURE OF CRACKING CATALYSTS. Ind. Eng. Chem., Prod. Res. Dev. 5 (2), 174-82 (1966); C.A. 65, 2029 (1966).

328. Dolinskaia, R. A., REFERENCES ON HEAT AND MASS TRANSFER. Inzhenerno-Fizicheskii Zhurnal 12, 685-700 (May 1967) (in Russian).

329. Don, W. A., PETROLEUM FUELS FOR INDUSTRIAL GAS TURBINES. Combust, Engine Progr. (1965); (Abstr) J. Inst. Petrol. V 51 N. 503 171A-172A (Nov. 1965).

330. Donachie, M. J., Sprague, R. A., Talboom. F. P., Bradley, E. F., (United Aircraft Corp.), EFFECTS OF TURBINE ATMOSPHERES ON SULFIDATION CORROSION. American Soc. of Mechanical Engineers, Gas Turbine Conference and Products Show, March 5-9, 1967, Paper 67-GT-2, 13 pp.

331. Donne, M. D. and Meerwald, E., EXPERIMENTAL LOCAL HEAT-TRANSFER AND AVERAGE FRICTION COEFFICIENTS FOR SUBSONIC TURBULENT FLOW OF AIR IN AN ANNULUS AT HIGH TEMPERATURES. International Journal of Heat and Mass Transfer 9, 1361-76 (Dec. 1966).

332. Donth, E., THERMODYNAMIC INVESTIGATION OF THE SINGULARITY PROPERTIES OF THE CRITICAL POINT. Physica 34 (1), 1-16 (1967) (in German).

333. Dorling, T. A., Burlace, C. J., Moss, R. L., HYDROGEN ADSORPTION ON (1-13%) PLATINUM/SILICA CATALYST. J. Catal. 12 (2), 207-9 (Oct. 1968).

334. Doroshenko, V. E., Zaitsev, S.F., Furletov, V.I., TWO MODES OF OPERATION OF A COMBUSTION CHAMBER MODEL AS A SELF-OSCILLATING THERMOACOUSTIC SYSTEM. PMTF-Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1967, 64-70 (1967).

BIBLIOGRAPHY (Cont'd)

335. Dosanjh, D. S. and Weeks, T. M., (Syracuse Univ.), SOUND GENERATION BY SHOCK-VORTEX INTERACTION. AIAA Journal 5, No. 4, 660-9 (1967); Prepared in cooperation with U.S. Air Force Flight Dynamics Lab., Wright-Patterson AFB, U.S. Army Grants DA-ARO (D) -31-124-G210, DA-ARO(D)-31-124-G615, May, 1966, 10 pp. (AD 655 713).

336. Douchez, M., STUDY OF TRANSFERS IN THE MECHANICS OF SINGLE-PHASE FLUIDS. VOLUME 2 - BOUNDARY LAYER, EXPERIMENTAL RESULTS. Paris, Masson et Cie. Editeurs, 1966, 419 pp. (in French).

337. Douglas, G. W. and O'Loughlin, J. R. (Tulane Univ.), THE RELATION BETWEEN FLAME SHAPE AND CHAMBER COMBUSTION EFFICIENCY FOR A FLAME STABILIZED BY AN OPPOSED-JET FLAMEHOLDER. American Inst. of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, 3rd, Washington D.C., July 17-21, 1967, Paper 67-472. 9 pp.

338. Douglass, H. W. and Nored, D. L., PERFORMANCE OF JP-4 FUEL WITH FLUORINE-OXYGEN (PROPELLANT) MIXTURES IN 1000-POUND-THRUST ROCKET ENGINES. NASA (Natl Aeron Space Admin) Res. Mem. N.E58C18 (June 11, 1958) 30 pp.

339. Dow Chem. Co., DEHYDROCYCLIZATION CATALYST. Neth. 6,616,007, May 15, 1968.

340. Dow Chem. Co., DEHYDROGENATION-CYCLISATION CATALYST. Brit. 50731/66 (C 07c); February 12, 1969.

341. Dow Chem. Co., MATERIAL FACTORS (FOR FLAME HAZARD EVALUATION-6. FERRIC CHLORIDE (TO) ISOPROPYL ACETATE. Chem. Eng. Progr. V63 N. 2 89-90 (February 1967).

342. Draganov, B. Kh., MIXING OF GAS STREAMS IN COMBUSTION CHAMBERS. Energeticheskoe Mashinostroenie (USSR) 1966 (1), 68-72; U.S. Air Force Translation, Sept. 1968, 15 pp. (AD 684 657).

343. Drake, H. M. (NASA, Office of Advanced Research and Technology), AN OVERVIEW OF HYPERSONIC AIRCRAFT MISSIONS AND TECHNOLOGY. Aviation and Space: Progress and Prospects; Proceedings of the Annual Aviation and Space Conference, Beverly Hills, Calif., June 16-19, 1968, pp. 458-63.

344. DuPont, A.A. (Garrett Corp.), JET PROPULSION. Space/Aeronautics 50, 59-63, 114 (July 31, 1968).

345. Du Plessis, M. P., et al., MEASUREMENT OF CONCENTRATION GRADIENT IN PIPE-LINE FLOW OF SUSPENSIONS BY GAMMA RADIATION TECHNIQUE. Trans. Engng. Inst. Canada 9, (B4), 11 pp.

346. Dulberger, L. H., ADVANCED INTERCEPTOR AIRCRAFT. Space/Aeron. 1966 (November), 54-66.

347. Dunn, R. G., SUPERSONIC COMBUSTION SIMULATION. Proc. of the OAR Res. Appl. Conf., 14 March 1967, March 1967, 157-182 (N68-16384).

BIBLIOGRAPHY (Cont'd)

348. Dunn, I. J. (Univ. Idaho), APPLICATION OF LINEAR FREE ENERGY RELATIONSHIPS (LFER) TO HETEROGENEOUS CATALYSIS. J. Catal. 11 (1), 79-81 (May 1968).

349. Dupin, J. (Nord-Aviation), AIR-BREATHING PROPULSION SYSTEM FOR THE FIRST STAGE OF THE SPACE TRANSPORT. Aerospace Proceedings 1966; Royal Aeronautical Society, Centenary Congress and International Council of Aeronautical Sciences, Congress, 5th, London, England, Sept. 12-16, 1966, Vol. 1, ed. by J. Bradbrook et al, London, MacMillan, 1967, pp. 515-35, (in French).

350. Durfee, R. L., DEVELOPMENT OF ADVANCED BORON SLURRY FUEL FORMULATIONS. Atlantic Res. Corp. Tech. Report, February 1966- February 1967 on Phase 2, Report No. 43-5806, U.S. Air Force AFAPL TR-67-46, Contract AF 33(657)-14336, May 1967, 133 pp. (AD 381 279) (REPORT CLASSIFIED CONFIDENTIAL).

351. Dwyer, F. G. and Eastwood, S. C. (to Mobil Oil Corp.), HYDROCARBON CATALYST. U.S. 3,278,416 (Cl. 208-87), October 11, 1966, Appl. Nov. 13, 1962; 4 pp., C.A. 66, 39617 (1967).

352. Dzerzhinskii, F. E., All-Union Thermotechnical Institute (by K. I. Ivanov, K. E. Zeger, V. E. Chmovzh, V. I. Polyakovskaya, G. V. Kudryavova), IMPROVING THE FRICTIONAL AND CORROSIVE PROPERTIES OF HEAVY LIQUID FUELS. USSR 189,110 (Cl. C 10g), Nov. 17, 1966, Appl. April 5, 1965; C.A. 67, 66357.

BIBLIOGRAPHY (Cont'd)

353. Foranini, I., A METHOD FOR THE MEASUREMENT OF THE LOCAL DISTRIBUTION OF TURBULENCE INTENSITY IN JET FLAMES. Combust. Flame 11(3), 255-9 (1967); C. A. 67, 55025.

354. Echigo, R. Hishiwaki N., Hirata, M., THE RADIATION OF LUMINOUS FLAMES. Symp. Combust. 11, 381-8, discussion 388-9 (1966); C. A. 67, 110234.

355. Echigoya, E., Morikawa, K., Furuova, T., STUDIES ON CORRELATION BETWEEN METHODS OF PREPARATION, STRUCTURES AND ACTIVITIES OF SUPPORTED PLATINUM METAL CATALYSTS. 1. A CORRELATION BETWEEN METHODS OF PREPARATION, STRUCTURES AND ACTIVITIES OF SUPPORTED PALLADIUM CATALYSTS. Kogyo Kagaku Zasshi 71(11), 1768-73, A111-A112 (Nov 1968) (In Japanese).

356. Eckert, B., THE DEVELOPMENT OF HIGHLY LOADED COMBUSTION CHAMBERS FOR GAS TURBINES. Brennstoff-Waerme-Kraft V16 N.11.565-73 (Nov. 1964).

357. Eckert, E. R. G., et al., HEAT TRANSFER BIBLIOGRAPHY. International Journal of Heat and Mass Transfer 12, 349-63 (March 1969).

358. Eckert, E. R. G., et al., HEAT TRANSFER BIBLIOGRAPHY. International Journal of Heat and Mass Transfer 11, 1715-26 (November 1968).

359. Eckert, E. R. G., et al., HEAT TRANSFER - A REVIEW OF CURRENT LITERATURE. International J. of Heat and Mass Transfer 11, 1421-60 (October 1968).

360. Eckert, E. R. G., Sparrow, E. M., Ibele, W. E., Goldstein, R. J., HEAT TRANSFER BIBLIOGRAPHY. International Journal of Heat and Mass Transfer 10, 823-59 (June 1967).

361. Eckert, E. R. G., Ibele, W. E., Goldstein, R. J., HEAT TRANSFER BIBLIOGRAPHY. International Journal of Heat and Mass Transfer 9, 959-75 (September 1966).

362. Economos, C. (General Appl. Sci. Labs., Inc.), EXPERIMENTAL DETERMINATION OF HEAT TRANSFER DUE TO HYDROGEN COMBUSTION IN A BASE-FLOW REGION. IAA Accession No. A66-16408. Avail. AIAA, 15pp. (1966); C. A. 67, 13081.

363. Eddington, R. B., INVESTIGATION OF SUPERSONIC SHOCK PHENOMENA IN A TWO-PHASE (LIQUID GAS) TUNNEL. California Inst. of Technology, Jet Propulsion Laboratory Technical Report No. 32-1096, March 15, 1967.

364. Edelman, R. B., and Fortune, O. F., (General Applied Science Labs., Inc), A QUASI-GLOBAL CHEMICAL KINETIC MODEL FOR THE FINITE RATE COMBUSTION OF HYDROCARBON FUELS WITH APPLICATION TO TURBULENT BURNING AND MIXING IN HYPERSONIC ENGINES AND NOZZLES. AIAA Aerospace Sciences Meeting, 7th, New York, January 20-22, 1969, Paper 69-86, 12pp.

BIBLIOGRAPHY (Cont'd)

365. Edelman, R. and Fortune, O., AN ANALYSIS OF MIXING AND COMBUSTION IN DUCTED FLOWS. AIAA Aerospace Sciences Meeting, 6th, Jan. 22-24, 1968, AIAA Paper No. 68-114.

366. Edelman, R. B. and Spadaccini, L. J. (Applied Science Laboratories., Inc.), ANALYTICAL INVESTIGATION OF THE EFFECTS OF VITIATED AIR CONTAMINATION ON COMBUSTION AND [illegible] AIR BREATHING ENGINE GROUND TESTS. AIAA, Aerodynamic Testing Conference, 4th, Cincinnati, Ohio, April 28-30, 19[illegible], Paper 69-338, 33 pp. U.S. Air Force Contract No. AF 40(600)-67-C-0007.

367. Edelman, R. B. and Weilerstein, G. (General Applied Science Labs., Inc.), A SOLUTION OF THE INVISCID-VISCID EQUATIONS WITH APPLICATIONS TO BOUNDED AND UNBOUNDED MULTICOMPONENT REACTING FLOWS. AIAA Aerospace Sciences Meeting, 7th, New York, January 20-22, 1969, Paper 69-85, 16pp.

368. Edmister, W. C., APPLIED HYDROCARBON THERMODYNAMICS. EFFECT OF PRESSURE ON HEAT CAPACITY AND JOULE-THOMSON COEFFICIENT. Hydrocarbon Process. 46(5), 187-90 (1967); C. A. 67, 47788.

369. Edmister, W. C., APPLIED HYDROCARBON THERMODYNAMICS. HEAT CAPACITY DIFFERENCES. Hydrocarbon Process 46(6), 187-92 (1967); C. A. 67, 57742.

370. Edmonds, P. and Cooney, J. J., IDENTIFICATION OF MICROORGANISMS ISOLATED FROM JET FUEL SYSTEMS. Appl. Microbiol. 15, 411-6 (1967).

371. Edmunds, E. W. and Turrentine, W. A., OPERATION AND PERFORMANCE OF A GE1 TURBOJET ENGINE AT VARIOUS SIMULATED FLIGHT CONDITIONS. Arnold Engineering Development Center, Arnold Air Force Station Technical Report 5 August - 26 September 1966, Report No. AEDC-TR-67-14, prepared in cooperation with ARO, Inc., U. S. Air Force Contract AF 400(600)-1200, March 1967, 65pp. (AD 379562L) (REPORT CLASSIFIED CONFIDENTIAL).

372. Edney, B. E., EFFECTS OF SHOCK IMPINGEMENT ON THE HEAT TRANSFER AROUND BLUNT BODIES. AIAA Journal 6(1), 15-21 (1968).

373. Edwards, D. H., Parry, D. J., Jones, A. T., THE STRUCTURE OF THE WAVE FRONT IN SPINNING DETONATION. Journal of Fluid Mechanics 26, 321-36 (October 1966).

374. Edwards, D. C., ENGINEERING OUTLINE; SHOCK WAVES IN GASES. Engineering 205, 161-4 (January 26, 1968).

BIBLIOGRAPHY (Cont'd)

375. Edwards, D. K. (University of California at Los Angeles) and Tobin, R. D. (North American Aviation, Inc., Rocketdyne Div.), EFFECT OF POLARIZATION ON RADIANT HEAT TRANSFER THROUGH LONG PASSAGES. American Society of Mechanical Engineers, Winter Annual Meeting and Energy Systems Exposition, New York, November 27 - December 1, 1966, Paper 66-WA/HT-32; ASME, Transactions, Series C - Journal of Heat Transfer 89, 132-8 (May 1967).

376. Edwards, W. R. (to Esso Research and Engineering Co.), METHOD FOR MAKING A ROCKET AND MISSILE FUEL. U. S. 3, 298, 948 (Cl. 208-66), January 17, 1967, Appl. February 13, 1959 and November 16, 1962; C. A. 66, 67 503 (1967).

377. Ehlers, F. E. (Boeing Sci. Res. Labs.), IBM 7090 PROGRAM FOR COMPUTING TWO-DIMENSIONAL AND AXIALLY SYMMETRIC SUPERSONIC FLOW OF AN IDEAL GAS. II. SUBROUTINES FOR COMPUTING THE SHOCK AND FREE STREAMLINE DIVIDING TWO REGIONS OF NONUNIFORM SUPERSONIC FLOW. NASA Accession No. N66-14519 Rept. No. DI-82-0462, 1965, 52pp.; C. A. 66 57351 (1967).

378. Eisenberg, J. D., HIGH-ENERGY FUELS FOR SUPERSONIC TRANSPORT RESERVES. U. S. National Aeronautics and Space Administration Report NASA TN D-3987, May 1967, 34pp.

379. Elco Corp., ANTIOXIDANT AND CATALYST. Ind. Eng. Chem. V57 N. 8.99 (Aug 1965).

380. Elrod, C. W., Botteri, B. P., Kelly, L. G., Paulson, A. M., Quinn, G. F. HYDROGEN - JP-4 DUAL FUEL CONCEPT FOR THE C-5A AIRCRAFT. U. S. Air Force Aero Propulsion Laboratory, Wright - Patterson A. F. B. Technical Report, Report No. AF APL-TR-66-54, September 1966, 64pp. (AD 806811).

381. El'terman, L. I., KINETICS, PRODUCT COMPOSITION, AND MECHANISM OF ETHYLENE OXIDE - INITIATED CRACKING OF PROPANE-BUTANE MIXTURES. Tr. Molodykh Uchenykh, Saratovsk. Univ., Vyp. Fiz., Saratov 1965, 147-55 (Russ); C. A. 65, 18377 (1966).

382. Emelianova, G. I. and Hassan, S. A., ABOUT THE ANOMALOUS CHARACTER OF SINTERING OF SUPPORTED CATALYSTS. Intern. Congr. Catalysis, 4th, Moscow, June 23-29, 1968, Preprint No. 73, 10pp.

383. Emmenthal, K. D., ON THE COMBUSTION AND FLOW PROCESSES IN PREHEATED GAS FLOW WITH HIGH PRESSURE. Deutschean Forschungsanstalt fur Luftund Raumfahrt, Inst. fuer Strahlantriebe, Sept. 1968, 23pp. (in German, English Summary) (N69-22397).

384. Engel, W. B. and Hazelton, R. F., MICROBES AND THEIR JET FUEL ENVIRONMENT. SAE - Paper 670869 for Meeting Oct. 2-6, 1967, 12pp.

BIBLIOGRAPHY (Cont'd)

385. Englin, B. A., Churshukov, E. S., Chirkova, G. B., Marinchenko, N. I., [illegible] CHARACTERISTICS OF JET FUELS IN THE PRESENCE OF CONDENSING WATER. Khim. i Tekh. Topliv i Masel 13(10), 50-2 (1968).

386. Englin, B. A., Gryazn[illegible], [illegible], Cmirnov, G. S., Kumishair, A. A., [illegible]leney, N. F., EFFECT OF ETHYL CELLOSOLVE ON THE THERMAL STABILITY OF T-1 AND TS-1 FUELS. Khim. Tekhnol. Topl. Masel 12(5), 56-8 (1967) (Russ), C. A. 66, 106792 (1967).

387. Englin, B. A., Rozhkov, I. V., [illegible], V. M., Tamodynskaya, T. F., PREVENTING THE FORMATION OF ICE CRYSTALS IN AVIATION FUELS. Khim. i Tekhnol. Topliv. i Masel. V8 N.12.50-55 (December 1963).

388. Epperly, W. R. and Pramuk, F. S. (to Esso Research and Engineering Co.), IMPROVING THERMAL STABILITY OF JET FUELS U. S. 3, 27[illegible], 422, (Cl. 208-310), October 11, 1[illegible], [illegible] September 12, 1962 and August 23, 1965; app.: C. A. 66, [illegible]759 (196[illegible])

389. Erdmann, J. C. and Jahoda, J. A. (Boeing Co.), DETERMINATION OF INSTANTANEOUS HEAT SOURCES WITH INERT THERMOMETERS. Journal of Applied Physics 38, 459-65 (February 1967).

390. Erivanskaya, L. A., Shevtsova, G. A. et al. DEHYDROCYCLIZATION OF 2-n-BUTYLNAPHTHALENE OVER A PLATINUM-ALUMINA CATALYST. Neftekhimiya 8, No. 2, 192-7 (March - April 1968).

391. Erofeev, B. V. and Ivan'kovich, E. F., CATALYSTS FOR DEHYDROCYCLIZATION OF PARAFFINS. U. S. S. R. 189, 597 (Cl. B 01j), November 30, 1966, Appl. August 9, 1965; C. A. 67, 83704.

392. Ershin, Sh. A. and Yarin, L. P., AERODYNAMICS OF A TURBULENT DIFFUSION FLAME JET IN A WAKE FLOW. Akademiya Nauk Kazakskoi SSR, Alma-Ata. Vestnik 18(4), (205), 46-51 (1962); L. J. Hofschlag, Johns Hopkins Univ., Applied Physics Lab. Translation, February 1969, 12pp. (AD 686 4[illegible]1).

393. Ershin, Sh. A. and Yarin, L. P., DIFFUSE COMBUSTION IN A LAMINAR BOUNDARY LAYER. Fizika Goreniia i Vzryva 1, 101-5 (April - June 1965); Combustion, Explosion, and Shock Waves 1, 69-72 (April - June 1965).

394. Ershin, Sh. A., Rybalova, R. P., Yarin, L. P., COMPUTATION OF A DIFFUSION FLAME IN A TRANSITIONAL FLOW RANGE. Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Vestnik 22(9), 48-50 (1966); U. S. Air Force Translation, September 1968, 9pp. (AD 685 512).

395. Esgar, J. B. (U. S. National Aeronautics and Space Administration, Lewis Research Center), THE IMPACT OF ADVANCED FUEL SELECTION UPON ENGINE DEVELOPMENT. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper.

BIBLIOGRAPHY (Contd)

396. Essenhigh, R. H. and Ramadass, V. (Penn State Univ.), IGNITION ENERGY OF DUST CLOUDS. Eastern Section of the Combustion Inst. 1968 Technical Meeting, October 1968. Paper.

397. Esso Research and Engineering Co. (by W. F. Arey, Jr. and W. J. Mattox) CATALYSTS FOR CATALYTIC CRACKING OF PETROLEUM FRACTIONS. Fr. 1, 390, 918 (Cl. C. 10g), March 5, 1965; U. S. Appl. Jan. 24, 1962; 7pp.; C. A. 63, 8100 (1965).

398. Esso Research and Engineering Co., HYDROCRACKING WITH ADDED HALOGEN OVER PLATINUM ON ZEOLITIC ALUMINOSILICATE. Brit. 1, 103, 335 corres. U. S. 3, 318, 802. publ. 2/14/68, f. U. S. 1/2/65.

399. Esso Research and Engineering Co., MOLECULAR-SIEVE CRACKING CATALYSTS OF IMPROVED STABILITY. Neth. Appl. 6, 406, 326 (Cl. B. 01j), December 6, 1965, Appl. June 4, 1964; 15pp.; C. A. 64, 13283 (1966).

400. Esso Research and Engineering Co., BIFUNCTIONAL CATALYST. Neth. Appl. 6, 610, 507 (C . B. 01j), January 27, 1967, U. S. Appl. July 26, 1965, 16pp.; C. A. 67, 4649.

401. Esso Research and Engineering Co., ELECTROSTATIC PROCESS FOR REMOVING WATER FROM LIQUID HYDROCARBONS. Neth. Appl. 6, 514, 388 (Cl. C 10g), May 8, 1967, Appl. November 5, 1965, 12pp.; C. A. 67, 110 321.

402. Esso Research and Engineering Co., POLYMETHYLBENZENES ISOMERIZED OVER HYDROTREATED MOLYBDENUM-SILICA-ALUMINA CATALYST. Belg. 718, 223, open January 20, 1969, Corresponds to U. S. 3, 409, 687, Appl. U. S. December 7, 1967.

403. Esso Research and Engineering Co., PREPARATION OF POTENTIAL HIGH ENERGY FUELS. French Patent No. 1, 537, 241 (Cl. C. 10 l), July 15, 1968; Appl. No. 577, 563.

404. Esterly, J. R. (NASA), GROUND TEST FACILITIES FOR AIRCRAFT AIRBREATHING PROPULSION SYSTEM DEVELOPMENT. University of Tennessee, Space Inst., Tullahoma, Tenn., Jan. 31, 1967, Lecture, 54pp.

405. Evans, A., Jr., Hibbard, R. R., Watt, J. J., FOULING CHARACTERISTICS OF ASTM JET A FUEL WHEN HEATED TO 700 DEG F IN A SIMULATED HEAT EXCHANGER TUBE. U. S. National Aeronautics and Space Administration, Lewis Research Center, Dec. 1968, 29pp. (N69-12851).

406. Every, R. L. and Thieme, J. C., IGNITION AND COMBUSTION CHARACTERISTICS OF LIQUID OXYGEN AND LIQUID METHANE MIXTURES. Chem. Eng. Progr. Symp. Ser. V62 N.61.113-17 (1966).

407. Eyster, H. C., Scribner, W. G., Short, F. R., SPECTROPHOTOMETRIC DETERMINATION OF PARTS-PER-BILLION IRON IN HIGH-TEMPERATURE HYDROCARBON JET FUELS. 152nd Acs Mtg (New York Sept 1966); Anal Chem V39 N.2 251-53 (Feb. 1967).

BIBLIOGRAPHY (Cont'd)

408. Fabuss, B. M. and Borsanyi, S., (Monsanto Research Corp.), MICRO COKER FOR FUEL HEAT STABILITY TESTS. U. S. 3, 319, 6[illegible]7 (Cl 23-2[illegible]), May 9, 19[illegible], Appl. September 6, 1963, [illegible]pp.; C. A. [illegible]; [illegible].

409. Fahlbusch, H. (Lockheed Aircraft Corp.), ON THE RECOVERY FACTOR IN FLOW OF CAMBERED WALLS. Zeitschrift fur Flugwissenschaften 15, 1[illegible]-6 (April 19[illegible]).

410. Fairbairn, A. R., THE HIGH TEMPERATURE PYROLYSIS OF SIMPLE ORGANIC MOLECULES AND THE FORMATION O[illegible]. Assistant Secretary of Defense (Manpower and Reserve Affairs), December 19[illegible], [illegible]pp. (AD [illegible]).

411. Faist, G. A. and Parry, H. J., INLET NOISE SUPPRESSOR STUDIES - I. Lockheed - California Co. Report No. LAC-18413, Dec. 19[illegible], 52pp. (AD 815 160L).

412. Faith, L. E., Bustany, S. N., Hanson, D. N., Wilke, C. R., PARTICLE PRECIPITATION BY SPACE CHARGE IN TUBULAR FLOW. Ind. Eng. Chem. Fundamentals 6, 519-26 (November 1967).

413. Fanter, D. L., Grayson, M. A., Wolf C. J. (McDonnell Douglas Corp.), [THE MECHANISM OF THE HIGH-TEMPERATURE] PYROLYSIS OF PROTONATED AND DEUTERATED CYCLOHEXANE AND CYCLOHEXENE. Amer. Chem. Soc. Mtg., 154th, Chicago, September 10-15, 1967, Abstr. Papers: Abstr. No. B 60.

414. Farbur, B. S., Abbott, S. D., et al. (Texas A and M Univ), THE DEHYDROGENATION OF [illegible]MENE TO α - METHYL-STYRENE. J. Catal. 12(2), 210-1 (October 19[illegible]).

415. Faro, I. D. V., and Keirsey, J. L., RAMJET TECHNOLOGY. SECTION ON FLOW PROCESSES AND ENGINE PERFORMANCE. CHAPTER 5B. SUPERSONIC INLETS. Johns Hopkins Univ., Applied Physics Lab. Technical Memo TG-610-5B-Rev. November 1967, 73pp. (PB 177 282).

416. Farrar, R. B. (Bendix Corp.), HIGH-DENSITY FUEL TO EXTEND RANGE OF RAMJET MISSILE. AIAA, Propulsion Joint Specialist Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-632; Journal of Spacecraft and Rockets 5, 1364-7 (November 1968).

417. Fedarovich, N. V. and Repryntsava, S. M., MECHANISM OF MOTION AND THE HEAT TRANSFER OF DISPERSED MATERIAL IN A VERTICAL CHANNEL. Akademiia Navuk BSSR, Vestsi, Seryia Fizika - Tekhnichnykh Navuk, 1967, No. 2, 87-91 (In Belorussian).

418. Fells, I. and Rutherford, A. G., BURNING VELOCITY OF METHANE-AIR FLAMES. Combustion and Flame 13(2), 130-8 (April 1969).

419. Fendell, F. E. (TRW, Inc.), ASYMPTOTIC TREATMENT OF PREMIXED FLAME STRUCTURE WITH DIFFUSION. AIAA Journal 5, 808, 809 (April 1967).

BIBLIOGRAPHY (Contd)

420. Fendell, F. E. and Smith R. R. (TRW Systems), DIFFUSION-FLAME SHAPE IN THE WAKE OF A FALLING DROPLET. AIAA Journal 5 (11), 1984-8 (1967); U. S. Army AROD-6433:5, revision of Report dated 1 March 1967, Contract DAHC04-67-C-0015, March 1967, 8pp. (AD 666 381).

421. Fendell, F. E., Sprankle, M. L., Dodson, D. S. (TRW, Inc.), THIN-FLAME THEORY FOR A FUEL DROPLET IN SLOW VISCOUS FLOW. Journal of Fluid Mechanics 26, 267-80 (October 1966).

422. Ferri, A., A REVIEW OF SCRAMJET PROPULSION TECHNOLOGY. AIAA, Annual Meeting, 3rd, Boston, Mass., November 29 - December 2, 1966, Paper 66-826; Journal of Aircraft 5, 3-10 (January - February 1968). U. S. Air Force Contract AF 33(615)-63-C-1184.

423. Ferri, A., REVIEW OF PROBLEMS IN APPLICATION OF SUPERSONIC COMBUSTION. J. Roy. Aeronautical Soc. 68, 575-95 (September 1964).

424. Ferri, A. and Libby, P. A. (Polytechnic Inst. of Brooklyn), A NEW TECHNIQUE FOR INVESTIGATING HEAT TRANSFER AND SURFACE PHENOMENA UNDER HYPERSONIC FLOW CONDITION. Journal of the Aeronautical Sciences 24(6), 464 (1957).

425. Ferris, J. C., TRANSONIC AERODYNAMIC CHARACTERISTICS OF A MODEL OF A SUPERSONIC FIGHTER-BOMBER AIRPLANE WITH EXTERNAL FUEL TANKS AND OTHER MODIFICATION. National Aeronautics and Space Administration Report No. NASA-TN-D-3701, NASA Accession No. N67-10748, 1966, 57 pp.; C. A. 66, 106434 (1967).

426. Feugier, A. and Van Tiggelen, A., IDENTITY OF THE IONS CREATED BY ELECTRON IMPACT IN FLAMES. Combustion and Flame 11, 234-8 (June 1967).

427. Fick, E. and Schwegler, H., QUANTUMSTATISTICAL THERMODYNAMICS WITH SEVERAL TEMPERATURES FOR INDIVISIBLE OBSERVATION LEVEL. Zeitschrift für Physik 200(2), 165-85 (1967) (In German).

428. Filatova, T. N., Tolstopyatova, A. A., Balandin, A. A., CATALYTIC PROPERTIES OF LUTETIUM OXIDE IN ALCOHOL DEHYDROGENATION AND DEHYDRATION AND TETRALIN DEHYDROGENATION REACTION. Zh. Fiz. Khim. 41(1), 35-9 (1967) (Russ); C. A. 67, 2567.

429. Fiorini, V., PERFORMANCE OF RAMJET ENGINES WITH SUPERSONIC COMBUSTION. Associazione Italiana di Aerotecnia and Associazione Italiana Razzi, Congresso Nazionale AIDA-AIR, Milan, Italy, Oct. 5-7, 1967; Rivista di Ingegneria, January 1968, p. 8-16.

430. Fischer, J. F. and Hausrath, A. H. (General Dynamics), STRUCTURAL CONSIDERATIONS IN THE DESIGN OF A LIQUID HYDROGEN TANK FOR HYPERSONIC VEHICLES. Society of Automotive Engineers, Aeronautic and Space Engineering and Manufacturing Meeting, Los Angeles, Calif., Oct. 3-7, 1966, Paper 660679, 13pp.

BIBLIOGRAPHY (Cont'd)

431. Fish, A. (Shell Research, Ltd.) THE NONISOTHERMAL OXIDATION OF NEOPENTANE. Combustion and Flame 13, 23-32 (February 1969).

432. Fish, A., Read, I. A., Affleck, W. S., Haskell, W. W. (Shell Research, Ltd.), THE CONTROLLING ROLE OF COOL FLAMES IN TWO-STAGE IGNITION. Combustion and Flame 13, 39-49 (February 1969).

433. Fish, A., (Shell Res. Ltd.), THE NONISOTHERMAL OXIDATION OF 2-METHYLPENTANE. II. THE CHEMISTRY OF COOL FLAMES. Proc. Roy. Soc., Ser. A 298(1455), 204-37 (1967); C. A. 67, 81655.

434. Fishel, N. A. (to Universal Oil Products Co.), A C_6 OR HIGHER CYCLOPARAFFIN IS DEHYDROGENATED. U. S. 3, 409, 691 (Cl 260-673.5), November 5, 1968, Appl October 10, 1966.

435. Fisher, H. D. and Weiss, H. G., INVESTIGATION OF SUPERSONIC AIRCRAFT FUEL TANK FIRE AND EXPLOSION HAZARDS. Dynamic Science Corp. Final Report June 1965 - August 1966, Report No. SN-76, AFAPL TR-66-105, U. S. Air Force Contract AF 33(615) - 2905, September 1966, 134pp. (AD 804 894).

436. Fisher, R. E. (Marquardt Corp.), FUTURE TRENDS IN EARTH ORBITAL TRANSPORTATION. American Astronautical Society, Annual Meeting, 13th, Dallas, Texas, May 1-3, 1967, Paper 67-84, 6pp.

437. Flanagan, J. E., EXPLICATION OF RATE PHENOMENA IN CATALYTIC SYSTEMS. Univ. Ariz., Diss. (1968) 105pp; Abstr. Diss. Abstr. B 29(4), 1338B (October 1968).

438. Fletcher, E. A. (University of Minnesota), EARLY SUPERSONIC COMBUSTION STUDIES AT NACA AND NASA. In Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., August 14-20, 1966, Proceedings. Pittsburgh, Pa., Combustion Inst., 1967, p. 729-37.

439. Flieder, W. G., Richard, C. E., Young, C. F., Walters, F. M. (AiResearch Manufacturing Co.), HYPERSONIC RESEARCH ENGINE STRUCTURES AND COOLING. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper (Classified).

440. Flossdorf, J. and Wagner, H. Gg., SOOT FORMATION IN NORMAL AND DISTURBED HYDROCARBON-AIR FLAMES. Z. Phys. Chem. (Frankfurt am Main) 154(3-4), 113-28 (1967) (Ger); C. A. 67, 23774.

441. Fomichev, M. S., PRESSURE PULSATION AND HEAT TRANSFER ON THE WALL IN THE DISCRETE VORTEX ZONE OF A RESTRAINED JET. Akademiia Nauk SSSR, Izvestiia, Energetika i Transport 1966, 115-8 (Nov. - Dec.) (In Russ.).

442. Fomichev, Yu. V., Gostunskaya, I. V., Kazanskii, B. A., CATALYTIC DEHYDROCYCLIZATION OF n-HEXANE ON ALUMINOPLATINUM CATALYST. Izv. Akad. Nauk SSSR, Ser. Khim. 1967(5), 1121-6 (Russ); C. A. 67, 108 336.

BIBLIOGRAPHY (Contd)

443. Fowler, R. G., CONVAIR HYPERSONIC SHOCK TUNNEL - OPERATING CONDITIONS. General Dynamics/Convair, June 1960, 50pp. (AD 681 815).

444. Franke, W., TESTING THE COMBUSTION PROPERTIES OF AEROJET FUELS IN A COMBUSTION CHAMBER. Freiberg. Forschungsh., A 1966(387), 117-31(Ger); C. A. 67, 34620.

445. Franklin, W., Heilbron, J., Moskowitz, S., Schober, T., SMALL GAS TURBINE ENGINE COMPONENT TECHNOLOGY - TURBINE. VOLUME I. PHASE I SUMMARY REPORT and VOLUME II. PHASE II SUMMARY REPORT. Curtiss Wright Corp., October 1968 and August 1968, 328pp., 224pp. (AD 680 73 and AD680 255)

446. Forde, J. M., Molder, S. and Szpiro, E. J., SECONDARY LIQUID INJECTION INTO A SUPERSONIC AIRSTREAM. Journal of Spacecraft and Rockets 3(8), 1172-6 (1966).

447. Francis, R. H. (Hawker Siddeley Aviation, Ltd., England), AIR-BREATHING REUSABLE LAUNCHERS. in Space Technology Conference, Palo Alto, Calif., May 9-12, 1967, Proceedings, New York, Society of Automotive Engineers, Inc. (SAE Conference Proceedings P-16), 1967, p. 169-74.

448. Fresco, G. P. (Allied Chem. Corp.), Klaus, E. E., Tewksbury, E. J. (Pa. State Univ.), MEASUREMENT AND PREDICTION OF VISCOSITY-PRESSURE CHARACTERISTICS OF LIQUIDS. Amer. Soc. Mech. Eng. Gas Lubric. Int. Symp., June 17-20, 1968; Abstr. Mech. Eng. 90(12), 65-7 (Dec. 1968).

449. Fridshtein, I. L. and Zimina, N. A., THE EFFECT OF VARIOUS ACTIVATOR'S ON THE PROPERTIES OF ALUMINUM-CHROMIUM CATALYSTS. Nauchn. Osnovy Podbora i Proizv. Katalizatorov, Akad. Nauk SSSR, Sibirsk. Otd. 1964, 274-80 (Russ); C. A. 63, 9100 (1965).

450. Fridshtein, I. L. and Zimina, N. A., THE EFFECT OF REDUCTION AND OXIDATION ON THE ACTIVITY OF ALUMINA-CHROMIUM CATALYSTS. Nauchn. Osnovy Podbora i Proizv. Katalizatorov, Akad. Nauk SSSR, Sibirsk. Otd. 1964, 267-73 (Russ); C. A. 63, 9100 (1965).

451. Frilette, V. J. and Weisz, P. B. (Socony Mobil Oil Co., Inc.), SELECTIVELY CRACKING ALIPHATIC HYDROCARBONS. U. S. 3, 257, 311 (Cl. 208-120) June 21, 1966, Appl. July 6, 1964; 4pp. Continuation-in-part of U. S. 3, 140, 322; C. A. 65, 8634 (1966).

452. Frisch, B. and Roeper, M., THE THEORY OF THE DYNAMIC FLOW METHOD IN THE MEASUREMENT OF SPECIFIC SURFACE AND MICROPOROSITY. Kolloid-Z. Z. Polym. 223, No. 2, 150-60 (April 1968).

453. Froning, H. D. (McDonnell Douglas Corp.), INTERSTELLAR PROPULSION - A POSSIBLE FUTURE DERIVITIVE OF AIR-BREATHING TECHNOLOGY. American Inst. of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-646, 10pp.

BIBLIOGRAPHY (Cont'd)

454. Frost, W. and Dzakowic, G. S. (Univ. of Tennessee Space Inst.), GRAPHICAL ESTIMATION OF NUCLEATE-BOILING HEAT TRANSFER. Ind. Eng. Chem., Process Des. Develop. 6(3), 346-7 (1967); C. A. 67, 13087.

455. Fulford, G. P. and Pei, D. C. T., A UNIFIED APPROACH TO THE STUDY OF TRANSFER PROCESSES. Ind. Eng. Chem. 60(5), 47-69 (1969).

456. Furlani, A., Moretti, G., Guerrieri, A., AROMATIZATION REACTIONS OF ACETYLENIC HYDROCARBONS: THE TIANIUM TETRACHLORIDE-DIETHYLALUMINUM CHLORIDE CATALYTIC SYSTEM. J. Polymer Sci., Part B 5(6), 523-6 (1967); C. A. 67, 43483.

457. Furno, A. L., Martindill, G. H., Zabetakis, M. G., LIMITS OF FLAMMABILITY OF HYDRAZINE-HYDROCARBON VAPOR MIXTURES. U. S. Bur. Mines Rept. Invest. N. 6505 (1964) 7p.

458. Fursov, A. P. and Zherdev, G. S., EXPERIMENTAL INVESTIGATION OF JET-ENGINE COMBUSTION CHAMBER COOLING. Aircraft Construction and Air-Fleet Equipment, ed. by Iu. N. Alekseev, Kharkov, Izdatel'stvo Khar'kovskogo Gosudarstvennogo Universiteta (Republikanskii Mezhvedomstvennyi Nauchno-Tekhnicheskii Sbornik, No. 12), 1967, p. 48-51 (In Russian).

BIBLIOGRAPHY (Contd)

459. Gabel, R. M., (Continental Aviation and Engineering Corp.), Moskowitz, S. L., Schober, T. E. (Curtiss-Wright Corp.), HIGH INLET TEMPERATURE DOUBLES TURBINE ENGINE POWER-BUT BLADE COOLING IS A MUST. SAE Journal 77 (5), 65-72 (May 1969).

460. Gadbois, S. E., Dunn, P. M., Kepler, C. E., Owen, F. S., O'Brien, R.L., INVESTIGATION OF THE SUPERSONIC THROUGH-FLOW COMPRESSOR CONCEPT. VOLUME II. ANALYTICAL AND EXPERIMENTAL INVESTIGATIONS OF SUPERSONIC CASCADES AND DIFFUSERS. United Aircraft Corp., Res. Labs. Final Report 15 November 1965 - 15 February 1967, Report No. UA CRL-F910391-15, U.S. Air Force AFAPL TR-67-60 Vol 2, U.S. Air Force Contract AF33(615)-3286, June 1967, 144 pp. (AD 815 963L).

461. Gaede, A. E. and Lopez, H. J. (Garrett Corp., AiResearch Manufacturing Co.) SELECTION OF NOZZLE CONTOURS FOR A RESEARCH SCRAM-JET ENGINE. AIAA, Propulsion Joint Specialist Conf. 3rd, Washington D. C., July 17-21, 1967, Paper 67-453, 8 pp.; Contract No. NAS 1-5116.

462. Gaillard-Cusin, F., James, H., Laffitte, P., NONEXPLOSIVE CHARACTER OF REACTIONS IN THE FIELD OF PENINSULAR COMBUSTION IN REACTION SYSTEMS WITH THREE EXPLOSION LIMITS. C. R. Acad. Sci., Paris, Ser. C 264 (17), 1447-50 (1967) (Fr.); C.A. 67, 75026.

463. Galanova, Z. S., RADIANT HEAT TRANSFER IN THE VICINITY OF THE STAGNATION POINT OF A BLUNT BODY. Leningrad Univ. Vestnik (USSR) 19, Seriya Matematiki, Mekhaniki i Astronomii, No. 1, 120-30 (1966); Johns Hopkins Univ., Applied Physics Lab. Report No. TG-230-T503, TT 66-61387, U.S. Navy Contract NOw-62-0604, December 1966. 16 pp. (AD 648 350).

464. Galich, P. N., Golubchenko, I. T., Gutyrya, V. S., SELECTIVE CRACKING OF NORMAL ALKANES ON ZEOLITE-CA-A. Neft i Gas. Prom., Inform. Nauchn.-Tekhn. Sb. 1965 (4), 51-3 (Russ.); C.A. 64, 7934 (1966).

465. Galitseiskii, B. M., Dreitser, G.A., Izosimov, V. G., Kalinin, E. K., Koshkin, V. K., EXPERIMENTAL STUDY OF UNSTEADY HEAT TRANSFER IN A TUBE IN THE PRESENCE OF A VARIABLE GAS FLOW RATE. Akademiia Navuk BSSR, Vestsi, Seryia Fizika-Tekhnichnykh Navuk, 1967, No. 2, 56-64 (Russ.).

466. Galitseiskii, B. M., Dreitser, G.A., Izosimov, V.G., Kalinin, E.K., Koshkin, V.K., EXPERIMENTAL STUDY OF UNSTEADY HEAT TRANSFER IN A TUBE DURING HEAT-FLUX FLUCTUATIONS. Akademiia Navuk BSSR, Vestsi, Seryia Fizika-Tekhnichnykh Navuk 1967, No. 2, 65-76 (Russ.).

467. Gallant, R. W. (Dow Chem. Co.), PHYSICAL PROPERTIES OF HYDROCARBONS. XV. C_5-C_8 ALKANES. Hydrocarbon Process. 46 (7), 121-9 (1967); C.A. 67, 94221.

468. Gault, J. D. and Gunter, D.E., Jr. (Boeing Co.), ATMOSPHERIC TURBULENCE CONSIDERATIONS FOR FUTURE AIRCRAFT DESIGNED TO OPERATE AT LOW ALTITUDES. Journal of Aircraft 5 (6), 574-7 (1968).

BIBLIOGRAPHY (Cont'd)

469. Gaydon, A. G., THE USE OF SHOCK TUBES FOR STUDYING FUNDAMENTAL COMBUSTION PROCESSES. Symp. Combust. 11, 1-13 (1966) (Pub. 1967); C.A. 67, 109967.

470. Gahin, J., THE SOVIET TU-144 CIVIL SUPERSONIC TRANSPORT. L'Aeronautique et l' Astronautique 1969, No. 8, 7-12 (in French).

471. Gelbin, D., THE SURFACE TRANSPORT OF VARIOUS GASES ON A PLATINUM-ALUMINA CATALYST. Chem. Eng. Sci. 23, No. 1, 41-9 (January 1968).

472. Gemperlein, H., FUELS FOR AIR-BREATHING JET-PROPULSION ENGINES. Deut Ges Mineraloelwiss u Kohlechem Bavarian Sect Mtg (Munich Jan. 10, 1963); Erdoel Kohle V16 N. 12.1196-1200 (Dec. 1963).

473. General Dynamics/Fort Worth, AMSA TASK S-7. DESIGN CHARACTERISTICS STUDY. VOLUME I. POINT DESIGN ANALYSIS REPORT. PROPULSION. SECTION 8. Final Report No. FZM-4822-1-8, U.S. Air Force Contract AF 33(657)-15360, June 1967, 100 pp. (AD 382 078L) (REPORT CLASSIFIED SECRET).

474. General Dynamics/Fort Worth Div., AMSA TASK S-7. DESIGN CHARACTERISTICS STUDY. VOLUME III. FINAL TECHNICAL REPORT. Report No. FZM-4822-3, U.S. Air Force Contract AF 33(657)-15360, June 1967, 240 pp. (AD 382 201L) (REPORT CLASSIFIED SECRET).

475. General Electric Co., Advanced Technology and Demonstrator Programs Dept., TURBO-ACCELERATOR CYCLE EVALUATION AND EXPERIMENTAL VERIFICATION. ITEM VI SYSTEM INTEGRATION. Final Report June 1964 - 22 November 1966, AFAPL TR-66-136, U.S. Air Force Contract AF 33(615)-1306, Dec. 1966, 154 pp. (AD 378 186L) (REPORT CLASSIFIED SECRET).

476. Gerard, G., STRUCTURAL GUIDELINES FOR MATERIALS DEVELOPMENT: SOME VEHICLE PERFORMANCE AND DESIGN GENERALIZATIONS. J. of Aircraft 5 (6), 564-9 (1968).

477. Gerashchenko, O.A. and Fedorov, V.G., THERMOELECTRIC HEAT-FLUX MEASURING ELEMENTS. Akad. Nauk SSSR. Sibirskoe Otdel. Inst. Avtomatiki i Elektrometrii. Trudy 2, 207-10 (1966); U.S. Air Force Translation FTD-HT-23-689-67. August 1967, 10 pp. (AD 667 704).

478. Gerasicheva, Z., Botnikov, Ya. A., Osipova, E.V., THERMAL CRACKING OF PARAFFINS FOR PREPARATION OF α-OLEFINS. Khim. i Tekhnol. Topliv i Masel 11 (9), 1-6 (1966) (Russ.); C.A. 65, 19895 (1965).

479. Gibson, C. H., Lyon, R. R., Hirschsohn, I., REACTION PRODUCT FLUCTUATIONS IN A SPHERE WAKE. AIAA Fluid and Plasma Dynamics Conf., June 24-26, 1968, AIAA Paper No 68-686.

480. Giedraitis, A., Gimbutis, G., et al., HEAT TRANSFER DURING TRANSVERSE FLOW OF A FREE JET OF THERMALLY DISSOCIATED GASES OVER A CYLINDER. Liet. TSR Mokslu Akad. Darb., Ser. B. 1966 (2), 135-41 (Russ.); C.A. 66, 57256 (1967).

BIBLIOGRAPHY (Cont'd)

481. Gil'debrand, E. I., LOW CONCENTRATION CATALYSTS ON CARRIERS. Int'l. Chem. Eng. 6 (3), 449-80 (July 1966); Katalizatory na Nositelyakh, Trudy Inst. Khimicheskikh Nauk, Akademiya Nauk Kazakhskoi SSSR 13, 67-117 (1965).

482. Gilinskii, S. M. and Chernyi, G. G., SUPERSONIC FLOW AROUND OF A SPHERE BY A COMBUSTIBLE MIXTURE OF GASES WITH CONSIDERATION OF IGNITION DELAY TIME. Akad. Nauk SSSR. Izvest. Mekhanika Zhidkosti i Gaza 1968 (1), 20-32; U.S. Air Force Trans., Aug. 1968, 29 pp. (AD 684639).

483. Gilinskii, S. M. and Chernyi, G. G., SUPERSONIC FLOW OF A COMBUSTIBLE GAS MIXTURE PAST A SPHERE WITH ALLOWANCE FOR THE IGNITION DELAY TIME. Izv. Akad. Nauk SSSR, Mekh. Zhidkosti i Gaza, 1968, 20-32 (Jan.-Feb.).

484. Gilinskii, S. M. and Zapryanov, Z.D., TRANSITION OF A COMBUSTION MIXTURE FROM SUPERSONIC FLOW TO THE CHAPMAN-JOUGET REGIME. Akad. Nauk SSSR, Izvest. Mekhanika Zhidkosti i Gaza 1967 (3), 137-40; U.S. Air Force Translation, July 1968, 15 pp. (AD 681 597).

485. Gill, W. N., Porta, E. W., Nunge, R. J., HEAT TRANSFER IN THERMAL ENTRANCE REGION OF COCURRENT FLOW HEAT EXCHANGERS WITH FULLY DEVELOPED LAMINAR FLOW. Int. Jnl. Heat Mass Transfer 11, 1408-12 (1968).

486. Gimbutis, G. and Tamulionis, A., HEAT TRANSFER IN COMBUSTION CHAMBERS DURING BURNING OF GAS-OXYGEN MIXTURES. Liet. TSR Mokslu Akad. Darb. Ser. B 1966 (2), 125-33 (Russ.); C.A. 66, 57356 (1967).

487. Ginzburg, I. P., AEROGASDYNAMICS. Moscow, Izdatel'stvo Vysshaia Shkola, 1966, 404 pp. (Russ.).

488. Gitis, K.M., Polinin, V.L., Samsonov, G.V., Kosolapova, T. Ya., Rozengart, M.E., CATALYTIC ACTIVITY OF Cr AND ITS CARBIDES IN AROMATIZATION OF HYDROCARBONS. Probl. Kinetiki i Kataliza, Akad. Nauk SSSR 11, 230-5 (1966) (Russ.); C.A. 66, 20653. (1967).

489. Gladrow, E.M. and De Feo, R. J. (Esso Research and Eng. Co.), HYDROCARBON OIL SILICA - ALUMINA CRACKING CATALYSTS CONTAINING GALLIUM OXIDE. U.S. 3,242,069 (Cl. 208-120), March 22, 1966, Appl. January 12, 1965; 7 pp. C.A. 64, 15654 (1966).

490. Gladrow, E.M. and De Feo, R.J. (Esso Research and Eng. Co.), SILICA-ALUMINA-GALLIUM OXIDE CATALYST. U. S. 3,198,749 (Cl. 252-453), August 3, 1965, Appl. Oct. 10, 1960, 6 pp.; C.A. 63, 11219 (1965).

491. Glawe, G. E., Krause, L.N., Dudzinski, T.J. (NASA Lewis Res. Ctr.), MULTIPLE-FUNCTION PROBE FOR AIRFLOW RESEARCH. AIAA Journal 7 (4), 776-7 (April 1969).

492. Glassman, I., Hansel, J., Eklund, T., (Princeton Univ.), HYDRODYNAMIC EFFECTS IN THE FLAME SPREADING, IGNITABILITY AND STEADY BURNING OF LIQUID FUELS. Combustion and Flame 13, 99-101 (February 1969).

BIBLIOGRAPHY (Contd)

493. Glenny, R. J. E. and Barnes, J. F., SOME MATERIALS AND COOLING TECHNIQUES APPLICABLE TO AIR-BREATHING ENGINES AT HIGH FLIGHT SPEEDS. Journal of Aircraft 3, 507-14 (Nov.-Dec. 1966).

494. Glickstein, M. R. and Whitesides, R. H. Jr., FORCED CONVECTION NUCLEATE AND FILM BOILING OF SEVERAL ALIPHATIC HYDROCARBONS. American Soc. of Mech. Engineers, Paper No. 67-HT-7, 1967, 8 pp.

495. Godar, R. L. (Petrolite Corp.), HYDROCARBON DEPOSIT INHIBITOR FOR USE IN HEAT EXCHANGERS OF OIL REFINERY EQUIPMENT. U.S. 3,328,285 (Cl. 208-48), June 27, 1967, Appl. August 19, 1960 and Jan. 6, 1965, 9 pp.; C.A. 67, 83706.

496. Goesch, W. H., Boensch, F. D., Phillips, L. R. (U.S. Air Force Flight Dynamics Lab.), STRUCTURAL DESIGN CONSIDERATIONS FOR CRYOGENIC FUELED HYPERSONIC CRUISE VEHICLES. AIAA, Annual Meeting and Tech. Display, 5th, Phil. Pa., Oct. 21-24, 1968, Paper 68-1088, 10 pp.

497. Goldaev, I.P. and Cherepanov, V.P., CALCULATION OF THE COMPOSITION OF THE COMBUSTION PRODUCTS OF $C_CH_HO_ON_N$-TYPE FUEL IN THE CASE OF A STOICHIOMETRIC FUEL-OXIDIZER RATIO. Aircraft Const. and Air Fleet Equipment. ed. by Iu. N. Alekseev, Kharkov, Izdatel'stvo Khar'kovskogo Gosudarstvennogo Univ. (Respublikanskii Mezhvedomstvennyi Nauchno-Tekhnicheskii Sbornik, No. 12), 1967, p. 43-7 (in Russian).

498. Goldaev, I.P. and Cherepanov, V.P., ENGINEERING METHOD FOR THERMODYNAMIC CALCULATIONS OF JET-TYPE COMBUSTION CHAMBERS USING HYDROCARBON FUEL AND AIR. Samoletostroenie i Tekhnika Vozdushnogo Flota (USSR) 1967 (10), 14-19; U.S. Air Force Translation, Sept. 1968, 13 pp. (AD 684 595).

499. Goldaev, I.P. and Pershin, A.P., STAND FOR EXPERIMENTAL INVESTIGATIONS OF PROCESSES OCCURRING IN HIGH-INTENSITY HEATING. Samoletostroenie i Tekhnika Vozdushnogo Flota. Vypusk 5, ed. by Iu. N. Alekseev, Kharkov, Izdatel'stvo Khar'kovskogo Universiteta, 1966, p. 18-25. (Russ.).

500. Goldburg, A., Murman, E.M., Shreeve R.P., Wygranski, I.J., A PREDICTIVE METHOD FOR THE BLENDING AND MIXING OF A SUPERSONIC TURBULENT JET AT A SMALL ANGLE TO A SUPERSONIC STREAM. Boeing Sci. Res. Labs., Oct. 1968, 30 pp. (AD 683 569).

501. Goldstein, M.E., Yang, W.-J., Clark, J.A. (Mass. Inst. of Tech.), MOMENTUM AND HEAT TRANSFER IN LAMINAR FLOW OF GAS WITH LIQUID-DROPLET SUSPENSION OVER A CIRCULAR CYLINDER. J. Heat Transfer 89 (2), 185-94 (1967); C.A. 67, 13130.

502. Golobic, R. A. and Nerem, R. M., SHOCK-TUBE MEASUREMENTS OF END-WALL RADIATIVE HEAT TRANSFER IN AIR. AIAA Journal 6, 1741-7 (Sept. 1968).

503. Golovin, N. E., WHAT FUTURE PROPULSION DEVELOPMENTS FOR SPACE EXPLORATION. Astronautics and Aeronautics 5, 44-6 (Nov. 1967).

BIBLIOGRAPHY (Contd)

504. Goodall, D. G. and Ingle, R., THE IGNITION OF FLAMMABLE FLUIDS BY HOT SURFACES. Amer. Soc. Test. Mater., Spec. Tech. Publ. No. 406, 64-104 (1966); C.A. 67, 23722.

505. Goodman, H., Bradley, R., Sickles, T., HIGH TEMPERATURE HYDROCARBON FUELS RESEARCH IN AN ADVANCED AIRCRAFT FUEL SYSTEM SIMULATOR ON FUEL AFFB-9-67, North American Rockwell Corp./Los Angeles Div., U.S. Air Force Tech. Report AFAPL-TR-68-25, Contract AF 33(615)-3228, Feb. 1968, 156 pp.

506. Gomozov, V. M. and Stanina, G. R., QUALITY CONTROL OF JET-AIRCRAFT FUEL. Khimi i Tekh. Topliv i Masel 13 (7), 38-40 (1968) (Russ.).

507. Gorbunov, G. M., Trusov, V. L., Kristoforov, I. L., INVESTIGATION OF THE HEAT RELEASE IN THE FLAME TUBE OF A GAS-TURBINE-ENGINE COMBUSTION CHAMBER IN THE INFLOW REGION OF SECONDARY AIR STREAMS. Aviatsionnaia Tekhnika 1968; No. 1, 56-63 (in Russian).

508. Gorbunov, G. M. and Solokhin, Z.L., TESTING OF AIRCRAFT AIR-BREATHING JET ENGINES. (SELECTED CHAPTERS). I Pytaniya Aviatsioonny kh Vozdushno-Reaktivnykh Dvigatelei, Moscow, 1967, p. 96-256; U.S. Air Force Trans., Oct. 1968, 203 pp. (AD 685 492).

509. Gorbunov, G.M. et al., INVESTIGATION OF THE WORKING PROCESS IN THE COMBUSTION CHAMBERS OF GAS-TURBINE ENGINES: SELECTED ARTICLES. Aviatsionny Inst., Moscow. Trudy (USSR) 1964, No. 157, 5-16, 51-90; U.S. Air Force Translation FTD-MT-65-114, TT 67-61676, March 1967, 78 pp. (AD 651 086).

510. Goresh, J. W. and Dunn, R. G., TURBULENT HEAT TRANSFER IN THE THERMAL ENTRANCE REGION OF A PERFECTLY INSULATED PIPE. U.S. Air Force Aerospace Research Labs., Office of Aerospace Res. Tech. Report No. ARL-66-0178, Sept. 1966, 47 pp. (AD 648 497).

511. Gorton, R. E. (United Aircraft Corp., Pratt and Whitney Aircraft Div.), TEMPERATURE MEASUREMENT FOR AIRCRAFT TURBINE ENGINE DEVELOPMENT. Soc. for Experimental Stress Analysis, Annual Spring Meeting, Ottawa, Canada, May 16-19, 1967, Paper. 36 pp.

512. Gosch, W. D. (RAND Corp.), THERMAL PROTECTION FOR LIQUID-HYDROGEN FUEL TANKS IN HIGH-SPEED, LONGRANGE AIRCRAFT. 1965, 66 pp. (AD 625 407); C. A. 66, 77897 (1967).

513. Gouse, S. W. (Massachusetts Inst. of Technology), AN INDEX TO THE TWO-PHASE GAS-LIQUID FLOW LITERATURE. Cambridge, Mass., M.I.T. Press, 1966. 867 pp. U. S. Navy Contract No. Nonr-1841(73).

514. Graham, R., Vidaurri, F., Jr., Gully, A., CATALYTIC DEHYDROGENATION OF CYCLOHEXANE. A TRANSPORT CONTROLLED MODEL. AIChE Journal 14 (3), 473-9 (1968).

BIBLIOGRAPHY (Contd)

515. Gravalos, F. G. (General Electric Co.), ANALYTICAL FOUNDATIONS OF AEROTHERMOCHEMISTRY. Zeitschrift für angewandte Mathematik und Physik 17, [illegible] (November [illegible], 196[illegible]).

516. Gray, P. F. and Yang, C. H. (Defense Res. Corp.), THE PRESENT THEORETICAL POSITION IN EXPLOSION THEORY. In Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., August 14-20, 1966, Proceedings. Pittsburgh, Pa., Combustion Inst., 1967, p. 1057-61.

517. Greenberg, A. E. (Aerospace Corp.), VEHICLES AND PROPULSION - AN OVERVIEW. American Astronautical Society, Annual Meeting, 1[illegible], Dallas, Texas, May 1-3, 1967, Paper 67-62. 15 pp.

518. Gremillion, A. F. (Monsanto Co.), CHROMIA-ALUMINA HYDROCARBON-CONVERSION CATALYST. U.S. 3,179,602 (Cl. 252-465), April 20, 1965, Appl. Sept. 6, 1961; 3pp.; C.A. 63, 5424 (1965).

519. Gregory, T. J., Petersen, R. H., Wynn, J. A., PERFORMANCE TRADEOFFS AND RESEARCH PROBLEMS FOR HYPERSONIC TRANSPORTS. Journal of Aircraft 2 (4), 266-71 (1965).

520. Gregory, T. J., Wilcox, D. E., Williams, L. J. (NASA, Ames Res. Ctr), THE EFFECTS OF PROPULSION SYSTEM-AIRFRAME INTERACTIONS ON THE PERFORMANCE OF HYPERSONIC AIRCRAFT. AIAA Propulsion Joint Specialist Conf., 3rd, Washington, D. C., July 17-21, 1967, Paper 67-493. 8pp.

521. Grenleski, S. E. and Billig, F. S. (Johns Hopkins Univ.), INVESTIGATION OF AN ACTIVELY COOLED LEADING EDGE FOR HYPERSONIC RAMJET ENGINES. Journal of Aircraft 5, 359-66 (July-August 1968).

522. Grenleski, S.E., Jr. and Falk, F., AN INVESTIGATION OF THE CATALYTIC IGNITION OF JP-5 AND AIR MIXTURES. Soc. Automotive Engrs. Natl. Aeron. and Space Eng. and Mfg. Mtg. (Los Angeles, 10/5-9/64) Paper N. 918C 8 pp.

523. Gretz, R. D. (Battelle Memorial Inst.), THE ROLE OF SURFACE DIFFUSION IN HETEROGENEOUS NUCLEATION MECHANISMS. Surface Science 5, 4[illegible]-77 (1967); AROD 5058: 2, U.S. Army Contract DA-ARO(D)-31-124-G624, August 1966, 13 pp. (AD 652 955).

524. Griffen, W. S., DESIGN AND PERFORMANCE OF FLUERIC SHOCK POSITION SENSOR FOR A MIXED-COMPRESSION SUPERSONIC INLET. U.S. Nat'l Aeron. and Space Admin., Lewis Res. Ctr, January 1969, 57 pp. (N 69-16582).

525. Griffith, B. J. and Little, H. R. (ARO Inc.), CORRELATION OF MASS INJECTION DRAG DATA AND SLENDER CONES AT HYPERSONIC SPEEDS. AIAA Journal 7 (3), 525-7 (March 1969).

BIBLIOGRAPHY (Cont'd)

526. Griffiths, J. F., Skirrow, G., Tipper, C.F.H., STUDIES OF STABILIZED LOW TEMPERATURE IGNITION. I-CYCLOHEXANE. Combustion and Flame 12, 443-5 (October 1968).

527. Griffiths, J. F., Skirrow, G., Tipper, C.F.H., STUDIES OF STABILIZED LOW TEMPERATURE IGNITION II - ACETALDEHYDE AND PROPENE. Combustion and Flame 13 (2), 195-8 (April 1969).

528. Grishin, A. M., IGNITION AND SELF-IGNITION OF REACTIVE SUBSTANCES UNDER IDEAL THERMAL-CONTACT CONDITIONS. Inzhenerno-Fizicheskii Zhurnal 13, 345-52 (Sept. 1967).

529. Grishin, A. M., IGNITION OF REACTING SUBSTANCES. PMTF-Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1966, 25-30 (Sept. - Oct.).

530. Groeneweg, J. F., MEASURED EFFECTS OF GASEOUS FLOW SYSTEM DYNAMICS ON ACOUSTIC-MODE INSTABILITY. Nat'l Aeron. and Space Adm., Lewis Res. Ctr., March 1969, 17 pp. (N69-20882).

531. Gross, H. J. and Schoen, G., THE DANGER OF IGNITION BY ELECTROSTATIC CHARGES GENERATED BY FUELS FLOWING THROUGH FILTERS. Erdoel Kohle, V. 17 N.4.279-82 (April 1964).

532. Gross, S. (Boeing Co.), AN IMPROVED FINITE-DIFFERENCE METHOD FOR HEAT-TRANSFER CALCULATIONS. Journal of Spacecraft and Rockets 4, 538 (April 1967).

533. Gruber, H. L. and Hausen, A., SELECTIVE DETERMINATION OF SPECIFIC METAL SURFACES. Kolloid-Z. Z.Polymere 214 (1), 66-78 (November 1966).

534. Grunnet, J. L. and Laster, M. L., PRESSURE RECOVERY IN HYPERSONIC ENGINE TEST FACILITIES. J. Spacecraft and Rockets 4 (5), 643-9 (May 1967).

535. Gryaznov, V. M., Mal'donado et al., CONVERSIONS OF n-PENTANE OR CYCLO-PENTANE ON (DRAWN) PLATINUM, PALLADIUM, OR PALLADIUM/SILVER ALLOY. Dokl. Akad. Nauk SSSR 183 (1), 101-4 (Chemistry) (November 1968).

536. Gukhman, A. A., APPLICATION OF SIMILARITY THEORY TO THE INVESTIGATION OF HEAT-AND MASS-TRANSFER PROCESSES. Moscow, Izdatel'stvo Vysshaia Shkola, 1967. 304 pp. (In Russ.).

537. Gunn, P. J., DIFFUSION AND CHEMICAL REACTION IN CATALYSIS AND ABSORPTION. Chem. Eng. Sci. 22, No. 11, 1439-55 (Nov. 1967).

538. Gureev, A. A., Rozhkov, I. V., Shirokov, G. B., Churshukov, E. S., A METHOD FOR EVALUATING THE CORROSIVE ACTION OF FUELS AND THE EFFECT-IVENESS OF ANTICORROSIVE ADDITIVES. Khim. i Tekhnol. Topliv. i Masel. V.11 No. 12 54-56 (Dec. 1966).

BIBLIOGRAPHY (Contd)

539. G[illegible]v, V. N., CALCULATION OF HYPERSONIC ASYMMETRIC JETS. Akademiia Nauk SSSR, Izvestia, Mekhanika Zhidkosti i Gaza, [illegible], [illegible] (Jan. - Feb.) (In Russ.).

540. G[illegible]man, D. and Jacobs, N. F. (Ill. Inst. Technol.), SHOCK TUBE STUDY OF INDUCTION PERIOD KINETICS OF THE ACETYLENE-OXYGEN REACTION. Amer. Chem. Soc. Mtg. ([illegible]th), Atlantic City, Sept. [illegible], [illegible], Abstr. Paper. No. PHYS-[illegible].

541. [illegible]yot, P., THE NORD-AVIATION "TURBO-RAM" COMBINATION-FROM THE "GRIFFON" TO A SPACE TRANSPORT VEHICLE. Doc-Air-Espace [illegible], 29-58 (January), (In French).

BIBLIOGRAPHY (Cont'd)

542. Haensel, V. and Hoekstra, J. (Universal Oil Products Co.), CATALYTIC DEHYDROGENATION OF PARAFFINIC HYDROCARBONS. U. S. 3,31[illegible],579 (Cl. 260-683.[illegible]), March 21, 1967, Appl. February 14, 1966; 4 pp.; C.A. 66, 117684 (1967).

543. Haensel, V. and Hoekstra, J. (to Universal Oil Products Co.). CATALYTIC DEHYDROGENATION OF PARAFFINIC HYDROCARBONS. U. S. 3,293,319 (Cl. 260-683.3), December 14, 1966. Appl. April 8, 1966, 5 pp.; C.A. 66, 39627 (1967).

544. Haensel, V. and Hoekstra, J. (Universal Oil Products Co.), DEHYDROGENATION CATALYSTS FOR PARAFFINIC HYDROCARBONS. U. S. 3,291,755 (Cl. 252-464), December 13, 1966, Appl. February 14, 1966; 4 pp.; C.A. 66, 30777 (1967).

545. Hahnemann, H. W., APPROXIMATE HEAT-TRANSFER THEORY FOR CHANNEL FLOWS. Forschung, im Ingenieurwesen 33 (1), 1-12 (1967) (in German).

546. Halls, G. A. (Rolls-Royce, Ltd., Aero-Engine Div.), AIR COOLING OF TURBINE BLADES AND VANES. Flight International 92, 73-7 (July 13, 1967). Abridged.

547. Halstead, C. J. and Jenkins, D. R. ("Shell" Research, Ltd.), PHOTOMETRIC METHODS FOR DETERMINING RADICAL CONCENTRATIONS IN HOT GASES IN NOZZLES. AIAA Journal 7 (2), 318-23 (1969).

548. Hamilton, W. F. and Holloway, R. A. (Lockheed Aircraft Corp.), SPONTANEOUS IGNITION TESTING FOR HIGH SPEED AIRCRAFT. Fire Resistance of Hydraulic Fluids; Symposium Presented at a Meeting of the American Society for Testing and Materials and the Society of Automotive Engineers, New Orleans, January 26, 27, 1966, Papers, Philadelphia, American Society for Testing and Materials (ASTM Special Technical Publication No. 406), pp. 150-68.

549. Hara, K., EFFECTS OF PREPARATIVE METHODS OF SILICA-ALUMINA CRACKING CATALYSTS ON THEIR GEL MICROSTRUCTURE, SURFACE ACIDITY, AND CATALYTIC ACTIVITY. Asahi Garasu Kenkyu Hokoku 15, 45-54 (1965) (Japan). C.A. 63, 12937 (1965).

550. Harper, C. W. (National Aeronautics and Space Administration), PROSPECTS IN AERONAUTICS RESEARCH AND DEVELOPMENT. (31st Wright Brothers Lecture). AIAA Aircraft Design for 1980 Operations Meeting, AIAA Paper No. 68-217, February 12-14, 1968; Journal of Aircraft 5 (5), 417-26, 427-8 (1968).

551. Haroldson, H. W., Lias, M. D., McGee, C. S., Miller, F. H., Oppenheim, J. E., XB-70 FLIGHT TEST SUMMARY REPORT. THERMAL ENVIRONMENT AND CONTROL (FLIGHTS 1-50 THRU 1-60). North American Aviation, Inc., Los Angeles Div. Report for November 1966-May 1967, Report No. NA-67-460, U. S. Air Force Contract AF 33(657)-15871, June 1967, 115 pp. (AD 815 446).

BIBLIOGRAPHY (Cont'd)

552. Harris, C. J. (General Electric Co.), EXPERIMENTAL IDENTIFICATION OF SHOCK TUNNEL FLOW REGIMES. AIAA Journal 7 (2), 365-7 (February 1969).

553. Harris, D. N., AVIATION FUEL SAFETY, Soc. Automotive Engrs. Mtg. Paper N. 660265 (1966); SAE (Soc. Automotive Engrs.) Trans. V74 (Pt. 2) 187-91 (1966).

554. Harris, J. C. and Steinmetz, E. A., OPTIMIZATION OF JP-4 FUEL EMULSIONS AND DEVELOPMENT OF DESIGN CONCEPTS FOR THEIR DEMULSIFICATION. Monsanto Research Corp. Final Report, USAAVLABS Technical Report 68-79, U. S. Army Contract DAAJ02-67-C-0107, November 1968, 109 pp. (AD683 597).

555. Harris, J. C. and Steinmetz, E. A., INVESTIGATION AND ANALYSIS OF AIRCRAFT FUEL EMULSIONS. Monsanto Research Corp., Dayton Lab. Final Report 15 June 1966-17 June 1967. U. S. Army USAAVLABS-TR-67-70, Contract DA-44-177-AMC-445(T), December 1967, 176 pp. (AD 668 248).

556. Harris, J. C. and Steinmetz, E. A (Monsanto Research Corp.), EMULSIFIED JET ENGINE FUEL. Society of Automotive Engineers, National Aeronautic Meeting, April 24-27, 1967, Paper 670365, 7 pp.

557. Hartmann, A., THEORY AND TEST OF FLOW MIXING FOR TURBOFAN ENGINES. Journal of Aircraft 5 (6), 522-7 (1968).

558. Hartmann, A., THEORETICAL AND EXPERIMENTAL INVESTIGATION ON FANENGINES WITH MIXING-OPTIMAL LAYOUT OF FANENGINES WITH AND WITHOUT MIXING. AIAA Propulsion Joint Specialist Conference, 3rd, Washington, D. C., July 17-21, 1967, Paper 67-416, 13 pp.

559. Hartmann, D., THE INFLUENCE OF RADIAL BLADE GAPS ON THE MECHANICAL EFFICIENCY OF MULTI-STAGE TURBINES. Ph.D. Thesis Technische Hochschule Hannover, West Germany, 1967, 137 pp. (in German) (N68-15123).

560. Harwood, C. F. and Pilpel, N., MEASUREMENT OF FLOW PROPERTIES OF POWDERS. Chem. and Process Eng. 47 (7), 92-6 (July 1968).

561. Hatchett, L. A. et al, FUEL-RELATED PROBLEMS IN ENGINE FUEL SYSTEMS. SAE Mtg. Paper N. 660714 (1966); SAE (Soc. Automot Eng.) Trans. V75 N. 3 441-63 (1967).

562. Hasegawa, K. and Kajikawa, M., THE ANALYSIS OF ANTI-ICING ADDITIVES IN JET FUEL BY INFRARED SPECTROPHOTOMETRY, 16th Chem. Soc. Japan Ann. Mtg. Bull. Japan. Petrol. Inst. V6.19-25 (1964).

563. Hawk, N. E. and Amick, J. L. (Univ. of Michigan), TWO-DIMENSIONAL SECONDARY JET INTERACTION WITH A SUPERSONIC STREAM. AIAA Journal 5, 655-60 (April 1967).

BIBLIOGRAPHY (Cont'd)

564. Hawthorne, R. D., Ackerman, G. H., Nixon, A. C., A MATHEMATICAL MODEL OF A PACKED-BED HEAT-EXCHANGER REACTOR FOR DEHYDROGENATION OF METHYLCYCLOHEXANE: COMPARISON OF PREDICTIONS WITH EXPERIMENTAL RESULTS. A.I.CH.E. Journal 14 (1), 69-76 (1968).

565. Hayes, B. (Univ. of California, Los Alamos Scientific Laboratory), RESEARCH NOTES ON DETONATION AND SHOCK GENERATED ELECTRICAL SIGNALS. Western States Section/The Combustion Inst. 1968 Fall Meeting, October 28-29, 1968, Paper 68-44.

566. Hazlett, R. N., CONTROL OF SULFATE REDUCING BACTERIA IN NAVY FUEL SYSTEMS. U. S. Naval Research Laboratory Interim Report No. NRL-MR-1737, December 1966, 8 pp. (AD 805 730L).

567. Hazlett, R. N., FACTORS IN THE COALESCENCE OF WATER IN FUEL. U. S. Naval Research Lab. Report No. NRL-6669, February 1968, 32 pp. (AD 667 715).

568. Heald, E. R. (Douglas Aircraft Co., Inc.), HYPERSONIC TRANSPORT DESIGN CONSIDERATIONS. Japan Society for Aeronautical and Space Sciences, Journal 15, 91-7 (March 1967) (in Japanese).

569. Heathman, J. H. (General Dynamics Corp.), and Phillips, L. R. (U. S. Air Force Flight Dynamics Lab.), DESIGN, FABRICATION AND TESTING OF A FLIGHTWEIGHT, 6,000 GALLON, LIQUID HYDROGEN TANKAGE SYSTEM FOR ADVANCED VEHICLE APPLICATIONS. AIAA and ASME, Structures, Structural Dynamics and Materials Conference, 9th, Palm Springs, Calif., April 1-3, 1968, AIAA paper 68-356. 16 pp.

570. Hedrick, H. G., Reynolds, R. J., Crum, M. G. (General Dynamics), FACTORS INFLUENCING THE MECHANISM OF CORROSION OF ALUMINUM ALLOYS BY AEROBIC BACTERIA. Develop. Ind. Microbiol. 8, 267-74 (1966); C.A. 67, 67162.

571. Hedrick, H. G., Carroll, M. T., Owen, H. P., Pritchard, D. J., VIABILITY OF SELECTED MICRO-ORGANISMS IN HYDROCARBON FUELS. Appl. Microbiol. V11.472-75 (1963); (Abstr) J. Appl. Chem. (London) V14 N.4.I-359 (Apr. 1964).

572. Heldenfels, R. R. (NASA, Langley Research Center), STRUCTURAL PROSPECTS FOR HYPERSONIC AIR VEHICLES. Aerospace Proceedings 1966; Royal Aeronautical Society, Centenary Congress and International Council of the Aeronautical Sciences, Congress, 5th, London, England, September 12-16, 1966. Volume 1, ed. by J. Bradbrooke et al., London, Macmillan, 1967, pp. 561-82, 583.

573. Henderson, H. T. and Nixon, A. C. (Shell Development Co.), STUDIES ON THE MEASUREMENT OF THERMAL STABILITY OF ADVANCED AIRCRAFT FUELS. Amer. Chem. Soc., Div. Petrol. Chem. Preprints 14 (3), B153-B161 (September, 1969).

BIBLIOGRAPHY (Contd)

574. Henderson, H. T. and Nixon, A. C. (Shell Development Co.), THE EFFECT OF OXYGEN CONCENTRATION ON THE THERMAL STABILITY OF NAPHTHENES. Amer. Chem. Soc., Div. Petrol. Chem., Preprints 12 (1), 119-28 (1967); C.A. 67, 55919.

575. Hendey, N. I., SOME OBSERVATIONS ON CLADOSPORIUM RESINAE AS FUEL CONTAMINANT AND POSSIBLE ROLE IN CORROSION OF ALUMINUM-ALLOY FUEL TANKS. Trans. Brit. Mycological Soc. V47 N.4.467-75 (1964); (Abstr) Corrosion Abstr. V4 N.5.345 (Sept. 1965).

576. Herkenrath, H. and Moerk-Moerkenstein, P., SURVEY ON PROBLEMS IN THE FIELD OF NUCLEATE BOILING AND FILM BOILING. NASA Accession No. N66-14379, Report No. NASA-TT-F-9809, 1965, 59 pp. (Ger); C.A. 66, 57258 (1967).

577. Herron, W. C. (Lockheed Aircraft Corp.) and Mettler, G. W. (Products Research and Chemical Corp.), CORROSION AND CORROSION CONTROL OF AIRCRAFT INTEGRAL FUEL TANKS. Materials Protection 8, 43-7 (April 1969).

578. Hersch, M., A MIXING MODEL FOR ROCKET-ENGINE COMBUSTION. NASA (Natl Aeron Space Admin) Tech Note N.D-2881 (June 1965) 24P.

579. Hetnarski, R. B., STRESSES IN LONG CYLINDER DUE TO ROTATING LINE SOURCE OF HEAT. AIAA Journal 7 (3), 419-23 (March 1969).

580. Heyman, R. J. (Martin Marietta, Denver Div.), COMBUSTION IN COMPRESSIBLE TURBULENT MIXING FLOWS. Western States Section/The combustion Inst. 1968 Fall Meeting, October 28-29, 1968. Paper 68-28.

581. Hiam, L., Wise, H., Chaikin, S. (Stanford Research Inst.), CATALYTIC OXIDATION OF HYDROCARBONS ON PLATINUM. J. Catalysis 10 (3), 272-6 (1968).

582. Hiatt, R. et al., HOMOLYTIC DECOMPOSITIONS OF HYDROPEROXIDES. SUMMARY AND IMPLICATIONS FOR AUTOXIDATION. IV. METAL-CATALYZED DECOMPOSITIONS. V. THERMAL DECOMPOSITIONS. Journal of Organic Chemistry 33, 1416-20; 33, 1430-5; 33, 1436-41 (1968).

583. Hill, D. E., PENETRATION OF A LIQUID JET INJECTED INTO A GAS STREAM. Douglas Aircraft Co. Report SM-47782, Revised October 1965.

584. Hill, E. C., Pritchard, J. A. V., Byron, D., Davies, I., THE ESTIMATION OF MICRO-ORGANISMS IN PETROLEUM PRODUCTS. J. Inst. Petrol. V53 N.524 275-79 (Aug 1967).

585. Hill, E. C., Evans, D. A., Davies, I., GROWTH AND SURVIVAL OF MICRO-ORGANISMS IN AVIATION KEROSINE. Inst. Petroleum - J. 53 (524), 280-4 (August 1967).

BIBLIOGRAPHY (Cont'd)

586. Hill, F. K., Unger, H. J., Dickens, W. P. (John Hopkins Univ.), SPECTROSCOPIC MEASUREMENTS OF COMBUSTION GAS COMPOSITION IN SUPERSONIC FLOW. American Institute of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, June 14-18, 1965, Paper 65-580; AIAA Journal 5, 873-81 (May 1967).

587. Hines, R. W. and Sabatella, J. A., TURBO-ACCELERATOR SYSTEMS INTEGRATION STUDY. Pratt and Whitney Aircraft Final Report 20 March 1964-20 June 1966, Report No. PWA-2870, AF APL-TR-66-78, U. S. Air Force Contract AF 33 (615) - 1305, October 1966, 249 pp. (AD 376 572L) (REPORT CLASSIFIED SECRET).

588. Hirschbeck, J. and Riedl, J. (Farbwerke Hoechst A.-G.), PROCESS FOR EVAPORATING AND SUPER HEATING THERMALLY UNSTABLE HYDROCARBON MIXTURES. U. S. 3, 330, 870 (Cl. 208-92), July 11, 1967, Ger. Appl. October 20, 1964, 3 pp.; C.A. 67, 75141.

589. Hirschler, H. E. (Sun Oil Co.), CRACKING CATALYSTS FOR HYDROCARBONS. U. S. 3,220,944 (Cl. 208-120), November 30, 1965, Appl. August 8, 1961, and March 16, 1965; 2pp.; C.A. 64, 6371 (1966).

590. Hishida, T., Uchijima, T., Yoneda, Y., LINEAR FREE ENERGY RELATIONSHIPS (LFER) IN HETROGENEOUS CATALYSIS. 7. REACTIVITY OF RING HYDROGENS IN CATALYTIC DEHYDROGENATION OF CYCLOHEXANES. J. Catal. 11 (1), 71-8 (May 1968).

591. Hitzman, D. O. and Linnard, R. E., CONTROL OF MICROBIAL GROWTHS IN THE STORAGE OF PETROLEUM FUELS 7th World Petrol. Congr. (Mexico City 4/2-8/67) Paper N.PD-36 (2).

592. Hlavacek, V., Marek, M., Kubicek, M. MODELING OF CHEMICAL REACTIONS. 10. MULTIPLE SOLUTIONS OF ENTHALPY AND MASS BALANCES FOR A CATALYTIC REACTION WITHIN A POROUS CATALYST PARTICLE. Chem. Eng. Sci. 23 (9), 1083-97 (September 1968).

593. Hoffman, A. L. (California Institute of Technology), A SINGLE-FLUID MODEL FOR SHOCK FORMATION IN MHD SHOCK TUBES. Journal of Plasma Physics 1, 193-207 (May 1967).

594. Hoffman, J. D. (Purdue University), A GENERAL METHOD FOR DETERMINING OPTIMUM THRUST NOZZLE CONTOURS FOR CHEMICALLY REACTING GAS FLOWS. American Institute of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, 2nd, Colorado Springs, Colo., June 13-17, 1966, Paper 66-638; AIAA Journal 5, 670-6 (April 1967); Grant No. NsG-592.

595. Holleman, B. M. B., POLLUTION IN AIRCRAFT FUELS. U. S. Dept. Commerce Clearinghouse Federal Sci. Tech. Inform. Tdck N.42 045 (1965); (Abstr) Corrosion Abstr. V5 N.6 425 (Nov. 1966).

BIBLIOGRAPHY (Contd)

596. Hollister, C. and Sinanoglu, O; MOLECULAR BINDING ENERGIES J. Am. Chem. Soc. V88 N.1.13-21 (1966).

597. Homan, F. R., ADVANCED TURBINE ENGINE GAS GENERATOR (AT EGG) DEVELOPMENT PROGRAM. Volume 1. HIGH INLET TEMPERATURE TURBINE PROGRAM AND HIGH STAGE LOADING COMPRESSOR PROGRAM. General Electric Co., Advanced Technology and Demonstrator Programs Dept. Final Report November 1965-August 1966 on Phase 1-B, U. S. Air Force Contract AF 33 (657)-15502, December 1966, 83 pp. (AD 378133L) (REPORT CLASSIFIED CONFIDENTIAL).

598. Homann, K. H., CARBON FORMATION IN PREMIXED FLAMES. Combust. Flame 11 (4), 265-87 (1967); C.A. 67, 75032.

599. Homann, K. H. and Wagner, H. Gg., SOME NEW ASPECTS OF THE MECHANISM OF CARBON FORMATION IN PREMIXED FLAMES in Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., August 14-20, 1966, Proceedings Pittsburgh, Pa., Combustion Institute. 1967, p. 371-78, 378, 379.

600. Homer, J. B. and Kistiakowsky, G. B., OXIDATION AND PYROLYSIS OF ETHYLENE IN SHOCK WAVES. J. Chem. Physics 47 (12), 5290-5 (1967).

601. Hong, V. Y. S., MICROBIAL-METAL CORROSION-LITERATURE REPORT. U. S. Army Weapons Command Rock Island, Research and Engineering Div. Final Technical Report RIA-67-534, February 1967, 33 pp. (AD 655 274).

602. Horak, J., HEAT AND MASS TRANSFER IN HETEROGENEOUS CATALYSIS. 1. CRITERIA FOR EVALUATION OF THE EFFECT OF THE DIFFUSION OF SUBSTANCES ON HEAT TRANSFER INSIDE OF A CATALYST PARTICLE ON THE REACTION RATE. Chem. Prumysl 42, No. 2, 57-60 (1967); Intern. Chem. Eng. 7, No. 3, 475-9 (July 1967).

603. Horeff, T. G. (U.S. Federal Aviation Administration), AIRCRAFT OPERATIONS: AS INFLUENCED BY ADVANCED FUELS AND SUPPORT CONCEPTS. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper.

604. Horn, K. P. and Reichenbach, R. E. (The Aerospace Corp.), FURTHER EXPERIMENTS ON SPREADING OF LIQUIDS INJECTED INTO A SUPERSONIC FLOW. AIAA Journal 7 (2), 358-9 (February 1969).

605. Horn, K. P. and Reichenbach, R. E., EXPERIMENTAL INVESTIGATION OF SECONDARY LIQUID INJECTION. Aerospace Corp., Calif. Lab. Operations. November 1968, 38 pp. (AD 686 465).

BIBLIOGRAPHY (Contd)

606. Horton, T. E. and Babineaux, T. L. (California Institute of Technology), INFLUENCE OF ATMOSPHERIC COMPOSITION ON HYPERSONIC STAGNATION-POINT CONVECTIVE HEATING. AIAA, Aerospace Sciences Meeting, 3rd, New York, January 24-26, 1966, Paper 66-29; AIAA Journal 5, 36-43 (January 1967).

607. Horton, T. E. and Menard, W. A., A PROGRAM FOR COMPUTING SHOCK-TUBE GASDYNAMIC PROPERTIES. Jet Propulsion Lab., Calif. Inst. of Tech., JPL-TR-32-1350; NASA-CR-99337, Contract NAS7-100, January 1969, 84 p. (N69-18025).

608. Horton, W. S., STATISTICAL ASPECTS OF SECOND AND THIRD LAW HEATS. National Bureau of Standards, Inst. for Materials Research, U. S. Air Force AFOSR 67-0555, July 1966, 9 pp. (AD 649673).

609. Hoseit, C., A METHOD FOR MEASURING THE MEAN AIR-FUEL RATIO AND THE DEGREE OF COMBUSTION IN THE RECIRCULATION ZONE BEHIND A FLAMEHOLDER. Tech. Hochschule Muenchen Dissertation (1966); (Abstr) VDI (Ver Deut Ingr) Z V108 N.34 1694 (12/1/66).

610. Hougen, O. A. (University of Wisconsin), ENGINEERING ASPECTS OF SOLID CATALYSTS. Industrial and Engineering Chemistry 53 (7), 509-28 (July 1961).

611. Howard, D. D., Thomas, N. A., Licitra, M. C., Roe, R. M., MICROWAVE MONITORING OF SEA WATER CONTAMINATION OF NAVY FUEL OILS. U. S. Naval Research Laboratory Report No. NRL-6552, June 1967, 22 pp. (AD 655 819).

612. Howard, W. M., AIR TRAFFIC DEMAND 1967-1990, Lockheed-California Co. Report No. LAC-OEA/SST/Q02, November 1966, 92 pp. (AD 812 964L).

613. Hube, F. K., MAXIMUM CONTRACTION AREA RATIOS AND PRESSURE DISTRIBUTIONS FOR AN AXISYMMETRIC HYPERSONIC INLET AT MACH NUMBERS 3, 4, AND 5. Arnold Engineering Development Center, Arnold Air Force Station Technical Report No. AEDC-TR-66-216 preparedin cooperation with ARO, Inc., U. S. Air Force Contract AF 40 (600) - 1200, November 1966, 21 pp. (AD 376953L) (REPORT CLASSIFIED CONFIDENTIAL).

614. Hube, F. K., and Shahrokhi, F. (The University of Tennessee Space Institute), THERMOCOUPLE TOTAL-TEMPERATURE, PROBE-RADIATION ERRORS. AIAA Journal 7 (4), 749-51 (April 1969).

615. Hudgins, R. R., A GENERAL CRITERION FOR ABSENCE OF DIFFUSION CONTROL IN AN ISOTHERMAL CATALYST PELLET. Chem. Eng. Sci. 23, No. 1, 93-4 (January 1968).

616. Hudson, R. H. (Avco Corp.), PRESSURE OSCILLATIONS IN A COMBUSTOR WITH DUAL-ORIFICE FUEL INJECTION. American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, March 5-9, 1967, Paper 67-GT-23, 8 pp.

BIBLIOGRAPHY (Contd)

617. Huet, C., COMPARATIVE STUDY OF FUELS FOR THE FIRST STAGE OF AN ATMOSPHERIC BOOSTER. Rech. Aerosp. No. 112, 7-12 (1967) (Fr.); C.A. 67, 110211.

618. Huet, C. and Marguet, R., RESEARCH OF AN OPTIMUM SOLUTION FOR A FIXED GEOMETRY RAMJET, IN THE MACH 5- MACH 7 RANGE, WITH SUCCESSIVELY SUBSONIC AND SUPERSONIC COMBUSTION. Office National D'Etudes et de Rechurches Aerospatiales, Paris (France), 5th Afitae Colloq. on Appl. Aerodyn., Poitiers, France 6-8 November, 1968, 30 pp. (N69-20800).

619. Huff, R. G. (Lewis Research Center), VARIATION OF CONVENTIVE HEAT-TRANSFER CO-EFFICIENT AROUND A SIMULATED ROCKET COOLING TUBE SECTION. U. S. National Aeronautics and Space Administration Technical Note NASA TND-5168, April 1969, 28 pp.

620. Huffman, J. W. and Lauer, R. F., PERFORMANCE OF A 1/6-SCALE F-111A INLET AT TRANSONIC AND SUPERSONIC MACH NUMBERS. Arnold Engineering Development Center, Arnold Air Force Station Technical Rept 11 October - 16 December 1966, Report No. AEDC-TR-67-90 prepared in cooperation with ARO, Inc., U. S. Air Force Contract AF 40 (600)-1200, May 1967, 63 pp. (AD 381329L) (CONFIDENTIAL).

621. Huston, W. B., SURFACE WARP AND AERODYNAMIC HEATING. Advisory Group for Aeronautical Research and Development Report No. AGARD-312, NATO N62-15913, October 1960, 29 pp. (AD 652 925).

622. Hwang, S. - T. and Kammermeyer, K. (Univ. of Iowa), GASEOUS DIFFUSION AND FLOW IN COMMERCIAL CATALYSTS AT PRESSURE LEVELS ABOVE ATMOSPHERIC. Ind. Eng. Chem., Fundam. 7 (4), 671-2 (November 1968).

BIBLIOGRAPHY (Cont'd)

623. Iizuka, H., Hirano, A., Shi'o, T., Yamamoto, M., Tsuru, S., UTILIZATION OF HYDROCARBONS BY MICROORGANISMS. Abh. Deut. Akad. Wiss. Berlin. Kl. Chem., Geol. Biol. 1965 (2), 163-9 (Pub. 1965) (Eng.); C.A. 67, 13465.

624. Irvine, T. F. and Hartnett, J. P. (ed.), ADVANCES IN HEAT TRANSFER. Volume 5. New York, Academic Press, Inc., 1968, 548 pp. Partial Contents: J. R. Howell, APPLICATION OF MONTE CARLO TO HEAT TRANSFER PROBLEMS. p. 1-54; D. P. Jordon, FILM AND TRANSITION BOILING. p. 55-128; F. Kreith, CONVECTION HEAT TRANSFER IN ROTATING SYSTEMS. p. 129-151; C. L. Tien, THERMAL RADIATION PROPERTIES OF GASES. p. 253-324.

625. Istratov, A. G. and Librovich, V. B., THE EFFECT OF TRANSPORT PROCESSES ON THE STABILITY OF A PLANE FLAME FRONT. Prikladnaia Matematika i Mekhanika 30, 451-66 (May-June 1966); PMM-Journal of Applied Mathematics and Mechanics 30 (3), 541-57 (1966).

626. Iungman, V. S., Gurvich, L. V., Rtishcheva, N. P., COMPOSITION AND THERMODYNAMIC PROPERTIES OF THE COMBUSTION PRODUCTS FROM METHANE BURNED WITH IONIZING ADMIXTURES. Teplofizika Vysokikh Temperatur 4, 507-12 (July-August 1966).

627. Ivanov, V. M., INFLUENCE OF PRESSURE ON INDICES OF COMBUSTION PROCESSES AND HEAT EXCHANGE IN HEAT-RESISTANT COMBUSTION CHAMBERS. Akad. Nauk SSSR, Inst. Goryuchikh Iskopaemykh. Trudy, 1965 (56), 40-64; U. S. Air Force Translation No. FTD-MT-24-136-67, August 1967, 30 pp. (AD 666 079).

628. Ivanov, V. A., Mironov, B. P., Volchkov, E. P., Kutateladze, S. S. Leontev, A. I., THE BREAK-UP OF A LIQUID JET; THE COMPUTATION OF HEAT TRANSFER IN NOZZLES; and THE INFLUENCE OF THE COMPRESSIBILITY AND NONISOTHERMICITY OF A GAS ON THE EFFECTIVENESS OF BARRIER COOLING WITH A TURBULENT BOUNDARY LAYER Zhur. Prikl. Mekh. i Tech. Fiz. (USSR) 1966 (4), 30-7, 116-20, 126-9; U. S. Air Force Translation, July 1968, 38 pp. (AD 682 435).

629. Ivanov, V. V., TEMPERATURE REGIME OF A SOLID BODY WITH VARIABLE HEAT-TRANSFER CONDITIONS ON ITS SURFACE. Aviatsionnaia Tekhnika 10 (1), 133, 134 (1967) (in Russian).

630. Ivanov, V. V., Salomatov, V. V., Chekhovich, V. Iu., QUASI-STATIONARY REGIME DURING RADIATIVE-CONVECTIVE HEATING OF BODIES. Akademiia Nauk SSSR, Izvestiia, Energetika i Transport 1967, 127-9 (January-February) (in Russian).

BIBLIOGRAPHY [illegible]

631. Ja[illegible], M. R. and Calkowski, M. J., [illegible] WATER IN JET FUEL AND [illegible] ITEM 2: PROTOTYPE INSTRUMENTATION. IIT Research Inst. [illegible] Report No. 6, 21 February-21 April 1967, Report No. IITRI-[illegible] U. S. Navy Contract NObs-4[illegible]5), April 1967, 12 pp. [illegible]

632. Ja[illegible], [illegible]rdy, K. R., Ke[illegible], H. G., Rudland, R. S., EFFECT OF A[illegible] ON CONVECTIVE HEAT TRANSFER. U. S. Air Force [illegible], NASA Accession No. N[illegible], 1967, 1[illegible] pp., C.A. 66, [illegible]

633. Ja[illegible], A., [illegible] MIXTURE AND APPLICATION TO [illegible] PLUME. AGARD Conf. Proc. No. 1, 271-301 (1966) [illegible], C.A. [illegible]

634. Jaffe, F. (W. R. Grace and Co.), CIS-DECALIN. U. S. 3,349,139, October [illegible], 1967.

635. Jain, V. K. and [illegible], ANALYTICAL [illegible] OF A STEADY CYLINDRICAL FLAME. Combustion and Flame [illegible] (December 1966).

636. Jain, [illegible] and Mukunda, H. S., ON THE IGNITION AND EXTINCTION PROBLEMS IN [illegible] SYSTEMS. International Journal of Heat and Mass Transfer 11, [illegible] March 1968.

637. Jallert, [illegible] PROPERTIES OF AIR AT HIGH TEMPERATURES. IV. Entropie 1[illegible], [illegible] November-December [illegible].

638. James, [illegible], Martin, B. [illegible], Martin, [illegible], FORCED CONVECTION HEAT TRANSFER IN ASYMMETRICALLY HEATED [illegible]TANGULAR DUCTS. Spaceflight 9, 1[illegible] April 1967).

639. Jamison, R. R. (Bristol Siddeley Engines, Ltd.), POWER UNIT FOR VERY HIGH SPEED WINGED VEHICLES. Aerospace [illegible] 1966; Royal Aeronautical Society, Centenary Congress and International Council of the Aeronautical Sciences Congress, 5th, London, England, September 12-16, 1966, Vol. 1, ed. by J. Bradbrooke et al., London, Macmillan, 1967, 483-510, 510-3.

640. Jenkins, R. M. and Hoglund, R. F. (Purdue Univ.), A UNIFIED THEORY OF PARTICLE GROWTH IN ROCKET CHAMBERS AND NOZZLES. AIAA Propulsion Joint Specialist Conference, 5th, June 9-13, 1969, AIAA Paper No. 6[illegible]-541, 10 pp.

641. John, A. W., SOME EFFECTS OF REFUELING VARIABLES ON JET FUEL ELECTRIFICATION. 30th API Div. Refining Midyear Mtg. (Montreal 5 10-12 65) Preprint N.38-65.32P.

BIBLIOGRAPHY (Contd)

642. Johns Hopkins Univ., Applied Physics Lab., RESEARCH AND EXPLORATORY DEVELOPMENT FOR THE OFFICE OF AERONAUTICAL RESEARCH NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. Quarterly Report 1 January-31 March 1967, Report No. NCR 67-1, U. S. Navy Contract NOw-62-0604, March 1967, 11 pp. (AD 382 182) (REPORT CLASSIFIED CONFIDENTIAL).

643. Johns Hopkins University, Applied Physics Lab., RESEARCH AND EXPLORATORY DEVELOPMENT FOR THE OFFICE OF AERONAUTICAL RESEARCH, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. Quarterly Report 1 October-31 December 1966, Report No. NCR 66-4, U. S. Navy Contract NOw-62-0604, December 1966, 11 pp. (AD 379101) (REPORT CLASSIFIED CONFIDENTIAL).

644. Johns Hopkins University, RESEARCH AND EXPLORATORY DEVELOPMENT FOR THE OFFICE OF AERONAUTICAL RESEARCH, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. Quarterly Report July-September 1966, Report No. NCR 66-3, U. S. Navy Contract NOw-62-0604, September 1966, 7 pp. (AD 302 [illegible]5).

645. Johns Hopkins University. EXPLORATORY DEVELOPMENT FOR MISSILE PROPULSION. Quarterly Report 1 July-30 September 1966. Report No. DCR 66-3, U. S. Navy Contract NOw-62-0604, September 1966, 17 pp. AD 377286L) (REPORT CLASSIFIED CONFIDENTIAL).

646. Johns Hopkins Univ., Applied Physics Laboratory, EXPLORATORY DEVELOPMENT FOR MISSILE PROPULSION. Quarterly Report 1 October-31 December 1966, Report No. DCR 66-4, U. S. Navy Contract NOw-62-0604, December 1966, 23 pp. (AD 379099L) (REPORT CLASSIFIED CONFIDENTIAL).

647. Johnson, C. J., SUPERSONIC TRANSPORT FUELS AND LUBRICANTS. U. S. Air Force Technical Documentary Report No. ASD-TDR-63-761, October 1962, 14 pp.

648. Johnson, D. E. (Wright-Patterson AFB), TWO-DIMENSIONAL JET MIXING IN A SUPERSONIC FLOW. Avail. CFSTI, 1966, 80 pp. (AD 635 25[illegible]); C.A. 67, 23698.

649. Johnson, J. E. (U. S. Naval Research Lab.), IGNITION AND COMBUSTION OF ACTIVATED CARBON CONTAINING ADSORBED HYDROCARBONS. Eastern Section of the Combustion Inst. 1968 Technical Meeting, October 21, 22, 1968. Paper.

650. Johnson, M. M. and Hepp, H. J. (to Phillips Petroleum Co.), DEHYDROGENATION OF PARAFFINS USING MOLYBDENUM SULFIDE-ALUMINA CATALYSTS. U. S. 3,280,210 (Cl. 260-683.3), October 18, 1966, Appl. September 8, 1964; 2 pp., C.A. 66, 10554 (1967).

651. Johnson, O. and Nozaki, K. (Shell Development Co.), PLATINUM CATALYSTS. U. S. 2,834,740 (May 13, 1958).

BIBLIOGRAPHY [illegible]

652. Johnston, R. K., Monita, C. M., Brown, R. [illegible], LIFE TESTS ON FILTER-SEPARATOR ELEMENTS. Southwest Research Inst. Report No. RS-[illegible], U. S. Air Force AFAPL-TR-68-144, Contract F 33615-68-C-1215, January 1969, 122 pp.

653. Johnston, R. K., Biebersdorf, F. W., et al., A STUDY OF EXISTING JP-4 BASE FUEL HANDLING PROCEDURES IN RELATION TO MICROBIAL CONTAMINATION. U. S. Dept. Com. Office Tech. Serv. AD-[illegible]352 (June 1964) 275 p.; (Abstr) Corrosion Abstr V4 N.2. [illegible] (March 1965).

654. Johnston, R. K. and Tyler, J. C., EFFECT OF ANTI-ICING ADDITIVE ON MICROBIAL GROWTH IN JET FUELS, Res. Results Serv. Ms N.64-412.22P.; (Abstr) Ind Eng Chem V56 N.12.109 (Dec. 1964).

655. Jones, I. W., CALCULATION OF THE THERMAL CONDUCTIVITY OF NORMAL HYDROGEN IN THE DENSE GASEOUS AND LIQUID STATES. International Journal of Heat and Mass Transfer 10, 745-54 (June 1967).

656. Jones, W. W. (General Motors Corp.), DEVELOPMENT OF A HIGH TEMPERATURE LONG LIFE TURBINE. Society of Automotive Engineers, National Aeronautic Meeting, April 24-27, 1967, Paper 670345, 6 pp.

657. Joslin, C. L. (Pratt and Whitney Aircraft), THE POTENTIAL OF METHANE AS A FUEL FOR ADVANCED AIRCRAFT. Aviation and Space; Progress and Prospects, Annual Aviation and Space Conference, June 16-19, 1968, Beverly Hills, Calif. American Society of Mechanical Engineers, New York, 1968, pp. 351-5.

658. Joslin, C. L. and Love, M. C. (Pratt and Whitney Aircraft), SOME HYPERSONIC CRUISE VEHICLE PROPULSION CONSIDERATIONS. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper, (CLASSIFIED).

659. Just, T., CHEMICAL REACTIONS AND ENERGY TRANSFER IN FAST GAS FLOWS. DVL-Nachrichten 1968, 378-81, (October).

660. Just, T. APPLICATION OF CHEMICAL REACTION KINETICS TO VARIOUS PROBLEMS OF AERONAUTICS AND ASTRONAUTICS. Yearbook 1965; Wissenschaftliche Gesellschaft für Luft-und Raumfahrt, European aeronautical Congress, 6th, Munich, West Germany, September 1-4, 1965, ed. by H. Blenk, Braunschweig, West Germany, Friedrick Vieweg und Sohn GmbH, 1966, p. 287-93 (in German).

661. Just, Th., Pippert, H., Roth, P., COMPARISON OF MEASUREMENTS OF RELAXING COMBUSTION GASES IN A NOZZLE FLOW WITH CHEMICAL-KINETIC CALCULATIONS. Wissenschaftliche Gesellschaft für Luft-und Raumfahrt and Deutsche Gesellschaft fur Raketentechnik und Raumfahrt, Gemeinsame Jahrestagung, Karlsruhe, West Germany, Oct. 5-6, 1967, Zeitschrift für Flugwissenschaften 17, 8-16 (January 1969) (in German).

BIBLIOGRAPHY (Cont'd)

662. Kadushin, A. A. and Korchek, Sh., THE QUANTITATIVE DETERMINATION OF BIS-PHENOL ANTIOXIDANT ADDITIVES IN PETROLEUM OILS BY INFRARED SPECTROSCOPY. Sbornik Prac Chemickotechnologickej Fakulty SVST, Bratislava, 1966, 195-200; U.S. Air Force Translation, November 1968, 11 pp. (AD 684632).

663. Kaganov, S. A., FLAME PROPAGATION PROCESSES. Zhur. Prikl. Mekh. i Tekh. Fiz. 1965, 160-2 (July-August); Journal of Applied Mechanics and Technical Physics 1965, p. 109, 110 (July-August) (translation).

664. Kalinin, E. K., UNSTEADY CONVECTIVE HEAT TRANSFER AND HYDRODYNAMICS IN CHANNELS. Akademiia Navuk BSSR. Vestsi, Seryia Fizika-Tekhnichnykh Navuk, 1967, No. 2, 77-86 (in Russian).

665. Kallergis, M., NOMOGRAPHIC REPRESENTATION OF PROCESSES IN A RAMJET EXTERNAL-COMBUSTION ENGINE. Wissenschaftliche Gesellschaft für Luft-und Raumfahrt and Deutsche Gesellschaft für Raketentechnik and Raumfahrt, Jahrestagung 1966, Bad Godesberg, West Germany, October 4-8, 1966, Paper, 51 pp. (in German).

666. Kamimoto, G., FUNDAMENTAL STUDY OF GUN SHOCK TUNNEL. Japan Society for Aeronautical and Space Sciences, Journal 15, 71-8 (March 1967) (in Japanese).

667. Kamptner, H. K., Krause, W. R., Schilken, H. P. (Farbwerke Hoechst A.-G., Ger.), HIGH TEMPERATURE CRACKING. Chem. Eng. 73 (5), 93-8 (1966); C.A. 64, 19387 (1966).

668. Kantorovich, B. V. (ed.), NEW METHODS FOR FUEL COMBUSTION AND PROBLEMS IN THE THEORY OF COMBUSTION. Nauka, Moscow, 1965, 205 pp. (Russ); C.A. 67, 66456.

669. Karp, I. N. and Soroka, B. S., DETERMINATION OF THE THERMODYNAMIC PROPERTIES OF THE EQUILIBRIUM COMBUSTION PRODUCTS OF METHANE. Teplofizika Vysokikh Temperatur 5, 437-44 (May-June 1967) (in Russian).

670. Karp, I. N., Soroka, B. S., Dashevskii, L. N., Pis'mennaia, S. D., MACHINE CALCULATION OF THERMODYNAMIC EQUILIBRIUM IN THE COMBUSTION PRODUCTS OF METHANE-OXYGEN MIXTURES. Teplofizika Vysokikh Temperatur 5, 69-78 (January-February 1967); High Temperature 5, 59-67 (January-February 1967) (Trans.).

671. Kassoy, D. R. and Williams, F. A. (Univ. of Calif., San Diego), VARIABLE PROPERTY EFFECTS ON LIQUID DROPLET COMBUSTION. AIAA Aerospace Sciences Meeting (6th), New York, January 22-24, 1968, Paper 68-181; AIAA Journal 6 (10), 1961-5 (October 1968).

672. Kato, H., Nishiwaki, N., Hirata, M., TURBULENT HEAT TRANSFER IN SMOOTH PIPES AT HIGH PRANDTL NUMBERS. Proc. Int. Congr. Appl. Mech., 11th, Munich 1964, 110-6 (Pub. 1966) (Eng.); C.A. 66, 77609.

[illegible]

673. Kautzky, D. E. and Westwater, J. W. (University of Illinois), FILM BOILING OF A MIXTURE ON A HORIZONTAL PLATE. International Journal of Heat and Mass Transfer 10, [illegible] (February 1967).

674. Kazanskii, B. A., CATALYTIC CONVERSIONS OF HYDROCARBONS. Kinetika i Kataliz 8, No. 5, [illegible] (1967).

675. Kazanskii, B. A., [illegible], Minachev, Kh. M., Eliseev, N. A., [illegible], Yu. [illegible], RAPIDLY INITIATING CATALYSTS FOR DEHYDROGENATION OF PARAFFIN HYDROCARBONS. Khim. Prom. [illegible] (1966) (Russ); C.A. [illegible].

676. Kemp, H. T., [illegible], J. W., Kell, R. M., (Battelle Memorial Inst.), DETERMINING EFFECTIVENESS OF BIOCIDAL ADDITIVES IN COATING. Journal of Paint Technology 39, No. 440, 365-7 (July 1967) (AD 640196).

677. Kenworthy, M. J. (General Electric Co.), NEW TECHNIQUES FOR SUPERSONIC COMBUSTION MEASUREMENTS. AIAA, Aerospace Sciences Meeting, 5th, New York, January [illegible], 1967, Paper [illegible], 10 pp.; U.S. Air Force Contracts AF 33(615)-1526 and AF 33(615)-[illegible].

678. Kerk, G. J. M. Van Der, NEW DEVELOPMENTS IN ORGANOLEAD CHEMISTRY. Ind. Eng. Chem. V58 N.10.29-35 (Oct. 1966).

679. Kesten, A. S. (United Aircraft Res. Lab.), AN INTEGRAL EQUATION METHOD FOR EVALUATING THE EFFECTS OF FILM AND PORE DIFFUSION OF HEAT AND MASS ON REACTION RATES IN POROUS CATALYST PARTICLES. AIChE Journal 15 (1), 128-31 (January 1969).

680. Khachkuruzov, G. A., ERRORS IN THE THERMODYNAMIC FUNCTIONS CALCULATED FOR IDEAL GASES FROM MOLECULAR DATA. Teplofizika Vysokikh Temperatur 4, 650-6 (September-October 1966); High Temperature 4, 592-7 (September-October 1966).

681. Khaikin, B. I. and Merzhanov, A. G., THEORY OF THERMAL EXPANSION OF A CHEMICAL REACTION FRONT. Fizika Goreniia i Vzryva, No. 3, 36-46 (1966) (In Russian).

682. Kharlamovich, G. D. and Soltsova, L. F., THE POSSIBILITY OF USING ALKYL-NAPHTHOLS AS ANTIOXIDANTS. Izvest. Vysshikh Uchebnykh Zavedenii Khimiya i Khimicheskaya Tekhnologiya (USSR) 10 (7), 789-91 (1967); U.S. Air Force Translation, July 1968, 10 pp. (AD 685002).

683. Khovakh, M. S., Khristich, V. A., Varshavskii, G. A., THE ALL-UNION METHODOLOGY CONFERENCE ON THE PROBLEMS OF VAPORIZATION (5th), COMBUSTION AND GAS DYNAMICS DISPERSION SYSTEMS (SELECTED ARTICLES). 1965, Tezisy Dokladov, Odessa, 1965, p. 15-7, 28-31, 37.; U.S. Air Force Translation July 1968, 18 pp. (AD [illegible]). Contents: The nonsteady state heat transfer between a fuel flame and the surrounding medium, The jet combustion of fuel in the circulation zone between a trough-shaped flame holder; A preliminary analysis of the conditions of igniting a single droplet of liquid fuel.

BIBLIOGRAPHY (Cont'd)

684. Kimberlin, C. N. (Esso Research and Engineering Co.), CRACKING NAPHTHA WITH A SYNTHETIC MORDENITE ZEOLITE. U.S. 3,247,098 (Cl 208-120), April 19, 1966, Appl. November 12, 1963; 5 pp. C.A. 64, 19296 (1966).

685. Kinslow, M. and Miller, J. T. (ARO, Inc.), NONEQUILIBRIUM EXPANSION OF A DIATOMIC GAS THROUGH A CONVERGENT-DIVERGENT NOZZLE. Physics of Fluids 9, 1705-8 (September 1966).

686. Kirk, H. F., RAMJET TECHNOLOGY, CHAPTER 13, FACILITIES AND TESTING. Johns Hopkins Univ. Report No. TG610-13 (Rev.), June 1968, 37 pp.

687. Klemm, R. F. and Blades, A. T., IONIZATION IN HYDROCARBON FLAMES. Nature 212, 920, 921, (November 26, 1966).

688. Klimenko, A. P. and Kozitskii, V. I., CALCULATION OF HEAT-TRANSFER COEFFICIENTS DURING THE BOILING OF LIGHT HYDROCARBON MIXTURES. Khim. Prom. Ukr. (Russ. Ed.) 1967 (4), 32-4 (Russ); C.A. 67, 118559.

689. Klimenko, A. P. and Kozitskii, V. I., EXPERIMENTAL STUDY OF HEAT TRANSFER DURING BOILING OF PROPANE. Neft. Gazov. Prom. 1967 (1), 40-3 (Russ); C.A. 67, 13136.

690. Kline, R. E. and Starnes, W. C. (to Gulf Research and Development Co.), DEHYDROCYCLIZATION OF HYDROCARBONS. U.S. 3,285,985 (Cl 260-673.5), November 15, 1966, Appl. May 1, 1963; 7 pp.; C.A. 66, 12744 (1967).

691. Kluiber, R. W. and Horrocks, W. D., Jr., THE THERMAL DECOMPOSITION OF COPPER (II) CHELATES OF N-SUBSTITUTED THIOPICOLINAMIDES. Inorganic Chemistry 5 (10), 1816-8 (1966).

692. Kluksdahl, (CHEVRON RESEARCH CO.), REFORMING WITH PLATINUM-RHENIUM CATALYST. U.S. 3,415,737, December 10, 1968, Appl. May 19, 1967, continuation-in-part of U.S. Appl. Serial No. 560,166, filed June 24, 1966 and now abandoned.

693. Klyacko, L. A., IGNITION OF AN AGGREGATE OF PARTICLES DURING HETEROGENEOUS REACTION. Pyrodynamics 6, 29-38 (January 1968); Teploenergetika 13 (8), 65-8 (1966).

694. Knecht, D. A., THE KINETICS OF THE THERMAL DECOMPOSITION OF CYCLOPENTENE AND THE HYDROGEN ISOTOPE EFFECT. Univ. Rochester, Diss. 1968, 195 pp.; Abstr.; Diss. Abstr. B 29 (5), 1627B (November 1968).

695. Knowles, C. P. and Gebhart, B., THE STABILITY OF THE LAMINAR NATURAL CONVECTION BOUNDARY LAYER. Journal of Fluid Mechanics 34, 657-86 (1968).

696. Kobish, T. R., Roberts, R. A., Schwartz, H. R., Gordon, R. K., Ault, E. A., EMULSIFIED FUELS COMBUSTION STUDY. Pratt and Whitney Aircraft, February 1969, 141 pp. (AD 687325).

BIBLIOGRAPHY (Cont'd)

697. Kochloefl, K. and Bazant, V., HYDROGENOLYSIS OF SATURATED HYDROCARBONS ON A NICKEL CATALYST - 1. KINETICS OF HYDROGENOLYSIS OF ETHYLCYCLOHEXANE AND REACTIVITY OF (EIGHT) ALKYLCYCLOHEXANES. J. Catalysis 8 No. 3:250-60 (July 1967).

698. Kogan, M. G., SOLUTION OF NONLINEAR PROBLEMS OF THE HEAT CONDUCTIVITY THEORY BY THE KANTOROVICH METHOD. Inzhenerno-Fizicheskii Zhurnal 12, 72-81 (January 1967).

699. Kolotushkina, E. V., Komarov, B. I., Medvedev, S. P., Nikolaeva, V. G., Ostroushchenko, M. S., HIGH TEMPERATURE CORROSION OF METALS IN THE COMBUSTION OF DISTILLATE TYPE GAS TURBINE FUELS. Khim. i Tekhnol. Topliv. i Masel. VII N.3.54-57 (March 1966).

700. Komatsu, Y., DEHYDROCYCLIZATION OF 3-METHYL-1,4,6-HEPTATRIENE (MHT). Bull. Chem Soc. Japan 41, No. 1, 167-71 (January 1968).

701. Komissarova, N. L., Erivanskaya, L. A., Plate, A. F., SOME FEATURES OF 1-n-BUTYL NAPHTHALENE OVER Cr_2O_3/AL_2O_3 AND Pt/C CATALYSTS. Neftekhimiya , No. 5, 725-30 (September-October 1967).

702. Kondelik, P., Horak. J., Tesarova, J., HEAT AND MASS TRANSFER IN HETEROGENEOUS CATALYSIS. I and EC Process Design and Development 7, No. 2, 250-2 (April 1968).

703. Kondrat'ev, V. N., KINETICS OF THE COMBUSTION REACTIONS OF GASEOUS-PHASE SYSTEMS. Fizika Gorenila i Vzryva 1968 (4), 446-54 (December).

704. Kondratiev, V. N., DETERMINATION OF THE RATE CONSTANT FOR THERMAL CRACKING OF METHANE BY MEANS OF ADIABATIC COMPRESSION AND EXPANSION. Symposium (International) on Combustion, 10th, University of Cambridge, Cambridge, England, August 17-21, 1964, p. 319-22 (Pub. 1965).

705. Konenko, I. R., Tolstopyatova, A. A., Balandin, A. A., THE CATALYTIC PROPERTIES OF TITANIUM, ZIRCONIUM, AND HAFNIUM DIOXIDES IN DEHYDROGENATION AND DEHYDRATION REACTIONS. Izv. Akad. Nauk SSSR, Ser. Khim. 1967 (3), 496-502 (Russ); C.A. 67, 81658.

706. Koshmarov, Iu. A. and Gorskaia, N. M., HEAT TRANSFER OF A PLATE IN A SUPERSONIC RAREFIED GAS FLOW. Inzhenernyi Zhurnal 5 (2), 261-74 (1965); Soviet Engineering Journal 5, 217-26 (March-April 1965).

707. Kosterin, V. A., Rzhevskii, E. V., Khismatullin, A. Ya., CERTAIN PROBLEMS IN TRANSVERSE FLOW DURING BURNING. Izv. Vysshikh Ucheb. Zavedenii Aviatsionnaya Tekh. (USSR) 1966 (1), 130-9; U.S. Air Force Translation FTD-MT-24-303-67, October 1967, 16 pp. (AD 668156).

708. Kosyreva, R. V. and Stepukhovich, A. D., THE INITIATED CRACKING OF ISOPENTANE. Neftekhimiya 5 (5), 683-7 (1966) (Russ), C.A. 64, 3257 (1966).

BIBLIOGRAPHY (Cont'd)

709. Kotov, Yu. A., and Melnikov, M. A., RECORDING SHOCK WAVES AND EXPLODING WIRE ELECTRICAL CHARACTERISTICS. Elektronnaya Obrabotka Materialov (USSR) 1966 (3), 28-32; U.S. Air Force Translation, July 1968, 15 pp. (AD 685439).

710. Kovalenko, N. D., PERTURBATIONS IN A SUPERSONIC FLOW DUE TO DISCRETE OR CONTINUOUSLY DISTRIBUTED MASS AND HEAT SOURCES. Inzhenerno-Fizicheskii Zhurnal 8, 684-6 (May 1965); Journal of Engineering Physics 8, 468,469 (May 1965).

711. Kowalewicz, A., EXPERIMENTAL INVESTIGATION OF THE PROBABILITY OF SPARK IGNITION OF FUEL DROPLET SUSPENSION IN AIR STREAM. Archiwum Budowy Maszyn 15 (1), 81-9 (1968).

712. Kowalewicz, A., SPARK IGNITION OF COMBUSTIBLE MIXTURES-SURVEY. Instytut Lotnictwa, Prace 1966, No. 27, 28-41.

713. Kraft, M. and Spindler, H., STUDIES OF SOME RELATIONS BETWEEN STRUCTURAL AND CATALYTIC PROPERTIES OF ALUMINA-SUPPORTED PLATINUM. Int. Congr. Catalysis, 4th, Moscow 1968, Paper 69.

714. Krakow, B., Tourin, R. H., Penzias, G. J. (Warner and Swasey Co.), POSSIBLE TECHNIQUES FOR OPTICAL MEASUREMENTS OF TEMPERATURE AND CONCENTRATION PROFILES IN A SUPERSONIC RAMJET. NASA Report No. NASA-CR-66112, 1966, 58 pp. (N66-35941); C.A. 67, 23182

715. Krase, W. H. (Rand Corp.), THRUST DEFLECTION FOR CRUISE. Journal of Aircraft 4, 162-4 (March-April 1967).

716. Krause, A., CATALYST POISONING. Monatsh. Chem. 99 (4), 1489-91 (July-August 1968) (in German).

717. Krause, E., Hirschel, E. H., Bothmann, Th., NORMAL INJECTION IN A THREE-DIMENSIONAL LAMINAR BOUNDARY LAYER. AIAA Journal 7 (2), 367-9 (February 1969).

718. Krause, F. R., Davies, W. C., Cann, M. W. P., DETERMINATION OF THERMO-DYNAMIC PROPERTIES WITH OPTICAL CROSS-CORRELATION METHODS. AIAA Journal 7 (4), 587-92 (April 1969).

719. Kreiter, C. G., Maasbol, A., Anet, F. A. L., Kaesz, H. D., Winstein, S. (Univ. of California, Los Angeles), VALENCY TAUTOMERISM IN METAL-OLEFIN COMPLEXES. CYCLOOCTATETRAENEMOLYBDENUM,-CHROMIUM, AND -IRON TRICARBONYLS. J. Amer. Chem. Soc. 88 (14), 3444-5 (1966).

720. Krotky, J., PHYSICAL AND THERMAL CHARACTERISTICS OF MODERN AIRCRAFT FUELS. Zpravodaj VZLU 1967 (5), 45-51 (in Czech).

721. Krouse, J. R. and Ellis, B. K., LONGITUDINAL AND DIRECTIONAL AERODYNAMIC CHARACTERISTICS OF SEVERAL HYPERSONIC AIRCRAFT CONFIGURATIONS. David Taylor Model Basin, Aerodynamics Laboratory Research and Development Report No. Aero-1126, DTMB 2367, January 1967, 28 pp. (AD 651905).

BIBLIOGRAPHY (Cont'd)

722. Kruager, R. H., THE FRICTIONAL BEHAVIOR OF MATERIALS IN JP-4 FLUID. Lubrication Eng. V 21 N. 12 501-5 (Dec. 1965).

723. Krylov, I. F., et al., USE OF ADDITIVES FOR PREVENTING ELECTRIC CHARGES ON PETROLEUM PRODUCTS. Khim i Teknol. Topliv i Masel, V12 N.7 53-56 (July 1967).

724. Krynitsky, J. A. (U.S. Office of Technical Services), AIR POLLUTION - FUEL QUALITY PROCUREMENT PROBLEMS. 1969 National Petroleum Refiners Association Annual Meeting, San Antonio, Texas, March 24-26, 1969, Paper Tech AM-69-17, 14 pp.

725. Kubota, T. and Fernandes, F. L. (Calif. Inst. of Tech.), BOUNDARY-LAYER FLOWS WITH LARGE INJECTION AND HEAT TRANSFER. AIAA Journal 6 (1), 22-28 (1968).

726. Kuchar, P. J. (Universal Oil Prod. Co.), THE DEHYDROGENATION OF C_6-C_{20} n-PARAFFINS. U.S. 3,429,944 (Cl 260-683.3), Feb. 25, 1969, Appl. December 27, 1967.

727. Kuchta, J. M. and Cato, R. J., HOT GAS IGNITION TEMPERATURES OF HYDROCARBON FUEL VAPOR - AIR MIXTURES. U.S. Bur. Mines, Rept. Invest. No. 6857, 14 pp. (1966); C.A. 66, 12704 (1967).

728. Kuchta, J. M., Bartowiak, A., Zabetakis, M. G., AUTOIGNITION OF HYDROCARBON JET FUEL. U.S. Bur. Mines, Rept. Invest. No. 6654 (1965) 25 pp.

729. Kudryartsev, A. V., EFFECT OF VAPORIZATION OF FUEL ON THE MAGNITUDE OF SELF-IGNITION DELAY IN TWO-PHASE MIXTURES. Fiz. Goreniya, Akad, Nauk Ukr. SSR, Respub. Mezhvedom. Sb. 1966, 94-103 (Russ); C.A. 67, 34626.

730. Kudryshev, L. I. and Zhemkov, L. N., GENERALIZATION OF THE THEORY OF REGULAR HEAT REGIME WITH VARIABLE THERMAL CAPACITY AND THERMAL CONDUCTIVITY COEFFICIENTS. Izvestiya Vysshikh Uchebnykh Zavedenii. Priborostroenie (USSR) (1958), No. 6, 100-8; Great Britian Ministry of Aviation, Technical Information and Library Services Report No. TIL/T. 5683, TT 67-60868, Jan. 1967. 13 pp. (AD 646664).

731. Kunugi, M. and Jinno, H., DETERMINATION OF SIZE AND CONCENTRATION OF SOOT PARTICLES IN DIFFUSION FLAMES BY A LIGHT-SCATTERING TECHNIQUE. In Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., August 14-20, 1966. Proceedings. Pittsburgh, Pa., Combustion Inst. 1967, p. 257-64, 264-6.

732. Kuo, M. H., MICROBIAL ECOLOGY IN A HYDROCARBON-WATER-METAL ENVIRONMENT. Stanford Res. Inst. Final Report 17 November 1965 - 31 January 1967, U.S. Army USA-NLABS67-68-PR, U.S. Army Contract DA-19-129-AMC-216(N), January 1967, 116 pp. (AD 813 185L).

BIBLIOGRAPHY (Contd)

733. Kurkchi', U. M., Garanin, V. I., Minachev, Kh. M., THE KINETICS OF CYCLOHEXANE ISOMERIZATION UNDER HYDROGEN PRESSURE ON A PLATINUM ZEOLITE CATALYST IN A GRADIENT-FREE SYSTEM. Kinet. i Katal. 9 (3), 571-6 (May - June 1968) (Russian).

734. Kuzmin, G. A., THERMAL STATE OF GAS-TURBINE ROTOR DISKS AND THEIR TEMPERATURE STRESSES. Trudy Aviatsionnyi Inst. Kazan (USSR) 1963 (76), 74-88; U.S. Air Force Translation FTD-HT-23-705-67, Oct. 1967, 17 pp. (AD 667 702).

735. Kuznetskii, R. S., ENTHALPY AND BOILING CROSS SECTION OF A LIQUID IN A HEATED TUBE. Inzhenerno-Fizicheskii Zhurnal 8, 632-4 (May 1965); Journal of Engineering Physics 8, 431, 432 (May 1965).

736. Kuznetsov, I. L., Trokhan, A. M., Baranova, G. R., Ignatenko, Iu. V., INVESTIGATION OF FLAME TURBULENCE BY THE PHOTOELECTRIC METHOD. Akad. Nauk SSSR, Doklady 171, 327-30 (Nov. 11, 1966); Soviet Physics-Doklady 11, 964-7 (May 1967) (Translation).

737. Kuznetsov, N. M., VIBRATIONAL RELAXATION IN A RECOMBINING EXPANDING GAS. Teplofizika Vysokikh Temperatur 4, 282-4 (March-April 1966); High Temperature 4, 275-8 (March-April 1966).

BIBLIOGRAPHY (Cont'd)

738. Lazart, R. M. and Mello, J. D. (Chandler Evans, Inc.), EMULSIFIED FUEL AND FUEL CONTROL SYSTEMS. ASME Gas Turbine Conf. and Products Show, March 9-13, 1969, ASME Paper 69-GT-40, 12 pp.

739. Lambrecht, J. and Schafer, E. (Junkers Flugzeug-und Motorenwerke GmbH, West Germany), A WEST GERMAN APPROACH TO REUSABLE LAUNCH VEHICLES. In Space Technology Conference, Palo Alto, Calif., May 9-12, 1967, Proceedings, New York, Society of Automotive Engineers, Inc. (SAE Conf. Proceedings P-16), 1967, p. 144-8.

740. Lamouche, R., VARIATION IN ELECTROSTATIC CHARGES DUE TO THE FLOW OF PETROLEUM PRODUCTS. Rev. Petroliere No. 1065 51-54 (1966); (Abst) J. Inst. Petrol V 52 No. 515 155A (Nov. 1966).

741. Lamoureux, P. E. (Millipore Ltd.), MONITORING AVIATION TURBINE FUEL FOR CONTAMINATION. Filtration Separation 3 (4), 295-7 (1966); C.A. 66, 4660 (1967).

742. Lander, H. and Nixon, A. C., ENDOTHERMIC FUELS FOR HYPERSONIC VEHICLES. AIAA 5th Annual Meeting and Tech. Display, Phil., Pa., Oct. 21-24, 1968, AIAA Paper No. 68-997. 12 pp.

743. Landis, D. M., COALESCENCE CENTRIFUGAL COALESCERS. Chem. Eng. Progr. V61 No. 10 58-63 (Oct 1965).

744. Landis, E. K., Wharton, W. W., Chang, L., Jones, G. M., Jr., CRITICAL POINT PHENOMENA. Chem. Eng. Progress 60 (2), 47-8 (1964).

745. Lappin, G. R. (Eastman Kodak Co.), AMIDE AND IMINE JET FUEL STABILIZERS. U. S. 3,326, 795 (Cl. 260-561), June 20, 1967, Appl. February 11, 1963, 3 pp.; C. A. 67, 75161.

746. Laufer, J., THOUGHTS ON COMPRESSIBLE TURBULENT BOUNDARY LAYERS. Rand Corp., March 1969, 19 pp. (AD 685 705).

747. Lavender, W. J. and Pei, D.C.T., THE EFFECT OF FLUID TURBULENCE ON THE RATE OF HEAT TRANSFER FROM SPHERES. International Journal of Heat and Mass Transfer 10, 529-39 (April 1967).

748. Lavrovskii, K. P., Rozental, A. L., Khabibulayeva, O. K., DEHYDROGENATION OF BUTANE MIXED WITH ETHYLENE AT REDUCED PRESSURE. Neftekhimiya 7 (6), 865-7 (1967).

749. Lawrence, R. A., SYMMETRICAL AND UNSYMMETRICAL FLOW SEPARATION IN SUPERSONIC NOZZLES. Ph. D. Thesis Southern Methodist Univ., U.S. National Aeronautic and Space Admin. NASA-CR-92587, Grant NGR-44-007-006, April 1967, 209 pp. (N68-15974).

BIBLIOGRAPHY (Contd)

750. Lazarev, P. P., CALCULATION OF THE GAS-DYNAMICAL AND THERMODYNAMIC PARAMETERS OF GASES BEHIND INCIDENT AND REFLECTED SHOCK WAVES. In Physical Optics (translation of Fizicheskaia Optika, Moscow, Izdatel'stvo Nauka, 1965) ed. by D. V. Skobel'tsyn, New York, Consultants Bureau, Division of Plenum Publishing Corp., 1966, p. 177-90.

751. LeMott, S. R., Levine, D. G., Peskin, R. L. (Esso Res. and Dev.), EFFECT OF FUEL MOLECULAR WEIGHT ON PARTICLE IGNITION. Eastern Section of the Combustion Inst. 1968 Technical Meeting, Oct. 21,22, 1968. Paper

752. Leas, A., RECLAMATION OF JP-6 TYPE JET FUELS WHICH BECAME THERMALLY UNSTABLE DURING STORAGE. U.S. Air Force. Aero Propulsion Lab. Tech. Doc. Report No. 64-74, June 1964, Iv.

753. Lee, B. H. K., NON-UNIFORM PROPAGATION OF MODERATE STRENGTH BLAST WAVES IN WEDGE AND CONICAL HYPERSONIC NOZZLES. Canadian Nat'l. Aero. Establishment, June 1968, 28 pp. (AD 680 471).

754. Lee, J. H. and Knystautas, R. (McGill Univ.), LASER SPARK IGNITION OF CHEMICALLY REACTIVE GASES. AIAA Journal 7 (2), 312-7 (Feb. 1969).

755. Lees, L. and Chapkis, R. L., SURFACE MASS INJECTION AT SUPERSONIC AND HYPERSONIC SPEEDS AS A PROBLEM IN TURBULENT MIXING: PART I. TWO-DIMENSIONAL FLOW. AIAA Journal 7 (4), 671-80 (April 1969).

756. Lefebvre, A. H., Ibrahim, A.R.A.F., Benson, N.C., FACTORS AFFECTING FRESH MIXTURE ENTRAINMENT IN BLUFF-BODY STABILIZED FLAMES. Combustion and Flame 10 (3), 231-9 (Sept. 1966).

757. Lefebvre, A. H. and Reid, R., THE INFLUENCE OF TURBULENCE ON THE STRUCTURE AND PROPAGATION OF ENCLOSED FLAMES. Combustion and Flame 10 (4), 355-66 (December 1966).

758. Lefler, E. D. (U.S. Air Force, Systems Command, Res. and Technology Div.), SOME PROPULSION/AIRFRAME INTEGRATION ASPECTS OF HYPERSONIC CRUISE AIRCRAFT. In NAECON '67: Proceedings of the Nineteenth Annual National Aerospace Electronics Conf., Dayton, Ohio, May 15-17, 1967, Technical Papers, Dayton, Ohio, Inst. of Electrical and Electronics Engineers, Inc., 1967, p. 71-5.

759. Leuchter, O., AN EXPERIMENTAL METHOD FOR STUDYING AIR-HYDROGEN SUPERSONIC COMBUSTION. AIAA, Aerodynamic Testing Conf., 4th, Cincinnati, Ohio, April 28-30, 1969, Paper 69-339, 11 pp.

760. Levin, V.A., APPROXIMATE SOLUTION OF THE PROBLEM OF A STRONG LOCALIZED EXPLOSION IN A COMBUSTIBLE MIXTURE. Akad. Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza 1967, 122-4 (Jan.-Feb.) (Russ.).

BIBLIOGRAPHY (Contd)

761. Levin, Ye. A., THERMAL CONDUCTIVITY DURING THE EXTERNAL [illegible] OF GAS T[illegible] ENGINE [illegible]. Inzhenerno-Fizicheskii Zhurnal (USSR) 12 (2), [illegible] (1967); U. S. Air Force Translation, Dec. 1967, 1[illegible] pp. (AD [illegible] [illegible]).

762. Levinter, M. E., Panchenkov, G. M., Tanatarov, M.A., DIFFUSION FACTORS IN THE PROCESS OF COKE FORMATION ON AN ALUMINO-SILICATE CATALYST. Khim. i Tekhnol. Topliv i Masel 11 (3), 9-13 (1966) (Russ); C.A. 64, 19271 (1966).

763. Levitskii, I. I., Gryaznov, M. [illegible] et al, THE ACTIVATION OF A PLATINUM-ALUMINA CATALYST IN THE ISOMERIZATION AND HYDROGENOLYSIS OF HYDROCARBONS BY HIGH-TEMPERATURE TREATMENT WITH HYDROGEN. Izv. Akad. Nauk SSSR, Ser. Khim. No. 10 [illegible]-1701 (1966).

764. Levy, R. M., Bauer, D. J., Roth, J. F. (Monsanto Co.), THE EFFECT OF THERMAL AGING ON THE PHYSICAL PROPERTIES OF ACTIVATED ALUMINA. Ind. Eng. Chem., Prod. Res. Develop. 7 (3), 217-20 (Sept. 1968).

765. Levy, S., FORCED CONVECTION SUB-COOLED BOILING: PREDICTION OF VAPOR VOLUMETRIC FRACTION. General Electric Co. Report No. GEAP-5157, AEC Accession No. [illegible], 1966, 33 pp.; C.A. 66, 57059 (1967).

766. Levy, S. (General Electric Co., Atomic Products Div.), FORCED CONVECTION SUB-COOLED BOILING-PREDICTION OF VAPOR VOLUMETRIC FRACTION. Int'l. Journal of Heat and Mass Transfer 10, 951-65 (July 1967).

767. Lewis, A. and Strawson, H. (Shell Res. Ltd.), PREDICTING FUEL REQUIREMENTS FOR THE CONCORDE. SAE National Aeronautics and Space Engineering and Manufacturing Meeting October 7-11, 1968, Paper No. 680734.

768. Lewis, J. E., Kubota, T., Lees, L. (California Inst. of Tech.), EXPERIMENTAL INVESTIGATION OF SUPERSONIC LAMINAR, TWO-DIMENSIONAL BOUNDARY-LAYER SEPARATION IN A COMPRESSION CORNER WITH AND WITHOUT COOLING. AIAA Journal 6 (1), 7-14 (1968).

769. Leyer, J. C., SOME CHARACTERISTICS OF UNSTABLE FLAME PROPAGATION IN A TUBE. C. R. Acad. Sci., Paris, Ser. A, B 264B (2), 112-5 (1967) (Fr.), C.A. 67, 101566.

770. Leynaert, J., AIR INTAKES FOR A MACH 7 AIRCRAFT. AFITAE Colloq. on Appl. Aerodyn. (5th), Poitiers, France, 6-8 November 1968, 18 pp. (in French, English Summary) (N69-20785).

771. Liao, S.C. and Chin, H.C., CATALYTIC PHENOMENA IN COMBUSTION PROCESS. I. ROLE OF WATER IN COMBUSTION PROCESS. Chung-Kuo K'o Hsueh Yuan, Ying Yung Hua Hsueh Yen Chiu Chi K'an 1966 (16), [illegible] (Ch); C.A. 67, 26131.

772. Libby, P. A. (Univ. of Calif.), HEAT AND MASS TRANSFER AT A GENERAL THREE-DIMENSIONAL STAGNATION POINT. AIAA Journal 5, 507-17 (March 1967).

BIBLIOGRAPHY (Contd)

773. E. Lichtner and D. Szalek, INVESTIGATIONS OF THE DEHYDROGENATION ACTIVITY OF POTASSIUM-CONTAINING IRON OXIDE CATALYST. Catalytic Hydrogenation Processes in Petrol. Refining and Chem. Symp. (Leuna [illegible] 22/66); (Abstr.) Chem. Tech. (Berlin) 20 No. 8, 466-68 (Aug 1968).

774. Lick, W. (Calif. Inst. of Tech.), WAVE PROPAGATION IN REAL GASES. Advan. Appl. Mech. 10 (1), 1-72 (1967); C.A. 67, 8504P.

775. Lieberman, A., COMPOSITION OF EXHAUST FROM A REGENERATIVE TURBINE SYSTEM. J. Air Pollution Control Assoc. V. 18 No. 3 149-53 (March 1968).

776. Linan, A., Urrutia, J. L., Fraga, E., ON DIFFUSIVE SUPERSONIC COMBUSTION. Aerospace Proceedings 1966; Royal Aeronautical Soc., Centenary Congress and Int'l. Council of the Aeron. Sci., Congress, 5th, London, England, Sept. 12-16, 1966. V. 2, ed. by J. Bradbrooke et al. London, Macmillan, 1967 p. 607-18. Grant No. AF EOAR 65-69; Ingenieria Aeronautica y Astronautica 18, 15-25 (Sept. - Oct. 1966).

777. Lindenhoffen, H. and Sherfner, R. H., MECHANISM OF WATER COALESCENCE-STUDIES OF COALESCENCE IN A FULL SCALE SINGLE ELEMENT SYSTEM. U.S. Naval Air Eng. Ctr., Aeronautical Engine Lab. Report No. NAEC-AEL-1856, July 1967, 32 pp. (AD 816 374L).

778. Lipshtein, R. A., Olkhovskii, G. G., Shuvalov, S. I., PATHS OF DEVELOPMENT OF STATIONARY GAS TURBINE ENGINES IN USSR. USE OF PETROLEUM FUEL AND DISSOLVED ADDITIVES FOR LOWERING VANADIUM CORROSION IN GAS TURBINE ENGINES. U.S. Dept. Comm. Cl. Fed. Sci. Tech. Inform. AD No. 634 815 (6 66); (Abstr) Corrosion Abstr. V6 N.2 156 (March 1967).

779. Liu, S. W. (Aerospace Corp.), ONSET OF SURFACE COMBUSTION IN STILL ATMOSPHERE. AIAA 7 (4), 734-6 (April 1969).

780. Loeffler, A. L. and Ruth, B. F., MECHANISM OF HINDERED SETTLING AND FLUIDIZATION. U.S. Atomic Energy Comm. ISC-[illegible], 64 pp. (1953); C.A. 50, 4587.

781. Loh, W. H. T. (ed.), JET, ROCKET, NUCLEAR, ION AND ELECTRIC PROPULSION: THEORY AND DESIGN. New York. Springer-Verlag New York, Inc. (Applied Physics and Engineering Series. Volume 7), 1968, 779 pp.
Partial Contents: W.H.T. Loh, FUNDAMENTALS OF THERMODYNAMICS AND AEROTHERMODYNAMICS. P. 3-116, W. H. T. Loh, THERMODYNAMIC CYCLE ANALYSIS OF GAS TURBINES AND AIR-BREATHING PROPULSION SYSTEMS, p. 119-206, W.H.T. Loh, AERODYNAMIC DESIGN OF AXIAL FLOW COMPRESSORS AND TURBINES. p. 207-235; G. L. Dugger, RAMJETS AND AIR-AUGMENTED ROCKETS. p. 236-275; A. F. Charwat, INTERACTION FLOWS DUE TO SUPERSONIC SECONDARY JETS. p. 407-507; A. K. Oppenheim, GASDYNAMICS OF EXPLOSIONS. p. 508-56[illegible], A. Ferri, SUPERSONIC COMBUSTION TECHNOLOGY. p. 562-598; S.I. Cheng, COMBUSTION INSTABILITY THEORY. p. 599-617.

BIBLIOGRAPHY (Cont.)

782. Lokai, V. I., GENERALIZATION OF EXPERIMENTAL DATA CONCERNING HEAT TRANSFER IN THE COOLED PORTION OF THE AIR-GAS FLOW AREA OF HIGH-TEMPERATURE GAS TURBINES. Aviatsionnaia Tekhnika 11 ([illegible]), 67-[illegible] (1968) (Russ.).

783. Lokai, V. I., STUDY OF THE EFFICIENCY OF AIR COOLING GAS TURBINE BLADES. Aviatsionnaia Tekhnika 11 ([illegible]), [illegible]-95 (1968) (Russian).

784. Lokai, V. I., Kili[illegible]nik v, [illegible] M., [illegible], R. [illegible], ENERGY LOSSES IN GAS TURBINES DUE TO AIR BLEEDING FOR COOLING PURPOSES. Aviatsionnaia Tekhnika 1[illegible] (1), [illegible]-7 (1967) (Russ.).

785. Lokai, V. I., SELECTION OF THE OPTIMAL ([illegible]) RATIO IN THE COOLED STAGES OF HIGH TEMPERATURE GAS TURBINES. Izvestiya Vysshikh Uchebnykh Zavedenii Aviatsionnaya Tekhnika (USSR) Special Issue [illegible] Jubilee 19[illegible], 125-3[illegible]; U. S. Air Force Translation, February 19[illegible], 21 pp. (AD 687 [illegible]).

786. Lombard, A. A. (Rolls-Royce, Ltd.), AIRCRAFT POWER PLANTS-PAST, PRESENT AND FUTURE. Royal Soc. (London), Proceedings, Series A, [illegible], 1-[illegible] (March 28, 1967).

787. Lombardo, [illegible], Moskowitz, S. L., Schnure, [illegible] A. (Curtiss-Wright Corp.), EXPERIMENTAL RESULTS OF A TRANSPIRATION-COOLED TURBINE OPERATED IN AN ENGINE FOR 100 HOURS AT [illegible] F TURBINE INLET TEMPERATURE. Amer. Soc. of Mechanical Engineers, Gas Turbine Conf. and Products Show, March 5-9 1967, Paper 67-[illegible], 11 pp.

788. London, S. A., Finef[illegible]k, V. R., Killian, L. N., MICROBIAL ACTIVITY IN AIR FORCE JET FUEL SYSTEMS. FINAL REPORT FOR FEB. 19[illegible]-APRIL 19[illegible]. U.S. Dept. Commerce Clearinghouse Fed. Sci. Tech. Info. AD [illegible], [illegible] (April 1965) 51 pp.; (Abstr) Corrosion Abstr. [illegible] (Jan. 19[illegible]).

789. Long, M. A., Odell, A. L., Richardson, J. R., THE REACTIONS OF HYDROCARBONS ON TRANSITION METAL CATALYSTS IN THE PRESENCE OF TRITIUM. I. THE LABELING OF CYCLOHEXANE BY EXCHANGE WITH TRITIUM GAS ON RANEY NICKEL. J. Catalysis 9 (4), 410-5 (1967).

790. Long, R. and Tompkins, E. E., FORMATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN PREMIXED ACETYLENE-OXYGEN FLAMES. Nature [illegible] (5080), 1011-12 (1967); C.A. 67, 25720.

791. Lopez, H. J. (AiRes. Manufacturing Co.), HYPERSONIC RESEARCH ENGINE AERODYNAMIC DESIGN. AIAA Propulsion Joint Specialist Conf., 5th, Colorado Springs, Colo., June 9-13, 1969, Paper (Classified).

792. Lopina, R. F. and Bergles, A. E., HEAT TRANSFER AND PRESSURE DROP IN TAPE GENERATED SWIRL FLOW. Mass. Inst. of Tech., Nat'l. Magnet Lab. Report No. [illegible]-[illegible]-51-47, F 44 620-67-C-0047, June 1967, 150 pp. (AD 654 759).

BIBLIOGRAPHY (Cont'd)

793. Lorinc, I., INVESTIGATION OF HYDROCARBON FLAMES. Magy. Kem. Lap'a 22 (5), 225-40 (1967) (Hung); C.A. 67, 45706.

794. Love, B.E., Hatchett, K.A., Peat, A.E., FUEL RELATED PROBLEMS IN ENGINE FUEL SYSTEMS. Soc. of Automotive Engineers, Aeron. and Space Engineering and Manufacturing Mtg., Los Angeles, Calif., Oct. 3-7, 1966, Paper 66C714, 24 pp.

795. Losorci, A. A., Malkova, S. S., Ionov, I.F., Lavrovskaya, E. V., Muselevich, D. L., Pchelina, D. P., EFFECT OF THE CHEMICAL STRUCTURE OF HYDROCARBONS ON THEIR THERMAL OXIDATION STABILITY. Khim. Tverd. Topl. 1967 (2), 66-9 (Russ.); C.A. 67, 73 209.

796. Lubard, S. C. and Schetz, J. A. (Univ. of Maryland), ATOMIZATION AND VAPORIZATION OF A LIQUID SHEET EXPOSED TO A SUPERSONIC AIRSTREAM. Amer. Inst. of Aeron. and Astronautics, Propulsion Joint Specialist Conf., 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-645, 8 pp.

797. Lucas, J. R. (General Motors Corp.), A PRELIMINARY EVALUATION OF AN EMULSIFIED FUEL MIXTURE IN THE MODEL T63 TURBINE ENGINE. Soc. of Automotive Engineers, Nat'l. Aeronautic Mtg., April 24-27, 1967, Paper 670368, 12 pp.

798. Luebben, M., Baumgaertel, G., Fetting, F., STABILITY OF DIFFUSION FLAMES IN COMBUSTION CHAMBERS. Chem. Ing. Tech. 38 (12), 1260-4 (1966); C.A. 66, 97080 (1967).

799. Lui, J. T. C. (Princeton Univ.), THE EFFECT OF WALL TEMPERATURE ON THE LOW REYNOLDS NUMBER HYPERSONIC STAGNATION REGION SHOCK LAYER. Int. J. Heat Mass Tranfer 10 (1), 83-95 (1967); C.A. 66. 57322 (1967).

800. Luikov, A. V., HEAT TRANSFER BIBLIOGRAPHY-RUSSIAN WORKS. International Journal of Heat and Mass Transfer 11, 755-67 (April 1968).

801. Luikov, A. V., HEAT TRANSFER BIBLIOGRAPHY-RUSSIAN WORKS. Int'l. J. of Heat and Mass Transfer 10, 999-1014 (July 1967).

802. Luikov, A. V., HEAT TRANSFER BIBLIOGRAPHY-RUSSIAN WORKS. Int'l. J. of Heat and Mass Transfer 9, 975-85 (Sept. 1966).

803. Lumpkin, R. E., Jr., EFFECTS OF MODEL STRUCTURE ON THE BEHAVIOR OF HETEROGENEOUS CATALYTIC REACTIONS. Univ. Rochester Diss. 1968, 255 pp.; Diss. Abstr. B29 (6), 2026B-2027B (Dec. 1968).

804. Luss, D. (Univ. Houston), BOUNDS ON THE EFFECTIVENESS FACTORS FOR EXOTHERMIC CATALYTIC REACTION. AIChE Journal 14 (6), 966-9 (Nov. 1968).

805. Lutz, O., RAMJET DESIGN AND PRINCIPLES OF OPERATION. VDI Zeitschrift 110 (22), 985-9 (1968).

BIBLIOGRAPHY (Cont'd)

806. Lydton, D., PROBLEMS IN APPLYING THE LINE REVERSAL METHOD OF TEMPERATURE MEASUREMENTS TO FLAMES. Combustion and Flame 12, 541-9 (Dec. 1968).

807. Lyle, R. G., GLOSSARY OF TERMS IN HIGH TEMPERATURE, THERMAL PROTECTION TECHNOLOGY. U.S. Nat'l. Academy of Sciences - National Research Council, Div. of Chemistry and Chemical Technology Report, U.S. National Aeronautics and Space Agency NASA-CR-92580, Contract NASr-162, January 1968, 22 pp. (N68-15621).

808. Lynch, R. A. (General Dynamics Corp.), PROPULSION FOR LIFTING ENTRY VEHICLES. AIAA, Aerospace Sciences Meeting, 6th, New York, N.Y., January 22-24, Paper 68-184, 8 pp.

BIBLIOGRAPHY (Contd)

809. Macdonald, J. A. (Great Brit. Ministry of Aviation), ASSESSMENT OF THE FLAMMABILITY OF AIRCRAFT FLUIDS. Fire Resistance of Hydraulic Fluids; Symposium Presented at a Meeting of the American Society for Testing and Materials, and The Society of Automotive Engineers, New Orleans, January 26,27, 1966, Philadelphia, American Society for Testing and Materials (ASTM Special Technical Publication No. 406), 1966, 44-63 (1966).

810. Mac Miller, C. J. (North American Aviation, Inc.), MIXED MISSIONS - POTENTIAL IMPROVEMENTS IN THERMAL MANAGEMENT OF HYPERSONIC DESIGNS. Society of Automotive Engineers, National Aeronautic Meeting, New York, N.Y., April 24-27, 1967, Paper 670354, 8pp.

811. Maikapar, G. I., OPTIMUM SHAPE OF LIFTING BODIES AT HYPERSONIC SPEEDS. Akademiia Nauk SSSP, Izvestiia, Mekhanika Zhidkosti i Gaza 1967, 35-47 (March-April) (in Russian).

812. Maile, P. G., Hawks, W. R., Edgington, P. J., THE DEVELOPMENT OF JET AIRCRAFT FUELS. 16th Deut Ges Mineraloelwiss U Kohlechem Ann Mtg (Cologne 10 8 64).; Erdoel Kohle 18(6), 441-5 (June 1965).

813. Main, R. P. and Bauer, E. (Heliodyne Corp.), EQUILIBRIUM OPACITIES AND EMISSIVITIES OF HYDROCARBON-AIR MIXTURES AT HIGH TEMPERATURES. J. Quant. Spectrosc. Radiat. Transfer 7(4), 527-57 (1967); C.A. 67, 69100.

814. Makofski, R. A. and Dickens, W. P. (Johns Hopkins Univ.), LOW-ALTITUDE HYPERSONIC FLOW SIMULATION BY MEANS OF A SUPERSONIC COMPRESSOR. J. Spacecraft Rockets 3(11), 1644-50 (1966); C.A. 66, 30496 (1967).

815. Malick, E. A. (to Phillips Petroleum Co.), PREVENTION OF MICROBIAL GROWTH, CORROSION AND THE LIKE. U.S. 3, 291, 580 (Cl. 44-53), December 13, 1966, Appl. April 30, 1962, and May 3, 1963; 7 pp.; C.A. 66, 30709 (1967).

816. Mamula, P., Pasek, J., Horak, J., Koudelik, P., HEAT AND MASS TRANSFER IN HETEROGENEOUS CATALYSIS. VII. EFFECT OF CATALYST HEAT CONDUCTIVITY ON THE OVER ALL HEAT-TRANSFER COEFFICEINT IN A PACKED TUBE. Chem. Prum. 17(8), 418-24 (1967) (Czech); C.A. 67, 118554.

817. Marble, F. E. (California Institute of Technology), ANALYTICAL STUDIES OF TWO-PHASE FLOW IN PROPULSION SYSTEMS. In 1967 Heat Transfer and Fluid Mechanics Institute, University of California, La Jolla, Calif., June 19-21, 1967, Proceedings, ed. by P. A. Libby, et al., Stanford, Calif., Stanford University Press, 1967, p. 191,192.

818. Marchal, R., FORMULAS OF RELATIVISTIC TRANSFORMATION IN THERMODYNAMICS. Entropie 1967, 9-12 (May-June) (in French).

BIBLIOGRAPHY (Contd)

819. Marchal, R. and Servanty, P., GAS TURBINES WITH PULSATING COMBUSTION CHAMBERS. Entropie [illegible], 37-40 (September-October).

820. Mardashev, Yu. S., THE KINETICS OF DEHYDROGENATION OF C_6H_{12} OVER NICKEL CATALYSTS. Acta Chim. Acad. Sci. Hung. [illegible](1), 35-9 (1968).

821. Marguet, R., DEVELOPMENT AND FLIGHT TESTS OF AN EXPERIMENTAL RAMJET AT MACH 5. Technique et Science Aeronautiques et Spatiales [illegible], 435-8 (Sept.-Oct.; Nov.-Dec.).

822. Marguet, R., DESIGN AND FLIGHT TESTS OF A MACH-NUMBER-5 EXPERIMENTAL RAMJET. Pyrodynamics 5, 307-40 (October 1967).

823. Marinchenko, N. I., Chertkov, Ya. B., Piskunov, V. A., COMBUSTION DEPOSIT FORMATION IN JET ENGINES. Khim. i Tekhnol. Topliv i Masel 9(1), 51-5 (1964).

824. Markov, S., RECENT SOVIET RESEARCH ON THE FORMATION OF PARTICULATE CONTAMINANTS, SEDIMENTS AND DEPOSITS IN JET FUELS. Aerospace Technology Div., Library of Congress, Report 67-54, 29 June 1968.

825. Marsh, K. J. Hawks, W. R., FIELD MEASUREMENTS OF THE GENERATION OF STATIC ELECTRICITY DURING THE ROUTINE FUELING OF AIRCRAFT. 30th API Div. Refining Midyear Mtg., Montreal, May 10-12, 1965. Preprint No. 37-65, 15 pp.

826. Martel, C. R. and Jones, H. F. (U.S. Air Force Aero Propulsion Lab.), ADVANCED HYDROCARBON FUEL HANDLING. American Institute of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-557, 7 pp.

827. Marumo, H., Ninomiya, M., THE PROPERTY OF METAL SALTS OF AMPHOTERIC SURFACE ACTIVE AGENTS AS THE INTERNAL ANTISTATIC AGENTS FOR LIQUID HYDROCARBONS. Kogyo Kagaku Zasshi 69(9), 1886-91, A105 (1966).

828. Mascitti, V. R., A SIMPLIFIED EQUILIBRIUM HYDROCARBON-AIR COMBUSTION GAS MODEL FOR CONVENIENT USE IN AIR-BREATHING ENGINE CYCLE COMPUTER PROGRAMS. U.S. National Aeronautics and Space Administration, Langley Research Center, 1968, 51 pp. (N 69-19694).

829. Mascitti, V. R., (NASA, Langley Research Center), A CLOSED-FORM SOLUTION TO OBLIQUE SHOCK-WAVE PROPERTIES. Journal of Aircraft 6, 66 (January-February 1969).

830. Mashireva, L. G. and Murakhovskaya, A. S., SPECTRAL DETERMINATION OF SODIUM IN DISTILLATE FUELS FOR GAS TURBINES. Khim. I Tekhnol, Topliv i Masel V12 N.8 53-55 (Aug. 1967).

831. Matheson, J. C., (United Aircraft Corp.), FLOX/LIGHT-HYDROCARBON PROPELLANT RESEARCH. Society of Automotive Engineers, Space Technology Conference, Washington, D.C., May 8-10, 1968, Proceedings. New York, Society of Automotive Engineers, Inc., 1968, p. 66-81.

BIBLIOGRAPHY (Cont'd)

832. Matsen, J. M. and Harding, J. W. (Esso Research and Engineering Co.), CONVERSION OF CYCLOHEXANE TO BENZENE. U.S. 3, 326, 994 (Cl. 260-668), June 20, 1967, Appl. December 3, 1963, 9 pp.; C.A. 67, 73315.

833. Matsumoto, H. and Morita, Y., THE ACTIVITIES OF ZEOLITE CATALYSTS FOR THE REACTION(S) OF AROMATIC HYDROCARBONS. Bull. Jap. Petrol. Inst. 10:8-13 (May 1968).

834. Maulard, J., MEASUREMENTS OF HEAT FLUXES IN VERY SHORT FLOWS. Colloque sur l'Aerodynamique Hypersonique et les Techniques l'Etude des Phenomenes Rapides, Saint-Louis, Haut-Rhin, France, June 14,15, 1966, Communication; ONERA, TP no. 372, 1966, 19pp.

835. Mayer, E. and Divoky, D. (National Engineering Science Co.), CORRELATION OF INTERMITTENCY WITH PREFERENTIAL TRANSPORT OF HEAT AND CHEMICAL SPECIES IN TURBULENT SHEAR FLOWS. AIAA Journal 4, 1995-2000 (November 1966).

836. Mayer, S. W. and Schieler, L. (Aerospace Corp.), COMPUTED RATE CONSTANTS AND ACTIVATION ENERGIES FOR THE ABSTACTION REACTION OF GROUND-STATE AND EXCITED OXYGEN WITH FUELS. Combustion Institute, Western States Section, Spring Meeting, University of Southern California, Los Angeles, Calif. April 29,30, 1968, Paper WSCI-68-2, 13pp.

837. Mayer, S. W. and Schieler, L. (Aerospace Corp.), ACTIVATION ENERGIES AND RATE CONSTANTS COMPUTED FOR REACTIONS OF OXYGEN WITH HYDROCARBONS. Journal of Physical Chemistry 72, 2628-31 (July 1968).

838. McAninch, H. C. (Continental Oil Co.), THE RELATION OF BOILING POINT AND DENSITY TO MOLECULAR STRUCTURE OF HEAVY HYDROCARBONS. Amer. Chem. Soc., Div. Petrol. Chem., Preprints 12(1), 51-6 (1967); C.A. 67, 55869.

839. McCourt, E. P. (U.S. Army Aviation Material Labs.), DEVELOPMENTS IN THE U.S. ARMY EMULSIFIED FUELS PROGRAM. AIAA, Propulsion Joint Specialist Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-558, 7pp.

840. McLaughlin, C. W. (Wright-Patterson A.F.B.), PERFORMANCE OF VARIOUS MIXTURES OF HYDROGEN AND METHANE. Avail. CFSTI, 1966, 89pp. (AD 652387); C.A. 67, 13433.

841. McMurray, G., EXPLORATORY DEVELOPMENT FOR MISSILE PROPULSION. Johns Hopkins University, Applied Physics Lab. Quarterly Report 1 January-31 March 1967, Report no. DQR/67-1, U.S. Navy Contract NOw-62-0604, March 1967, 29pp. (AD 381 551L) (Report Classified Confidential).

842. McRae, R. P., EXPERIMENTAL INVESTIGATION OF A LIQUID JET INJECTED ACROSS A HIGH VELOCITY GAS STREAM. Douglas Aircraft Co. Report SM-47879, May 1966.

BIBLIOGRAPHY (Cont'd)

843. Meckstroth, F. A. and Bartle, E. R. (General Dynamics Corp.), QUICK CHANGE, HIGH VACUUM WINDOW AND HEAT TRANSFER GAUGE INSTALLATION FOR SHOCK TUBES. Review of Scientific Instruments. 38, 448 (March 1967).

844. Medvedev, V. N. and Starligov O. D., CATALYTIC DEHYDROGENATION OF ISOPENTANE IN FLOW VS. IMPULSE SYSTEMS. Izv. Akad. Nauk SSSR, Ser. Khim. 1966(6), 1578-80.

845. Meerovich, I. G., TEMPERATURE FIELD IN MULTILAYER SYSTEMS WITH VARIABLE THERMOPHYSICAL PROPERTIES. Inzhenerno - Fizicheskii Zhurnal 12, 484-90 (April 1967).

846. Meguerian, G. H. and Rakowsky, F. W. (American Oil Co.), HYDROCARBON IGNITION IN THE PRESENCE OF METAL OXIDES. Combustion and Flame 11(2), 135-40 (April 1967) Contract No. DA-18-108-AMC-198(A).

847. Meier, H. U., A COMBINED TEMPERATURE AND PRESSURE PROBE FOR COMPRESSIBLE FLOW. AIAA Journal 7(3), 529-30 (March 1969).

848. Meier zu Koecker, H. and Muelders, B., MEASUREMENTS OF THE IGNITION DELAY AND COMBUSTION RATE OF FREE FALLING HYDROCARBON DROPS. Erdoel Kohle V17 N.9. 721-25 (Sept. 1964).

849. Meier zu Koecker, H., IGNITION DELAY TIME OF FUEL DROPS...PROBLEMS IN PREDICTIVE VALIDITY OF LABORATORY IGNITION DELAY MEASUREMENTS. Chem.-Ingr.-Tech. V39 N.7 415-21 (4/10/67).

850. Melvin, A., FLAME PROPAGATION ON THERMAL IGNITION. Combustion and Flame 13(2), 199-203 (April 1969).

851. Mercer, W. E., III (Wright-Patterson A.F.B.), CONVECTION AND RADIATION HEAT TRANSFER IN THE ENTRANCE REGION BETWEEN PARALLEL PLATES. NASA Accession No. N65-33987, 1965, 129pp. (AD 618027); C.A. 67, 13132.

852. Merzhanov, A. G., THE THEORY OF STABLE HOMOGENEOUS COMBUSTION OF CONDENSED SUBSTANCES. Combustion and Flame 13(2), 143-56 (April 1969).

853. Messerlie, R. L. and Cox, D. M. (General Motors Corp.), PERFORMANCE INVESTIGATION OF VARIABLE TURBINE GEOMETRY IN GAS TURBINE ENGINES. AIAA Propulsion Joint Specialist Conference, 3rd, Washington, D.C., July 17-21, 1967, Paper 67-417, 17pp.

854. Messerlie, R. L. Gill, J. C., Naylor, M. W. (General Motors Corp.), INCREASED TURBINE TEMPERATURE ENGINES AS APPLIED TO A MULTIMISSION AIRCRAFT. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper. (Classified).

855. Metcalfe, T. B., KINETICS OF COKE COMBUSTION IN CATALYST REGENERATION. Brit. Chem. Eng. 12(3), 388-9 (1967); C.A. 67 110286.

BIBLIOGRAPHY (Contd)

856. Mezaki, R. (Yale Univ.), SIGNIFICANCE OF ADSORPTION EQUILIBRIUM CONSTANTS OF RATE EQUATIONS INVOLVING SOLID CATALYSTS. AIChE Journal 14(6), 904-6 (November 1968).

857. Miale, J. N., Chen, N. Y., Weisz, P. B. (Mobil Oil Corp.), CATALYSIS BY CRYSTALLINE ALUMINOSILICATES. IV. ATTAINABLE CATALYTIC CRACKING RATE CONSTANTS, AND SUPERACTIVITY. J. Catalysis 6(2), 278-87 (1966); C.A. 65, 16108 (1966).

858. Miale, J. N. and Weisz, P. B. (Socony Mobil Oil Co., Inc.), ALUMINO SILICATE CRACKING CATALYSTS. U.S. 3, 173, 855 (Cl 208-120), March 16, 1965, Appl. December 29, 1961; 11pp. C.A. 63, 412 (1965).

859. Michel, R. (ONERA), THERMAL CHARACTERISTICS OF BOUNDARY LAYERS AND PRACTICAL CALCULATION OF HYPERSONIC HEAT TRANSFER. Progress in Aeronautical Sciences. Vol. 9. ONERA TP no. 452, 1966, 135 pp. (in French).

860. Miele, A., GENERAL STUDY OF OPTIMUM AERODYNAMIC SHAPES IN SUPERSONIC, HYPERSONIC, AND FREE-MOLECULAR FLOW. Rice Univ., 1969, 46pp. (AD 848 370).

861. Migdal, D., Klein, K., Moretti, G. (Grumman Aircraft Engineering Corp.), TIME-DEPENDENT CALCULATIONS FOR TRANSONIC NOZZLE FLOW. AIAA Journal 7(2), 372-4 (February 1969).

862. Mikhailov, V. V., METHOD OF DESIGNING SUPERSONIC NOZZLES WITH ALLOWANCE FOR THE EFFECT OF VISCOSITY. Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza, 1969, 69-72 (January-February).

863. Mikhaylov, Yu., CRITERIAL EQUATIONS OF NONSTEADY HEAT AND MASS TRANSFER IN MOIST MATERIALS. Izv. Akad. Nauk Latv. SSR, Ser. Energ. (Riga), 1962(10), 87-9; U.S. Air Force Translation FTD-HT-67-475, August 1967, 11pp (AD 662 794) (N68-15 119).

864. Mikheev, M. A., COMPUTATION FORMULAS FOR CONVECTIVE HEAT TRANSFER. Izv. Akad. Nauk SSSR, Energ. Transp. 1966(5), 96-104 (Russ.); C.A. 66, 12398 (1967).

865. Milford, C. M. and Migdal, D. (Grumman Aircraft Engineering Corp.), EFFECT OF BACK PRESSURE ON NOZZLE THRUST. J. Aircraft 4(6), 562-3 (November-December 1967).

866. Miller, W. J., FLAME IONIZATION AND COMBUSTION INHIBITION. Aerochem Res. Labs., Inc., TP-151; TR-1, Contract CST-102, January 1967, 26pp. (N68-17035).

[illegible]

867. Miller, W. J. (AeroChem Research Laboratories, Inc.), LOW-PRESSURE FLAME COMPOSITION AND THE ORIGIN OF $C_3H_3^+$. Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., August 14-20, 1966, Proceedings. Pittsburgh, Pa., Combustion Institute, 1967, p. 311-9, 319, 320. U.S. Navy Contract No. Nonr-3609(00).

868. Miller, W. J. (AeroChem Research Labs., Inc.), IONIZATION IN COMBUSTION PROCESSES. Oxidation and Combustion Revs. 3, 97-127 (1968).

869. Miller, W. J., INHIBITION OF LOW PRESSURE FLAMES. Combustion and Flame 13(2), 210-2 (April 1969).

870. Mills, G. A., Heinemann, H., Milliken, T. H., Oblad, A. G., CATALYTIC MECHANISM. Industrial and Engineering Chemistry 45, no. 1, 134-7 (1953).

871. Milne, T. A. and Greene, F. T., MASS SPECTROMETER STUDY OF METAL-CONTAINING FLAMES. Midwest Research Inst. Final Technical Summary Report, 1 September 1961-30 November 1967, U.S. Navy Contract Nonr-3599(00), January 1968, 25pp. (AD 664 332).

872. Minachev, Kh. D. and Markov, M. A., CATALYTIC PROPERTIES OF RARE EARTH OXIDES IN REFORMING OF HYDROCARBONS AND CYCLIC ALCOHOLS. Probl. Kinetiki i Kataliza, Akad. Nauk SSSR 11, 223-9 (1966) (Russ.); C.A. 66, 20646. (1967).

873. Minachev, Kh. M., Isakov, Ya. I., Geranin, V. I., PREPARING CATALYSTS FOR THE CONVERSION OF AROMATIC HYDROCARBONS. U.S.S.R. 187, 735 (Cl. B 01J), October 20, 1966, Appl. June 21, 1965; C.A. 67, 4647.

874. Minns, H., Oliver, B. H., Rolston, J. H., (Polymer Corp. Ltd.), A HYDROCARBON DEHYDROGENATION CATALYST. U.S. 3, 409, 696 (Cl. 260-680), November 5, 1968, Appl. July 16, 1964.

875. Mirels, H. (Aerospace Corp.), FLOW NONUNIFORMITY IN SHOCK TUBES OPERATING AT MAXIMUM TEST TIMES. Physics of Fluids 9, 1907-12 (October 1966). U.S. Air Force Contract AF 04(695)-669.

876. Mitrofanova, A. N., Boronin, V.S., Poltorak, O. M., DEHYDROGENATION OF CYCLOHEXANE ON PLATINIZED SILCIA GELS OF VARIOUS TYPES. Vestn. Mosk. Univ. Ser. II 21(5), 40-4 (1966) (Russ.); C.A. 66, 37060 (1967).

877. Mitschka, P., Schneider, P., Beskov, V. S., EFFECT OF INTERNAL DIFFUSION ON CATALYTIC REACTIONS. 5. NONISOTHERMAL CASE WITH A MONOMOLECULAR LANGMUIR-HINSHELWOOD RATE EQUATION. Collect. Czech. Chem. Commun. 33(11), 3598-3617 (November 1968).

878. Miyabe, H., Ogoshi, H., Katsuta, M., Takahashi, E., CATALYTIC CRACKING OF HEXANE OVER FLUORINE-TREATED ALUMINA CATALYSTS. Kogyo Kagaku Zasshi 68(4), 649-53 (1965)(Japan).; C.A. 65, 12365 (1966).

BIBLIOGRAPHY (Cont'd)

879. Mizrahi, I. and Nigam, I. C., REACTION GAS CHROMATOGRAPHY. II. DEHYDROGENATION OF MONOTERPENE COMPOUNDS ON PLATINUM-ALUMINA CATALYST. J. Chromatogr. 25(2), 230-41 (1966); C.A. [illegible], [illegible] (1967).

880. Mobil Oil Corp., CATALYSTS FOR HYDROCARBON CONVERSION. Brit. 1,064,985 (Cl. C [illegible]), April 12, 1967, U.S. Appl. October 24, 1962, 6pp.; C.A. [illegible], 73514.

881. Mobil Oil Corp., STABILIZED JET AIRCRAFT FUEL. Brit. 1,053,065 (Cl. C 011) December 30, 1966; U.S. Appl. May 31, 1963; 6pp.; C.A. 66, 78105 (1967).

882. Mobil Oil Corp. (by R. L. Wadlinger, E. J. Rosinski, C. J. Plank), SYNTHETIC ZEOLITE. Brit. 1,074,1[illegible] (Cl. C 01b), June 28, 1967, Appl. December 4, 1963, 15pp.; C.A. 67, [illegible]6131.

883. Moehring, J. T. and Mentzer, R. L. (General Electric Co.), PROGRESS AND PERSPECTIVE-GE4 ENGINE SYSTEMS AND A KEROSINE FUEL [illegible] SUPERSONIC TRANSPORT PROPULSION. ASME 14th Annual International [illegible] [illegible]bine Conference and Products Show, March 9-13, 1969, 17pp.

884. Monaghan, M. T., Siddall, R. G., Thring, M. W., THE INFLUENCE OF INITIAL DIAMETER ON THE COMBUSTION OF SINGLE DROPS OF LIQUID FUEL. Combustion and Flame 12, 45-55 (February 1968).

885. Mons, R. F., and Sforza, P. M. (Polytechnic Institute of Brooklyn), CHEMICAL REACTIONS IN COMPRESSIBLE TURBULENT MIXING FLOWS. AIAA Propulsion Joint Specialist Conference, 5th, June 9-13, 1969, AIAA Paper no. 69-5[illegible]7, 11pp.

886. Moore, D. R., REAL GAS EFFECTS IN HYPERSONIC AERODYNAMIC HEATING. University of Texas, Defense Research Laboratory Report no. DRL-485 prepared in Cooperation with Johns Hopkins University, Applied Physics Laboratory CF-2987, U.S. Navy Contract NOrd-16 498, June 1962, 55pp. (AD 650 954).

887. Moore, H. B. and Clinch, J. M., APPLICATION OF EXTENDED PLUG NOZZLE NOISE SUPPRESSION THEORY TO A SMALL TURBOJET ENGINE. Williams Research Corp. Final Report, U.S. Federal Aviation Agency Report FAA ADS-56, U.S. Federal Aviation Agency Contract FA-64-WA-5062, August 1965, 180pp. (AD 645 978).

888. Morgan, J. T. (U.S. Air Force Aero Propulsion Lab.) FUEL DEVELOPMENT PROGRAMS AND THEIR IMPACT ON AIRCRAFT SUPPORT CONCEPTS. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969. Paper.

889. Morgenthaler, J. H. and Marchello, J. M. ([illegible] Univ.), TH[illegible] TRANSFER COEFFICIENT IN [illegible] FLOW. American Institute of Chemical Engineers, Annual Meeting, [illegible], Symposium on Fundamentals of Fluid Dynamics, Philadelphia, Pa., December [illegible], Paper; International Journal of Heat and Mass Transfer 9, 14[illegible] (December 19[illegible]).

890. Morris, [illegible], IN A [illegible] OF FUEL AND ENGINE LUBRICANT REQUIREMENTS FOR THE [illegible]. [illegible] Automotive Engrs.-Am. [illegible] Mech. Engrs. Air Transport + Space Mtg. (New York 4 27-30 [illegible]) Paper N. [illegible].

891. Morris, C. [illegible], COOLANT, FUEL AND LUBRICANT MODIFICATION MATERIALS FIELD EVALUATION. U.S. Army [illegible] and [illegible] Laboratory, Aberdeen Proving Ground Report no. [illegible]-215, October 19[illegible], 27pp. (AD [illegible]) (REPORT CLASSIFIED CONFIDENTIAL).

892. Morrison, M. [illegible] and Scheller, K. (U.S. Air Force Aerospace Research Labs), SPECTRAL CHARACTERISTICS OF HYDROCARBON-AIR FLAMES CONTAINING ALUMINUM MA[illegible] AND BORON. Combustion and Flame 15, 95-7, (February 19[illegible]).

893. Morrison, R. T., ORIENTATION AND REACTIVITY IN FREE RADICAL AROMATIC SUBSTITUTION. New York University, Dept. of Chemistry Final Report, U.S. Air Force AFOSR 67-1059, U.S. Air Force Contract AF-AFOSR-519-64, April 19[illegible], 5pp. (AD [illegible]2250).

894. Mortikov, E. S., Rozengart, M. I., Kazanskii, B. A., DEHYDROCYCLIZATION OF n-HEPTENES UNDER CONDITIONS OF A [illegible] SYSTEM AND IN THE [illegible] FLOW-TYPE SETUP. Izv. Akad. Nauk SSSR, Ser. Khim. 19[illegible](1), 103-6.

895. Moss, R. L., THE STRUCTURE AND ACTIVITY OF HETEROGENEOUS CATALYSTS. Chem. Engr. (London), No. 129: CE114-CE141 (June 1966); C.A. 65, 6345.

896. Mosse, A. I., TRANSPORT IN A BOUNDARY LAYER ON A PLATE WITH TWO REACTION FRONTS. Sb. [illegible] Teplo-Massoobmena, Inst. Teplo-Massoobmena Akad. Nauk Belorussk. SSR 19[illegible], 48-54 (Russ.); C.A. 67, 45521.

897. Mostyn, R. A. and Cunningham, A. F., SOME APPLICATIONS OF ATOMIC ABSORPTION SPECTROSCOPY TO THE ANALYSIS OF FUELS AND LUBRICANTS. J. Inst. Petrol. 53(519), 101-8, discussion 108-11 (1967); C.A. 67, 4560.

898. Moulds, W. J. and Young, J. D., AERODYNAMIC HEATING AND ABLATION COMPUTER PROGRAM (HEAT AB). U.S. Air Force Weapons Laboratory, Kirtland A.F.B. Technical Report January-May 1966, Report no. AFWL-TR-66-105, October 1966, 44pp. (AD 800 437).

[illegible]. M[illegible], [illegible] (General Electric [illegible]), [illegible] AIRCRAFT [illegible] ENVIRONMENTAL [illegible] THE [illegible]. Society of Automotive Engineers, Automotive Engineering Congress, Detroit, Mich., January [illegible]-13, 19[illegible]7, Paper 670[illegible], 11 pp.

900. Mrowca, [illegible] and Katz, T. [illegible], CATALYSIS OF A CYCLOADDITION REACTION BY RHODIUM ON CARBON. J. Am. Chem. Soc. [illegible](17), [illegible] (19[illegible]).

901. Mucha, Z., APPLICATION OF THE [illegible]-PINCH EFFECT FOR GENERATION OF STRONG SHOCK WAVES. Academie Polonaise des Sciences, Bulletin, Serie des Sciences Techniques 15(1), [illegible]-15 (1967).

902. Mueller, H. and Wencke, K., DEHYDROGENATION OF CYCLOHEXANE IN LOW-CONCENTRATION RHENIUM [illegible] CATALYSTS. Monatsber. Deut. Akad. Wiss. Berlin [illegible], [illegible] (19[illegible]) [illegible]; C.A. [illegible], 26127.

903. [illegible], A., PROBLEMS OF HYPERSONIC AERODYNAMICS AND AERODYNAMIC HEATING AT HYPERSONIC MACH NUMBER, WITH EMPHASIS ON LOW REYNOLDS NUMBERS. Simposio Spaziale Europeo, 4th. Rome, Italy, June 1[illegible]-21, 19[illegible], Comunicazione; Missili e Spazio [illegible], [illegible] (June 19[illegible]) (in Italian). U.S. Air Force Contract AF EOAR [illegible].

904. Müll[illegible]r, W., EXPERIMENTAL INVESTIGATION OF COMBUSTION AT TURBINE CASCADES. Nordrhein-Westfalen, Forschungsberichte [illegible], no. [illegible], [illegible]pp. (in German).

905. Munson, T. R. and Spindler, R. J., TRANSIENT THERMAL BEHAVIOR OF DECOMPOSING MATERIALS. I. GENERAL THEORY AND APPLICATION TO CONVECTIVE HEATING. AVCO Corp. Report RAD-TR-62-14, U.S. Air Force [illegible]-TDR-[illegible], Contracts AF 04(647)-305, AF 04(647)-258, AF 04([illegible]) [illegible], January 1965, p. 383-407 (N[illegible]-31629) (AD [illegible]).

906. Murakami, [illegible]. KINETICS IN THE PULSE POISONING TECHNIQUE (FOR CATALYSTS). Kogyo Kagaku Zasshi 71(9), 1[illegible], [illegible] (September 1968) (in Japanese).

907. Muroi, S. and Hosoi, K., A HIGH-SURFACE-AREA FINELY DIVIDED METAL, USEFUL AS A CATALYST. J. Appl. Polymer Sci. 11, no. 11, [illegible] (November, 1967).

908. Murthy, S. N. B. (University of Massachusetts), SIMPLE SCALING PARAMETERS FOR AIR-BREATHING ENGINES. J. Aircraft 4 ([illegible]), 5[illegible]-9 (November-December 1967).

909. Myers, B. F. and Bartle, E. R. (General Dynamics Corp.), REACTION AND IGNITION DELAY TIMES IN THE OXIDATION OF PROPANE. American Institute of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-633. 10pp. U.S. Air Force Contract No. AF 33(615)-67-C-1382.

[illegible]

[illegible] Myers, [illegible] and [illegible], F. B., [illegible] TION AND [illegible] Journal of [illegible]

211. [illegible] al., [illegible] TRANSPORT [illegible] Chemische Technik 12, [illegible] (19[illegible]).

912. Natov, [illegible] M., [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] Ind. [illegible] Nauk [illegible], Neftg. Inst. 12e, [illegible]

913. Naumenkov, [illegible] [illegible] [illegible] [illegible] IN A [illegible] [illegible] Journal 11, [illegible] May 19[illegible] (in Russian).

914. National Academy of [illegible] National Research Council, HIGH-TEMPER-ATURE [illegible] AND [illegible] PROBLEMS. Conference at Rice University, Houston, Texas, January 19[illegible], Report No. [illegible] [illegible] Air Force Contract AF-AFOSR-[illegible], 19[illegible], [illegible]pp.

915. Nathan I., [illegible], [illegible], [illegible], STUDY PROGRAM FOR [illegible] [illegible] AIR. General Applied Science Labs, Inc. Final Report 1 November 19[illegible]-30 November 19[illegible], Report no. GASL-TR-[illegible], [illegible] Air Force AFAPL-TR-[illegible], [illegible] Air Force Contract AF 33(615)-[illegible], February 19[illegible], 1[illegible] pp. (AD [illegible]) REPORT CLASSIFIED CONFIDEN-TIAL.

916. Naumov, V. [illegible], Balandin, A. [illegible], et. al., INVESTIGATION OF THE DECOM-POSITION OF [illegible] [illegible] HYDROGENATION OF TETRALIN AND DEHYDRATION OF TRIMETHYL[illegible] [illegible] MOLYBDENUM OXIDES. Izv. Akad. Nauk SSSR, Ser. Khim. 19[illegible] [illegible]; CA [illegible], [illegible].

917. Naziev, Ya. M., HEAT CONDUCTIVITY OF LIQUID HYDROCARBONS OF THE [illegible] [illegible]. [illegible] Vysshikh Ucheb. Zavedenii, Neft i Gaz [illegible], [illegible] (Russ); CA [illegible], [illegible] 196[illegible]).

918. Neilson, [illegible] A. and Gilchrist, A., AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF PARTICLES ENTRAINED BY THE GAS FLOW IN NOZZLES. Journal of Fluid Mechanics 35, [illegible] February 20, 1969).

919. Nellthorp, [illegible] (British Aircraft Corp.), TEST RIG FOR CONCORDE'S FUEL SYSTEM. The Engineer [illegible], [illegible] March 10, 1967).

920. Nerem, R. M., Carlson, L. A., Hartsel, J. E. (Ohio State Univ.), [illegible] [illegible] PHENOMENA [illegible] NORMAL [illegible] WATER IN A DIS-[illegible]. American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, [illegible], June [illegible], 196[illegible], Paper [illegible]; AIAA Journal [illegible], [illegible] May 19[illegible]).

921. Nestor, [illegible] and [illegible] (Naval Air Propulsion Test Center), [illegible] FLAME [illegible] FUEL TANK FLAMMABILITY. Society of Automotive Engineers, Air Transportation Meeting, New York, N.Y., April 29-May 2, 196[illegible], Paper [illegible], 10pp.

BIBLIOGRAPHY (Cont)

922. [illegible], [illegible] (U.S. Naval Air Propulsion Test Center), THE EFFECT OF [illegible] FLIGHT CONDITIONS ON THE FLAMMABILITY OF AIRCRAFT [illegible]. Annual National Conference on Environmental Effects on Aircraft and Propulsion Systems, 7th, Princeton, N.J., September [illegible], [illegible]. Proceedings, p. [illegible].

923. Nettleton, M. [illegible], [illegible] MIXTURE RATIO BY [illegible]. Combustion and Flame 12, [illegible] (October [illegible]).

924. Neumann, R. D. and [illegible], [illegible], THE INFLUENCE OF SHOCK WAVE-BOUNDARY LAYER EFFECTS ON THE [illegible] AIRCRAFT. U.S. Air Force Flight Dynamics Lab., March [illegible], [illegible]pp. AD [illegible].

925. Nevstrueva, [illegible] and Antidze, [illegible], EFFECT OF UNDERHEATING ON THE [illegible] OF A BOILING [illegible] IN [illegible] FLOWS. Akademiia Nauk SSSR, Izvestiia, Energetika i Transport 1967, 113-9 (January-February) (in Russian).

926. Nixon, A. C. (Shell Development Co.), THE MANUFACTURING AND LOGISTICS STRUCTURE OF ADVANCED FUEL SELECTION. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969. Paper.

927. Nixon, A. C. (Shell Development Co.), ENDOTHERMIC FUELS AS HEAT SINKS FOR HYPERSONIC FLIGHT. Space/Aeronautics 47, 112-4 (May 1967).

928. Nixon, A. C. and Ackerman, G. H. (Shell Development Co.), FUEL SIMULATOR FOR HYPERSONIC AIRCRAFT ENDOTHERMIC FUELS. Amer. Chem. Soc., Div. Petrol. Chem., Preprints 13(1), 51-61 (1968).

929. Nixon, A. C., Ackerman, G. H., Faith, L. E., Henderson, H. T., Ritchie, A. W., Ryland, L. B., VAPORIZING AND ENDOTHERMIC FUELS FOR ADVANCED ENGINE APPLICATION. PART II. STUDIES OF THERMAL AND CATALYTIC REACTIONS, THERMAL STABILITIES, AND COMBUSTION PROPERTIES OF HYDROCARBON FUELS. Shell Development Co., U.S. Air Force AFAPL-TR-67-114, Part II, Contract No. AF 33(615)-3789, September 1968, 545pp.

930. Nixon, A. C. and Ritchie, A. W. (Shell Development Co.), DEHYDROGENATION OF BICYCLOHEXYL OVER A PLATINUM ON ALUMINA CATALYST IN THE ABSENCE OF ADDED HYDROGEN. Amer. Chem. Soc., Div. Petrol. Chem., Preprints 12(1), 175-89 (1967); C.A. [illegible], [illegible].

931. Nixon, J. and Beerbower, A. (ESSO Research and Engineering Co.), EMULSIFIED FUEL FOR AIRCRAFT. American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, Washington, D.C., March 17-21, 1968, Paper 68-GT-24; Mechanical Engineering 90, 26-33 (December 1968).

[illegible]

932. [illegible], [illegible] and [illegible], [illegible] (Dow Chemical Co.), [illegible] PHOSPHATE CATALYST AND METHOD FOR DEHYDROGENATION AND CRACKING ALKANES AND OLEFINS. U.S. [illegible] ([illegible]), June 20, 1967, Appl. January [illegible], 1964, [illegible]pp.; C.A. [illegible], 118[illegible].

933. Norris, [illegible] and Parravano, [illegible], EFFECT OF GAS ATMOSPHERE UPON THE SINTERING OF PLATINUM MICRO[illegible]. Englehard Industries Technical Bulletin IX (4), 129 (19[illegible]).

934. Norris, R. [illegible], MAKING WATER PRESENT IN PETROLEUM DISTILLATES INNOCUOUS AND INHIBITING BACTERIAL GROWTH. U.S. 3,334,975 (Cl. [illegible]), August 8, 1967, Appl. July 29, 196[illegible], [illegible]pp.; C.A. 67, 110 [illegible].

935. [illegible], T. P., Starikova, A. I., Stekhun, A. I., Bondarenko, L. P., THE MERCAPTAN CONTENT OF MIDDLE DISTILLATE (JET) FUELS. Khim. i Tekhnol., Topliv i Masel 12(6), 56-7 (1967).

936. North American Aviation, Inc., Los Angeles Division, AMSA SYSTEM STUDIES-TASK S-7. POINT DESIGN ANALYSIS REPORT, VOLUME I-SUMMARY AND A/V PHYSICAL CHARACTERISTICS. Final Report 1 August 1966-1 July 1967, Report no. NA-67-[illegible]-Vol-1, U.S. Air Force Contract AF 33(657)-15343, July 1967, 94pp. (AD 382193L) (REPORT CLASSIFIED SECRET).

937. North American Aviation, Inc., Los Angeles Div., AMSA SYSTEM STUDIES-TASK S-7. POINT DESIGN ANALYSIS REPORT. VOLUME II-PERFORMANCE AND AERODYNAMICS. Final Report 1 August 1966-30 June 1967, Report no. NA-67-437-Vol-2, U.S. Air Force Contract AF 33(657)-15343, June 1967, 257pp. (AD 382 133L) (REPORT CLASSIFIED SECRET).

938. North American Aviation, Inc., Los Angeles Div., AMSA SYSTEM STUDIES. TASK S-7. DESIGN CHARACTERISTICS STUDY. Part I. Final Technical Report 1 August 1966-1 July 1967, Report no. NA-67-436-Pt-1, U.S. Air Force Contract AF 33(657)-15343, July 1967, 84pp. (AD 382 213L) (REPORT CLASSIFIED SECRET).

939. North American Aviation, Inc., Los Angeles Div., AMSA SYSTEM STUDIES. TASK S-7. DESIGN CHARACTERISTICS STUDY. Part II. Final Technical Report 1 August 1966-1 July 1967, Report no. NA-67-436-Pt-2, U.S. Air Force Contract AF 33(657)-15343, June 1967, 505pp. (AD 382 204L) (REPORT CLASSIFIED SECRET).

940. North American Aviation, Inc., Los Angeles Div., AMSA SYSTEM STUDIES-TASK S-7. DESIGN CHARACTERISTICS STUDY. Part III. Final Technical Report 1 August 1966-1 July 1967, Report no. NA-67-436-Pt-3, U.S. Air Force Contract AF 33(657)-15343, July 1967, 305pp. (AD 382 194L) (REPORT CLASSIFIED SECRET).

[illegible]

941. North American Aviation, Inc., Los Angeles Div., [illegible] Final Report 1 August 1964–1 July 1967, Report no. NA[illegible], U.S. Air Force Contract AF [illegible], July 1967, [illegible]pp. (AD [illegible]) (REPORT CLASSIFIED SECRET).

942. North American Aviation, Inc., Los Angeles Div., [illegible] CHARACTERISTICS STUDY. [illegible] ANALYSIS REPORT. VOLUME [illegible]. Final Report 1 August 1964–1 July 1967, Report no. NA[illegible], U.S. Air Force Contract AF 33(657)-15345, July 1967, [illegible]pp. (AD [illegible] 207) (REPORT CLASSIFIED SECRET).

943. North American Aviation, Inc., Los Angeles Div., THERMODYNAMIC FLIGHT TEST DATA REDUCTION FOR THE MODEL XB-70A AIR VEHICLE NO. 2, FLIGHT NO. 15, Report no. NA-65-504-1[illegible], January 1966, [illegible]pp. (AD 814 125).

944. North American Aviation, Inc., Los Angeles Div., THERMAL ANALYSIS FLIGHT TEST DATA REDUCTION FOR THE MODEL XB-70A AIR VEHICLE NO. 1 FLIGHT NO. 3. Report no. NA-64-1[illegible], November 1964, 107pp. (AD 814 1[illegible]).

945. Novikov, P. A. and Smol'skii, B. M., STUDY OF THE EFFECT OF MASS TRANSFER ON THE HEAT TRANSFER DURING SUBLIMATION OF A RAREFIED GAS MEDIUM IN THE CASE OF A COUETTE FLOW. Inzhenerno-Fizicheskii Zhurnal 12, 4[illegible] (April 1967) (in Russian).

946. Novikov, [illegible] and Kiseantsev, [illegible], ON THE EXISTENCE AND UNIQUENESS OF THE SOLUTION TO THE SYSTEM OF EQUATIONS OF THERMAL CONDUCTION THEORY. Zhur. Prikl. Mekh. i Tekh. Fiz. 1965, 90-3 (July-August); Journal of Applied Mechanics and Technical Physics 1965, p.54,55 (July-August) (translation).

947. Nonak, E. J. and Koros, R. M. (Esso Res. and Eng. Co.), ACTIVATION OF SUPPORTED NICKEL OXIDE BY PLATINUM AND PALLADIUM. J. Catal. 7(1), 50-6 (1967); C.A. 66, 69290 (1967).

948. Nowakowski, L., DEHYDROGENATION OF PROPANE IN THE PRESENCE OF A STATIONARY BED OF ALUMINO-CHROMIUM CATALYST. Przem. Chem. 45(12), 671-5 (1966) (Pol); C.A. 66, 104629 (1967).

[illegible]

949. [illegible], INVESTIGATION OF THE [illegible] COMPOSITE [illegible]. VOLUME I. PERFORMANCE POTENTIAL AND [illegible] DESIGN STUDY OF THE [illegible] INFLOW ENGINE. United Aircraft Corp., Research Labs, Final Report 15 November 1965 - 15 February 1967, Report No. [illegible], U.S. Air Force AFAPL TR-67-[illegible], U.S. Air Force Contract AF [illegible], June 1967, [illegible] pp (AD [illegible]) (REPORT CLASSIFIED CONFIDENTIAL).

950. [illegible], E. A. and Stroup, [illegible], 1965 ADVANCED RAMJET CONCEPTS PROGRAM. VOLUME 2. FURTHER RAMJET SYSTEM TEST. Marquardt Corp. Final Report 1 March 1965 - 15 April 1966, Report No. 25152-[illegible]-2, AFAPL TR-[illegible]-Vol-2, U.S. Air Force Contract AF [illegible], October, 1966, 61 pp. (AD 376 [illegible]) (REPORT CLASSIFIED CONFIDENTIAL).

951. Okuyama, M. and Zung, J. T. (College of William and Mary), EVAPORATION-CONDENSATION COEFFICIENT FOR SMALL DROPLETS. Journal of Chemical Physics 46, 1580-5 (March 1, 1967).

952. Olcer, N. Y. (Illinois Institute of Technology), ON A GENERAL HEAT FLOW PROBLEM. Journal of Mathematics and Physics 46, 99-106 (March 1967).

953. Olfe, D. B. (University of California, La Jolla), A MODIFICATION OF THE DIFFERENTIAL APPROXIMATION FOR RADIATIVE TRANSFER. AIAA Journal 5, 638-43 (April 1967).

954. Olfe, D. B. and Cavalleri, R. J. (University of California, San Diego, Dept. of the Aerospace and Mechanical Engineering Sciences), SHOCK STRUCTURE WITH NON-GRAY RADIATIVE TRANSFER, Proceeding of the Heat Transfer and Fluid Mechanics Institute 1967, 88-114; U.S. Army AROD-5155:20, U.S. Army Contract DA-31-124-ARO(D)-257, U.S. Navy Contract Nonr-2216(24), 1967, 30 pp. (AD 654 977).

955. Olstad, W. B. (NASA, Langley Research Center), CORRELATIONS FOR STAGNATION-POINT RADIATIVE HEAT TRANSFER. AIAA Journal 7(1), 170-2 (January 1969).

956. Olympios, S., LOW SPEED EXPERIMENTAL INVESTIGATION OF THE 3-DIMENSIONAL PERFORMANCE OF A COMPRESSOR CASCADE OF BLUNT TRAILING EDGE BLADES. Von Karman Inst. for Fluid Dynamics (Belgium) Report No. VKI-TR-13, U.S. Air Force Grant AF-EOAR-64-63, 1962, 67 pp. (AD 600 393).

957. Opdyke, G. (Avco Corp., Lycoming Div.), INITIAL EXPERIENCE WITH EMULSIFIED FUELS AT AVCO LYCOMING. Society of Automotive Engineers, National Aeronautic Meeting, April 24-27, 1967, Paper 670366, 10 pp.

958. Oppenheim, A. K., GASDYNAMICS OF EXPLOSIONS AND ITS RELEVANCE TO PROPULSION. Proc. of the OAR Res. Appl. Conf., 14 March 1967, March 1967, p. 39-56 (N68-16379).

959. [illegible]

960. [illegible]

961. [illegible] Moscow, [illegible] 1967, 424 pp. in Russian.

962. [illegible], R. A. and [illegible] [illegible] Air Force [illegible] Contract [illegible] August [illegible] 10 pp. (AD [illegible]).

963. [illegible] and [illegible], OPERATION OF AUTOMATIC [illegible] [illegible] Air Force [illegible] Arnold Engineering Development Center Technical Report January [illegible], Report No. AEDC-[illegible], [illegible] Air Force Contract AF [illegible], December [illegible] 40 pp. (AD [illegible]).

964. [illegible] (McDonnell Douglas Astronautics Co.), [illegible] AIAA Propuls. Joint Specialist Conference, [illegible] Colorado Springs, Colo., June 9-13, 1969. Paper. (Classified).

965. Osterhout, [illegible], Jr., [illegible] FOR THE SUPERSONIC TRANSPORT. A PROGRESS REPORT. Soc. Automotive Engrs. - Am. Soc. Mech. Engrs. Air Transp. and Space Mtg (New York, April 27-30, 1964) Paper [illegible].

966. Othmer, D. F. and Chen, H., CORRELATING AND PREDICTING THERMODYNAMIC DATA-REFERENCE SUBSTANCE EQUATIONS AND PLOTS. Ind. Eng. Chem. [illegible], 39-61 (196[illegible]).

967. Otsap, B. A. (Marquardt Corp.), FLUIDICS FOR RAMJET CONTROL SYSTEMS. Fluidics Quarterly 1, 10-37 (July 1968).

968. Otsap, B. A. and Yankura, G. A. (Marquardt Corp.), A FLUIDIC FUEL CONTROL SYSTEM FOR AN ADVANCED RAMJET ENGINE. AIAA Propulsion Joint Specialist Conference, 3rd, Washington, D.C., July 17-21, 1967, Paper 67-477, 14 pp.

969. Otsap, B. A. and Yankura, G. A. (Marquardt Corp.), APPLICATION OF FLUIDICS TO RAMJET CONTROL SYSTEMS. In Society of Automotive Engineers, Aerospace Systems Conference, Los Angeles, Calif., June 27-30, 1967, Proceedings. New York, Society of Automotive Engineers, Inc., 1967, p. 197-214.

[illegible]

[illegible]. [illegible], B. A., [illegible] ADVANCED [illegible] PROGRAM. [illegible] AND FLUID CONTROL SYSTEM FOR [illegible] ENGINES. [illegible] Final Report 1 March [illegible] - [illegible] April [illegible], Report No. [illegible], AFAPL [illegible], [illegible] Air Force Contract AF [illegible], [illegible] Dec 196[illegible], [illegible] pp. (AD [illegible]) (REPORT CLASSIFIED CONFIDENTIAL).

[illegible]. [illegible], Y., COKE FORMATION KINETICS ON A SILICA-ALUMINA CATALYST. Univ. Microfilms (Ann Arbor, Mich.), Order No. [illegible], [illegible] pp.; Diss. Abstr. B [illegible] (12), 4575 (1967); C.A. [illegible], [illegible].

BIBLIOGRAPHY (Contd)

972. Paal, Z. and Dobrovolszky, M. I., DEHYDROCYCLIZATION ON METALLIC CATALYSTS. I. AROMATIZATION OF [illegible] ON A NICKEL-ALUMINA CATALYST. Acta Chim. Acad. Sci. Hung. 4_(4), [illegible] (1966)(Eng.); C.A. 6_, [illegible]119 (1967).

973. Paal, Z. and Tetenyi, P., INVESTIGATION OF DEHYDROCYCLIZATION ON METAL CATALYSTS. 4. PARALLELISM OF THE DEHYDROGENATION OF CYCLOHEXANE AND DEHYDROCYCLIZATION. Acta Chim. Acad. Sci. Hung. [illegible], No. 3, [illegible] (1966).

974. Paal, Z. and Tetenyi, P., DEHYDROCYCLIZATION ON METALLIC CATALYSTS. II. AROMATIZATION OF HEXENES ON CARRIER-FREE NICKEL AND PLATINUM CATALYSTS. Acta Chim. Acad. Sci. Hung. 5_(2), 193-204 (1967) (Eng); C.A. 6_, 116091.

975. Paal, Z. and Tetenyi, P., MECHANISM OF DEHYDROCYCLIZATION ON METAL CATALYSTS. Kem. Kozlen. 28(1), 13-32 (1967)(Hung); C.A. 6_, 116240.

976. Pagel, L. L. and Warmbold, W. R. (McDonnell Douglas Corp.), ACTIVE COOLING OF A HYDROGEN FUELED SCRAMJET ENGINE. AIAA, Annual Meeting and Technical Display, 5th, Philadelphia, Pa., October 21-24, 1968, Paper 68-1091, 9 pp.

977. Palm-Leis, A. and Strehlow, R. A. (University of Illinois, Urbana), ON THE PROPAGATION OF TURBULENT FLAMES. Combustion and Flame 13(2), 111-29 (April 1969).

978. Palmer, H. B. (Pennsylvania State Univ.), APPROACH TO THE STEADY STATE IN COMPETITIVE-CONSECUTIVE GAS REACTIONS. Combustion and Flame 11, 120-4 (April 1967) Contracts No. Nonr-1858(25); No. NR-098-038.

979. Palmer, H. B. (Pennsylvania State Univ.), THE ROSIN EQUATION AND COMBUSTION INTENSITY IN GASEOUS FLAMES. Ind. Eng. Chem. 60(3), 79 (1968).

980. Panchenkov, G. M., Levinter, M. E., Tanatarov, M. A., TWO MECHANISMS OF COKE FORMATION ON ALUMINO-SILICATE CATALYST. Izv. Vysshikh Uchebn. Zavedenii, Neft i Gaz 9(7), 63-5 (1966)(Russ.); C.A. 66, 4635v (1967).

981. Panchenkov, G. M., Levinter, M. E., Tanatarov, M. A., EFFECT OF NITROGEN BASES ON ALUMINOSILICATE CRACKING CATALYSTS. Izv. Vysshikh Uchebn. Zavedenii, Neft i Gaz 8(9), 61-3 (1965)(Russ.); C.A. 64, 4028 (1966).

982. Panchenkov, G. M., Kazanskaya, A. S. Pershin, A. D., KINETIC RELATIONSHIPS OF PROPANE DEHYDROGENATION. Neftekhimiya 7(6), 858-64 (1967).

983. Pantazopol, D. and Comanescu, Tr., SUPERSONIC COMBUSTION AROUND A CONICAL OBSTACLE. Revue Roumaine des Sciences Techniques, Serie de Mecanique Appliquee 13(5), 785-97 (1968)(in French).

BIBLIOGRAPHY (Contd)

984. Panton, R. (Oklahoma State Univ.) and Oppenheim, A. K. (University of California), SHOCK RELAXATION IN A PARTICLE-GAS MIXTURE WITH MASS TRANSFER BETWEEN PHASES. AIAA Journal 6(11), 2071-7 (1968).

985. Parkinson, H. C., CONVECTIVE HEAT TRANSFER IN ROCKET ENGINES, PART 2, HEAT TRANSFER TO THE NOZZLE. Rocket Propulsion Establishment (England), December 196[illegible], 32 pp. (N69-15 331).

986. Paterson, N. J. and Sullivan, J. N. (Chevron Research Co.), REDUCTION OF FOULING OF HIGH TEMPERATURE SURFACES IN HYDROCARBON OIL HANDLING AND PROCESSING EQUIPMENT. U.S. 3,322,664 (Cl. 208-48), May 30, 1967, Appl. June 26, 1964, 5 pp.; C.A. 67, 45799.

987. Pearson, L. W., Gaede, A. E. (AiResearch Manufacturing Co.), Thornberg, G. H., Nelson, G. H. (Fluidyne Engineering Corp.), HYPERSONIC RESEARCH ENGINE PROJECT: EXHAUST NOZZLE DEVELOPMENT PROGRAM. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper (Classified).

988. Peckham, D. H. and Crabtree, L. F., THE RANGE PERFORMANCE OF HYPERSONIC AIRCRAFT. Great Britain Royal Aircraft Establishment Technical Report No. TR-66178, June 1966, 27 pp. (AD 802 543).

989. Penner, S. S. (University of California, La Jolla) and Li, T. (North American Aviation, Inc.), THERMODYNAMIC CONSIDERATIONS OF DROPLETS AND BUBBLES. AIAA Journal 5, 1526, 1529 (August 1967).

990. Penner, S. S. and Davidor, W., PARAMETRIC SOLUTION OF THE ONE-DIMENSIONAL FLOW EQUATIONS WITH HEAT ADDITION. In 1967 Heat Transfer and Fluid Mechanics Institute, University of California, La Jolla, Calif., June 19-21, 1967, Proceedings. Ed. by P. A. Libby et al, Stanford, Calif., Stanford University Press, 1967, p. 233-46. U.S. Army Grant DA-ARO(D)-31-124-G-747.

991. Penner, S. S. and Libby, P. A. (University of California, La Jolla), CONVECTIVE LAMINAR HEAT TRANSFER WITH COMBUSTION FOR A LEWIS NUMBER OF UNITY. International Academy of Astronautics, International Symposium on Fluid Dynamics of Heterogeneous, Multi-Phase Continuous Media, Naples, Italy, October 3-6, 1966, Paper; Astronautica Acta 13, 75-91 (January-February 1967) U.S. Army Grant No. DA-ARO(D)-31-124-G-747.

992. Penzin, V. I., OPTIMALITY CONDITIONS FOR SUPERSONIC FLOWS WITH OBLIQUE SHOCK WAVE FOLLOWED BY HEAT INFLUX. Aviats. Tekh. 9(4), 114-20 (1966) (Russ.); C.A. 67, 25908.

993. Perree, M. and Blouri, B., DEHYDROCYCLIZATION OF SATURATED AND UNSATURATED STRAIGHT-CHAIN HYDROCARBONS. I. IN THE PRESENCE OF AN (ACTIVATED) ALUMINA-SUPPORTED CHROMIA CATALYST. Bull. Soc. Chim. Fr. 1968(10), 4195-4202 (October).

BIBLIOGRAPHY (Cont'd)

994. Peskin, R. L., A THEORETICAL INVESTIGATION OF AEROSOL FLAMMABILITY. Rutgers - The State University, New Jersey Annual Progress Report No. 2, 1 March 1966 - 28 February 1967, U.S. Army Edgewood Arsenal EA [illegible], U.S. Army Contract DA-AMC-[illegible] (A), April 1967, [illegible] pp. (AD 81[illegible]).

995. Peskin, R. L. Polymeropoulos, C. E., Yeh, P. S. (Rutgers Univ.), RESULTS FROM A THEORETICAL STUDY OF FUEL DROP IGNITION AND EXTINCTION. AIAA Journal 5, 2173-8 (December 1967).

996. Peskin, R. L. and Yeh, P. S. (Rutgers Univ.), RESULTS FROM A THEORY OF FUEL DROP IGNITION. AIAA, Aerospace Sciences Meeting, 3rd, New York, January 24-26, 1966, Paper 66-70, 16 pp.; C.A. 6[illegible], 4[illegible].

997. Peters, C. E., TURBULENT MIXING AND BURNING OF COAXIAL STREAMS INSIDE A DUCT OF ARBITRARY SHAPE. U.S. Air Force, Arnold Engineering Development Center prepared in cooperation with ARO, Inc., January 1969, 205 pp. (AD 6[illegible] 397).

998. Peters, C. E., Phares, W. J., Cunningham, T. H. M., THEORETICAL AND EXPERIMENTAL STUDIES OF DUCTED MIXING AND BURNING OF COAXIAL STREAMS. AIAA Aerospace Sciences Meeting, 7th, January 20-22, 1969, AIAA Paper No. 69-85.

999. Petersen, E. E. (University of California, Berkeley), ON THE USE OF CRITERIA FOR DETERMINING TRANSPORT LIMITATIONS WITHIN HETEROGENEOUS CATALYSTS. Chem. Eng. Sci. 23, No. 1, 94-6 (January 1968).

1000. Petersen, R. H., Gregory, T. J., Smith, C. L., SOME COMPARISONS OF TURBORAMJET-POWERED HYPERSONIC AIRCRAFT FOR CRUISE AND BOOST MISSIONS. Journal of Aircraft 3(5), 398-405 (1966).

1001. Petersen, W. A., DEVELOPMENT OF HOT STRIP COKER TEST. Esso Products Research Division, Esso Research and Engineering Co. Report No. RL-6CM-68, October 2, 1968, 32 pp.

1002. Peterson, W. C., Zaalouk, M. G., Goetze, A. J. (University of North Carolina), DEVELOPMENT AND EVALUATION OF TRANSFER FUNCTIONS FOR NUCLEATE, TRANSITION AND FILM BOILING. Franklin Institute, Journal 285, 285-96 (April 1968).

1003. Petukhov, B. S. and Mikhin, V. A., EXPERIMENTAL STUDY OF HEAT TRANSFER DURING THE SUPERSONIC FLOW OF GAS IN A CIRCULAR TUBE. Teplofizika Vysokikh Temperatur 4, 228-32 (March-April 1966); High Temperature 4, 224-8 (March-April 1966).

1004. Pfenninger, H., OPERATING RESULTS WITH GAS TURBINES OF LARGE OUTPUT. Am. Soc. Mech. Engrs. Winter Ann. Mtg. (New York, November 25-30, 1962) Paper N.62-WA188; J. Eng. Power V86 N.1.29-49 (Jan 1964).

BIBLIOGRAPHY (Contd)

1005. Phillips Petroleum Co. (by J. A. Shotton), COLD-RESISTANT JET FUEL. Ger. 1, 224,0[illegible] (Cl. C1[illegible]), September 1, 1966; U.S. Appl. January 4, 196[illegible]; 5 pp.; C.A. 66, 10765 (1967).

1006. Pin-Chuan, C., ENERGY SOURCES IN AIRCRAFT ENGINES. Hang K'ung Chih Shih (Mainland China) [illegible] (7), 16; U.S. Air Force Translation October [illegible], 7 pp. (AD 6[illegible]).

1007. Pilcher, G. and Chadwick, J. D. M. (University of Manchester, England), MEASUREMENTS OF HEATS OF COMBUSTION BY FLAME CALORIMETRY. IV. n-PENTANE, ISOPENTANE, NEOPENTANE. Trans. Faraday Soc. 63(10), 2357-61 (1967); C.A. 67, 103352.

1008. Pines, H. and Abramovici (Northwestern Univ.), ALUMINA: CATALYST AND SUPPORT. 38. AROMATIZATION OF HYDROCARBONS. 21. DEHYDROGENATION AND SKELETAL ISOMERIZATION OF 2-PHENYLPROPANE-2-^{14}C AND ETHYLBENZENE-β-^{14}C OVER "NONACIDIC" CHROMIA-ALUMINA. J. Org. Chem. 34(1), 70-2 (January 1969).

1009. Pines, H. and Goetschel, C. T. (Northwestern Univ.), ALUMINA CATALYST AND SUPPORT. XXV. DEHYDROGENATION AND SKELETAL ISOMERIZATION OF BUTYLBENZENE OVER CHROMIA-ALUMINA CATALYST. XXXI. DEHYDROGENATION OF 2-PHENYLBUTANE-2-^{14}C. J. Catal. 6(3), 371-9, 380-4 (1966); C.A. 66, 37105, 37106 (1967).

1010. Pitzer, E. W. (to Phillips Petroleum Co.), HALOGEN-CONTAINING η-ALUMINA AS A CATALYST FOR HYDROCARBON DEHYDROGENATION. U.S. 3,290,407 (Cl. 260-683.3), December 6, 1966, Appl. September 23, 1964, 3 pp.; C. A. 66, 39626 (1967).

1011. Plank, P. P. (Lockheed Aircraft Corp.), HYPERSONIC THERMAL-STRUCTURAL CONCEPT TRENDS. Society of Automotive Engineers, Aeronautic and Space Engineering and Manufacturing Meeting, Los Angeles, October 3-7, 1966, Paper 660678, 10 pp.

1012. Pleshanov, A. S., Konkov, P. A., Ionov, V. P., Nikolaev, G. N., NONISENTROPIC NONEQUILIBRIUM GAS FLOW THROUGH A NOZZLE WITH ALLOWANCE FOR FRICTION AND HEAT EXCHANGE: EXPERIMENTAL STUDY OF A FLOW OF DISSOCIATED GASES THROUGH A SUPERSONIC NOZZLE. Issledovaniya po Fizicheskoi Gasodinamike Moscow, 1966, 141-9; U.S. Air Force Translation, July 1968, 34 pp. (AD 682 466).

1013. Poliakov, Iu. A., EXPONENTIAL-POINT METHOD IN UNSTEADY HEAT TRANSFER. Teplofizika Vysokikh Temperatur 5, 137-40 (January-February 1967).

1014. Polinin, V. L. and Rozengart, M. I., MECHANISM OF THE SIDE REACTIONS IN THE DEHYDROCYCLIZATION OF n-OCTANE. Acad. of Sciences (USSR). Bull. Div. Chem. Sci. 1967, 1391-4 (July 1967).

BIBLIOGRAPHY (Contd)

1015. Polyakov, Yu. A., UNSTEADY-STATE HEAT TRANSFER DURING REFLECTION OF SHOCK WAVE. Issled. Fiz. [illegible], Akad. Nauk SSSR, Energ. Inst. 1966, [illegible]-200 (Russ); C.A. 66, [illegible] (1967).

1016. Polymer Corp. Ltd. (H. [illegible], B. H. Oliver, J. H. Rolston). A HYDROCARBON ISOMERIZATION CATALYST. U.S. 3,[illegible] (Cl. 260-683), November [illegible], 1966, Appl. Canada July 16, 1964.

1017. Polymer Corp. Ltd., ISOMERIZATION OF HYDROCARBONS. Brit. 1,[illegible] (Cl. B 01j), February 22, 1967; Can. Appl. May 12, 1964, 6 pp.; C.A. 66, 115283 (1967).

1018. Polymeropoulos, C. E. and Peskin, R. L., IGNITION AND EXTINCTION OF LIQUID FUEL DROPS - NUMERICAL COMPUTATIONS. Combustion and Flame 13(2), 166-72 (April 1969).

1019. Poplawski, B., CONVECTIVE HEAT AND MASS TRANSFER IN THE COMBUSTION OF CHEMICALLY ACTIVE SUBSTANCES IN THE BOUNDARY LAYER ON A POROUS SURFACE. U.S. Library of Congress, Aerospace Technology Div. Report ATD-66-26, March 1966, 18 pp. (N66-[illegible]); C.A. [illegible], 23719.

1020. Popov, V. N., Tsederberg, N. V., Morozova, N. A., AN EXPERIMENTAL STUDY OF THE THERMOPHYSICAL PROPERTIES OF PETROLEUM PRODUCTS. Izv. Vysshikh Uchebn. Zavedenii Neft i Gaz 8(1), 79-81 (1965).

1021. Posey, K., Jr. et al, FEASIBILITY STUDY OF TURBINE FUEL GELS FOR REDUCTION OF CRASH FIRE HAZARDS. Western Company of North America Research Div. Final Report, U.S. Federal Aviation Agency Contract FA64WA-5053, February 1966, 55 pp. (PB 170 575).

1022. Posey, K.. Jr. and Schleicher, R., FEASIBILITY STUDY OF TURBINE FUEL GELS FOR REDUCTION OF CRASH FIRE HAZARDS. Western Co. of North America, Research Div. Final Report, U.S. Federal Aviation Agency FAA-ADS 62, Contract FA-64-WA-5053, February 1966, 62 pp. (AD 632 918).

1023. Pratt and Whitney Aircraft, Florida Research and Development Center, JTF17A-21B TURBOFAN ENGINE SPECIFICATION. Report No. Spec-2710, U.S. Federal Aviation Agency Contract FA-SS-66-8, August 1966, 6[illegible] pp. (AD804527L).

1024. Pratt and Whitney Aircraft, Florida Research and Development Center, JTF17A-21L TURBOFAN ENGINE SPECIFICATION. Report No. Spec-[illegible]A, U.S. Federal Aviation Agency Contract FA-SS-66-8, August 1966, 67 pp. (AD804528L).

1025. Predvoditelev, A. S. (ed.), PROPERTIES OF GASES AT HIGH TEMPERATURES. Moscow, Izdatel'stvo Nauka, 1967, 134 pp. Partial Contents: Rozhdestvenskii, I.B., Shevelev, V.P., Olevinskii, CALCULATION OF THE COMPOSITION AND THERMODYNAMIC FUNCTIONS OF ARBITRARY REACTING GASEOUS SYSTEMS. pp. 14-21; Predvoditelev, A. S., THEORY OF IGNITION OF TWO-PHASE MIXTURES, p. 116-22. Predvoditelev, A. S., CONDITIONS OF

BIBLIOGRAPHY (Cont'd)

IGNITION IN INFLAMMABLE GAS MIXTURES. pp. 125-31. Salamandra, G. D., VIBRATIONAL PROPAGATION OF FLAMES IN A TUBE. pp. 132-6.

1026. Priceman, S. and Sama, L. (Sylvania Electric Products, Inc.), THE OXIDATION PROTECTION OF REFRACTORY METAL HYPERSONIC AIRCRAFT STRUCTURES. AIAA Paper No. 66-1090, 1968, 7 pp.

1027. Prietsch, W., DETERMINATION OF WATER IN AEROJET FUELS. Freiberg. Forschungsh., A 1966(387), 105-16 (Ger.); C.A. 67, 31596.

1028. Princeton Chem. Res., Inc., DEHYDROGENATION-CYCLIZATION OVER NICKEL AND CERIUM ON ALUMINA. Neth. Appl. 6615079. Corres. to U.S. 3,299,156, open 5-16-68.

1029. Prust, H. W., Jr., Schum, H. J., Behning, F. P., COLD-AIR INVESTIGATION OF A TURBINE FOR HIGH-TEMPERATURE ENGINE APPLICATION. 2: DETAILED ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF STATOR PERFORMANCE. U.S. National Aeronautics and Space Administration NASA-TN-D-4418, February 1968, 45 pp. (N68-10652).

1030. Pudoveev, A. P., DIAGRAM FOR OPTIMUM DESIGN OF A SYSTEM OF SHOCKS IN AXIALLY SYMMETRICAL SUPERSONIC DIFFUSERS WITH EXTERNAL COMPRESSION. Izv. Vyss. Ucheb. Zav. Aviatsionnaya Tekhnika (USSR) 1966(2), 151-5; U.S. Air Force Translation FTD-HT-23-682-67, July 1967, 9 pp. (AD 666 078); Gt. Brit. Royal Aircraft Establishment Translation RAE-LIB-TRANS-1259, November 1967, 6 pp. (N68-17159).

1031. Pujol, Y., DETERMINATION OF THE COMPOSITION AND ENTHALPY OF HIGH-TEMPERATURE GASEOUS MIXTURES TAKING THEIR SECOND VIRAL COEFFICIENTS INTO ACCOUNT. Entropie 1968, 39-47 (March-April)(in French).

1032. Pun, W. M. and Spalding, D. B., A PROCEDURE FOR PREDICTING THE VELOCITY AND TEMPERATURE DISTRIBUTIONS IN A CONFINED, STEADY, TURBULENT, GASEOUS, DIFFUSION FLAME. International Astronautical Federation, International Astronautical Congress, 18th, Belgrade, Yugoslavia, September 24-30, 1967, Proc. Vol. 3, Pergamon Press, Ltd. 1968 p. 3-21.

BIBLIOGRAPHY (Cont'd)

1033. Quick, A. W., SOME NEW RESEARCH RESULTS CONCERNING FLAMES WITH ENERGY INPUT. International Council of the Aeronautical Sciences, Congress, 6th, Munich, West Germany, September 9-13, 1968, Paper 68-01, [illegible] pp. (In German).

1034. Quigg, H. T. and Schirmer, R. M., EFFECT OF SULFUR IN JP-5 FUEL ON HOT CORROSION OF COATED SUPERALLOYS IN MARINE ENVIRONMENT. Phillips Petroleum Co., Research Div. Progress Report No. 3, 1 October - 31 December 1966, Report No. 4706-67R. U.S. Navy Contract NOw-66-0553, April 1967, 111 pp. (AD814 [illegible]).

1035. Quigg, H. T., EFFECT OF JP-5 SULFUR CONTENT ON HOT CORROSION OF SUPERALLOYS IN MARINE ENVIRONMENT. U.S. Dept. Com. Office Tech. Serv. AD-603422 (Aug 1964) 31P., (Abstr) Corrosion Abstr. V4 N.2.138 (Mar 1965).

BIBLIOGRAPHY [illegible]

1036. Rafalski, P. and Zyczkowski, M., THE LAGRANGIAN APPROACH TO THE NONLINEAR BOUNDARY HEAT-TRANSFER PROBLEM. AIAA Journal 6 [illegible] August 1968).

1037. Rakhmatulin, Kh. A., [illegible], A. Ya., [illegible], A. [illegible] DYNAMICS. Volume [illegible] August 1968, 270 pp. AD [illegible] Air Force Translation,

1038. Ransom, V. H., Thompson, H. D., Hoffman, J. D., (Purdue Univ.), ANALYSIS OF THREE-DIMENSIONAL SUPERSONIC EXHAUST NOZZLE FLOW FIELDS BY A NEW [illegible] METHOD OF CHARACTERISTICS. AIAA Aerospace Sciences Meeting (7th), New York, January 20-22, 1969, AIAA Paper 69-5, 11 pp. AD 685 [illegible]).

1039. Rapp, [illegible], THE INFLUENCE OF THE CHEMICAL COMPOSITION OF LIQUID [illegible] ON THE CHARACTERISTICS OF [illegible] FLAMES. Energ. Atomtech. [illegible] 1967) (Ger.); C. A. [illegible]

1040. Rebuffet, P., EXPERIMENTAL AERODYNAMICS, Volume 2. Paris, Dunod, [illegible] pp. (in French).

1041. Reddy, [illegible], FILM COOLING EMPLOYING ANNULAR INJECTION. Institution of Engineers (India), Journal, Mechanical Engineering Division [illegible] January 19[illegible]).

1042. Reid, W. T., A BATTELLE STUDY OF THERMOCOUPLE REACTIONS INVOLVED IN [illegible] AND DEPOSITS, [illegible] Gas Turbines Burning Fuel [illegible] Symp. Atlantic City [illegible] Preprint. 9 pp.

1043. Rein, [illegible], A METHOD FOR MEASURING THE TEMPERATURE DISTRIBUTION IN STABILIZED FLAMES [illegible] Abstr. [illegible], November 196[illegible] Abstr., Diss.

1044. Reingold, L. and Serruys, M., STABILIZED COMBUSTION IN A SHOCK WAVE IN A PERMANENT SUPERSONIC FLOW. [illegible] (July - August) (in French).

1045. Reinhart, W. A. and [illegible], NEW GENERATION ENGINES - THE COMMERCIAL TRANSPORT [illegible] Society of Automotive Engineers, Air Transportation Meeting, New York, N. Y., April 29 - May 2, 1968, Paper [illegible], 11 pp.

1046. Relyea, D. L. and Perlmutter, [illegible] (University of Illinois), A STIRRED REACTOR WITH [illegible] CATALYST WALL. I&EC Process Design and Development 7, No. [illegible] April 1968).

1047. Rekos, N. F. (NASA), NEW GENERATION ENGINES - RESEARCH PROGRAMS AND OUTLOOK. Society of Automotive Engineers, Air Transportation Meeting, New York, N. Y., April 29 - May 2, 1968, Paper [illegible], 12 pp.

BIBLIOGRAPHY (Cont'd)

1048. [illegible], V. [illegible], et al., RAPID DETERMINATION OF STABILITY OF THE ALUMINUM [illegible] POTASSIUM [illegible] CATALYSTS. [illegible] Nauchn. [illegible] Inst. No. [illegible], [illegible]; C. A. [illegible], [illegible].

1049. [illegible], V. M. and [illegible], [illegible] A., INVESTIGATION OF THE [illegible] A [illegible] FOR A PLANE [illegible] [illegible] [illegible] [illegible] Matematicheskikh Nauk [illegible], [illegible] [illegible] [illegible] (in Ukrainian).

1050. Resler, E. L. (Cornell Univ.), CHEMICAL STUDIES USING GASDYNAMIC WAVE INTERACTIONS IN DYNAMICS OF FLUIDS AND PLASMAS; Proceedings of a Symposium, University of Maryland, College Park, Md., October [illegible], [illegible], ed. by [illegible] Pai, New York, Academic Press, [illegible], p. 155-93 (U. S. Air Force Contract AF 49(638) - [illegible]).

1051. Rettie, I. H. and Lewis, W. G. E., DESIGN AND DEVELOPMENT OF AN AIR INTAKE FOR A SUPERSONIC TRANSPORT AIRCRAFT. Journal of Aircraft 5 (6), [illegible] (November - December 1968).

1052. Reynolds, R. J., [illegible], M. J., Hedrick, H. G., STUDIES ON THE MICROBIOLOGICAL DEGRADATION OF AIRCRAFT FUEL TANK COATINGS. Develop. Ind. Microbiol. 8, [illegible] (1967).

1053. Reznik, L. G., Rybakov, K. V., Inozemtseva, M. N., DETERMINING THE PARTICLE SIZE DISTRIBUTION OF IMPURITIES IN LIGHT PETROLEUM PRODUCTS. Khim. I Tekhnol. Topliv I Masel V12 N.2 [illegible] (February 1967).

1054. Rhudy, R. W., PARAMETRIC STUDIES OF THE INTERFERENCE HEATING ON TYPICAL WINGED SCRAMJET VEHICLES AT MACH NUMBERS 6, 8 and 10. Arnold Engineering Development Center, Final Report, 7 November 1966 - 4 April 1967, Report No. AEDC-TR-67-[illegible], Prepared in cooperation with ARO, Inc., (U. S. Air Force Contract AF 40(600) - 1200, June 1967, 14 pp. (AD 816 075).

1055. Richardson, J. L. and Getz, R. J., INVESTIGATION OF HEAT TRANSFER IN NONEQUILIBRIUM REACTING SYSTEMS. Aeronutronic Final Report, 14 July 1966 - 1 April 1968, Report No. U-4347, NASA-CR-[illegible], Contract NASw-999, April 1968, 158 pp. (N68-2[illegible]).

1056. Richardson, P. D., THE EFFECT OF VIBRATIONS AND OSCILLATIONS ON HEAT TRANSFER FROM A CIRCULAR CYLINDER. Brown Univ., U. S. Air Force ARL [illegible], U. S. Air Force Contract AF 33(615) - 1265, November 1966, 105 pp. (AD 649724).

1057. Richmond, J. K. and Parsons, R. J., DRIVER GAS CONTAMINATION IN SHOCK TUNNELS. Boeing Scientific Research Labs., (prepared in cooperation with Sheffield Univ. England), December 1966, 17 pp. (AD [illegible] 129).

BIBLIOGRAPHY (Contd)

1058. Richmond, J. K., Parsons, R. J., Swithenbank, J., ON SHOCK-TUNNEL SIMULATION OF SCRAMJET COMBUSTION CHAMBER PERFORMANCE. (Boeing Scientific Research Labs., Flight Sciences Lab., prepared in cooperation with Sheffield Univ. (England), Dept. of Fuel Technology and Chemical Engineering. November 1968, 29 pp. (AD 682 127).

1059. Richmond, J. K. and Shreeve, R. P. (Boeing Co.), NEW TECHNIQUES FOR OBTAINING KINETIC DATA WITH SHOCK-INDUCED COMBUSTION. AIAA, Aerospace Sciences Meeting, 5th, New York, January 23-26, 1967. Paper 67-[illegible], 13 pp.

1060. Richmond, J. K. and Shreeve, R. P., WIND-TUNNEL MEASUREMENTS OF IGNITION DELAY USING SHOCK-INDUCED COMBUSTION. AIAA Journal 5 (10), [illegible]-84 (1967).

1061. Richmond, J. K., Shreeve, R. P., Thayer, W. J., STEADY SHOCK-INDUCED COMBUSTION AS A MEANS OF ANALYZING THE COUPLING BETWEEN FUEL INJECTION AND KINETIC PROCESSES. Combustion Institute, Western States Section, Fall Meeting, Seattle, Wash., October 30, 31, 1967, Paper WSCI 67-[illegible], 7 pp.

1062. Richmond, J. K. (Boeing Co.) and Swithenbank, J. (Sheffield Univ. England), ON SHOCK-TUNNEL SIMULATION OF SCRAMJET COMBUSTION CHAMBER PERFORMANCE. AIAA Aerospace Sciences Meeting, 7th, New York, January 20-22, 1969, Paper 69-[illegible], 8 pp.

1063. Ritchie, A. W., Bailey, J. E., Nixon, A. C., EFFECT OF PORE SIZE ON THE STABILITY OF PLATINUM-ALUMINA CATALYSTS IN NAPHTHENE DEHYDROGENATION. Amer. Chem. Soc., Div. Petrol. Chem., Preprints 14 (3), B[illegible]-B51 (1969).

1064. Ritchie, A. W. and Nixon, A. C., THE EFFECT OF STRUCTURE ON THE RATES OF PYROLYSIS OF NAPHTHENES. 151st Am. Chem. Soc., Natl. Meeting (Pittsburgh March 22-31, 1966), Am. Chem. Soc., Div. Petrol. Chem., Preprints 11, N-2.C100-C109 (March 1966).

1065. Robins, P., FUTURE FUEL - WHAT'S IN THE PIPELINE. Aeroplane 113, 4-9 (April 19, 1967).

1066. Rodionov, E. L., GRAPHICAL CORRELATION OF THE DIMENSIONLESS EQUATION FOR LOCAL HEAT TRANSFER WITH SIMULTANEOUS FREE AND FORCED CONVECTION. Inzh. - Fiz. Zh. 11 (5), 559-63 (1966); C. A. 66, 57255 (1967).

1067. Roginskii, O. G. and Falis L. A., THE MECHANISM OF OSCILLATORY COMBUSTION OF A GAS; and AERODYNAMIC THEORY OF JETS AND FLAMES. Nauchno-Tekhnicheskoe Obshchestvo Energeticheskoi Promyshlennosti Tsentralnoe Pravlenie Sektsiya Gaz[illegible] Teoriya i Praktika Szhiganiya Gaza 3, Leningrad, 1967, 5-29 pp. [illegible]; U. S. Air Force Translation, October 1968, 41 pp. (AD 685979).

BIBLIOGRAPHY (Cont'd)

1068. [illegible], THE EFFECTS OF A JET FUEL ANTI-ICING ADDITIVE ON FUEL TANK LININGS. U. S. Naval Research Laboratory, Report No. NRL [illegible], October [illegible], [illegible] pp. (AD [illegible]).

1069. R[illegible]m, J., A STUDY OF THE MACH NUMBER FIELD OF A HOT TURBULENT SUPERSONIC [illegible] [illegible] Research Laboratory, Research Note, Report No. [illegible], U. S. Air Force Contract AF [illegible], U. S. Army Contract DA[illegible], October [illegible], [illegible] pp. (AD [illegible]).

1070. R[illegible]m, J., and [illegible]ziner, A., LAMINAR HEAT TRANSFER TO A TWO-DIMENSIONAL BLUNT BASE FROM THE HIGH-ENTHALPY FLOW IN THE SHOCK TUBE. Isreal Annual Conference on Aviation and Astronautics, 9th, February [illegible], [illegible] 1967, Paper; Isreal Journal of Technology [illegible] 1-2), 90-[illegible] 1967).

1071. Rosenblatt, G. M (Pennsylvania State University), EFFECT OF RESTRICTIONS TO MOLECULAR FLOW UPON MEASUREMENTS OF VAPORIZATION RATE AND VAPOR PRESSURE. Journal of Physical Chemistry [illegible], No. [illegible], [illegible] (1967); U. S. Army ARO-D [illegible], U. S. Army Contract DA-[illegible]-ARO-D-[illegible], September [illegible], 10 pp. (AD 65[illegible]).

1072. Rosner, D. E. (AeroChem Research Labs., Inc.), CONVECTIVE DIFFUSION LIMITATIONS ON THE RATES OF CHEMICAL REACTIONS AT SOLID SURFACES - KINETIC IMPLICATIONS, In Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., August 14-20, 1966, Proceedings, Pittsburgh, Pa., Combustion Institute, 1967, p. [illegible], 1966. U. S. Air Force Contracts No. AF 49(638)-1654 and No. 49(638)-1657.

1073. Rosser, W. A., THE SHAPE AND SIZE OF A DROP DIFFUSION FLAME. Combustion and Flame 11, 442-4 (October 1967).

1074. Rosser, W. A., Inami, S. H., Wise, H., (Stanford Research Inst.), THE QUENCHING OF PREMIXED FLAMES BY VOLATILE INHIBITORS. Combustion and Flame 10, 287-94 (September 1966), U. S. Air Force Contract AF 33(616)-6[illegible]3.

1075. Ruth, J. F., Abell, J. J., Schaefer, A. R. (Monsanto Co.), CATALYTIC DEHYDROGENATION OF HIGHER NORMAL PARAFFINS TO LINEAR OLEFINS OVER MOLYBDENA - ALUMINA CATALYSTS. Ind. Eng. Chem., Prod. Res. Develop. 7 (4), 254-8 (December 1968).

1076. Rotte, G., DESIGN AND ANALYSIS OF A WIDE MACH NUMBER RANGE, FIXED GEOMETRY SCRAMJET ENGINE INLET. General Applied Science Laboratories, Inc., Technical Report, Report No. GASL-TR-617, U. S. Army Contract DA-01-021-AMC-14077(Z), October 1966, 62 pp. (AD 376 451) Report Classified Confidential).

BIBLIOGRAPHY [illegible]

1077. Rotte, G., TECHNIQUES FOR THE ANALYSIS OF THREE-DIMENSIONAL EFFECTS IN HYPERSONIC INLETS. General Applied Science Laboratories, Inc., Technical Report, Report No. [illegible], U. S. Army Contract [illegible], August [illegible], [illegible] pp. (AD [illegible]).

1078. [illegible], H. W., [illegible], L., [illegible], 1965 ADVANCED RAMJET CONCEPTS PROGRAM. Volume I. LOW [illegible] INVESTIGATION. Part 1. COMPONENTS AND SYSTEMS. Marquardt Corp., Final Report, March 1, 196[illegible]–April 1[illegible], 1966, Report No. [illegible], AFAPL TR-[illegible], U. S. Air Force Contract AF 33 (615)-2[illegible], October [illegible], 340 pp. (AD [illegible]) (Report Classified Confidential).

1079. Roush, M. S., MATERIALS STUDY OF PROTECTIVE COATINGS FOR GAS TURBINE [illegible] COMPONENTS. Garrett Corp., AiResearch Mfg. Div., Engineering Report No. MP-[illegible]-MR, U. S. Air Force Contract AF 34 (601)-14101, September 196[illegible], 55 pp. (AD 809196L).

1080. Roy, D. and Thodos, G. (Northwestern Univ.), THERMAL CONDUCTIVITY OF GASES – HYDROCARBONS AT NORMAL PRESSURES. I and EC Fundamentals 7, 529-34 (November 1968).

1081. Rozengart, M. I., Mortikov, E. S., Kazanskii, B. A., THE DEHYDRO-CYCLIZATION OF INDIVIDUAL n-HEPTENES ON AN ALUMINUM-CHROMIUM-POTASSIUM CATALYST. Neftekhimiya 9 (1), 41-6 (January – February 1969).

1082. Rozengart, M. I., Polinin, V. L., Kazanskii, B. A., AROMATIZATION OF n-OCTANE ON ALUMINUM-CHROMIUM-POTASSIUM CATALYST. Izv. Akad. Nauk SSSR, Ser. Khim. 1966 (8), 1523-8 (Russ); C. A. 66 [illegible] (1967).

1083. Rozhkov, I. V., Churshukov, F. S., Griazno v, A. P., [illegible], V. I., Korrilova, OPERATIONAL CHARACTERISTICS OF JET FUELS PURIFIED OF MERCAPTANS. Khim. i Tekh. Topliv i Masel 13 (10), 1968, 47-9.

1084. Rubins, P. M. and Bauer, R. C., PREMIXING THE FUEL IN A SCRAMJET – BONE OR BONUS. Astronautics and Aeronautics 1967 (May), 17-18.

1085. Rubins, P. M. and Bauer, R. C., A HYPERSONIC RAMJET ANALYSIS WITH PREMIXED FUEL COMBUSTION. AIAA 2nd Propulsion Joint Specialist Conference Paper 66-648, June 1966, 39 pp.

1086. Rubinshtein, A. M., Slovetskaya, K. I., Brueva, T. R., CHEMICAL SORPTION OF HYDROCARBONS ON ALUMINUM-CHROMIUM-POTASSIUM CATALYST. Metody Issled. Katal. Katal. Reakts., Akad. Nauk SSSR, Sib. Otd., Inst. Katal. 1, 276-85 (1965) Russ); C. A. 67, 76587.

1087. Rubinshtein, I. A., Popova, E. A., Krein, S. E., EFFECT OF THE ASSOCIATION OF SULFUR – ORGANIC COMPOUNDS WITH AROMATIC HYDROCARBONS ON THE OXIDATIVE STABILITY OF OIL. Khim. i Tekh. Topliv i Masel 13 (11), 49-52 (1968).

BIBLIOGRAPHY (Cont'd)

1088. Rudenko, A. P., Rodicheva, M. [illegible], Bodrina, D. E., Balandin, A. A., FORMATION OF CUMENE, TOLUENE, AND XYLENE DURING CRACKING OF CUMENE ON SILICA GEL. Vestn. Mosk. Univ., Ser. II: Khim. 21 (4), 99-102 (1966) (Russ); C. A. 66, 10067 (1967).

1089. Rudov, Iu. M. and Uskov, V. N., APPROXIMATE METHOD OF CALCULATING THE PARAMETERS OF A SUPERSONIC GAS JET IMPINGING ON AN INCLINED PLANE BARRIER. Aviatsionnaia Tekhnika 11 (3), 79-84 (1968).

1090. Rutovskii, V. B., GAS-DYNAMIC CALCULATION OF A DIFFUSIVE COMBUSTION FLAME IN A WAKE FLOW. Aviatsionnaia Tekhnika 10 (1), 79-86 (1967) (in Russian).

1091. Ryashentseva, M. A., Afanas'eva, Yu. A., Minachev, Kh. M., THE CATALYTIC PROPERTIES OF ALUMINA-PALLADIUM CATALYSTS CONTAINING OXIDES OF RARE EARTH METALS. Izv. Akad. Nauk SSSR, Ser. Khim. 1968, No. 3, 518-22 (March).

1092. E. Sada & C. Y. Wen, EFFECT OF CATALYST POISONING ON THE OVER-ALL SELECTIVITY AND ACTIVITY. 59th AIChE Ann. Mtg. (Detroit 12/4-8/66) Program: Abstr. No. 50b.

BIBLIOGRAPHY (Contd)

1093. Sagalovich, A. V., Klyachko-Gurvich, A. L., Slinkin, A. A., ACTIVITY OF Ni-ZnO CATALYSTS IN THE DEHYDROGENATION OF CYCLOHEXANE. Izv. Akad. Nauk SSSR, Ser. Khim. 1968 (1), 106-16.

1094. Sagomonian, A. Ia., IMPACT OF A SUPERSONIC JET AGAINST A SURFACE. Moskovskii Universitet, Vestnik, Seriia I - Matematika, Mekhanika, 21, 98-103 (November - December 1966) (in Russian).

1095. Salant, R. F. and Toong, T. (Massachusetts Inst. of Technology), SOME FUNDAMENTALS OF COMBUSTION INSTABILITY. Oxidation and Combustion Reviews 2, 185-206 (1967); U. S. Air Force AFO SR-68-0630, Contract AF 49(638)-1354, March 1968, 24 pp. (AD 667 137).

1096. Salooja, K. C. (Shell Research, Ltd.), IGNITION BEHAVIOURS OF MIXTURES OF HYDROCARBONS. Combustion and Flame 12 (6), 597-602 (1968).

1097. Salooja, K. C. (Shell Research, Ltd.), COMBUSTION STUDIES OF OLEFINS AND OF THEIR INFLUENCE ON HYDROCARBON COMBUSTION PROCESSES. Combustion and Flame 12 (5), 401-10 (October 1968).

1098. Salooja, K. C., STUDIES OF OXIDATION PROCESSES LEADING TO IGNITION OF BUTANES, BUTENES AND CYCLOBUTANE. Combustion and Flame 11 (4), 320 - 8 (1967); C. A. 67, 75027.

1099. Salkowski, M. J., DETECTION OF WATER IN JET FUEL AND RESIDUAL FUEL. ITEM 2: PROTOTYPE INSTRUMENTATION. IIT Research Inst., Technology Center Bi-monthly progress report No. 5, 21 December 1966 - 21 February 1967, Report No. IITRI-C6091-2-5, U. S. Navy Contract NObs-94353, February 1967, 17 pp. (AD 808316).

1100. Salkowski, M. J., DETECTION OF WATER IN JET FUEL AND RESIDUAL FUEL. ITEM 2: PROTOTYPE INSTRUMENTATION. IIT Research Institute, Bi-monthly Progress Report No. 3, 21 August - 21 October 1966, Report No. IITRI-C6091-2-3, U. S. Navy Contract NObs-94353, October 1966, 29 pp. (AD 801481).

1101. Salvatore, G., THE SCRAMJET AS A SPACE BOOSTER - CRITERIA OF APPLICABILITY. Rivista di Ingegneria 1968, 583-93 (July - August).

1102. Samuylov, E. V. Rozhdestvenskii, I. B., Voskresenskaya, N. V., Tsitelauri, N. N., Olevinskii, K. K., THERMODYNAMIC PROPERTIES AND COMBUSTION - PRODUCT TRANSFER PROPERTIES OF HYDROCARBON FUELS AT TEMPERATURES UP TO 4000 K. Termodinamicheskie Svoistva i Svoistva Perenosa Produktov Goreniya Uglevodorodnykh Topliv pri Temperaturakh Do 4000 K. SML 107/162, n.p., n.d., p. 1-35; U.S. Air Force Translation, August 1968, 36 pp. (AD 685 132).

1103. Sandri, R., ON THE GENERAL MECHANISM OF FLAME PROPAGATION. Canada, National Research Council, Division of Mechanical Engineering and National Aeronautical Establishment, Quarterly Bulletin, No. 1, 1968, p. 79-84.

BIBLIOGRAPHY (Cont'd)

1104. Sanematsu, H. S. (University of Southern California), TURBULENT FLAME PROPAGATION PARAMETERS. Combustion and Flame 13, 91-95 (February 1969).

1105. Saprykin, G. S., CALCULATION OF THE WORKING PROCESS IN A COOLED GAS TURBINE. Izv. Vysshikh Ucheb. Zavedenii. Energetika (USSR) 1966 (6), 55-62; U.S. Air Force Translation FTD-MT-67-63, June 1967, 23 pp. (AD 668 754).

1106. Sartori, G., Furlani, A., Vorfall, G., THE CATALYTIC SYSTEMS CHROMIUM (III) ACETYLACETONATE - TRIETHYLALUMINUM AND VANADIUM (III) ACETYLACETONATE-DIETHYLALUMINUM MONOCHLORIDE IN THE AROMATIZATION OF ACETYLENIC HYDROCARBONS. Chim. Ind. (Milan) 49 (4), 357-61 (1967) (Ital); C. A. 67, 5525k.

1107. Sastri, S. R. S., ESTIMATE HEATS OF VAPORIZATION OF HYDROCARBONS. Brit. Chem. Eng. 13 (8), 1159 (August 1968).

1108. Satcunanathan, S. and Zaczek, B. J., THE SPONTANEOUS IGNITION AND IGNITION DELAY OF LIQUID FUEL DROPLETS IMPINGING ON A HOT SURFACE. Institution of Mechanical Engineers, Thermodynamics and Fluid Mechanics Convention, Bristol, England, March 27-29, 1968, Paper 41, 13 pp.

1109. Sato, T., Kunitomo, T., Nakashima, F., Fujii, H., RADIATION FROM LUMINOUS FLAME. II. EXPERIMENTAL STUDY IN THE CASE OF COMBUSTION OF LIQUID FUELS. Bull. JSME (Jap. Soc. Mech. Eng.) 9 (36), 768-77 (1966) (Eng.); C. A. 66, 48004 (1967).

1110. Satterfield, C. N. and Cadle, P. J. (Massachusetts Inst. Technol.), DIFFUSION IN COMMERCIALLY MANUFACTURED PELLETED CATALYSTS. I and EC Process Design and Development 7, No. 2, 256-260 (April 1968).

1111. Saunders, D. And Heicklen, J., SOME REACTIONS OF OXYGEN ATOMS--1. C2F4, C3F6, C2H2, C2H4, C3H6, 1-C4H8, C2H6, C-C3H6, and C3H8. J. Phys. Chem. Volume 70, N.6. 1950-58 (June 1966).

1112. Savage, G. M. (to UpJohn Co.), PETROLEUM FUELS CONTAINING ANTIBIOTIC COMBINATIONS. U.S. 3, 300, 287 (Cl. 44-50), January 24, 1967, Appl. September 12, 1963; 2 pp.; C. A. 66, 57620 (1967).

1113. Savage, R. T. and Jaeck, C. L., INVESTIGATION OF TURBULENT HEAT TRANSFER AT HYPERSONIC SPEEDS. VOLUME I. ANALYTICAL METHODS. Boeing Co., Aerospace Group, Final Report, March 1965- March 1967, Report No. D2-113531-1, U. S. Air Force AFFDL-TR-67-14-Vol-1, Contract AF 33(615)-2372, December 1967, 135 pp. (AD 667 798).

BIBLIOGRAPHY (Cont'd)

1114. Savage, R. T., Jaeck, C. L., Mitchell, J. R., INVESTIGATION OF TURBULENT HEAT TRANSFER AT HYPERSONIC SPEEDS. VOLUME III. THE LAMINAR - TURBULENT RHO SUB r MU SUB r MOMENTUM INTEGRAL AND TURBULENT NONSIMILAR BOUNDARY LAYER COMPUTER PROGRAMS. Boeing Co., Aerospace Group, Final Report, March 1965 - March 1967, U. S. Air Force AFFDL-TR-67-144-Vol-3, Contract AF 33(615)-2572, December 1967, 232 pp. (AD 667 804).

1115. Sawyer, R. F., Smith, D. S., Starkman, E. S., OXIDES OF NITROGEN FROM GAS TURBINES. J Air Pollution Control Assoc. V18 N.1 30-35 (January 1968).

1116. Sch[illegible]r, B. A., CHEMI-IONIZATION IN FLAMES AND HEAT OF OXIDATION. Com[illegible]stion and Flames 13 (2), 208-10 (April 1969).

1117. Schaefer, E., MEASUREMENT OF HEAT TRANSFER IN ROCKET ENGINES. PART 2. RESULTS AND COMPARISON WITH THEORETICAL CALCULATIONS Technische Hochschule Stuttgart (West Germany). Arbeitsgemeinschaft fuer Raketentechnik und Raumfahrt, December 1968, 49 pp. (in German) (N69-15585).

1118. Scaggs, N. E. and Dunn, R. G. (Wright-Patterson AFB), DEVELOPMENT OF A FACILITY FOR SUPERSONIC COMBUSTION SIMULATION. AIAA, Aerodynamic Testing Conference, Los Angeles, Calif., September 21 - 23, 1966, Paper 66-743, 19 pp.; C. A. 67, 4489.

1119. Schetz, J. A., ANALYSIS OF THE MIXING AND COMBUSTION OF GASEOUS AND PARTICLE LADEN JETS IN AN AIR STREAM. AIAA Aerospace Sciences Meeting, 7th, January 20-22, 1969, AIAA Paper 69-33.

1120. Schetz, J. A. and Billig, F. S. (Univ. of Maryland), PENETRATION OF GASEOUS JETS INJECTED INTO A SUPERSONIC STREAM. J. Spacecraft Rockets 3 (11), 1658-65 (1966); C. A. 66, 30495 (1967).

1121. Schetz, J. A. and Favin, S. (Johns Hopkins Univ.), AN ANALYSIS OF THE IGNITION OF SLOT-INJECTED GASEOUS HYDROGEN IN A SUPERSONIC AIR STREAM. Combustion and Flame 11, 397-407 (October 1967).

1122. Schetz, J. A. and Gilreath, H. E., TANGENTIAL SLOT INJECTION IN SUPERSONIC FLOW AIAA J. 5, 2149-54 (December 1967).

1123. Schirmer, R. M., MORPHOLOGY OF DEPOSITS IN AIRCRAFT FUEL SYSTEMS. Progress Report No. 1, U. S. Navy Contract N0019-68-C-0252, August 1968.

1124. Schirmer, R. M. and Quigg, H. T. (Phillips Petroleum Co.), EFFECT OF JP-5 SULFUR CONTENT ON HOT CORROSION OF SUPERALLOYS IN MARINE ENVIRONMENT. American Society for Testing and Materials, Annual Meeting, 69th, Atlantic City, N. J., June 26 - July 1, 1966, Paper 105, 33 pp.

BIBLIOGRAPHY (Contd)

1125. Schirmer, R. M. and Quigg, H. T. (Phillips Petroleum Co.), EFFECT OF SULFUR IN JP-5 FUEL ON HOT CORROSION OF COATED SUPERALLOYS IN MARINE ENVIRONMENT. Annual National Conf. on Environmental Effects on Aircraft and Propulsion Systems, 8th, Bordentown, N. J., October 8-10, 1968, Proc. 143-159.

1126. Schleyer, P. von R., Isele, P. R., Bingham, R. C., BRIDGEHEAD REACTIVITY IN BICYCLO (3.3.1) NONANE SYSTEMS. J. Org. Chem. 31 (3), 1239-40 (March 1966).

1127. Schlichting, H. and Das, A., SOME PRINCIPAL PROBLEMS IN THE FIELD OF TURBINE AERODYNAMICS. L'Aerotecnica 46, 179-94 (October 1966).

1128. Schmitz, R. A. (Univ. of Illinois, Urbana), FURTHER STUDY OF DIFFUSION FLAME STABILITY. Combustion and Flame 11 (1), 49-62 (1967); C. A. 66, 117550 (1967).

1129. Schnabel, K. H., CATALYTIC PROPERTIES OF PLATINUM CATALYSTS - 5. THE EFFECT OF ALKALI (KOH) ON ACTIVITY OF PLATINIZED CHARCOAL. Kinetika i Kataliz 8, No. 3, 583-91 (May - June 1967).

1130. Schollkopf, V., Fellenberger, K., Patsch, M., Schleyer, P. von R., Su, T., van Dine, G. W., ACETOLYSIS OF ENDO- AND EXO-BICYCLO - (n, 1, 0) ALKYL-TOSYLATES. Tetrahedron Letters 1967 (37), 3639-44.

1131. Schultze, G. R., HIGH-TEMPERATURE CORROSION BY COMBUSTION PRODUCTS OF HIGH- AND MEDIUM-DENSITY FUEL OILS. Werkstoffe Korrosion V17 N.1 (1966); (ABSTR) Corrosion ABSTR V6 N.1 16 (January 1967).

1132. Schwartz, F. G., Allbright, C. S., Ward, C. C., FUNDAMENTALS OF FUEL STABILITY. U. S. Bureau of Mines Technical Report No. 19, Dept. of the Army Project 1A024401A106, May 1968, 57 pp.

1133. Schwartz, F. G. and Ward, C. C., FUNDAMENTALS OF FUEL STABILITY. U. S. Bureau of Mines Technical Report No. 17, Dept. of the, Army Project 1A024401A106, June 1966, 33 pp.

1134. Schwarz, F. J., Crowder, W. E., Jr., Driggers, H. H. (LTV Aerospace Corp.), UNIVERSAL HYPERSONIC TEST VEHICLE (UHTV) MISSION CONCEPTS. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper (Classified).

1135. Scott, J. E., Jr. (Univ. of Virginia), MIXING AND COMBUSTION OF A SUPERSONIC FUEL JET AND A SUBSONIC, COAXIAL GAS STREAM. 1965, 52 pp. (AD 469 052); C. A. 66, 87207 (1967).

1136. Scribner, W. G., Short, F. R., Eyster, H. C., Weis, J. D., DETERMINATION OF PARTS PER BILLION IRON IN HYDROCARBON JET FUELS. Monsanto Research Corp. Summary Report, 24 January 1964 - 28 December 1965, U. S. Air Force AFAPL-TR-66-44, Contract No. AF 33(615)-1317, April 1966, 21 pp. (AD 636 604); C.A. 67, 13503.

BIBLIOGRAPHY (Cont'd)

1137. Sebastian, C. R. (North American Aviation, Inc.), THERMAL-STABILITY ASPECTS OF COMMERCIAL KEROSINE FOR THE SUPERSONIC TRANSPORT. AIAA Propulsion Joint Specialist Conference, 2nd, Colorado Springs, Colo. June 13-17, 1966, Paper 66-670; Journal of Aircraft 4, 292-6 (July - August 1967).

1138. Seddon, J., BOUNDARY LAYER INTERACTION EFFECTS IN INTAKES WITH PARTICULAR REFERENCE TO THOSE DESIGNED FOR DUAL SUBSONIC AND SUPERSONIC PERFORMANCE. Gt. Brit. Royal Aircraft Establishment Report RAE-TR-66099, March 1966, 35 pp. (N68-17304).

1139. Sedlock, D., THE APPLICATION OF A NON-SIMILAR LAMINAR BOUNDARY LAYER ANALYSIS TO HYPERSONIC INLET COMPRESSION SURFACES. U. S. Air Force Flight Dynamics Lab., Wright-Patterson A. F. B. Report No. AF FDL-TR-66-146, December 1966, 37 pp. (AD 654672).

1140. Seleznev, V. A., Pokhil, P. F., Maltsev, V. M., Bavykin, I. B., AN OPTICAL METHOD OF MEASURING THE BURNING-SURFACE TEMPERATURE OF CONDENSED SYSTEMS. Combustion and Flame 13 (2), 139-42 (April 1969).

1141. Seligmiller, H. L., JET ENGINE EXHAUST SMOKE. Great Britain Office of Naval Research Report No. ONRL-56-66, November 1966, 23 pp. (AD 806520).

1142. Selin, V. V., METHOD OF CALCULATING TRANSIENTS IN GAS TURBINE POWER PLANTS. Izv. Vysshikh Ucheb. Zavedenii. Energetika (USSR) 1964 (12), 55-64; U. S. Air Force Translation FTD-MT-24-155-67, September 1967, 17 pp. (AD 667642).

1143. Sens, W. H. and Meyer, R. M., (United Aircraft Corp.), NEW GENERATION ENGINES - THE ENGINE MANUFACTURER'S OUTLOOK. Society of Automotive Engineers, Air Transportation Meeting, New York, N. Y., April 29- May 2, 1968, Paper 680278, 12 pp.

1144. Sepucha, R. C. and Olfe, D. B. (University of California, San Diego), ACCURACY OF CONSTANT DENSITY AND CONSTANT PRESSURE ASSUMPTIONS FOR RADIATING SHOCK WAVES. AIAA Journal 7 (3), 551-2 (March 1969).

1145. Sergeev, G. T., HEAT AND MASS TRANSFER IN A BOUNDARY LAYER OF COMPRESSIBLE GAS DURING CHEMICAL REACTIONS. Obshch. Vop. Teplo - Massoobmena, Inst. Teplo - Massoobmena Akad. Nauk Beloruss. SSR 1966, 31-6 (Russ); C.A. 67, 45502.

1146. Sergeev, V.L., EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER IN THE REGION OF A STAGNATION POINT. Inzhenerno-Fizicheskii Zhur. 9, 657-66 (November 1965); Journal of Engineering Physics 9, 416-422 (November 1965) (Engl. Transl.).

BIBLIOGRAPHY (Cont'd)

1147. Sergienko, S. R., Medvedeva, V. D., Lebedev, B. V., Elyseeva, L. M., [illegible] CATALYSTS. Izv. Akad. Nauk Turkm. SSR, Ser. Fiz. - Tekh., Khim. Geol. Nauk 1967 (2), 54-60 (Russ); C.A. 67, 73070.

1148. Cernys, M., Reinbold, L., Castebois, P., CERTAIN STABILIZED COMBUSTIONS IN SUPERSONIC FLOW. Compt. Rend. (Paris), A 266 (12), 644-6 (1968).

1149. Cforza, P. M., Trentacoste, N. P., Mons, R. F., TURBULENT MIXING: A REVIEW, REVALUATION, AND EXTENSION. AIAA Aerospace Sciences Meeting, 7th, January 20-22, 1969, AIAA Paper No. 69-31.

1150. Shah, R. K. and Osborn, H. H., ADVANCED HEAT EXCHANGER DESIGNS OF COMPACT HEAT EXCHANGERS WHEN OPERATING IN A MARINE ENVIRONMENT. Air Preheater Co., Inc. Final Report, U. S. Navy Contract NObs-92519, May 1967, 250 pp. (AD 814742).

1151. Shahrokhi, F. and Wolf, P. (The University of Tennessee Space Institute), AN INVESTIGATION OF RADIATIVE HEAT TRANSFER IN PARTICIPATING MEDIA. AIAA Journal 7 (4), 791-3 (April 1969).

1152. Shape, R. W., YJ93 TURBOJET ENGINE. VOLUME I. General Electric Co., Flight Propulsion Div., Semi-annual Progress Report No. 2 (Final), 25 January - 29 March 1967, Report No. R67FPD[illegible]-Vol-1, U. S. Air Force Contract AF 33(657)-16590, May 1967, 26 pp. (AD 814577L).

1153. Shape, R. W., YJ93 TURBOJET ENGINE. VOLUME II. MATERIALS. General Electric Co., Flight Propulsion Div. Semi-annual Progress Report No. 2 (Final), for period ending 29 March 1967, Report No. R67FPD[illegible]-Vol-2, U. S. Air Force Contract AF 33(657)-16590, March 1967, 21 pp. (AD 814681L).

1154. Sharfshtein, A. Kh., USE OF THERMOCOUPLES MADE OF ALLOYS OF TUNGSTEN AND RHENIUM FOR MEASURING FLAME TEMPERATURES UP TO 3000°K. Tr. Ufim. Aviats. Inst. No. 6, 33-40 (1965) (Russ); C.A. 67, 92069.

1155. Shimulis, V. I., Moskovskaya, M. F., Taxano, S., INFLUENCE OF THE STEPWISE INHOMOGENEITY OF A PALLADIUM SURFACE ON THE KINETICS OF CYCLOHEXENE DEHYDROGENATION. 1. THE STEPWISE PRESSURE DEPENDENCE OF THE REACTION RATE. Kinet. i Katal. 9 (3), 577-84 (May - June 1968) (in Russian).

1156. Sharma, O. P. (University of California, La Jolla), PHASE - CHANGE PROBLEMS WITH VARIABLE SURFACE TEMPERATURES. AIAA Journal 5, 677-82 (April 1967). U. S. Army Contract DA-31-124-ARO(D)-257.

BIBLIOGRAPHY (Contd)

1157. Shatil, A. A., Khainovski, Y. S., Muravenko, V. D., THE COMBUSTION OF NATURAL GAS UNDER PRESSURE IN A GAS TURBINE. Tel-Gasfoszerung V. 11 N.1.67-71 (1966); (Abstr), J. Inst. Petrol. V. 52, N.509.65A (May 1966).

1158. Shayeson, M. W. (General Electric Co.), THERMAL STABILITY MEASUREMENT OF FUELS FOR THE U.S. SUPERSONIC TRANSPORT ENGINE. ASME 14th Annual International Gas Turbine Conference and Products Show, March 9-13, 1969, 12 pp.

1159. Shayeson, M. W., THE REDUCTION OF JET ENGINE EXHAUST SMOKE WITH FUEL ADDITIVES. SAE Aeron. + Space Eng. + Mfg. Mtg. (Los Angeles, October 2-6, 1967), Paper N. 670866, 8 pp.

1160. Shchelkin, K. I., HYDRODYNAMICS OF COMBUSTION. Fizika Goreniia i Vzryva 2nd (4), 455-66 (December) (in Russian).

1161. Shchelkin, K. I. and Troshin, Ia. K., GAS DYNAMICS OF COMBUSTION. Baltimore, Mono Book Corp., 1965, 222 pp. Translation.

1162. Shell Development Co., BREAKING THE JET FUEL BARRIER. Chem. Week V. 99, N. 23.61-62,64 (December 5, 1966).

1163. Shell Internationale Research Maatschappij N. V., CORROSION INHIBITORS FOR PETROLEUM PRODUCTS IN STORAGE TANKS OR PIPELINES. Neth. Appl. 6, 607, 303 (Cl. C 10e), December 9, 1966; Ger. Appl. June 8, 1965; 8 pp., C. A. 66, 97303 (1967).

1164. Shir, C. C. and Joseph, D. D., CONVECTIVE INSTABILITY IN A TEMPERATURE AND CONCENTRATION FIELD. Arch. for Rat. Mech. and Anal. 30, 38-80, (1968).

1165. Shiralkar, B. S. and Griffith, P. (Massachusetts Inst. of Technology), DETERIORATION IN HEAT TRANSFER TO FLUIDS AT SUPER-CRITICAL PRESSURES AND HIGH HEAT FLUXES. ASME, Transactions, Series C - Journal of Heat Transfer 91, 27-36 (February 1969).

1166. Shirasaki, T. and Furuoya, I., STUDIES ON CORRELATION BETWEEN METHODS OF PREPARATION, STRUCTURES AND ACTIVITIES OF SUPPORTED PLATINUM METAL CATALYSTS. 2. MECHANICAL STRUCTURE AND LATTICE IMPERFECTION OF SUPPORTED PALLADIUM CATALYSTS. Kogyo Kagaku Zasshi 71 (11), 1774-8, A112 (November 1968).

1167. Shopov, D. and Palazov, A., AN IR STUDY OF HYDROCARBON CHEMISORPTION ON A NICKEL-SILICA CATALYST. Kinetika i Kataliz 8 (4), 862-6 (July - August 1967).

1168. Shopov, I., POLYMERS WITH CONJUGATED SYSTEMS. I. POLY (ACENAPHTHYLENE). Vysokomol. Soedin., Ser. B 9 (7), 546-9 (1967) (Russ); C.A. 67, 82524.

BIBLIOGRAPHY (Cont'd)

1169. Short, G. R., Cotter, J. C., Sun, Y. H. (AiResearch Manufacturing Co.), SUPERSONIC RECIRCULATION ENGINE [illegible] DEVELOPMENT PROGRAM. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9 - 13, 1969, Paper (Classified).

1170. Sichel, M. and Yin, Y. K., AXISYMMETRIC SIMILARITY SOLUTION FOR [illegible] TRANSONIC NOZZLE FLOW. Univ. of Michigan 1966, 31 pp. (AD 646 255); C.A. 67, 117011 (1967).

1171. Sichel, M. (Univ. of Michigan), EFFECT OF LONGITUDINAL VISCOSITY ON THE FLOW AT A NOZZLE THROAT. NASA Accession No. N6 -31[illegible], 1966, 64 pp. (AD 667 593); C.A. 66, 87102 (1967).

1172. Sichel, M. (University of Michigan), COMPUTER EXPERIMENTS RELATED TO CHEMICAL PROPULSION. AIAA Journal 5 (9), 1557-49 (1967); C.A. 67, 92445.

1173. Sigillito, V. G., ON A CONTINUOUS METHOD OF APPROXIMATING SOLUTIONS OF THE HEAT EQUATION. Johns Hopkins Univ., Applied Physics Lab. Technical Memo Report No. TG-763, U.S. Navy Contract NOw-62-0604, October 1966, 30 pp. (AD 642 320).

1174. Silverstein, A. (NASA, Lewis Research Center), PROGRESS IN AIRCRAFT GAS TURBINE ENGINE DEVELOPMENT. Aerospace Proceedings 1966; Royal Aeronautical Society, Centenary Congress and International Council of Aeronautical Sciences, Congress, 5th, London, England, September 12-16, 1966. Vol. 2, ed. by J. Bradbrooke et al., London Macmillan, 1967, 587-604, 605.

1175. Silverstein, C. C., HEAT PIPE GAS TURBINE REGENERATORS. American Society of Mechanical Engineers, Winter Annual Meeting and Energy Systems Exposition, New York, December 1-5, 1968, Paper 68-WA/GT-7, 9 pp.

1176. Simonson, M. R., INVESTIGATION OF HIGH GAS TEMPERATURE UTILIZATION FOR ADVANCED TIP TURBINE FANS. General Electric Co., Flight Propulsion Division Technical Report No. R66FPD[illegible], USAAVLABS TR-66-37, U.S. Army Contract DA-44-177-AMC-218(T), August 1966, 64 pp. (AD643 026).

1177. Simpson, E. C. (U.S. Air Force Systems Command), POTENTIAL IN PERFORMANCE IMPROVEMENTS IN AIR BREATHING PROPULSION. Aviation and Space: Progress and Prospects; Proceedings of the Annual Aviation and Space Conference, Beverly Hills, Calif., June 16-19, 1968, New York, American Society of Mechanical Engineers, 1968, pp. 343-50.

1178. Simpson, F. H., Fiedler, L. J., Acurio, J., SMALL GAS TURBINE ENGINE COMPONENT TECHNOLOGY, HIGH-TEMPERATURE TURBINE MATERIALS RESEARCH. Boeing Co., Turbine Div. Final Report, 1 May 1964 - 31 August 1965, Report No. D6-3258, U. S. Army USAAVLABS TR-66-62, U. S. Army Contract DA-44-177-AMC-173(T), December 1966, 168 pp. (AD 651 105).

BIBLIOGRAPHY (Cont'd)

1179. Simpson, F. M. (Ingersoll-Rand Co.), A RAPID APPROXIMATE METHOD OF DETERMINING AXIAL-FLOW TURBINE DISK AND BLADE TEMPERATURES. American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, March 5-9, 1967, Paper 67-GT-14, 8 pp.

1180. Sinclair Research, Inc. (C. C. [illegible], J. [illegible], L. R. Beckberger), HYDROCARBON DEHYDROGENATION CATALYSTS. Fr. 1, 474, 605(Cl. [illegible]), March 24, 1967, U. S. Appl. April 5, 1965, 7 pp.; C.A. 67, 66355.

1181. Singer, K., MONTE CARLO CALCULATION OF THERMODYNAMIC PROPERTIES OF SIMPLE FLUIDS. Nature 212, 1449 (December 24, 1966).

1182. Skifstad, J. G. (Purdue Univ.), IRREGULAR REFRACTION OF A STRONG SHOCK WAVE BY A WEDGE OF HOT GAS. Phys. Fluids 10 (2), 455-7 (1967); C.A. 66, [illegible] (1967).

1183. Skinner, J. H., PLANE-FLAME SIMULATION OF THE WAKE BEHIND AN INTERNALLY PROPELLED VEHICLE. PART III. EXPERIMENTAL SIMULATION OF A SUPERSONIC VEHICLE BY A DETONATION. Doctoral thesis Rensselaer Polytechnic Inst., Dept. of Aeronautical Engineering and Astronautics. TR-AE-67[illegible]-PT-3, Contract [illegible], November 1967, 41 pp. (PB 175 324).

1184. Sk[illegible], V. T., Lebedev, E. V., [illegible], V. A., DEHYDROCRACKING OF NORMAL PARAFFINIC HYDROCARBONS ON OXIDE AND SULFIDE CATALYSTS. Nauchn. Osnovy Podbora i Proizv. Katalizatorov, Akad. Nauk SSSR, Sibirsk. Otd. 1964, 316-36 (Russ); C.A. 63, 8081.

1185. Skorodelov, D. I. and Voinov, A. N., INVESTIGATION OF THE PECULIARITIES OF PRE-FLAME PROCESSES AND IGNITION OF HYDROCARBONS OF VARIOUS STRUCTURES. PART I - VARIATION OF COOL FLAME DELAY AND IGNITION DELAY WITH COMPRESSION TEMPERATURE AND PRESSURE. Kinetika i Kataliz (SSSR) [illegible], 252-60 (1967); Shell Research, Ltd. (England). Thornton Research Center Transl. No. 11[illegible], 1967, 17 pp. (N67-1917[illegible]).

1186. Slinko, M. G., OPTIMAL PORE STRUCTURE, SHAPE AND SIZE OF THE CATALYST PELLETS. Int. Congr. Catal. (4th), Pore Struct. and Transp. Processes Symp. (Novosibirsk July 5-7, 1968). Preprint No. 2, 15 pp.

1187. Slinko, M. G., Malinovskaya, O. A., Beskov, V. S., OPTIMUM PORE STRUCTURE OF CATALYSTS. Khim. Prom. 43, No. 9, 641-6 (September 1967).

1188. Slovetskaya, K. I., Preeva, T. R., Rubinshtein, A. M., ADSORPTION OF HYDROGEN AND CYCLOHEXANE ON DECATIONATED Y-TYPE ZEOLITE. Izv. Akad. Nauk SSSR, Ser. Khim. 1968 (2), 249-52.

1189. Slovetskaya, K. I. and Rubinshtein, A. M., ADSORPTION OF BENZENE ON CHROMIA/ALUMINA/POTASSIUM OXIDE CATALYSTS WITH CHROMIUM IN DIFFERENT VALENCE STATES. Izv. Akad. Nauk SSSR, Ser. Khim. 1968 (2), 273-6.

BIBLIOGRAPHY (Contd)

1190. [illegible], [illegible], Tamagno, J., Fruchtman, I., ANALYSIS OF HYDROCARBON - AIR [illegible] FLAMES. AIAA, Propulsion Joint Specialist Conference, 2nd, Colorado Springs, Colo., June 13-17, 1966, Paper 66-575, 52 pp., C.A. [illegible], 23715.

1191. [illegible], [illegible] and [illegible], [illegible] A., INVESTIGATION OF NITROGEN RADIATION IN THE [illegible] DOMAIN BEHIND A SHOCK FRONT. Zhur. Prikl. [illegible] (USSR) [illegible] (4), [illegible] (196[illegible]); Lockheed Missiles and Space Co. Translation, [illegible], 7 pp. ([illegible]).

1192. [illegible], O. D. and Medvedev, V. N., THE USE OF ALUMINA-CHROMIA CATALYSTS IN THE DEHYDROGENATION OF PARAFFINIC HYDROCARBONS. Neftekhimiya 2 (1), 35-40, (January - February 1962).

1193. Smith, J. D. (Shell Research, Ltd.), THE EFFECT OF METALS AND ALLOYS ON THE THERMAL STABILITY OF AVTUR 50. Aircraft Engineering 39, 19-22, 26 (April 1967).

1194. Smith, L. B. (The Marquardt Corp.), HYPERSONIC RAMJET PROPULSION HIGHLIGHTS. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper (Classified).

1195. Smith, L. B., Mott, H. C., Weber, E. A., ADVANCED CONCEPTS STUDIES. Wright Air Development Division, Wright-Patterson A.F.B., Directorate of Systems Management Evaluation Report, WADC TR-59-62, November 1959, 120 pp. (AD 377517L) (Report Classified Secret).

1196. Smith, R. L. and Prater, C. D. (Mobil Oil Corp.), SOME CAPABILITIES AND LIMITATIONS OF KINETIC STUDIES IN HETEROGENEOUS CATALYSIS AS ILLUSTRATED BY CYCLOHEXANE - CYCLOHEXENE - BENZENE INTERCONVERSION OVER A SUPPORTED PLATINUM CATALYST. Chem. Eng. Progress Symposium Series 63 (73), 105-21 (1967).

1197. Smolderen, J. J., LOW DENSITY HIGH TEMPERATURE GAS DYNAMICS. Von Karman Inst. for Fluid Dynamics (Belgium) Final Scientific Report 1 November 1966 - 31 October 1967, U. S. Air Force AFOSR-68-0463, Grant AF-EOAR-10-67, October 1967, 16 pp. (AD 666 478).

1198. Soeffker, E. and Renner, A., SUCTION LOSSES OF SHARP-LIP AIR INTAKES. Deutsche Forschungsanstalt fur Luft-und Raumfahrt Report No DLR-FB-65-26, 1965; Gt. Brit. Royal Aircraft Establishment Translation RAE-LIB-TRANS-1246, August 1967, 27 pp. (N68-16945).

1199. Sokolik, A. S., Karpov, V. P., Semenov, E. S., MACROKINETIC CHARACTERISTICS OF TURBULENT FLAMES (KINETIC BASIS OF THE "PULSATING IGNITION MODEL"). Nauchno - Tekhnicheskoe Obshchestvo Energeticheskoi Promyshlennosti Tsentralnoe Pravlenie Sektsiya Gazifikatsii Teoriya i Praktika Szyiganiya Gaza 3, Leningrad, 1967, P. 150-67. U. S. Air Force Translation, October 1968, 34 pp. (AD 685 358).

BIBLIOGRAPHY (Cont.)

1200. Sokolskaya, A. M., Reshetnikov, S. M., Fasman, A. B., Sokolskii, D. V., DEPENDENCE OF THE CATALYTIC ACTIVITY OF METALS ON THEIR POSITION IN THE PERIODIC SYSTEM OF ELEMENTS. Katalizatory Zhidkofaznoi Gidrogenizatsii, Akad. Nauk Kazakhsk. SSR, Trudy Inst. Khim. Nauk 14, 200-9, Alma Ata, 1966; International Chem. Eng. 7, No. 3, 525-32 (July 1967).

1201. Soloukhin, R. I., EXOTHERMAL REACTION ZONE IN ONE-DIMENSIONAL SHOCK WAVES IN GASES. Fiz. Goreniya Vzryva 1966 (3), 12-18 (Russ); C. A. 66, 69301 (1967).

1202. Sorenson, N. E. and Smeltzer, D. B., INVESTIGATION OF A LARGE-SCALE MIXED COMPRESSION AXISYMMETRIC INLET SYSTEM CAPABLE OF HIGH PERFORMANCE AT MACH NUMBERS 0.6 to 3.0. U. S. National Aeronautics and Space Administration Report NASA-TM-X-1507, February 1968, 180 pp. (N68-17028).

1203. Sorko, P. M., BIOCIDAL FUEL ADDITIVES. Chem. Brit. V. 1 N.11.545 (November 1965).

1204. Sotter, J. G. and Clayton, R. M. (Jet Propulsion Lab.), MONITORING THE COMBUSTION PROCESS IN LARGE ENGINES. J. Spacecraft Rockets 4 (5), 702-3 (1967); C. A. 67, 110 221.

1205. Spadaccini, L. J. and Chinitz, W., (General Applied Science Labs., Inc.) THE COMBUSTION OF POLYMER FUELS IN HIGH TEMPERATURE, SUPERSONIC AIR. Eastern Section of the Combustion Inst. 1968 Technical Meeting. October 21, 22, 1968.

1206. Spadaccini, L. J. (General Applied Science Labs., Inc.) and Chinitz, W. (Cooper Union), SUPERSONIC COMBUSTION OF PROPANE. AIAA Journal 6, 1591-3 (July 1968). U. S. Air Force Contract AF 33(657)-[illegible]6.

1207. Spaid, F. W. and Zukoski (Douglas Aircraft Co., Inc.), A STUDY OF THE INTERACTION OF GASEOUS JETS FROM TRANSVERSE SLOTS WITH SUPERSONIC EXTERNAL FLOWS. AIAA Journal 6 (2), 205-12 (February 1968).

1208. Spengler, G. and Erlmeier, R., FUELS FOR FLIGHT SPEEDS UP TO MACH 3.5. DVL-Nachrichten 1969, 439-42 (March) (in German).

1209. Spengler, G. and Gemperlein, H. (DVLR), FUELS FOR HIGH MACH NUMBER AIRCRAFT. Yearbook 1965; Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, European Aeronautical Congress, 6th, Munich, West Germany, September 1-4, 1965, ed. by H. Blenk, Braunschweig, West Germany, Friedrich Vieweg und Sohn GmbH, 1966, 414-8 (in German).

1210. Spengler, G., Hoseit, C., A METHOD FOR MEASURING THE MEAN AIR-FUEL RATIO AND THE DEGREE OF COMBUSTION IN THE RECIRCULATION ZONE BEHIND A FLAME HOLDER. Brennstoff-Chem. V. 48 N. 4 99-106 (April 1967).

BIBLIOGRAPHY (Contd)

1211. Spindler, H. and [illegible], K., DETERMINING THE AVERAGE CRYSTALLITE SIZE AND THE AMOUNT OF CRYSTALLINE PLATINUM IN PLATINUM-ON-ALUMINA CATALYSTS BY X-RAY DIFFRACTION STUDIES WITH THE AID OF A COMPUTER. Chem. Tech. (Berlin) 20 (9), [illegible]-55 (September 196[illegible]).

1212. Spozhakina, A. A., Moskovskaya, I. F., Topchieva, K. V., DETERMINATION OF HIGH TEMPERATURE ADSORPTION HEATS OF HYDROCARBONS ON CRACKING CATALYSTS. Vestn. Mosk. Univ., Ser. II: Khim. 20 (5), 13-8 (1965). C.A. 64, [illegible] (1966).

1213. Stabler, R., SIMULATED FUEL - XM-[illegible] VIBRATION TEST. Lockheed Missile and Space Co. Report No. LMSD-[illegible], U. S. Air Force Contract AF 33 (600)-27991, July 1956, 2pp. (AD [illegible]).

1214. Stahel, E. P. and Ferrell, J. K., HEAT TRANSFER. Ind. Eng. Chem. 61 (1), 31-40 (1969).

1215. Stahel, E. P. and Ferrell, J. K., HEAT TRANSFER, Ind. Eng. Chem. 60 (1), 75-83 (1968).

1216. Stalker, R. J., THE FREE-PISTON SHOCK TUBE. Aeronautical Quarterly 17, 351-70 (November 1966).

1217. Stanford, W. A., JET FUEL - JP-4 CHARACTERISTICS AND QUALITY ASSURANCE. Natl. Petrol. Refiners Assoc. Mid-Continent Reg. Mtg. (Wichita June 7-9, 1966) (Dearborn, Mich June 16-17, 1966) Tech. Paper N. 66-34. 7P.

1218. Stanners, G. W., AIRCRAFT FUEL TANK PRESSURIZATION AND VENTING SYSTEMS. World Aerospace Systems 2, 426-8, 431 (November 1966).

1219. Starkman, E. S. and Samuelson, G. S. (University of California, Berkeley), FLAME-PROPAGATION RATES IN AMMONIA-AIR COMBUSTION AT HIGH PRESSURE, in Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., August 14-20, 1966, Proceedings, Pittsburgh, Pa., Combustion Institute, 1967, p. 1037-44.

1220. Ste[illegible], K. E. and Thompson, W. P., ARC TUNNEL STUDIES OF NONEQUILIBRIUM STAGNATION POINT HEAT TRANSFER. Aerospace Corp., Laboratories Division Report for November 1965 - July 1966, Report No. TR-1001 (2240-10)-1, SSD TR-66-182, U. S. Air Force Contract AF 04(695)-1001, October 1966, 25 pp. (AD 803609).

1221. Starshinov, A. I., METHOD FOR CALCULATING THE PARAMETERS OF A PRIMARY SHOCK WAVE AT THE EXIT OF A NONSTATIONARY JET FROM A NOZZLE. Leningradskii Universitet, Vestnik, Matematika, Mekhanika, Astronomiia 22, 113-7 (January 1967) (in Russian).

1222. Steffensen, R. J., A FORTRAN IV PROGRAM FOR THERMOCHEMICAL CALCULATIONS INVOLVING THE ELEMENTS AL, B, BE, C, F, H, LI, MG, N, AND O AND THEIR COMPOUNDS. Purdue Univ. Dissertation (1966) 162 pp., (Abstr) Dissertation abstr. Sect. B Sci. + Eng., V. 27 N.2.495B (August 1966).

BIBLIOGRAPHY (Cont'd)

1223. Stezhkin, A. I. and Chalykh, M. D., GREATER ATTENTION TO JET PROPELLANT PURITY. Khimiia i Tekhnologiia Topliv i Masel 12, 49-51 (January 1967).

1224. Stephanov, S. L., Ward, T. E. (McDonnell Douglas Astronautics Co. - Western Division), Holmgren, J. S. (Donald W. Douglas Labs.), APPLICATION OF HEAT PIPE TECHNOLOGY TO ROCKET ENGINE COOLING. AIAA Propulsion Joint Specialist Conference, 5th, June 9-13, 1969, AIAA Paper 69-582, 16 pp.

1225. Stepka, F. S., CONSIDERATIONS OF TURBINE COOLING SYSTEMS FOR MACH 3 FLIGHT. Lewis Research Center, U. S. National Aeronautics and Space Administration Report No. NASA-TN-D-4491, April 1968, 24 pp.

1226. Sterligov, O. D. and Eliseev, N. A., EFFECT OF REDUCTION ON PROPERTIES OF A POTASSIUM - PROMOTED ALUMINA-CHROMIA CATALYST IN THE DEHYDROGENATION OF ISOPENTANE TO ISOAMYLENES. Kinetika i Kataliz 8 (4), 829-33 (July - August 1967).

1227. Sterligov, O. D., Medvedev, V. N., Papko, T. S., DEHYDROGENATION OF ISOPENTANE OVER ALUMINA/CHROMIA/LITHIUM OXIDE CATALYSTS. Neftekhimiya 8, No. 2, 166-73 (March - April 1968).

1228. Stiel, L. I. (Syracuse Univ.), EXTENSIONS OF THE THEOREM OF CORRESPONDING STATES. Ind. Eng. Chem. 60 (5), 50-60 (1968).

1229. Streed, C. W. (Mobil Oil Corp.), SUPERSONIC JET FUELS. U. S. 3, 328, 288 (Cl. 208-89), June 27, 1967, Appl. September 26, 1963, 8 pp.; C.A. 67, 83696.

1230. Stormont, D. H., SST'S TO SPUR BIG JET-FUEL SURGE. Oil Gas J. V. 65 N.20 39-42 (May 15, 1967).

1231. Strikitsa, B. I., SOLUTION OF INVERSE HEAT-TRANSFER PROBLEMS BY THE METHOD OF SCALING FUNCTIONS. Inzhenerno-Fizicheskii Zhurnal 12, 330-5 (March 1967) (in Russian).

1232. Stroud, J. F. and Miller, L. D. (Lockheed - California Co.), HYPERSONIC INLET BOUNDARY - LAYER RESEARCH. AIAA, Propulsion Joint Specialist Conference, Colorado Springs, Colo., June 14-18, 1965, Paper 65-605; Journal of Aircraft 3, 548-54 (November - December 1966).

1233. Stroup, A. E. and Dendot, J. G. (The Marquardt Corp.), EXPERIMENTAL INVESTIGATION OF A STORABLE-FUELED EJECTOR RAMJET. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Springs, Colo., June 9-13, 1969, Paper (Classified).

BIBLIOGRAPHY (Cont'd)

1234. Strock, W. G. and Reichenbach, H. W., INVESTIGATION OF FREELY EXPANDING SPHERICAL COMBUSTION WAVES USING METHODS OF HIGH-SPEED PHOTOGRAPHY. Symp. Combust. 11, 677-82 (1966) (Pub. 1967); C.A. 67, 101550.

1235. Sturgess, G. J., APPLICATION OF FILM COOLING THEORY TO THE COOLING OF AIRCRAFT GAS TURBINE CHAMBERS. Royal Aeronautical Society, Journal 71, 430-4 (June 1967).

1236. Sulzmann, K. G. P. (General Dynamics/Astronautics), HIGH TEMPERATURE, SHOCK TUBE CO_2 - TRANSMISSION MEASUREMENTS AT 4.25 μ. J. Quant. Spectrosc. Radiat. Transfer 4, 375-413 (1964).

1237. Summerfield, M. and Krier, H. (Princeton Univ.), ERRORS IN NONSTEADY COMBUSTION THEORY IN THE PAST DECADE (A REVIEW). AIAA Aerospace Sciences Meeting, 7th, New York, January 20-22, 1969, Paper 69-178. 26 pp.

1238. Sun, Y. H. and Kuo, K. K. (Garrett Corp., AiResearch Manufacturing Co.), A SIMPLIFIED FLOW-FIELD ANALYSIS OF A TWO-DIMENSIONAL OR AXISYMMETRIC SUPERSONIC COMBUSTOR. AIAA Propulsion Joint Specialist Conference, 3rd, Washington, D. C., July 17-21, 1967, Paper 67-494, 9 pp.

1239. Suttrop, F., EXPERIMENTS IN IMPACT - INDUCED COMBUSTION FOR USE IN HYPERSONIC ENGINES. Yearbook 1965; Wissenschaftliche Gesellscraft fur Luft-und Raumfahrt, European Aeronautical Congress, 6th, Munich, West Germany, September 1-4, 1965, ed. by H. Blenk, Braunschweig, West Germany, Friedrich Vieweg und Sohn GmbH, 1966, 408-13 (in German).

1240. Swift, H. E., Lutinski, F. E., Kehl, W. L. (Gulf Research and Development Co.), INVESTIGATION OF THE METALLIC PHASES IN REDUCED, IMPREGNATED NICKEL AND NICKEL-COPPER SILICA-ALUMINA CATALYSTS. J. Phys. Chem. 69 (10), 3268-74 (1965)., C.A. 63, 14103 (1965).

1241. Swithenbank, J. (University of Sheffield, England), HYPERSONIC AIR-BREATHING PROPULSION. Progress in Aeronautical Sciences. Vol. 8, ed. by D. Kuchemann, Oxford, Pergamon Press, Ltd., 1967, pp. 229-94.

1242. Sychev, V. V., CERTAIN PROBLEMS OF CRITICAL-POINT THERMODYNAMICS. Teplofizika Vysokikh Temperatur 5, 192-5 (January - February 1967).

BIBLIOGRAPHY (Contd)

1243. Tabakoff, W. and Sprunger, E. V., AN ANALYTICAL AND EXPERIMENTAL TRANSONIC PERFORMANCE OF A CLUSTERED EXHAUST NOZZLE. Wissenschaftliche Gesellschaft für Luft- und Raumfahrt and Deutsche Gesellschaft für Raketentechnik und Raumfahrt, Jahrestagung 1966, Bad Godesberg, West Germany, October 4-8, 1966. Paper, 31 pp.

1244. Takeyama, T. and Miyama, H., A SHOCK-TUBE STUDY OF THE ACETYLENE-OXYGEN REACTION. Bull. Chem. Soc. Japan, 38 (6), 936-40 (June 1965); C.A. 63, 9796.

1245. Takeyama, T. and Miyama, H., KINETIC STUDIES OF AMMONIA OXIDATION IN SHOCK WAVES. I. THE REACTION MECHANISM FOR THE INDUCTION PERIOD. Chem Soc. Japan, Bull. 38 (10), 1670-4 (1965); II. THE RATE OF AMMONIA CONSUMPTION. 39 (11), 2352-5 (1966); III. THE RADIATION OF EXCITED OH RADICALS. 39 (12), 2609-12 (1966); IV. COMPARISON OF INDUCTION FOR NH_3-O_2-Ar MIXTURES. 41, 1761-5 (1968).

1246. Talantov, A. V., RESEARCH ON COMBUSTION IN FLOW. Izvestiya Vysshikh Uchebnykh Zavedenii. Aviatsionnaya Tekhnika (USSR). Special Issue 40th Jubilee, p. 55-65 (1967); U.S. Air Force Translation, August 1968, 22 pp. (AD 685 422).

1247. Talbot, L. and Willis, D. R. (Univ. of Calif. at Berkeley), A NOTE ON ROTATIONAL ENERGY DIFFUSION IN SHOCK WAVES. Rarefied Gas Dynamics, Symposium (5th) 1, 803-12 (1967); U.S. Air Force Grant AF-AFOSR-538-67, 1967, 8 pp. (AD 655 167).

1248. Tanatarov, M. A., Panchenkov, G. M., Levinter, M. E., COKE FORMATION ON AN ALUMINOSILICATE CATALYST. Zh. Fiz. Khim. 40 (7), 1571-7 (1966) (Russ.) C. A. 65, 15110 (1966).

1249. Taniewski, M. and Nowakowski. L., DEHYDROCYCLIZATION (AROMATIZATION) OF ALKANES IN THE PRESENCE OF THE ALUMINA-CHROMIA-POTASSIUM CATALYST AS USED IN DEHYDROGENATION OF PROPANE. Zesz. Nauk. Politech. Slask., Chem. No. 30, 135-44 (1966) (Pol.); C.A. 66, 37516 (1967).

1250. Tanji, H., Uchiyama, M., Amano, A., Tokuhisa, H., THERMAL DEHYDROGENATION OF CYCLOPENTENE. PYROLYSIS OF CYCLOPENTENE. Kogyo Kagaku Zasshi 70 (3), 307-11 (1967) (Japan); C.A. 67, 72975.

1251. Tao, F. F. and Appeldoorn, J. K. (Esso Research and Engineering Co.), THE BALL-ON-CYLINDER TEST FOR EVALUATING JET FUEL LUBRICITY. American Soc. of Lubrication Engineers, Annual Mtg., 23rd, Cleveland, Ohio, May 6-9, 1968, Preprint 68 AM 4A-2. 8 pp.; ASLE Transactions 11, 345-52 (1968).

1252. Tarasevich, L. I., EXPERIMENTAL INVESTIGATION OF HEAT AND MASS TRANSFER IN THE REACTING BOUNDARY LAYER ON A POROUS PLATE. Obshchie Voprosy Teplo-i Massoobmena (General Problems of Heat and Mass Transfer), Minsk, 1966, p. 37-47; U.S. Air Force Trans., Nov. 1968, 19 pp. (AD 683 988).

BIBLIOGRAPHY (Cont'd)

1253. Tarifa, C. S., EFFECT OF CHEMICAL KINETICS ON COMBUSTION OF FUEL DROPLETS. Sou. Azione 1966 (12), 48-73 (Italian); C.A. 66, 97709 (1967).

1254. Tarifa, C. S. and Torralbo, A. M. (Instituto Nacional de Tecnica Aeroespacial, Madrid, Spain), FLAME PROPAGATION ON THE INTERFACE OF A GAS AND A REACTING MEDIUM. Ingenieria Aeronautica y Astronautica 18, 15-25 (Nov.-Dec. 1966) (in Spanish).

1255. Tartarelli, R. and Morelli, F., APPARENT KINETICS FOR CATALYST POISONING IN STRONG PORE DIFFUSION REGIMES OF nTH ORDER REACTIONS. J. Catal. 11 (2), 159-61 (June 1968).

1256. Taylor, G. F., Thomson, S. J., Webb, G., THE ADSORPTION AND RETENTION OF HYDROCARBONS BY ALUMINA-SUPPORTED PALLADIUM CATALYST. J. Catal. 12 (2), 150-6 (Oct. 1968).

1257. Taylor, W. F. (Esso Res. and Engineering Co.), MECHANISM OF DEPOSIT FORMATION IN WING TANKS. SAE National Aeronautic and Space Engineering and Manufacturing Mtg. Paper No. 680733, Oct. 7-11, 1968.

1258. Taylor, W. F., THE STUDY OF HYDROCARBON FUEL VAPOR PHASE DEPOSITS. Esso Research and Engineering Co. Quarterly Progress Report No. 10. 16 Aug. 1968-16 November 1968, U. S. Air Force Contract AF 33(615)-3575, Nov. 1968, 25 pp.

1259. Taylor, W. F., THE STUDY OF HYDROCARBON FUEL VAPOR PHASE DEPOSITS. Esso Research and Engineering Co. Quarterly Progress Report No. 9, May 16 - August 16, 1968, U. S. Air Force Contract AF 33(615)-3575, August 1968, 45 pp.

1260. Taylor, W. F., THE STUDY OF HYDROCARBON FUEL VAPOR PHASE DEPOSITS. Esso Res. and Eng. Co. Quarterly Prog. Report No. 8, Feb. 16 - May 16, 1968, U. S. Air Force Contract AF 33(615)-3575, May 1968, 42 pp.

1261. Taylor, W. F. and Wallace, T.J., THE STUDY OF HYDROCARBON FUEL VAPOR PHASE DEPOSITS. Esso Res. and Eng. Co. Quarterly Prog. Report No. 6, Aug. 16 - Nov. 16 1967, U. S. Air Force Contract AF 33 (615)-3575, November 1967, 25 pp.

1262. Taylor, W.F. and Wallace, T. J., KINETICS OF DEPOSIT FORMATION FROM HYDROCARBONS. Ind. and Eng. Chem., Product Res. and Dev. 6, 258-62, 7, 198-202, (December 1967) (Sept. 1968); pt. 3, J. Appl. Chem. 18 251-4 (August 1968).

1263. Technological Lab. RVO-TNO, Rijswijk (Netherlands), VELOCITY MEASUREMENTS FOR SHOCK AND DETONATION WAVES. Sept. 1968, 32 pp. (Dutch) (N69-21389).

1264. Tesner, P. A. and Tsibulevsky, A. M., KINETICS OF DISPERSED CARBON GASIFICATION IN DIFFUSION FLAMES OF HYDROCARBONS. Combust. Flame 11 (3), 227-33 (1967); C. A. 67, 55816.

BIBLIOGRAPHY (Contd)

1265. Tereshchenko, E. R., Zaloga, B. D., Maksimov, S. M., METHOD OF APPRAIS-ING THERMAL STABILITY OF FUELS UNDER DYNAMIC CONDITIONS (COLLECTION OF ARTICLES)., Metody Otsenki Ekspluatatsionnykh Svoistv Reaktivnykh Topliv i Smazochnykh Materialov Sbornik Statei, Moscow 1966, 1-151; U. S. Air Force Translation FTD-MT-66-99, May 1967, 156 pp. (AD 668 115).

1266. Tetenyi, P. and Babernics, L., CHEMISORPTION OF BENZENE ON NICKEL AND PLATINUM. J. Catal. 8 (3), 215-22 (1967); C.A. 67, 76588.

1267. Tetenyi, P. and Schachter, K., KINETICS OF THE CATALYTIC DEHYDROGENATION OF HYDROAROMATIC COMPOUNDS. VIII. CATALYTIC ACTIVITY OF METALS IN THE DEHYDROGENATION OF CYCLIC HYDROCARBONS. Acta Chim. Acad. Sci. Hung. 50 (1-4), 129-44 (1966) (Eng); C.A. 66, 85215 (1967).

1268. Thayer, W. W., HYPERSONIC AIRCRAFT AUXILIARY POWER SUBSYSTEM ANALYSIS. VOLUME I. SUBSYSTEM SELECTION. Douglas Aircraft Co, Aircraft Div. Final Report 1 April - 31 October 1966, AFAPL TR-66-125-Vol-1, U. S. Air Force Contract AF 33(615)-3681, Jan. 1967, 282 pp. (AD 379 621) (REPORT CLASSIFIED SECRET).

1269. Thayer, W. W., Verrette, J. A., Taylor, C.S., HYPERSONIC AIRCRAFT AUXILIARY POWER SUBSYSTEM ANALYSIS. VOLUME II. REFINEMENT OF SELECTED SUBSYSTEM. Douglas Aircraft Co., Aircraft Div. Final Report 1 Nov. 1966-31 March 1967, U.S. Air Force AFAPL TR-66-125-Vol-2, U. S. Air Force Contract AF 33(615)-3681, May 1967, 54 pp. (AD 814609).

1270. Thiele, E. W., DEVELOPMENT OF THE CONCEPT OF INTRAPARTICLE DIFFUSION IN CATALYSIS. AIChE Annual Meeting, 59th, Detroit, December 4-8, 1966, Program Abstr. No. 3a.

1271. Thomas, A. and Williams, G. T. (Shell Res., Ltd.), FLAME NOISE-SOUND EMISSION FROM SPARK-IGNITED BUBBLES OF COMBUSTIBLE GAS. Royal Soc. (London), Proceedings, Series A, 294, 449-66 (Oct. 18, 1966).

1272. Thomas, D. L., AN AUTOMATIC REMOTELY OPERATED SODIUM D-LINE REVERSAL TEMPERATURE MEASURING TECHNIQUE. Combustion and Flame 12 (6), 569-74 (1968).

1273. Thompson, J. K. (U.S. Federal Aviation Agency) NEW ENVIRONMENTS FOR SST. AIAA Paper no. 68-996, 1968, 7 pp.

1274. Thompson, J. W. and Ownby, J. C., AMIDES OF N-ACYL SARCOSINES. U.S. 3,324,155 (Cl. 260-404.5), June 6, 1967, Appl. August 2, 1966, 2 pp.; C.A. 67, 73179.

1275. Thompson, J. W. and Ownby, J. C. (Eastman Kodak Co.), JET FUEL ADDITIVES. U.S. 3,323,884 (Cl. 44-66), June 6, 1967, Appl. June 15, 1965, 3 pp.; C.A. 67, 45791.

1276. Thring, M.W., POWER GENERATION FOR AIRCRAFT IN THE SECOND CENTURY. Aeronautical J. 72, 735-8 (September 1968).

BIBLIOGRAPHY (Cont'd)

1277. Tinson, R. (Shell Res., Ltd.), THE ELECTROSTATIC HAZARD DURING LOADING OF PETROLEUM PRODUCTS INTO GLASS-REINFORCED PLASTIC TANKS. J. Inst. Petrol. [illegible], 305-11 (1967); C.A. [illegible].

1278. Toberman, L., Wilhelm, F., Kaatz, H. W., Aspelin, L. L., RECENT DEVELOPMENTS IN (PNEUMATIC) INSTRUMENTATION AND FUEL SYSTEMS FOR TURBOCHARGED AND/OR PRESSURIZED AIRCRAFT. SAE Mtg. Paper No. [illegible] (1967); (Abstr.) SAE (Soc. Automotive Engrs.) J. [illegible] N. 6 [illegible] (June 1967).

1279. Tokatbaeva, F. M., Tarambaeva, G. P., [illegible], D. V., THE INFLUENCE OF SURFACE-ACTIVE CATIONS ON THE CATALYTIC ACTIVITY AND SELECTIVITY OF PLATINUM BLACK. Kinet. i Katal. 9 (3), 690-2 (May-June 1968) (Russ.).

1280. Tolubinskii, V. I., (ed.) PHYSICS OF COMBUSTION. Kiev, Izdatel'stvo Naukova Dumka, 1966, 116 pp. (Russian).

1281. Tolubinskii, V. I. and Ostrovskii, Iu. N., HEAT-TRANSFER MECHANISM IN THE BOILING OF BINARY MIXTURES. In Heat Transfer and Hydrodynamics in Two-Phase Media, ed. by V. I. Tolubinskii, Kiev, Izdatel'stvo Nauk. Dumka, 1967, p. 9-17 (Russian).

1282. Torichnev, N. N., Bolshakov, G. F., Gulin, E. I., PHYSICAL AND CHEMICAL FUNDAMENTALS IN THE USE OF MOTOR, JET AND ROCKET FUELS. U.S. Dept. Commerce Clear. Fed. Sci. Tech. Inform. N.TT-66-[illegible] (July 1966); (Abstr.) Corrosion Abstr. V6 N.2 156 March 1967).

1283. Townend, L. H., ON HYPERSONIC CRUISING AIRCRAFT WHICH CAN HAVE ALL LEADING EDGES SWEPT. PART I: DESIGN OF AIR INTAKES. Great Britain Royal Aircraft Establishment Technical Report No. RAE-TR-67046, Feb. 1967, 38 pp. (AD 816 376).

1284. Tsuji, H. and Yamaoka, I., THE COUNTER-FLOW DIFFUSION FLAME IN THE FORWARD STAGNATION REGION OF A POROUS CYLINDER. In Symposium (Int'l.) on Combustion, 11th, University of Calif., Berkeley, Calif., Aug. 14-20, 1966, Proceedings. Pittsburgh, Pa., Combustion Inst., 1967, p. 979-84.

1285. Tung, S. E. and McIninch, E. (Continental Oil Co.), HIGH-PURITY ALUMINA. III. ION-RADICAL CRACKING OF CUMENE ON ALUMINA. J. Catalysis 4 (5), 586-93 (1965), C.A. 63, 17816 (1965).

1286. Turner, N. H., THE KINETICS OF THE THERMAL DECOMPOSITION OF 1-METHYLCYCLOPENTENE. Univ. Rochester, Diss. 1968, 154 pp.; Abstr., Diss. Abstr. B29 (5), 1653B-4B (Nov. 1968).

1287. Tyler, L.D. and Zumwalt, G.W. (Oklahoma State Univ.), NUMERICAL SOLUTIONS OF THE FLOW FIELD PRODUCED BY A PLANE SHOCK WAVE EMERGING INTO A CROSS FLOW. AEC Accession No. 30 167, Report No. SC-DC-65-1916, 136 pp. (1965); C. A. 66, 5811 m (1967).

BIBLIOGRAPHY (Cont'd)

1288. Tyutunov, V. A. and Lovinskiy, S. I. AIRCRAFT ENGINES. Moscow, 1964, p. 19-55, 58-65, 71-169, 180-310, 354-365; U. S. Air Force Translation FTD-MT-65-212, May 1967, 293 pp. (AD 662 481) (N68-15130, N68-15131, N68-15132, N 68-15133)
Contents: 1. Fundamentals of Engineering Thermodynamics, pp. 1-38
2. Aviation Fuels and Oils. Fuel Combustion, pp. 39-48
3. The Theory of Jet Engines, pp. 49-279.

BIBLIOGRAPHY (Contd)

1289. Cherni, M. S. (Joint Inst. for Lab. Astrophysics), FLOW FIELDS OF FLAME PROPAGATING IN [illegible] BASED ON THE [illegible] APPROXIMATION. Physics of Fluids 6 [illegible], 1174-8 [illegible]; Revision of report dated [illegible] October 1962. Prepared in cooperation with Michigan Univ., U.S. Navy Contract Nonr-1224(32), May [illegible], 6 pp. (AD [illegible]).

1290. [illegible], E. W. (Battelle Memorial Inst.), ABLATION THERMAL PROTECTION SYSTEMS. Science 158, [illegible] (November [illegible], 1967).

1291. Union Carbide Corp., HYDROGENATION OR DEHYDROGENATION OF HYDROCARBONS. Brit. 1,11[illegible] (Cl. C7c), May 22, 1968.

1292. United Aircraft Corp., United Aircraft Research Labs. HYDROCARBON FUELED SCRAMJET. Volume I - INLET INVESTIGATION, Volume II - NOZZLE INVESTIGATION, Volume III - SCRAMJET EFFECTIVENESS STUDIES, Volume IV - COMBUSTOR INVESTIGATION, Volume V - COOLING INVESTIGATION. U.S. Air Force AFAPL-TR-68-146, Pt 1-5, Contract No. AF 33-[illegible], 1968.

1293. U.S. Air Force Flight Dynamics Lab., Wright-Patterson A.F.B., FIFTY MEGAWATT ELECTROGASDYNAMICS FACILITY. Edition No. 1, April 1967, 15 pp. (AD [illegible]).

1294. U.S. Air Force, Foreign Technology Division, [illegible] FOR AIR-BREATHING PROPULSION SYSTEMS. Report No. FTD-[illegible]-115-66-2, January 1967, 35 pp. (AD [illegible]L) (REPORT CLASSIFIED SECRET).

1295. U.S. Air Force, Research and Technology Division, PROCEEDINGS OF AIAA PROPULSION JOINT SPECIALIST CONFERENCE (2nd). VOLUME I. AIR BREATHING PROPULSION. Report No. RTD-TR-66-Vol [illegible], September 1966, 911 pp. (AD 378075L) (REPORT CLASSIFIED SECRET).

1296. U.S. Army Aviation Material Laboratory, CHEMICALS CAN THICKEN REGULAR HYDROCARBON FUELS TO A GELATIN-LIKE CONSISTENCY. Hydrocarbon Process V46 N.3 11 (March 1967).

1297. U.S. Federal Aviation Agency, Economics Division, AVIATION FORECASTS: FISCAL YEARS, 1967-1977. February 1967, 41 pp. (AD 6[illegible]).

1298. U.S. Library of Congress, Aerospace Information Division, HYDROCARBON-OXIDIZING AND SULFATE-REDUCING BACTERIA. A COMPILATION OF ABSTRACTS. U.S. Dept. Comm., Office Tech. Serv. AD N.404,908 (May 10, 1963) 3 pp.; (Abstr.) Corrosion Abstr. V3 N.1.15 (January 1964).

1299. U.S. Library of Congress, Aerospace Information Div., (A REVIEW OF) CURRENT INFORMATION ON (USSR DEVELOPMENTS IN) FUELS AND LUBRICANTS. Report No. AID-U-64-37, TT 65-64459, May 1964, 13 pp. (AD 623248).

1300. U.S. Library of Congress, Aerospace Technology Div., PROPULSION TECHNOLOGY. MONTHLY SURVEY No. 4. ATD WORK ASSIGNMENT Nos. 68, 76, 88. Report No. ATD-67-10, January 1967, 52 pp. (AD 815096).

BIBLIOGRAPHY (Cont'd)

1301. U.S. Naval Weapons Center, PROPULSION DEVELOPMENT DEPARTMENT REVIEW, PART 4. LIQUID PROPULSION. July-September 1967, U.S. Navy NWC TP 4100-7, Part 4, September 1967, 44 pp. (REPORT CLASSIFIED CONFIDENTIAL).

1302. Universal Oil Products Co., DEHYDROGENATION OF ALKYL AROMATICS. U.S. 3,379,796.

1303. University of Virginia, PROJECT SQUID. Semi-annual Progress Report 1 April-30 September 1966, U.S. Navy Contract Nonr-3623(00), October 1966, 64 pp. (AD 800761).

1304. Usov, Yu. N., Skvortsova, E. V., Kuvshinova, N. I., Ralkova, G. A., Il'in, V. F., CONVERSIONS OF n-HEPTANE AND n-OCTANE IN THE PRESENCE OF ALUMINO-MOLYBDENUM CATALYST. Kinet. Katal. 7(5), 809-15 (1966) (Russ); C.A. 66, 26241 (1967).

1305. Usov, Yu. N., et al, DEHYDROGENATION OF ISOPENTENES AND ISOPENTANE ON ALUMINA-CHROMIA-POTASSIUM OXIDE CATALYST. Neftekhimiya 7 (5), 941-8 (1967) (Russ); Petroleum Chemistry 7 (2), 95-104 (1967); C.A. 67, 90535.

1306. Usov, Yu. N., Kuvshinova, N. I. Skvortsova, E. V., Masledakova, G. G., CONVERSIONS OF C_8-C_{10} ALIPHATIC HYDROCARBONS IN THE PRESENCE OF REFORMING CATALYSTS. Neftekhimiya 6 (6), 872-81 (1966) (Russ); C.A. 66, 87273 (1967).

1307. Ustinov, M. D., FLOW OF AN IDEAL GAS BEHIND A SHOCK WAVE OF FINITE AMPLITUDE. Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza 1967, 88-90 (January-February) (in Russian).

1308. Van Stralen, S. J., THE MECHANISM OF NUCLEATE BOILING IN PURE LIQUIDS AND IN BINARY MIXTURES. I. International Journal of Heat and Mass Transfer 9, 995-1020 (October 1966).

1309. Van Thiel, M. (ed.), COMPENDIUM OF SHOCK WAVE DATA (UCRL-50108), Vol. I: Sections A-1, A-2. Lawrence Radiation Lab., Livermore, California 1966; C.A. 66, 22518 (1967).

1310. Van Tiggelen (ed.), OXIDATION AND COMBUSTION. Volume 1. Paris, Editions Technip (Collection Science et Technique du Petrole, No. 11), 1968. 569 pp. in French. Contents: GENERAL CHARACTERISTICS OF COMBUSTION REACTIONS. p. 2-13; THERMODYNAMICS OF COMBUSTION AND CONCEPTS OF AEROTHERMOCHEMISTRY. p. 15-70; GENERAL THEORY OF CHAIN REACTIONS. p. 71-222; OXIDATION AND SELF-IGNITION IN THE GASEOUS PHASE. p. 223-299; PROPERTIES OF INFLAMMABLE GASEOUS MIXTURES. p. 301-434; THEORY OF DEFLAGRATION IN THE GASEOUS PHASE. p. 435-552.

BIBLIOGRAPHY (Cont'd)

1511. Van Tiggelen, A. (ed.), OXIDATION AND COMBUSTION. Volume 2. Paris, Editions Technip (Collection [illegible] et Technique du Petrole, No. [illegible]), [illegible], 477 p. In French. Contents: [illegible] IN THE TURBULENT [illegible]. p. [illegible], COMBUSTION IN A HETEROGENEOUS SYSTEM. p. [illegible]. CHEMILUMINESCENCE AND IONIZATION IN FLAMES. p. [illegible]; DETONATION. p. [illegible]; LIQUID-PHASE RADICAL OXIDATION. p. [illegible]-1006.

1512. Van Tiggelen, A. and B[illegible], J., OXIDATION AND COMBUSTION - [illegible]. PROPAGATION OF [illegible]. Rev. Inst. Franc. Petrole Ann. Combust. Liquides 21 [illegible] (May 1966).

1513. Van Tiggelen, A., De Soete, G., Van Tiggelen, P. J., OXIDATION AND COMBUSTION. V-OXIDATION AND SPONTANEOUS IGNITION IN THE GAS PHASE. Institut Francais du Petrole, Revue, 21, 1151-1205 (July-August 1966) (in French).

1514. Van Tiggelen, A., Karr, C., Monnot, G., COMBUSTION IN A HETEROGENEOUS SYSTEM. Institut Francais du Pétrole, Revue 21, 1507-75 (October 1966) (in French).

1515. Vanquickenborne, L. and Van Tiggelen, A., THE STABILIZATION MECHANISM OF LIFTED DIFFUSION FLAMES. Combust. Flame 10 (1), 59-69 (1966), C.A. 65, 83552.

1516. Venerian, G., EFFECT OF MODULATION ON THE ONSET OF THERMAL CONVECTION. California Inst. of Technology, Division of Engineering and Applied Science Report No. 97-15, U.S. Navy Contract Nonr 220(35), March 1968, 25 pp. (AD 667476).

1517. Verkamp, F. J., Hardin, M. C., Williams, J. R. (General Motors Corp., Allison Div.), AMMONIA COMBUSTION PROPERTIES AND PERFORMANCE IN GAS-TURBINE BURNERS. In Symposium (International) on Combustion, 11th, University of California, Berkeley, Calif., August 14-20, 1966, Proceedings, Pittsburgh, Pa., Combustion Institute, 1967, p. 985-91. 992. U.S. Army Contract No. DA-20-113-AMC-05553(T), U.S. Air Force Contract AF 33(657)-13687.

1518. Veziroglu, T. N. and Chandra, S., THERMAL CONDUCTANCE OF TWO DIMENSIONAL CONSTRICTIONS. Miami Univ. (Fla.), Dept. of Mechanical Engineering Interim Report, U.S. National Aeronautics and Space Administration NASA-CR-92574, Grant NGR-10-007-010, January 1968, 34 pp. (N68-15872).

1519. Vidaurri, F. C., Jr., THE KINETICS OF METHYL CYCLOPENTANE (MCP) REACTIONS OVER A PLATINUM ON η-ALUMINA CATALYST. Texas Technol. Coll. Diss. 1968, 212 pp.; Diss. Abstr. B29 (6), 2026B-2029B (December 1968).

1520. Vilenskii, V. D., GENERAL LAWS IN THE STABILIZATION OF THE HEAT-TRANSFER COEFFICIENT FOR THE FLOW OF A LIQUID IN A CHANNEL. Teplofizika Vysokikh Temperatur 4, 675-82 (September-October 1966); High Temperature 4, 633-9 (September-October 1966).

BIBLIOGRAPHY (Contd)

1521. Vilenskii, V. D., SOME GENERAL REGULARITIES IN NONSTATIONARY HEAT TRANSFER DURING THE PASSAGE OF A LAMINAR FLUID FLOW THROUGH A CHANNEL. Teplofizika Vysokikh Temperatur 4, 838-45 (November-December 1966).

1522. Vilyunov, V. N., HEAT THEORY OF IGNITION. Fizika Goreniya i Vzryva (USSR) 1966 (2), 77-82; U.S. Air Force Translation, September 1968, 11 pp. (AD 686636).

1523. Vinckier, J. and Van Tiggelen, A., STRUCTURE AND BURNING VELOCITY OF TURBULENT PREMIXED FLAMES. Combustion and Flame 12 (2), 561-8 (December 1968).

1524. Viskanta, R. and Merriam, R. L. (Purdue Univ.), SHIELDING OF SURFACES IN COUETTE FLOW AGAINST RADIATION BY TRANSPIRATION OF AN ABSORBING-EMITTING GAS. International Journal of Heat and Mass Transfer 10, 641-53 (May 1967).

1525. Viskanta, R., Schornhorst, J. R., and Toor, J. S., ANALYSIS AND EXPERIMENT OF RADIANT HEAT EXCHANGE BETWEEN SIMPLY ARRANGED SURFACES. Purdue University, School of Mechanical Engineering Technical Report May 1965-June 1967, U.S. Air Force AFFDL-TR-67-94, Contract AF 33(615)-2902, June 1967, 131 pp. (AD 655335).

1526. Voinov, A. N. and Skorodelov, D. I., CHARACTERISTICS OF PREIGNITION PROCESSES AND IGNITION OF HYDROCARBONS OF VARIOUS STRUCTURES. I. DELAY IN COOL-FLAME APPEARANCE AND IGNITION AS A FUNCTION OF TEMPERATURE AND PRESSURE. II. INTENSITY OF THE COOL-FLAME STAGE. Kinet. Katal. 8 (2), 252-60, 8 (3), 495-505 (1967) (Russ); Kinetics and Catalysis 8 (2), 219-25, 8 (3), 428-36 (1967) (Eng. trans); C.A. 67, 75033.

1527. Voorhees, C. G. and Bertin, J. J., EFFECT OF UPSTREAM MASS INJECTION ON THE PRESSURE FIELD IN A CAVITY. AIAA Journal 7 (4), 747-9 (April 1969).

1528. Vorobev, V. F., CALCULATION OF THE TEMPERATURE OF A TWO-LAYER WALL OF A SECTION OF A STRUCTURE UNDER EXTERNAL HEAT-EXCHANGE CONDITIONS THAT VARY WITH TIME. Prikladnaya Mekhanika 1, No. 7, 14-20 (1965); U.S. Air Force Translation Report No. FTD-HT-65-485, TT 67-60352 (AD 646638).

BIBLIOGRAPHY (Contd)

1329. Wadsworth, J., CATALOGUE OF UNCLASSIFIED REPORTS [illegible] BY AERODYNAMICS DEPARTMENT IN [illegible]. Great Britain Royal Aircraft Establishment Report No. Library Bibliography - [illegible], February [illegible], [illegible] pp. (AD [illegible]).

1330. Wakayama, N., Mori, Y., Inokuchi, H., CATALYTIC BEHAVIOR OF ORGANIC SEMICONDUCTORS. RELATION BETWEEN REACTIVITY AND VALENCY OF THE AROMATIC ANION IN AROMATIC ALKALI METAL COMPLEXES. J. Catal. 12 (1), 15-18 (September 1968).

1331. Walburn, P. [illegible], ACTIVATION ENERGIES IN A BAFFLE STABILIZED FLAME. Combustion and Flame 12, [illegible] (December [illegible]).

1332. Walker, D. C. (to Esso Research and Engineering Co.), SEPARATION OF PARAFFINS AND NAPHTHENES WITH AN ALUMINUM HALIDE ETHERATE. U.S. 3,308,176 (Cl. 260-666), March 7, 1967. Appl. Dec. 28, 1964, 3 pp.; C.A. 67, 2814.

1333. Walker, L. A., and Markland, E., CALCULATION OF HEAT TRANSFER TO TURBINE BLADING IN THE PRESENCE OF SECONDARY FLOW. International Journal of Heat and Mass Transfer 10, 49[illegible]-518 (April 1967).

1334. Wasan, D. T. and Wilke, C. R. (Lawrence Radiation Lab., University of California), ANALYSIS OF GAS-PHASE MASS TRANSFER IN TURBULENT FLAMES. Report No. [illegible]-11629, NASA Accession No. N65-[illegible], [illegible]. [illegible] pp.; C.A. 66, 87[illegible] (1967).

1335. Watt, J. J., Evans, A., Jr., Hibbard, R. R., FOULING CHARACTERISTICS OF ASTM JET A FUEL WHEN HEATED TO [illegible]°F IN A SIMULATED HEAT EXCHANGER TUBE. NASA-TN-D-4958, December [illegible], 29 pp. (N 69-12851).

1336. Watton, A. (U.S. Air Force, Office of Deputy for Development Planning), DESIGN TRENDS IN HYPERSONIC CRUISE AIRCRAFT AND THEIR PROPULSION SYSTEMS. AIAA Propulsion Joint Specialist Conference, 5th, Colorado Spring, Colo., June 9-13, 1969. Paper (Classified).

1337. Watton, A. (U.S. Air Force), A REVIEW OF CURRENT TRENDS IN TECHNOLOGY FOR REUSABLE LAUNCH VEHICLES, in Space Technology Conference, Palo Alto, Calif., May 9-12, 1967, Proceedings, New York, Society of Automotive Engineers, Inc. (SAE Conference Proceedings P-16), 1967, p. 258-65; IAA 7, 2569 (A 67-2965[illegible]).

1338. Watton, A., Jr., THE MECHANISM OF THE FUEL-MIXING PROCESS IN DIFFUSION-TYPE SUPERSONIC COMBUSTION. U.S. Air Force Aeronautical Systems Div., September [illegible], 257 pp. (AD [illegible]).

1339. Weatherford, W. D., COALESCENCE OF SINGLE DROPS AT LIQUID-LIQUID AND LIQUID-SOLID INTERFACES. Southwest Research Inst. Technical Report 15 October 1965-15 October [illegible], Report No. RS-[illegible], AFAPL TR-67-5, U.S. Air Force Contract AF 33(615)-2327, February 1967, 6[illegible] pp. (AD 807293).

BIBLIOGRAPHY (Contd)

1340. Webb, B. A., MARQUARDT MATERIALS RESEARCH ACTIVITIES, 1965-1965. Marquardt Corp. Report MR-20323, 1965, 27 pp. (N 66-2[illegible]); C.A. 67, 23004.

1341. Weber, R. J. (NASA, Lewis Research Center), LIQUEFIED NATURAL GAS AS A FUEL FOR SUPERSONIC AIRCRAFT. American Gas Association, Distribution Conference, May 1-4, 1967, Paper, 12 pp.

1342. Weber, R. J. (NASA, Lewis Research Center), A REVIEW OF THE POTENTIAL OF LIQUID-METHANE FUEL FOR SUPERSONIC TRANSPORTS. National Academy of Sciences, Cryogenic Engineering Conference, Cleveland, Ohio, August 19-21, 1968, Paper, 16 pp.

1343. Weihs, D. and Manheimer-Timnat, Y., CARBON DIOXIDE DISSOCIATION RELAXATION TIMES, MEASURED IN A SHOCK TUBE. AIAA Journal 7 (4), 764-6 (April 1969).

1344. Weis, J., RELATIONS BETWEEN STRUCTURE AND CATALYTIC PROPERTIES OF CRYSTALLINE AND NONCRYSTALLINE ALUMINUM OXIDES PREPARED FREE OF ALKALI. I. CATALYTIC PROPERTIES AND PRIMARY STRUCTURE. II. CATALYTIC PROPERTIES AND SECONDARY STRUCTURE. Z. Anorg. Allg. Chem. 354 (3-4) 149-62, 163-71 (1967) (Ger.); C.A. 67, 103272, 103273.

1345. Weisz, P. B. and Miale, J. N., SUPERACTIVE CRYSTALLINE ALUMINOSILICATE HYDROCARBON CATALYSTS. J. Catalysis 4 (4), 527-9 (1965); C.A. 63, 13054 (1965).

1346. Weitkamp, A. W. (to Standard Oil Co., Indiana), cis-ISOMERS OF POLYCYCLIC AROMATICS. U.S. 3,349,140, October 24, 1967.

1347. Wells, P. B. and Bates, A. J., CATALYTIC ISOMERIZATION OF TETRALIN. J. Chem. Soc. A 1968 (12), 3064-9.

1348. Welna, H. J. and Reilly, D. H., PRELIMINARY EVALUATION OF FLIGHT-WEIGHT XRJ 47-W-5 RAM-JET ENGINE AT A MACH NUMBER OF 2.75. U.S. National Aeronautic and Space Administration Report NACA-RM-E56G22, 1965, 43 pp. (N66-36416); C.A. 67, 23697.

1349. Wendel, O., TURBINE AND COMPRESSOR FAILURE ANALYSIS. Lockheed-California Co. Report for 1 January 1965-6 April 1966, Report No. LR-19968, August 1966, 42 pp. (AD 814094L).

1350. Wendelbo, A. H., WARDING OFF AIRCRAFT ENEMIES - CORROSION AND LIGHTNING. S.A.E. (Soc. Automotive Engrs.) J. V74 N 8.52-55 (August 1966).

1351. Wendlandt, W. W. (Texas Technological College), THERMAL DECOMPOSITION OF METAL COMPLEXES - III. STOICHEIOMETRY OF THE THERMAL DISSOCIATION OF SOME HEXAMMINE COBALT (III) COMPLEXES. J. Inorg. Nucl. Chem. 25, 545-51 (1963).

BIBLIOGRAPHY (Contd)

1352. Wennerstrom, A. J. and Olympios, G., A THEORETICAL ANALYSIS OF THE FRONT-TRAILING-EDGE SUPERSONIC COMPRESSOR AND COMPARISON WITH EXPERIMENT. U.S. Air Force Aerospace Research Laboratories, Office of Aerospace Research, Wright-Patterson A.F.B. Report No. ARL-66-0276 prepared in cooperation with Ohio State Univ. Research Foundation, November 1966, 91 pp. (AD 650154).

1353. Westkaemper, J. C., AN EXPERIMENTAL EVALUATION OF THE INSULATED-MASS TECHNIQUE OF MEASURING HEAT TRANSFER AT HIGH VELOCITIES. Texas Univ., Defense Research Lab. Report No. DRL-430 prepared in cooperation with Johns Hopkins Univ., Applied Physics Lab. CF-2765, U.S. Navy Contract NOrd-16498, March 1959, 57 pp. (AD 644533).

1354. Wetterstad, L., THE SUPERSONIC COMBUSTION RAMJET. Luftfahrttechnik Raumfahrttechnik 12, 342-9 (December 1966).

1355. Weymann, H. D. (University of Rochester), FINITE SPEED OF PROPAGATION IN HEAT CONDUCTION, DIFFUSION, AND VISCOUS SHEAR MOTION. American Journal of Physics 35, 488-96 (June 1967).

1356. Whisman, M. L. and Ward, C. C., STORAGE STABILITY OF HIGH TEMPERATURE FUELS. PART II. THE EFFECT OF STORAGE UPON THERMALLY INDUCED DEPOSITION OF LABELED FUEL COMPONENTS. U.S. Bureau of Mines, U.S. Air Force AFAPL-TR-68-52-Pt-II, Contract No. F33615-67-M-5003, March 1969, 126 pp.

1357. Whisman, M. L. and Ward, C. C., STORAGE STABILITY OF HIGH TEMPERATURE FUELS. PART I. MICRO FUEL COKER TESTS OF FUEL-RADIOTRACER BLENDS BEFORE STORAGE. U.S. Bureau of Mines Initial Technical Report March 1967-March 1968, U.S. Air Force AFAPL-TR-68-52-Pt-1, Contract F33615-67-M-5003, March 1968, 103 pp. (AD 667818).

1358. Whisman, M. L. and Ward, C. C., STORAGE STABILITY OF HIGH TEMPERATURE FUELS. U.S. Air Force AFAPL-TR-65-13-Pt-1, Contract 20 (33-615)-64-1009, February 1965, 91 pp. (AD 612468); C.A. 66, 97217.

1359. Whitaker, R. T., MICROBIAL CONTAMINANTS IN AVIATION FUELS AND THEIR EFFECTS UPON FUELING SYSTEMS. Air Force Civ. Engr. 8 (4), 28-30 (November 1967).

1360. Whiting, T. R., DESIGN CONSIDERATIONS OF REUSABLE LAUNCH VEHICLES. Douglas Aircraft Corp. Report DAC-57912-57917, October 1966.

1361. Whitlock, H. W. and Siefken, M. W., THE TRICYCLO[4.4.0.0^{3,8}]DECANE TO ADAMANTANE REARRANGEMENT. J. Amer. Chem. Soc. 90 (18), 4929-39 (August 28, 1968).

1362. Whitlow, J. B., Jr., Eisenberg, J. D., Shovlin, M. D., POTENTIAL OF LIQUID-METHANE FUEL FOR MACH-3 COMMERCIAL SUPERSONIC TRANSPORTS. U.S. National Aeronautics and Space Administration Report No. NASA-TN-D-3471, 1966, 83 pp. (N 66-30257); C.A. 67, 4563.

BIBLIOGRAPHY (Cont'd)

1363. Whitlow, J. B., Jr., Eisenberg, J. D., Shovlin, M. P. (NASA, Lewis Research Center), LIQUID METHANE AS A FUEL FOR THE SUPERSONIC TRANSPORT. Cryogenic Technology 3, 245-8 (November-December 1967).

1364. Whitney, W. J., ANALYTICAL INVESTIGATION OF THE EFFECT OF COOLING AIR ON TWO-STAGE TURBINE PERFORMANCE. U.S. National Aeronautics and Space Administration, Lewis Research Center, January 1969, 24 pp. (N 69-17392)

1365. Whitney, W. J., Szanca, E. M., Bider, B., Monroe, D. E., COLD-AIR INVESTIGATION OF A TURBINE FOR HIGH-TEMPERATURE-ENGINE APPLICATION. 3. OVERALL STAGE PERFORMANCE. National Aeronautics and Space Administration Report NASA-TN-D-4389, February 1968, 23 pp. (N 68-15745).

1366. Wickersham, W. S., VULNERABILITY TESTING OF AIRCRAFT NON-METALLIC FUEL TANKS AND FIRE SUPPRESSION MATERIALS. Goodyear Tire and Rubber Co., Aviation Products Div. Final Report No. 19-452, U.S. Army Contract DA-33-019-AMC-322(X), December 1965, 126 pp. (AD 378608L) (REPORT CLASSIFIED CONFIDENTIAL).

1367. Willbanks, C. E. (ARC, Inc.), SENSITIVITY OF PREMIXED COMPRESSION-INITIATED SUPERSONIC COMBUSTION TO SMALL PERTURBATIONS IN INLET FLOW VARIABLES. AIAA, Annual Meeting and Technical Display, 5th, Philadelphia, Pa., October 21-24, 1968. Paper 68-995, 10 pp.

1368. Williamson, R. C. and Russell, J. A., ON-LINE ANALYSIS OF JET ENGINE EXHAUST. S.A.E. Combined Fuels and Lubricants Powerplant and Transp. Mtgs., (Pittsburgh October 30-November 3, 1967) Paper N.670945, 11 p.

1369. Wilson, D. R., Rittenhouse, L. E., Korman, W., Lacey, J. J., Jr., Siler, L. G., ADVANCED EXPERIMENTAL TECHNIQUES FOR STUDY OF HYPER-VELOCITY FLIGHT. Volume 3. HYPERVELOCITY TECHNIQUES SYMPOSIUM (5th) UNIVERSITY OF DENVER, MARCH 1967. Arnold Engineering Development Center, Arnold Air Force Station, prepared in cooperation with Aro, Inc., March 1967, 109 pp. (AD 381592) (REPORT CLASSIFIED CONFIDENTIAL).

1370. Wilson, G. R., Smith, J. O., Martin, H. F., Klein, D., Barrington, E. C., EFFECTS OF SELECTED STRAINS OF MICROORGANISMS ON THE COMPOSITION OF FUELS AND LUBRICANTS. Monsanto Research Corp. Final Report 1 September 1962-27 November 1964, Report No. MRB-2023F, FTD-TDR 63-4117-pt-2, U.S. Air Force Contract AF 33(657)-9814, January 1966, 154 pp. (AD 328 516); C.A. 67, 13467.

1371. Wilson, R. E., HANDBOOK OF SUPERSONIC AERODYNAMICS-VISCOSITY AND HEAT TRANSFER EFFECTS. U.S. Naval Ordnance Lab. Report 1488, 5, August 1, 1966, (AD 544217).

1372. Winegardner, D. K. and Schmitz, R. A. (University of Illinois), DYNAMICS OF HETEROGENEOUS REACTION AT A STAGNATION POINT. AIAA Journal 5 (9), 1589-95 (1967); C.A. 67, 92653.

BIBLIOGRAPHY (Cont'd)

1373. Winkler, E. M., STAGNATION TEMPERATURE PROBES FOR USE AT HIGH SUPERSONIC SPEEDS AND ELEVATED TEMPERATURES. U.S. Naval Ordnance Lab. Report 3834, 1954.

1374. Winterfeld, G., FLAME STABILIZATION WITH FLAME HOLDERS IN SUPERSONIC FLOWS. DVL-Nachrichten 1967, 260-2 (June) (in German).

1375. Wood, B. J. (Stanford Research Inst.), DEHYDROGENATION OF CYCLOHEXANE ON A (PALLADIUM-SILVER) HYDROGEN-POROUS MEMBRANE. J. Catal. 11 (1), 30-4 (May 1968).

1376. Wood, W. D. and Smith, W. K. (U.S. Bureau of Mines), THE ENTHALPIES OF COMBUSTION OF TOLUENE, BENZENE, CYCLOHEXANE, CYCLOHEXENE, METHYLCYCLOPENTANE, 1-METHYLCYCLOPENTENE, AND n-HEXANE. API Res. Proj. 62 Prepubl. Rep. No. TR 6, May 1968, 23 pp.

1377. Woodruff, L. W., Hearne, L. F., Keliber, T. J. (Lockheed Aircraft Corp.), INTERPRETATION OF ASYMPTOTIC CALORIMETER MEASUREMENTS. AIAA Journal 5, 791-7 (April 1967).

1378. Woods, F. J., Umstead, M. E., Johnson, J. E., VAPOR PHASE OXIDATION OF HYDROCARBONS. PART 2. EFFECT OF OXYGEN CONCENTRATION ON PLATINUM-CATALYZED COMBUSTION AND IONIZATION. U.S. Naval Research Lab., February 1969, 16 pp. (AD 684072).

1379. Woodworth, C. W., Buss, V., Schleyer, P. von R., HYDROGENOLYSIS OF CYCLOPROPANE DERIVATIVES. APPLICATION TO THE SYNTHESIS OF AN AXIAL t-BUTYLCYCLOHEXANE, 2-t-BUTYL-ADAMANTANE. Chemical Communications 1968, 569-70.

1380. Woolard, H. W., AN APPROXIMATE ANALYSIS OF THE TWO-DIMENSIONAL SUPERSONIC FLOW PAST A PLANE WALL WITH SUPERCRITICAL HEAT ADDITION IN A NORMAL PLANE. Johns Hopkins University, Applied Physics Laboratory APL/JHU CF-2613, March 1959 (AD 654450).

1381. Wooldridge, C. E. and Muzzy, R. J. (United Aircraft Corp.), BOUNDARY-LAYER TURBULENCE MEASUREMENTS WITH MASS ADDITION AND COMBUSTION. AIAA Journal 4, 2009-16 (November 1966).

1382. Worley, W. E., RAMJET TECHNOLOGY: CHAPTER 7, FUEL SYSTEMS. Johns Hopkins Univ., Applied Physics Lab. Technical Memo APL-TG-610-7-Rev, prepared in cooperation with Bendix Corp., U.S. Navy Contract NOw-62-0604, November 1967, 157 pp. (PB 177425).

1383. Wright, W. A. (Sun Oil Co.), AN IMPROVED VISCOSITY-TEMPERATURE CHART FOR HYDROCARBONS. Journal of Materials 4, 19-27 (March 1969).

1384. Wu, J. M., Lee, S. C., Whoric, J. M., SOME CHARACTERISTICS OF AN ELECTRIC DISCHARGE IN A SUPERSONIC GAS STREAM. AIAA 7 (3), 536-8 (March 1969).

BIBLIOGRAPHY (Cont'd)

1385. Wu, Y., KINETIC THEORY OF THERMAL TRANSPIRATION. University of Illinois, Coordinated Science Laboratory Report No. R-340, U.S. Army Contract DA-28-043-AMC-00073 (E), N 00014-66-C0010-A01, February 1967, 30 pp. (AD 647845).

1386. Yang, W. (University of Michigan) and Yeh, H., STAGNATION-POINT FORCED CONVECTION IN TWO-PHASE FLOW. AIAA Journal 5, 1282, 1283 (June 1967).

1387. Yarin, L. P., MATHEMATICAL ANALYSIS OF DIFFUSION COMBUSTION IN THE BOUNDARY LAYER OF A HIGH-VELOCITY STREAM. Problemy Teploenergetiki i Prikladnoi Teplofiziki (USSR) 1966 (3), 80-8; Johns Hopkins Univ., Applied Physics Lab. Translation, February 1969, 16 pp. (AD 684569).

1388. Yasumura, J., Yoshino, T., Abe, S., A NEW METHOD OF PREPARING A NICKEL CATALYST. Ind. Eng. Chem., Prod. Res. Develop. 7 (4), 252-6 (December 1968).

1389. Yen, S. M. and Hicks, B. L., INITIAL BEHAVIOR OF THE PSEUDO-SHOCK. Illinois Univ., Coordinated Science Lab. Report No. R-350, U.S. Army Contract DA-28-043-AMC-00073 (E). May 1967, 39 pp. (AD 652594).

1390. Yoshimura, F., Mitsui, S., Tsuchida, Y., DEHYDROGENATION OF TETRALIN BY FERRIC OXIDE. Kogyo Kagaku Zasshi 70 (6), 1046-7 (1967) (Japan); C.A. 67, 116732.

1391. Youssef, T. E. A., EXPERIMENTAL DETERMINATION OF THE VELOCITY AND PRESSURE PROFILES IN THE COMBUSTION ZONE IN A MODEL OF A GAS TURBINE COMBUSTION CHAMBER. S.A.E. Automotive Eng. Congr. (Detroit January 9-13, 1967) Paper N.670201, 15 p.

1392. Yumlu, V. S. (Shell Research Ltd.), THE EFFECTS OF ADDITIVES ON THE BURNING VELOCITIES OF FLAMES AND THEIR POSSIBLE PREDICTION BY A MIXING RULE. Combustion and Flame 12, 14-8 (February 1968).

BIBLIOGRAPHY (Cont'd)

1393. Zababkin, E. I. and Simonenko, V. A., CONVERGENT SHOCK WAVE IN A HEAT-CONDUCTING GAS. Prikl. Mat. Mekh. 29 (2), 354-6 (1965) (Russ); C.A. 63, 3440.

1394. Zabetakis, M. G. (U.S. Bureau of Mines), SAFETY WITH CRYOGENIC FLUIDS. New York, Plenum Press, 1967, 168 pp.

1395. Zabotin, L. I. and Tartiynik, E. I., DEACTIVATION OF PLATINUM-ALUMINA CATALYST BY NITROGEN COMPOUNDS. Izv. Vyssh. Ucheb. Zaved., Neft i Gas 11 (7), 49-52 (1968)(in Russian).

1396. Zaidman, N. M., Dzis'ko, V. A., Karnaukhov, A. P., Krasilenko, N. P., Koroleva, N. G., Vishnyakova, G. P., STUDY OF THE REGULARITY OF CRYSTALLIZATION OF PLATINUM ON SUPPORTS. I. RELATION OF THE DISPERSION AND ACTIVITY OF PLATINUM, SUPPORTED ON ALUMINUM OXIDE, TO THE SURFACE CONCENTRATION AND PROPERTIES OF THE SUPPORTS. Kinet. Kataliz 9 (4), 863-9 (1968) (Russ).

1397. Zaitova, A. Ya., Volkova, L. I., Mochal'nikova, T. P., Mel'der, N. A., EFFECT OF IRON ON ACTIVITY AND SELECTIVITY OF SYNTHETIC ALUMINOSILICATE [CRACKING] CATALYST. Khim. Tekhnol. Topl. Masel 12 (4), 6-7 (1967) (Russ); C.A. 67, 75075.

1398. Zaslonko, I. S., Kozarko, S. M., Riabikov, O. B., AMPLIFICATION OF COMPRESSION WAVES DURING THE BURNING OF GAS MIXTURES. Fizika Goreniia i Vzryva 3, 555-60 (December 1967) (in Russian).

1399. Zaturska, M. B. and Adler, J., FLAME IGNITION FROM A SPHERICAL HOT GAS POCKET. Quarterly Journal of Mechanics and Applied Mathematics 19, 485-95 (November 1966).

1400. Zavitsanos, P. D. (G. E. Co.), OXIDATION KINETICS OF PYROLYTIC GRAPHITES. Eastern Section of the Combustion Inst. 1968 Technical Meeting, October 21, 22, 1968.

1401. Zeleznik, F. J. and Gordon, S. (NASA, Lewis Research Center), CALCULATION OF COMPLEX CHEMICAL EQUILIBRIA. Ind. Eng. Chem. 60 (6), 27-57 (1968).

1402. Zengel, A. E., COMPARISON OF THE CAPABILITIES OF A FUEL COKER AND THE MINEX HEAT EXCHANGER FOR DETERMINING HYDROCARBON FUEL THERMAL STABILITY. U.S. Air Force AFAPL-TR-64-154, March 1965, 98 pp. (AD 616361); C.A. 67, 23765.

1403. Zemskov, G. V., et al., OXIDATION OF A NICKEL ALLOY IN SULFHUR-BEARING ATMOSPHERES. Fiz. Metal. i Metalloved. V20 N.5 (1965); (Abstr.) Corrosion Abstr. V6 N.2 154 (March 1967).

1404. Zhigalko, E. F., SHOCK WAVE DIFFRACTION AND REFLECTION PROBLEMS. Leningradskii Universitet, Vestnik, Matematika, Mekhanika, Astronomiia 22, 78-82 (January 1967) (in Russian).

BIBLIOGRAPHY (Cont'd)

1405. Zhomov, A. K., Kholdyakov, N. I., Makeeva, A. I., Mishin, V. M., METHYLTRICHLOROSILANE AS AN ACTIVATOR OF DEHYDROCYCLIZATION OF PARAFFIN HYDROCARBONS. Neftepererab. Neftekhim. 1967 (4), 35-6 (Russ); C.A. 67, 55924.

1406. Zhorov, Yu. M., Venkatachalam, K. A., Panchenkov, G. M., GENERAL KINETIC EQUATIONS FOR DEHYDROCYCLIZATION REACTIONS OF NORMAL PARAFFINS ON OXIDE CATALYSTS. Neftekhimiya 6 (6), 831-7 (1966) (Russ); C.A. 66, 67592 (1967).

1407. Zhorov, Yu. M., Kuznetsov, O. I., Panchenkov, G. M., CATALYST FOR DEHYDROGENATION CRACKING OF NORMAL PARAFFINS. U.S.S.R. 186, 391 (Cl. BOlj), October 5, 1966, Appl. February 25, 1965; C.A. 66, 78084 (1967).

1408. Zimmer, M. F. and Zimmer-Galler, R. (U.S. Naval Propellant Plant), RESEARCH AND REVIEWS OF FUELS FOR AIR-BREATHING PROPULSION. The Performance of High Temperature Systems; Proceedings of the Third Conference, Pasadena, Calif., December 7-9, 1964, Vol. 1, ed. by G. S. Bahn, New York, Gordon and Breach, Science Publishers, Inc., 1968, p. 171-208.

1409. Zrelov, V. N. and Piskunov, V. A., JET ENGINE AND JET FUEL. Moscow, Izdatel'stvo Mashinostroenie, 1966, 312 pp. (in Russian).

1410. Zrelov, V. N., EFFECT OF ALKYL- AND AMINOPHENOLS ON THE THERMAL STABILITY AND CORROSIVE PROPERTIES OF RAMJET FUELS. Neftepererab. Neftekhim. 1967 (6), 17-21 (Russ); C.A. 67, 101624.

1411. Zrelov, N. N. and Marinchenko, N. I., THE FORMATION OF PRECIPITATES IN REACTIVE FUELS. Neftepererab. Neftekhim. (USSR), 1966 (9), 13-7; Institute of Modern Languages Inc., AERDL T-1881-66, U.S. Army Contract DA-44-009-AMC-1563(T), December 1966, 11 pp. (AD 645944).

1412. Zrelov, V. N. and Marinchenko, N. I., CHEMICAL COMPOSITION OF MICRO-IMPURITIES IN JET FUELS FROM SULFUROUS PETROLEUM. U.S. Dept. Commerce Clearinghouse Federal Sci. Tech. Inform. AD N.608.734 (November 1964) 11 p.; (Abstr.) Corrosion Abstr. V5 N.1.41 (January 1966).

1413. Zrelov, V. N. and Marinchenko, N. I., THE CHEMICAL COMPOSITION OF MICRO IMPURITIES IN JET FUELS FROM SOUR CRUDES. Khim. i Tekhnol. Topliv i Masel V8 N.11.57-61 (November 1963).

1414. Zrelov, V. N. and Piskunov, V. A., ABRASIVE PROPERTIES OF MICROCONTAMINATION AND OXIDATION PRODUCTS OF JET FUELS. U.S. Dept. Commerce Clearinghouse Federal Sci. Tech. Inform. AD N.626.963 (1966); (Abstr.) Corrosion Abstr. V5 N.6 459 (November 1966).

1415. Zvirin, Y., HEAT TRANSFER BETWEEN A PULSATING IMPINGING JET AND A FLAT SURFACE. Isreal Annual Conference on Aviation and Astronautics, 9th, February 22, 23, 1967, Paper; Isreal Journal of Technology 5 (1-2), 152-69 (1967).

BIBLIOGRAPHY (Cont'd)

3416. Zysina-Molozhen, L. M. and Polyak, M. P., CALCULATION OF THE TEMPERATURE FIELDS IN A BLADE OF A HIGH TEMPERATURE GAS TURBINE DURING INTERNAL COOLING. Teplo-i Massoperenos, Minsk, Nauka i Tekhn. Press 5, 261-71 (1966); U.S. National Aeronautics and Space Administration Translation NASA-TT-F-11183), January 1968, 11 pp. (N 68-15795).

BIBLIOGRAPHY (Contd)

1417. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME I. SUMMARY. (AD 385 322L)

1418. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME I. SUMMARY. (AD 385 323L)

1419. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME II. MISSION ANALYSIS AND SELECTION. (AD 385 324L)

1420. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME IV. THREAT DEFINITION AND HYPERSONIC VEHICLE SURVIVAL. (AD 385 330L)

1421. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME V. SPECIAL STUDIES OF THE WORTH OF HYPERSONIC SPEED. (AD 385 331L)

1422. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME VI. COMPARATIVE ANALYSIS. (AD 385 325L)

1423. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME VII. ATTRACTIVE SCRAMJET APPLICATIONS. (AD 385 326L)

1424. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME VIII. TECHNICAL ASSESSMENTS. (AD 385 332L)

1425. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME IX. COST ANALYSIS. (AD 385 333L)

1426. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME I. PROGRAM SUMMARY (AD 385 169L)

1427. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME II. OPERATIONS ANALYSIS. BOOK 1 - INITIAL MISSION SCREENING. (AD 385 170L)

1428. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME II. OPERATIONS ANALYSIS. BOOK 2 - OFFENSE MISSION ANALYSIS, INCLUDING SURVIVABILITY. (AD 385 171L)

1429. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME II. OPERATIONS ANALYSIS. BOOK 3 - DEFENSE MISSION ANALYSIS. (AD 385 172L)

1430. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME III. WEAPON SYSTEM CHARACTERISTICS. (AD 385 173L)

1431. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME IV. TECHNOLOGY DEMONSTRATION AND DEVELOPMENT. (AD 385 174L)

1432. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME V. AERODYNAMICS. (AD 385 175L)

1433. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME VI. PROPULSION SYSTEMS. (AD 385 176L)

BIBLIOGRAPHY (Contd)

1434. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME VII. STRUCTURES AND WEIGHTS. (AD 385 177L)

1435. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME X. COSTS. (AD 385 180L)

1436. HYPERSONIC SCRAMJET VEHICLE STUDY. VOLUME IX. AVIONICS. (AD 385 177L)

1437. HYDROCARBON SCRAMJET FEASIBILITY PROGRAM. VOLUME I: ENGINE AND COOLING INVESTIGATIONS. (AD 384 567L)

1438. HYDROCARBON SCRAMJET FEASIBILITY PROGRAM. VOLUME II. EFFECTIVENESS STUDIES. (AD 384 591L)

1439. 1966 ADVANCED RAMJET CONCEPTS PROGRAM. VOLUME VI. ADVANCED PROPULSION APPLICATIONS INVESTIGATIONS. (AD 385 375L)

1440. HYDROCARBON-FUELED SCRAMJET. VOLUME I. HYDROCARBON FUELED SCRAMJET ENGINE INVESTIGATION. (AD 385 821L)

1441. HYDROCARBON-FUELED SCRAMJET. VOLUME II. SCRAMJET ENGINE/STRUCTURE COOLING WITH HYDROCARBON FUELS. (AD 385 822L)

1442. HYDROCARBON-FUELED SCRAMJET VOLUME III - EFFECTIVENESS STUDIES OF HYDROCARBON SCRAMJET ENGINE. (AD 385 834L)

1443. WIND TUNNEL TESTS OF A MARQUARDT DUAL MODE SCRAMJET INLET MODEL AT MACH NUMBERS FROM 2 TO 10. (AD 382 441L)

1444. DUAL MODE SCRAMJET. PART I. INLET DESIGN AND PERFORMANCE CHARACTERISTICS. (AD 385 990L)

1445. DUAL MODE SCRAMJET. PART II. COMBUSTOR DESIGN AND PERFORMANCE CHARACTERISTICS. (AD 385 991L)

1446. SCRAMJET INCREMENTAL FLIGHT TEST PROGRAM. VOLUME III. SCRAMJET PROPULSION SYSTEM. (AD 385 994)

1447. THE EFFECT OF EXTERNAL FUEL INJECTION ON THE FUEL-AIR MIXING EFFICIENCY AND INLET PERFORMANCE OF A SUPERSONIC COMBUSTION RAMJET ENGINE. (AD 822 092)

1448. CALCULATION OF PRESSURE LOSSES IN JET ENGINE COMBUSTION CHAMBERS - TRANSLATION. (AD 821 853)

1449. A SIMPLIFIED STUDY OF OPEN-CYCLE MAGNETOHYDRODYNAMIC POWER GENERATION AND AN EXAMINATION OF THE POSSIBLE ROLE OF SUPERSONIC COMBUSTION IN THE CYCLE. (AD 819 895)

1450. HIGH TEMPERATURE HYDROCARBON FUELS RESEARCH IN AN ADVANCED AIRCRAFT FUEL SYSTEM SIMULATOR ON FUEL AFFB-8-67. (AD 820 688)

BIBLIOGRAPHY (Cont'd)

1451. AEROSOL FLASHING. PART I. SHOCK TUBE INVESTIGATION OF IGNITION. (AD 384 254)

1452. FLAME STABILIZATION IN SUPERSONIC FLOWS AT LOW GAS TEMPERATURES - TRANSLATION. (AD 822 267)

1453. LIGHT EMISSION FROM SHOCK HEATED GASES. (AD 822 677L)

1454. IGNITION OF AVIATION KEROSINE BY HOT PIPES. (AD 824 289)

1455. STEADY STATE SOLUTIONS OF THE EQUATIONS OF BURNING. (AD 818 545)

1456. IGNITION TEMPERATURES. I. STANDARD PYROTECHNIC MIXTURE AND COMPONENTS. (AD 821 062)

1457. AUTOGENOUS IGNITION OF FLAMMABLE R-70 FLUIDS. (AD 820 959L)

1458. EVALUATION OF FLAME FUEL MIXES IN COLD WEATHER ENVIRONMENT. (AD 383 400)

1459. INVESTIGATION AND COMPILATION OF THE THERMODYNAMIC PROPERTIES OF HIGH TEMPERATURE CHEMICAL SPECIES. (AD 821 221)

1460. INVESTIGATION AND COMPILATION OF THE THERMODYNAMIC PROPERTIES OF HIGH TEMPERATURE CHEMICAL SPECIES. (AD 818 224)

1461. EXPERIMENTAL PROGRAM TO DETERMINE THE THERMODYNAMIC PROPERTIES OF SOLUTIONS OF LIQUIFIAD LIGHT GASES. (AD 821 952)

1462. EXPERIMENTAL PROGRAM TO DETERMINE THE THERMODYNAMIC PROPERTIES OF SOLUTIONS OF LIQUIFIED LIGHT GASES. (AD 817 514)

1463. PROPULSION TECHNOLOGY: SURVEY OF RUSSIAN AND EAST EUROPEAN LITERATURE. (AD 824 773)

1464. INTERNATIONAL PROPULSION SYMPOSIUM, 1967, THE COLLEGE OF AERONAUTICS, CRANFIELD ENGLAND. (AD 820 336)

1465. RESEARCH ON OPERATIONAL SLURRY FUELS. (AD 382 983)

1466. RESEARCH ON OPERATIONAL SLURRY FUELS. (AD 385 075)

1467. HOT PANEL COKER TEST TECHNIQUE AND APPARATUS (TR CONFIGURATION). (AD 824 164)

1468. JET FUEL DECONTAMINATION STUDIES. (AD 818 061L)

1469. STUDY OF AVIATION-FUEL FILTER/SEPARATORS. (AD 823 519)

1470. LUBRICITY PROPERTIES OF HIGH-TEMPERATURE JET FUELS. (AD 822 760)

BIBLIOGRAPHY (Contd)

1471. EVALUATION OF THE AERONAUTICAL ENGINE LABORATORY LIGHT TRANSMISSION AND MILLIPORE FILTER METHOD OF ANALYZING AVIATION FUELS FOR SOLID CONTAMINATION. (AD 822 257L)

1472. HEF-3 THERMAL STABILITY STUDIES. (AD 821 102L)

1473. ANALYSIS OF TRACE METALLIC CONTAMINANTS IN JET FUELS BY NEUTRON ACTIVATION. (AD 821 067)

1474. THE STUDY OF HYDROCARBON FUEL VAPOR PHASE DEPOSITS. (AD 823 732)

1475. THE STUDY OF HYDROCARBON FUEL VAPOR PHASE DEPOSITS. (AD 819 925)

1476. THE STUDY OF HYDROCARBON FUEL VAPOR PHASE DEPOSITS. (AD 818 166)

1477. LUBRICITY PROPERTIES OF HIGH-TEMPERATURE JET FUELS. (AD 821 576)

1478. FUNDAMENTAL INVESTIGATION OF THE DEGRADATION OF HYDROCARBON FUELS. (AD 385 419)

1479. DETERMINATION OF THE EFFECTS OF COPPER IN STABILITY PROBLEMS ENCOUNTERED WITH GAS TURBINE FUELS. (AD 822 954L)

1480. DEVELOPMENT OF SST FUEL TANK SEALANTS. (AD 817 946L)

1481. EXPERIMENTAL INVESTIGATION OF HYPERSONIC FLOWS — TRANSLATION. (AD 824 060)

1482. ON THE INFLUENCE OF THE ADDITION OF HEAT TO HYPERSONIC FLOW -- TRANSLATION. (AD 823 795)

1483. REAL GAS PROPERTY EFFECTS ON FLOW AND HEAT TRANSFER IN THE ENTRANCE REGION OF A PARALLEL-PLATE CHANNEL. (AD 817 990)

1484. FREE-FORCED CONVECTION HEAT TRANSFER IN A CURVED CHANNEL. (AD 817 991)

1485. THEORY OF FLOW INCLUDING CHEMICAL REACTION---TEXT IN FRENCH. (AD 8[illegible] 77[illegible])

1486. MICROWAVE MEASUREMENTS OF NON-EQUILIBRIUM AIR PLASMAS BEHIND SHOCK WAVES CONTAINING ELECTROPHILIC GASES. (AD 817 650)

1487. SCRAMJET THERMAL PROTECTION PROGRAM. (AD 818 153)

1488. SCRAMJET THERMAL PROTECTION PROGRAM. (AD 818 154)

1489. HEAT TRANSFER IN THE VICINITY OF A 15 DEGREES COMPRESSION CORNER AT MACH NUMBERS FROM 2.5 TO 4.4. (AD 825 554)

1490. HEAT TRANSFER TO SUPERCRITICAL KEROSENE. (AD 824 271)

BIBLIOGRAPHY (Contd)

1491. ON ONE-DIMENSIONAL FRICTIONLESS COMPRESSIBLE GAS FLOW WITH HEAT ADDITION AND AREA CHANGE UNDER PARTICULAR CONSIDERATION OF THE TRANSONIC REGIME. TEXT IN GERMAN. (AD 818 775)

1492. ON THE EFFECT OF VIBRATIONS ON NUCLEATE BOILING HEAT TRANSFER AT NEAR SATURATED CONDITIONS. (AD 818 402)

1493. SUPERCRITICAL PRESSURE LIQUID HYDROGEN HEAT TRANSFER DATA COMPILATION. (AD 818 418L)

1494. HEAT TRANSFER IN CO-AXIAL SYSTEMS. (AD 820 182)

1495. OFFSET RECTANGULAR PLATE-FIN SURFACES -- HEAT TRANSFER AND FLOW FRICTION CHARACTERISTICS. (AD 822 954)

1496. OBLIQUE FLOW HEADERS FOR HEAT EXCHANGERS - THE INFLUENCE OF INLET VELOCITY PROFILES. (AD 822 953)

1497. NOTES ON THE PROGRESS OF FREE-FLIGHT TRIALS TO MEASURE HEAT TRANSFER AT MACH NUMBERS UP TO 5. (AD 816 971)

1498. HYPERSONIC RAMJET HEAT TRANSFER AND COOLING PROGRAM. VOLUME V: CONTROL SYSTEM STUDIES AND EXPERIMENTS. (AD 382 779L)

1499. HEAT TRANSFER FROM A CYLINDRICAL SOURCE TO LIQUID IN POROUS MEDIA. (AD 819 824L)

1500. TRANSIENT HEAT TRANSFER MEASUREMENT WITH THIN-FILM RESISTANCE THERMOMETERS -- DATA REDUCTION TECHNIQUES. (AD 823 515)

1501. STUDY OF HEAT TRANSFER CHARACTERISTICS OF HOT-GAS IGNITERS. (AD 821 548)

1502. THE IGNITION OF PURE ACETYLENE THROUGH SHOCK WAVES -- TRANSLATION. (AD 816 452L)

DOCUMENT CONTROL DATA - R & D

Shell Development Company, A Division of Shell Oil Company	Unclassified N/A

VAPORIZING AND ENDOTHERMIC FUELS FOR ADVANCED ENGINE APPLICATION.
Part III. Studies of Thermal and Catalytic Reactions, Thermal Stabilities, and Combustion Properties of Hydrocarbon Fuels

Final Report - June 1966-September 1969

A. C. Nixon, G. H. Ackerman, L. E. Faith, H. T. Henderson, A. W. Ritchie, L. B. Ryland and T. M. Shryne

February 1970	562	58

AF 33(615)3589 3048 Task No. 304805	AFAPL-TR-67-114 Part III, Vols I and II

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Air Force Aero Propulsion Laboratory.

Air Force Aero Propulsion Laboratory
Wright Patterson Air Force Base, Ohio

The feasibility of utilizing hydrocarbon fuels for high speed air craft depends upon the endothermic and enthalpic capacity of the hydrocarbons, and the combustion properties of the products. At Mach 8 a supersonic combustion ram jet engine would require about 1900 Btu of cooling per pound of fuel. The enthalpic capacity of hydrocarbons can be augmented by thermal and catalytic reactions. These have been studied. The rate of thermal cracking can be accelerated by means of additives. The rate of dehydrogenation of naphthenes, a strongly endothermic reaction, can be increased by the use of improved catalysts based on platinum on alumina. The stabilities of such catalysts are inversely proportional to the pore size of the support and are affected by composition. Dispersed catalysts have some advantages over bed type catalysts and some indications of possible success have been observed. About 1/3 of the 850 catalysts developed for naphthene dehydrogenation has been more active than the standard laboratory catalyst, although none is orders of magnitude better. Wall catalysts have the advantage of low pressure drop and are showing efficiency benefits also. Calculations show that diffusion limitations can be avoided if the coating thickness is no more than about 3 mils thick. Satisfactory operation with both improved bed catalysts and wall catalysts has been demonstrated in the fuel system simulator with both methylcyclohexane and Decalin. Heat transfer studies have been carried out with MCH, Decalin, SHELLDYNE-H and JP-7 fuel in small diameter test sections under heat fluxes up to 8 x 10[6] Btu per hour per square foot. Studies on the effect of high temperatures on the thermal stability of various fuels have been continued with emphasis on methods of measuring deposits on tube surfaces. Combustion and electron back scattering are the methods of present choice and an instrument based on the latter principle has been designed. Mathematical models are being devised to represent the various portions of an endothermic fuel system with present emphasis on the development of heat transfer correlations and a model for the dehydrogenation of Decalin. Physical properties for Decalin and JP-8 are included. Calculation of the rate of oxidation of normal octane and SHELLDYNE-H from shock tube studies indicate similar rates of reaction and temperature coefficients.

KEY WORDS

Endothermic fuels
Advanced fuel systems
High density fuels
Fuel properties
Supersonic combustion
Shock tube
Catalytic reaction
Dehydrogenation
Catalysts
Wall catalysts
Reaction kinetics
Kinetic models
heat sink
Thermal reaction
Hydrocarbon fuels
Literature survey
Thermal stability
Deposit measurement