VII. AROBIN PROCESS

The Arobin process is a method of manufacture of aromatics from the high boiling residues of the DHD (dehydrogenation of naphthanes) and the HF (hydroforming) processes. The available charge stock consisted of about 5% residues from the distillation. The process was developed to the pilot plant stage only, with a catalyst volume of 25 cubic ft., and a charge rate of 120 gallons/hour.

The following details of the process as applied to HF plant residues were secured from Dr. Herold of Leuna, who is in charge of development work on further utilization of products from existing processes.

Charge to Arobin Plant

Bottoms from HF process charging mixed Rumanian and Hungarian straight run gasoline :

API Gravity	21.2
Engler Distillation	
IBP	316° F.
50%	383
E.P.	676
Bromine No.	14.4
Aromatics & Olefins	98.5%
Pour Point	-66°F
Elementary Analysis:	
Carbon	90.59%
Hydrogen	9.42
Sulphur	0.08

Operating Conditions

Catalyst Temperature (According to Catalyst activity)	752-852° F.
Space velocity (liquid)	0.65 vol. oil/vol. catalyst/hr.
Gasoline concentration at stripper	50% (by volume)
Pressure	2,940 psi
Circulating gas	1000-5000 volumes/volume gasoline/hour, to control the heat of reaction (about 0.360 BTU/lb charge)
Chemical consumption of hydrogen	5.45-6.20 cubic ft./lb of finished gasoline.

Catalyst - "KK" catalyst + 1% MoO_3
(see below for method of preparation)

The MoO_3 acts as a hydrogenation catalyst and thus prevents the formation of polymers which would cause coking.

Yield and Quality of the Product

Average Net Yield	Weight %
Methane	0.2
Ethane	1.7
Propane	4.8
Isobutane	3.8
N-Butane	2.4
Gasoline	85.7
	98.6

Quality of the finished product (Arobin)

API Gravity	43.2
Octane No. (Motor Method)	86
+ 4.55 cc/gal TEL	93.5
Bromine No.	0.84
Reid Vapour Pressure	5.9
Corrosion	Neg.
Freezing Point	Below -76°F
Gum (Glass dish)	4.0 mg/100 cc
Aniline Point	Below 4°F.
Aromatics & Olefins	65.0 Vol.%
Naphthenes	27.0
Paraffins	8.0
Elementary Analysis	
Carbon	88.50 %
Hydrogen	11.45

Engler Distillation

IBP	117° F.
7.0% at	176
20.0	212
41.0	248
72.0	284
95.0	320
99.0	333
Residue	0.8%

Preparation of the Arobin Catalyst

1. Preparation of alumina. Commercial alumina is dissolved in hot 25% caustic solution, to give about 1.66 lbs. Al_2O_3/gallon.

This solution is added to 45% nitric acid to give a pH of 6. Precipitation temperature not over 122°F. After precipitation, the solution is filtered or decanted, the precipitate is washed with pure water until the effluent shows no nitrate, and dried at 248° F, until the ash content is about 70%.

2. Preparation of the silica gel. Waterglass solution (Sp. g. 1.333, SiO_2 27%) and 10% sulphuric acid are reacted at 50-59°F to give a 3-4 pH. On heating to 158-176°F, the clear sol congeals. This gel is broken into 1¼"-2" pieces and washed until the wash water shows no trace of sulphate. The gel is dried at 248°F to an ash content of about 70%. It is pulverized in a mill (Wibratom) until at least 90% of the powder will pass a 10,000 mesh (per unit) sieve.

3. Preparation of the "KK" Catalyst from the gel. The alumina is kneaded in a kneading machine with enough water to make a plastic mass. A 45% nitric acid solution is added, the quantity being 10% of that theoretically needed to form aluminium nitrate. Then the powdered silica gel is added with continuous kneading to give a ratio Al_2O_3: SiO_2 = 1:9. The mass is further kneaded for 6 to 10 hours. The mass is then extruded for feed to an adjoining candy manufacturing machine (Franconia), where it is formed into spheres.

4. Preparation of the Arobin Catalyst. The above spheres are soaked with ammonium molybdate solution made up in such proportions that one weight per cent MoO_3 is absorbed. The spheres absorb practically all the liquid. They are then drained and dried at 356°F.

A 5-pound sample of this Arobin catalyst was secured for further testing.

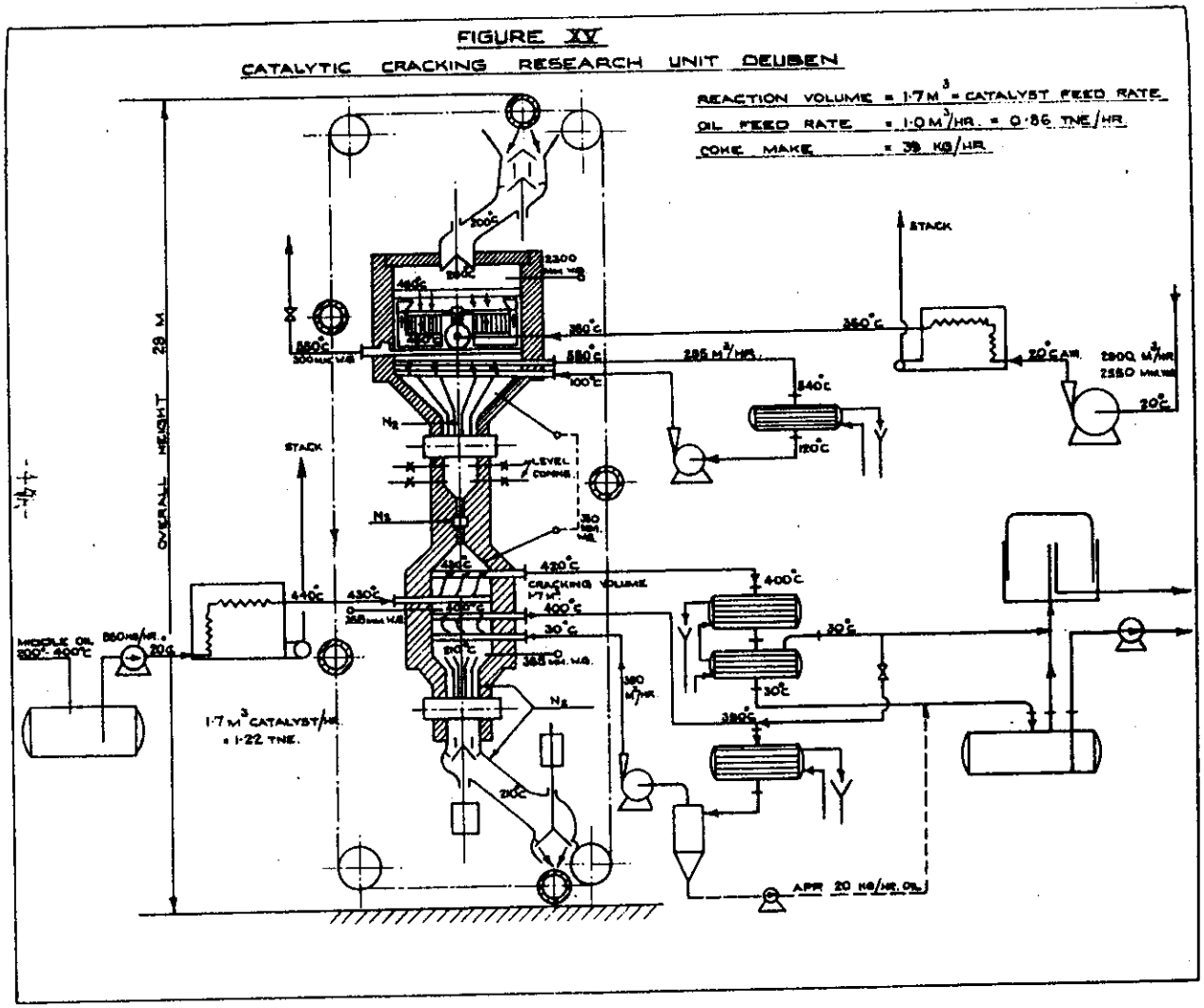
FIGURE XV
CATALYTIC CRACKING RESEARCH UNIT DEUBEN
REACTION VOLUME = 1·7 M³ = CATALYST FEED RATE
OIL FEED RATE = 1·0 M³/HR. = 0·86 TNE/HR.
COKE MAKE = 39 KG/HR.
OVERALL HEIGHT 29 M
STACK
CRACKING VOLUME 1·7 M³
1·7 M³ CATALYST/HR. = 1·22 TNE.
APPR 20 KG/HR. O₂