ENCLOSURE (F)

ENCLOSURE (F)

DESCRIPTION

OF THE

FIRST NAVAL FUEL DEPOT

OFUNA

ENCLOSURE (F)

LIST OF ILLUSTRATIONS

LIST OF APPENDICES

ENCLOSURE (F)

DESCRIPTION OF THE FIRST NAVAL FUEL DEPOT, OFUNA

HISTORY

The First Naval Fuel Depot, located in OFUNA, Kanagawa Prefecture, was officially established on 21 April 1941. This Depot was devoted exclusively to research, process development, and practical testing of fuels and lubricants. Previously, the research activities and pilot plant studies had been conducted at the Tokuyama Naval Fuel Depot, and the practical product testing had been performed at the Naval Aviation Technical Depot, YOKOSUKA (later the First Technical Depot). The Depot at OFUNA was established by the Navy so as to centralize all Naval activities pertaining to this particular field at one independent plant.

The aviation fuel and lubricating oil research department of the Naval Aviation Depot was first transfered to OFUNA and reestablished on 27 May 1938, as the Experimental Department of the Naval Fuel Depot. It was then considered desirable to move the research department of the TOKUYAMA Naval Fuel Depot to OFUNA. This transition was begun in June 1939 and completed in March 1940. In April 1941, the independent organization known as the First Naval Fuel Depot was officially established, and it continued operation until 15 August 1945.

BUILDINGS AND GROUNDS

The First Naval Fuel Depot occupies an area of approximately 100 acres and is located about a mile and a half from OFUNA Station. A map of the Depot is included as Appendix (I), and a panoramic view is shown in Figure 1(F). There are a total of 74 buildings within the grounds. Of these, 37 were devoted exclusively to technical work, while the remainder were used for office space, shops, storage, and other related facilities. Nearly all of the laboratories were solid structures built of steel and concrete. The 37 buildings mentioned above provided nearly nine acres of floor space for laboratories, pilot plants, and test apparatus.

Included herein as Figures 2(F) to 20(F) are photographs of some units of the research equipment of the Depot. Although these photographs show only a portion of the equipment, they are indicative of the type of research conducted at OFUNA. Detailed descriptions of all items of equipment are given in the technical reports submitted by the Japanese personnel attached to the First Naval Fuel Depot. These reports are included as Enclosures in the NavTechJap Reports, Index Nos. X-38(N)-1 to -10, inclusive.

The Depot suffered no bomb damage and was never exposed to bombing attacks; however, elaborate preparations had been taken to protect key points from possible damage. Two extensive underground shelters had been built as well as several smaller ones. The buildings containing files, records, and communication centers were carefully protected. The only wooden laboratories on the premises were torn down in June 1945 to minimize the fire hazard.

An extensive cave building program was started in the fall of 1944. Nine large caves to be used primarily for storage of raw materials and equipment were built on or near the Depot during the last year of the war. A series of underground laboratories were also started but were not completed. There were to be ten individual and connected laboratory rooms in one large cave. Some of the individual laboratories had been completed and were being used at the termination of the war. Photographs of the outside view of one of the caves and an underground laboratory are shown in Figures 2(F) and 3(F), respectively.

ENCLOSURE (F)

Although not directly subjected to bombing attacks, the increasing number of bombings on nearby cities during the final months of the war made it necessary for the Depot to be more and more self-sufficient. An example of the extent of this self-sufficiency is indicated by the fact that in 1945 it was found necessary to set aside a building for the manufacture of laboratory glassware, since all commercial sources had been destroyed.

PERSONNEL AND ORGANIZATION

As originally established, the First Naval Fuel Depot consisted of a Research Department and an Experimental Department, in addition to the departments concerned with general affairs, accounts, and medical treatment. The Research Department was responsible for both research and pilot plant studies pertaining to fuels and lubricants, and the Experimental Department was concerned with full scale tests of fuels and lubricants.

As time progressed it was apparent that the Japanese engineering design facilities were inadequate, and it became increasingly difficult to transfer the application of laboratory results to pilot plant stage and also to full scale design for the Naval Refineries at YOKKAICHI and TOKUYAMA. To meet this need, the Chemical Engineering Department was established in April 1944.

Each of the departments described above was broken down into sections, the nature of which varied with changes of emphasis in research activity. A detailed itemization of the organization as it was at the termination of the war is shown in Appendix II.

When first organized in April 1941, there was a staff of 45 and a worker complement of 1,000 men employed at the Depot. The first Superintendent of the Depot was Rear-Admiral Hiromitsu YANAGIHARA. By October 1943 the staff had increased to 120 men, and there were 1940 workers. At this time Vice-Admiral Aiki OBATA was appointed as Superintendent. He remained in this capacity until 1 May, 1945, when he was relieved by Vice-Admiral Nobusuke YAMAGUCHI. At the end of the war there were 3,210 men employed at the First Naval Fuel Depot, and of this number, 410 composed the staff.

Aside from the department heads, most of the key research personnel attached to the Depot had commissions in the Japanese Navy as engineering specialists. A breakdown of the classification of the heads of departments and sections connected with the technical activities is as follows: 6 Naval Officers (1 Vice-Admiral, 3 Captains, 1 Commander, 1 Lt. Commander), 12 Engineering Naval Officers (1 Captain, 2 Commanders, 7 Lt. Commanders, 2 Lieutenants), 3 civilian engineers, and one civilian chemist.

WARTIME RESEARCH

Detailed discussions of the wartime research projects investigated at the First Naval Fuel Depot are included in the NavTechJap reports referenced herein. These projects covered a wide field of application and present a comprehensive picture of the quality and scope of Japanese research activity. The personnel directing this research were competent chemists and chemical engineers, although there appeared to be a scarcity of skilled assistants and technicians.

About 30 patents were granted to the First Naval Fuel Depot during the war. A complete list of these and other patents held by the Depot is given in Appendix III.

ENCLOSURE (F)

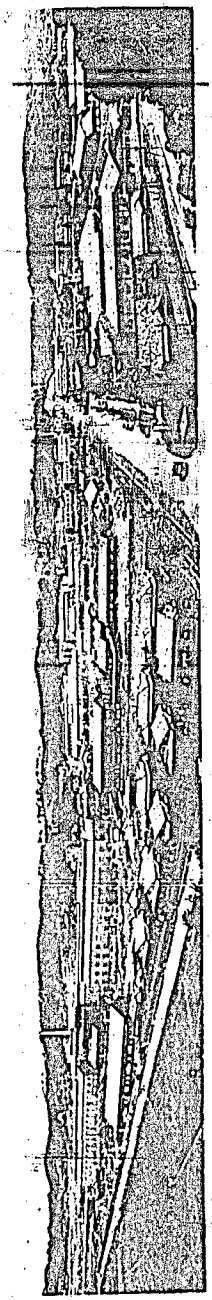


Figure 1(F)

PANORAMIC VIEW OF THE FIRST NAVAL FUEL DEPOT, OFUNA

ENCLOSURE (F)

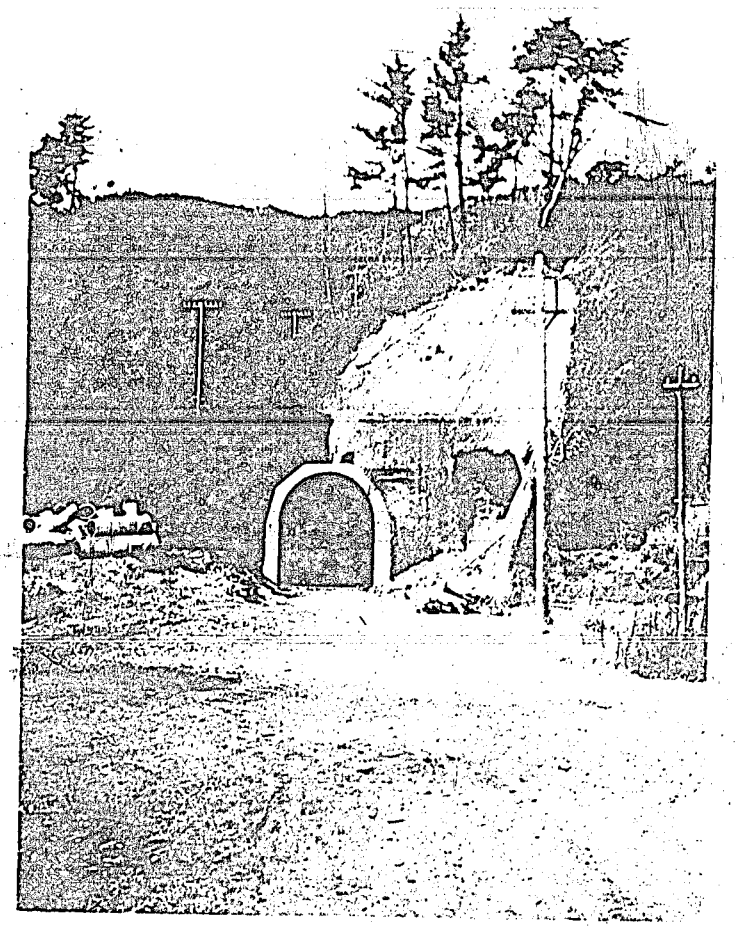


Figure 2(F)

ENTRANCE TO THE MAIN UNDERGROUND RESEARCH LABORATORY

ENCLOSURE (F)

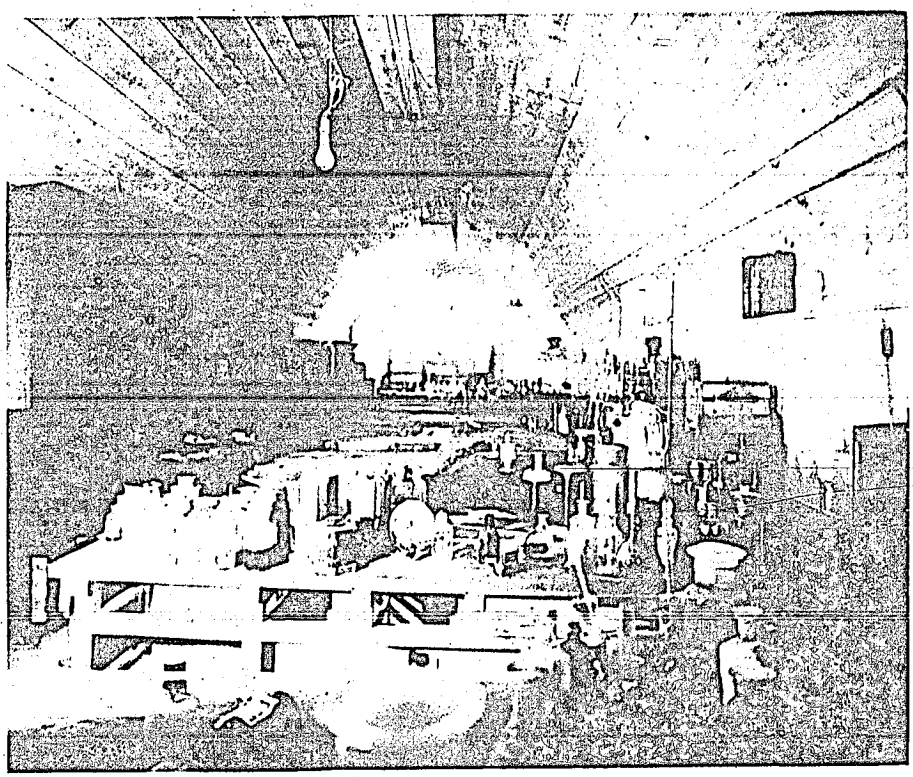


Figure 3(F)
A TYPICAL UNDERGROUND RESEARCH LABORATORY

ENCLOSURE (F)

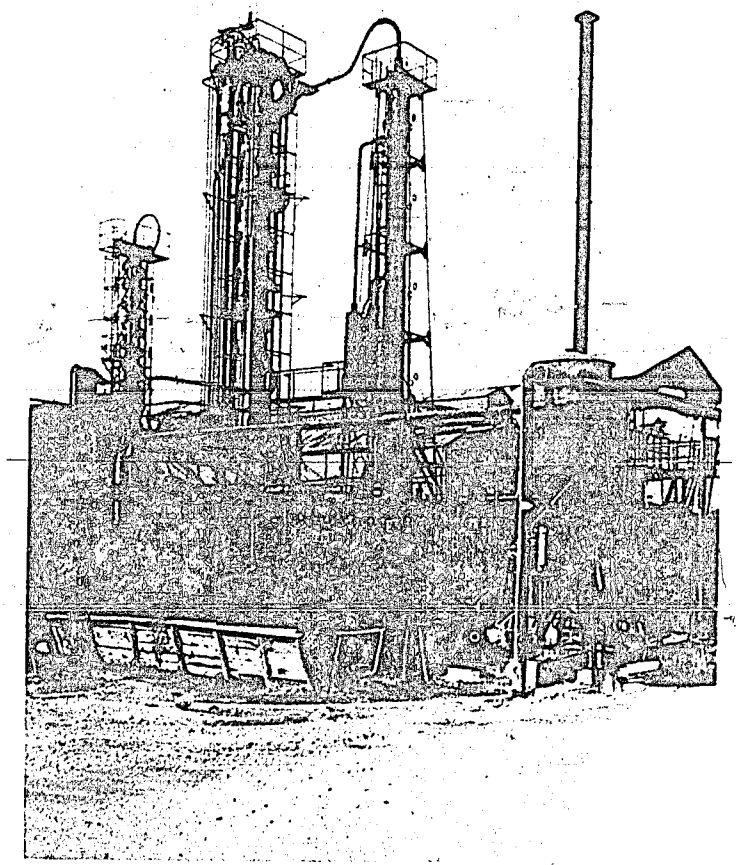


Figure 4 (F)
CONTINUOUS CRUDE OIL DISTILLATION UNIT
(Sixty barrels per day capacity)

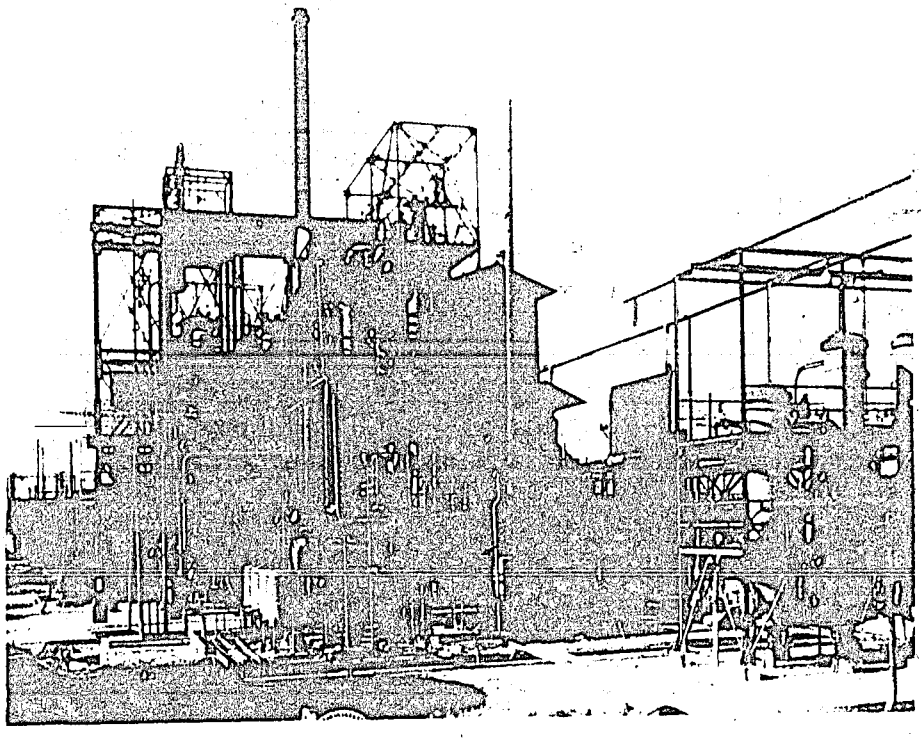


Figure 5(F)

CATALYTIC CRACKING PILOT PLANT

(Twenty-five barrels per day charge capacity)

Figure 6(F)

REACTION CHAMBERS, HEAT EXCHANGERS AND GAS SEPARATORS
OF THE 200 ATMOSPHERE COAL HYDROGENATION PILOT PLANT

ENCLOSURE (F)

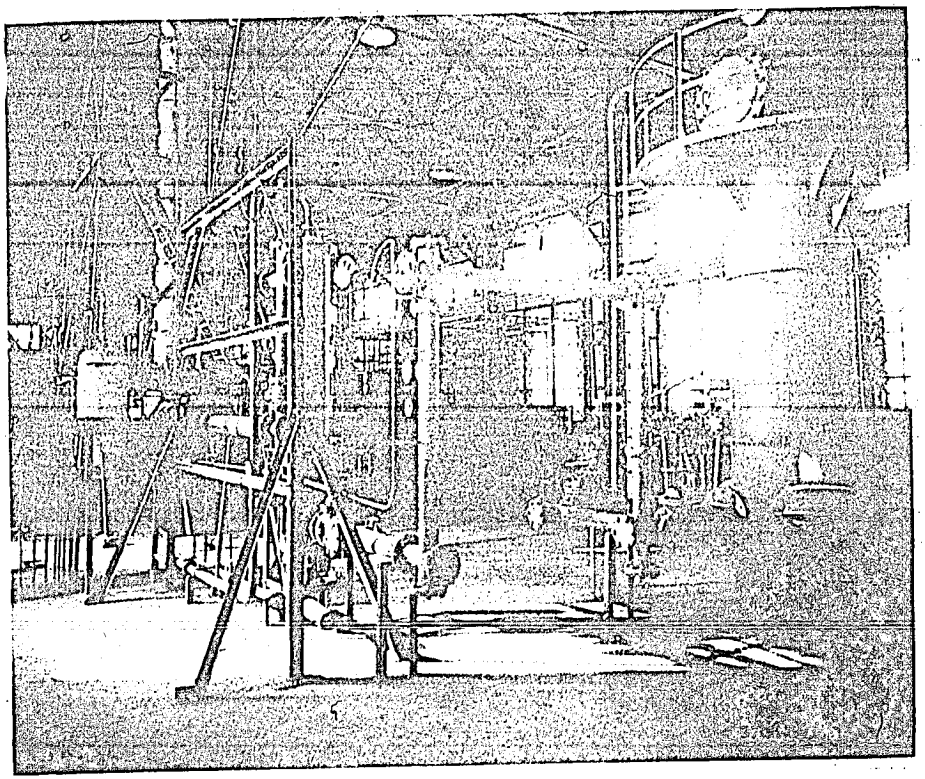


Figure 7(F)

PILOT PLANT APPARATUS FOR MANUFACTURE OF ACETYLENE
BY THE ELECTRIC-ARC CRACKING OF METHANE

ENCLOSURE (F)

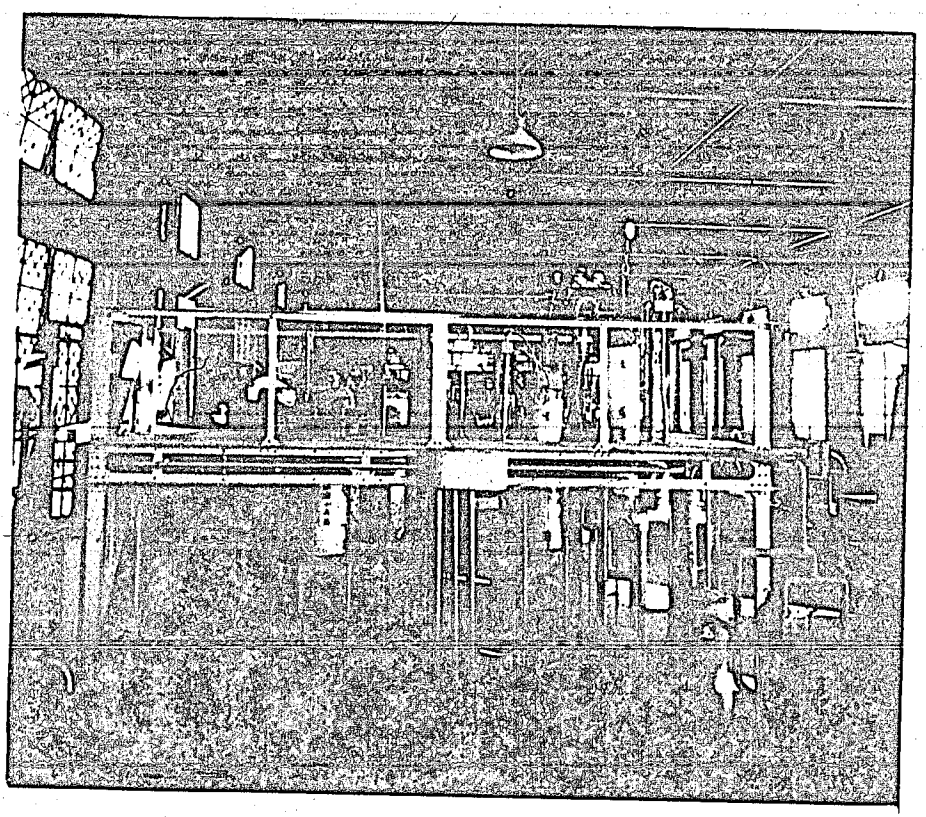


Figure 8(F)

PILOT PLANT FOR STUDYING THE EXTRACTION OF COAL WITH BASIC OIL FROM SHALE

ENCLOSURE (F)

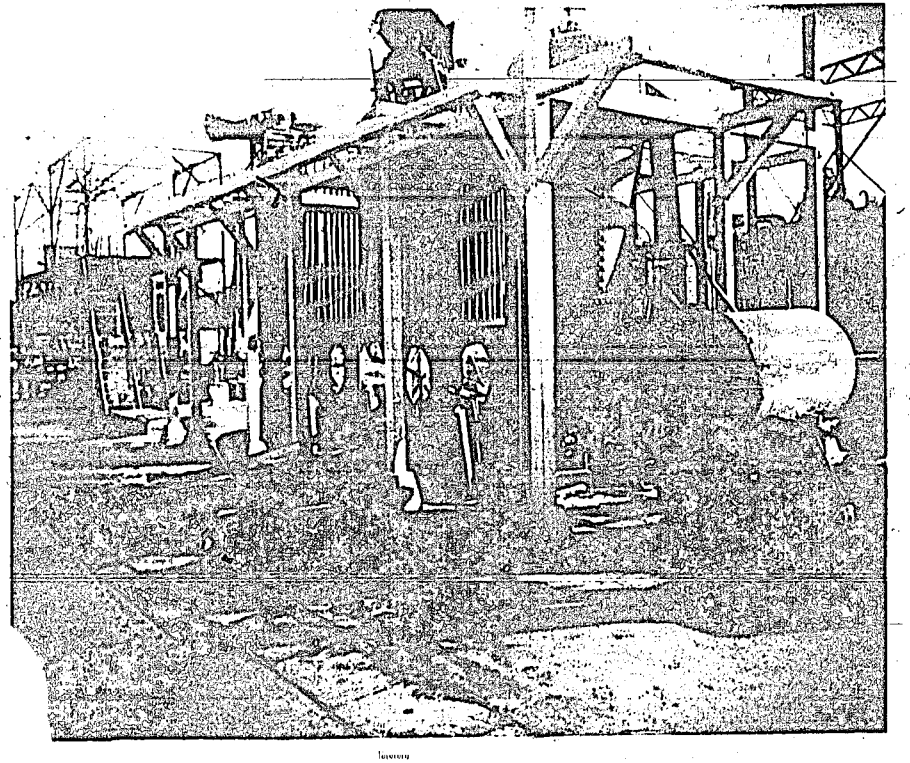


Figure 9(F)
PILOT PLANT FOR HYDROLYSIS OF WOOD
(Twelve kilograms of wood per day capacity)

ENCLOSURE (F)

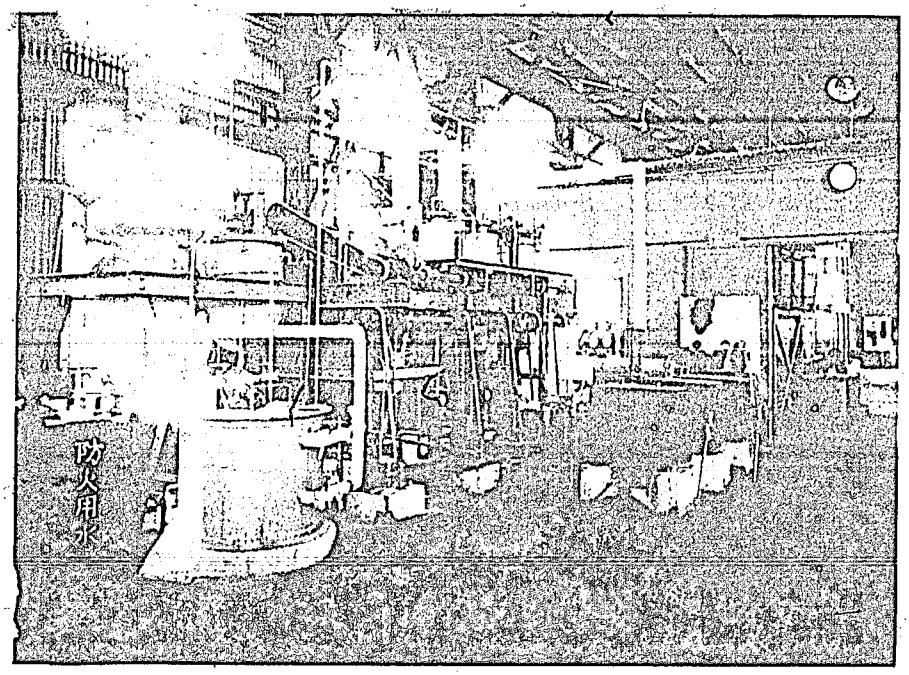


Figure 10(F)
ACETONE-BENZOL DEWAXING PILOT PLANT
(Fifty liters of oil per day charge capacity)

ENCLOSURE (F)

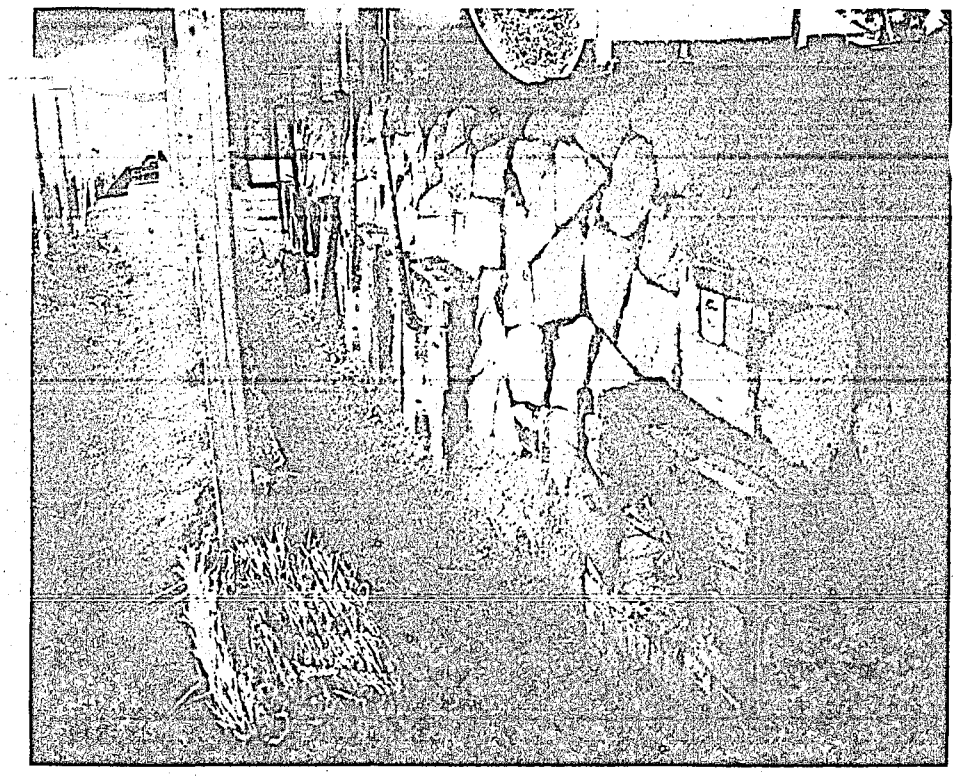


Figure 11(F)

PINE ROOT CARBONIZATION RETORTS DESIGNED FOR RURAL INSTALLATION

Figure 12(F)

SIMPLIFIED PINE ROOT OIL CATALYTIC REFORMING UNIT
DESIGNED FOR RURAL INSTALLATION

ENCLOSURE (F)

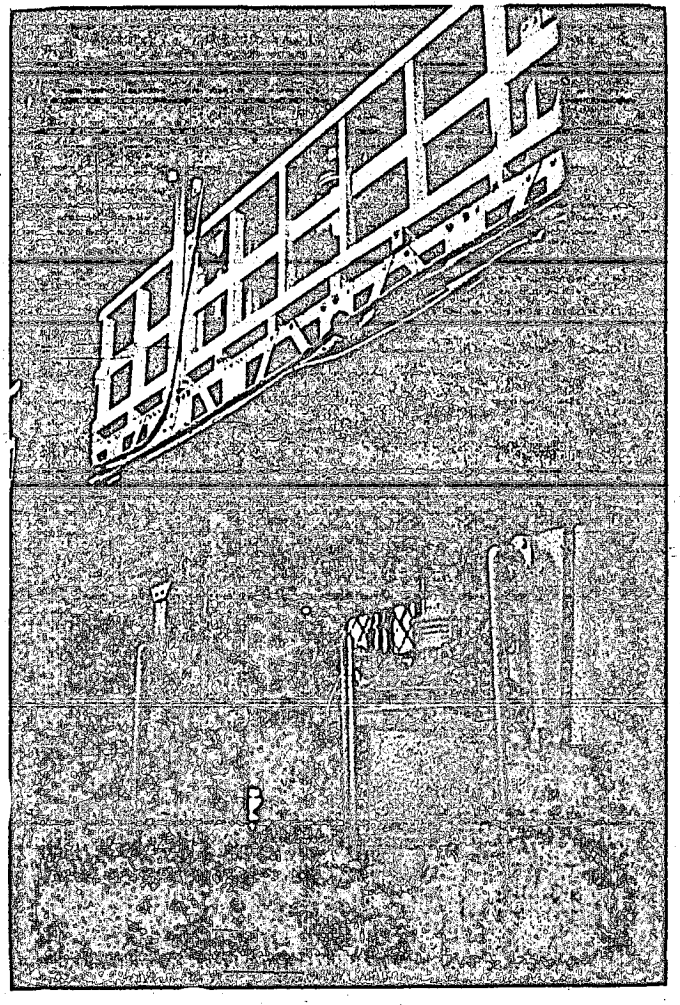


Figure 13(F)

VACUUM DISTILLATION COLUMNS
FOR PREPARATION OF 80% HYDROGEN-PEROXIDE

ENCLOSURE (F)

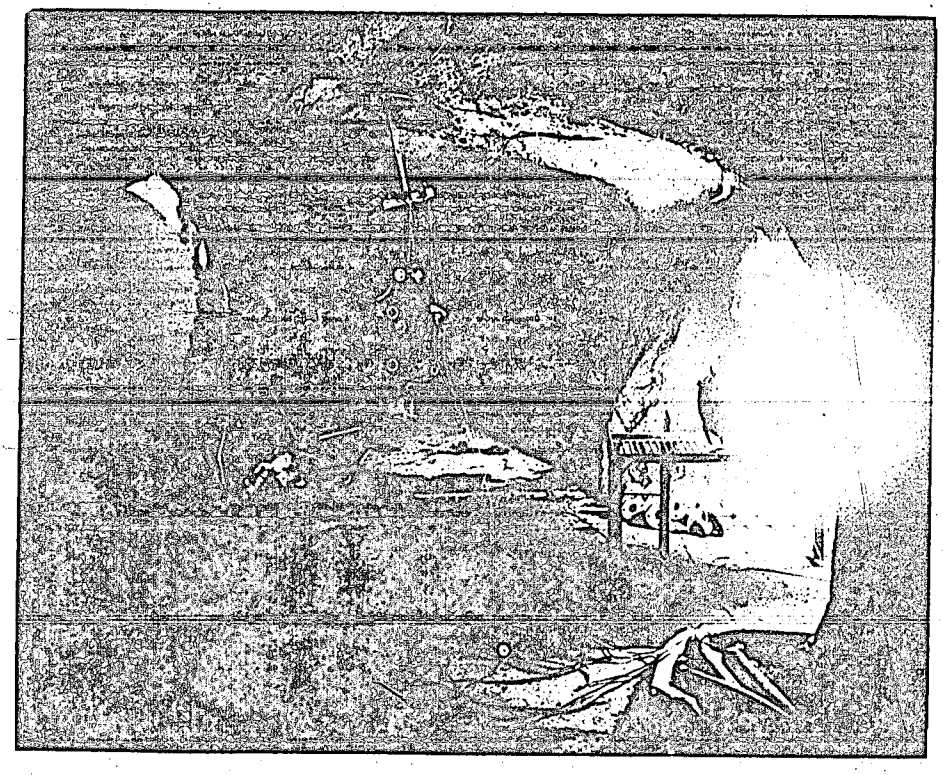


Figure 14(F)

UNDERGROUND TIN-LINED TANKS
FOR STORAGE OF 80% HYDROGEN-PEROXIDE

ENCLOSURE (F)

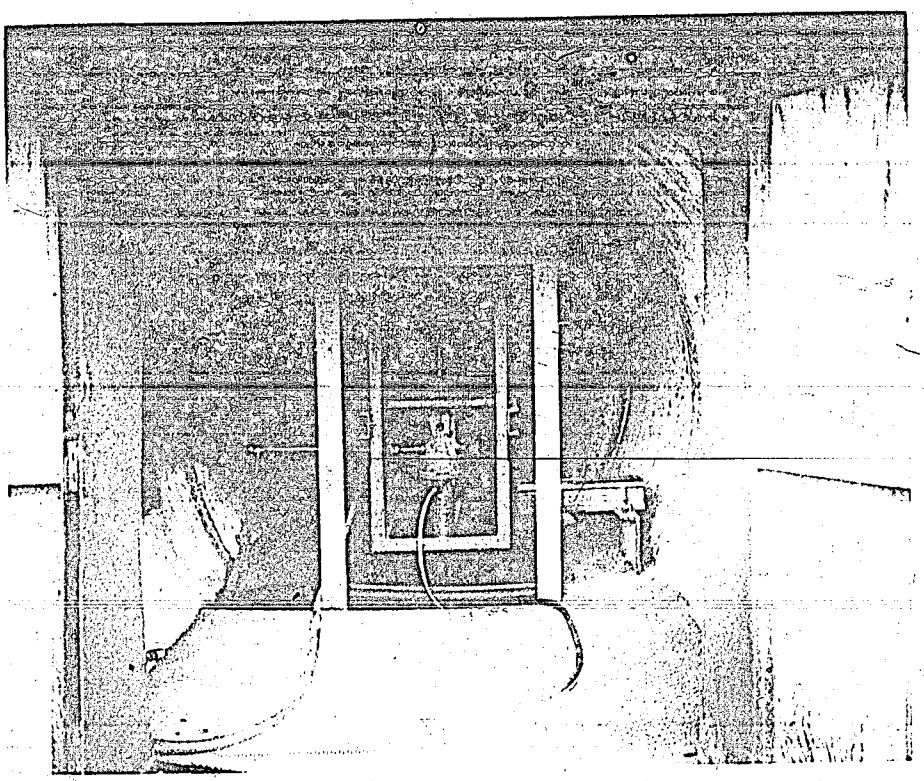


Figure 15(F)

EXPERIMENTAL APPARATUS FOR STUDYING THE COMBUSTION OF HYDROGEN-PEROXIDE AND HYDRAZINE TYPE ROCKET FUELS

ENCLOSURE (F)

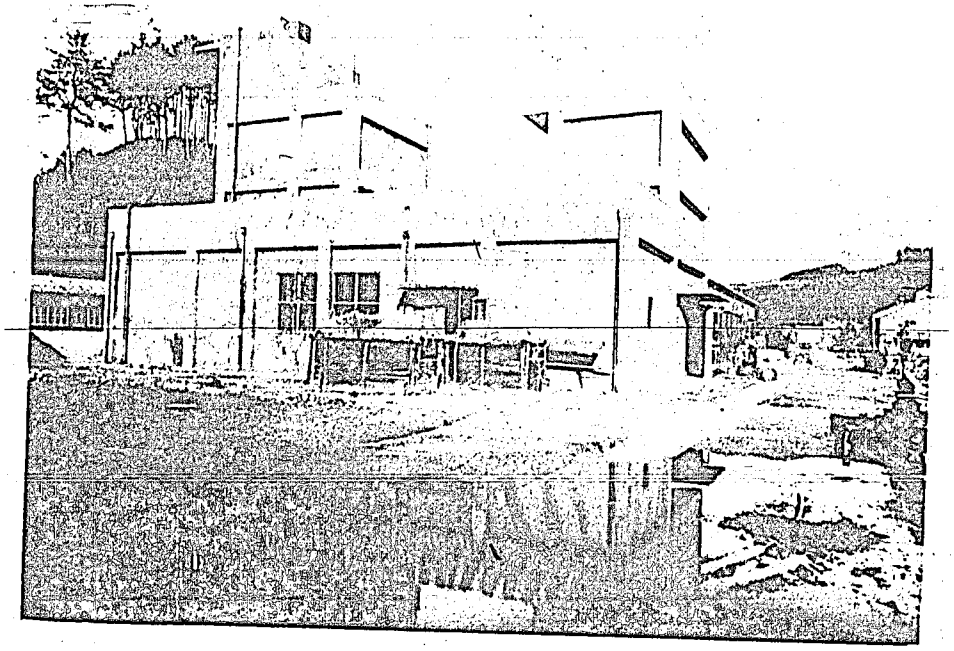


Figure 16(F)

FULL-SCALE AIRCRAFT ENGINE FUEL TEST CELL

ENCLOSURE (F)

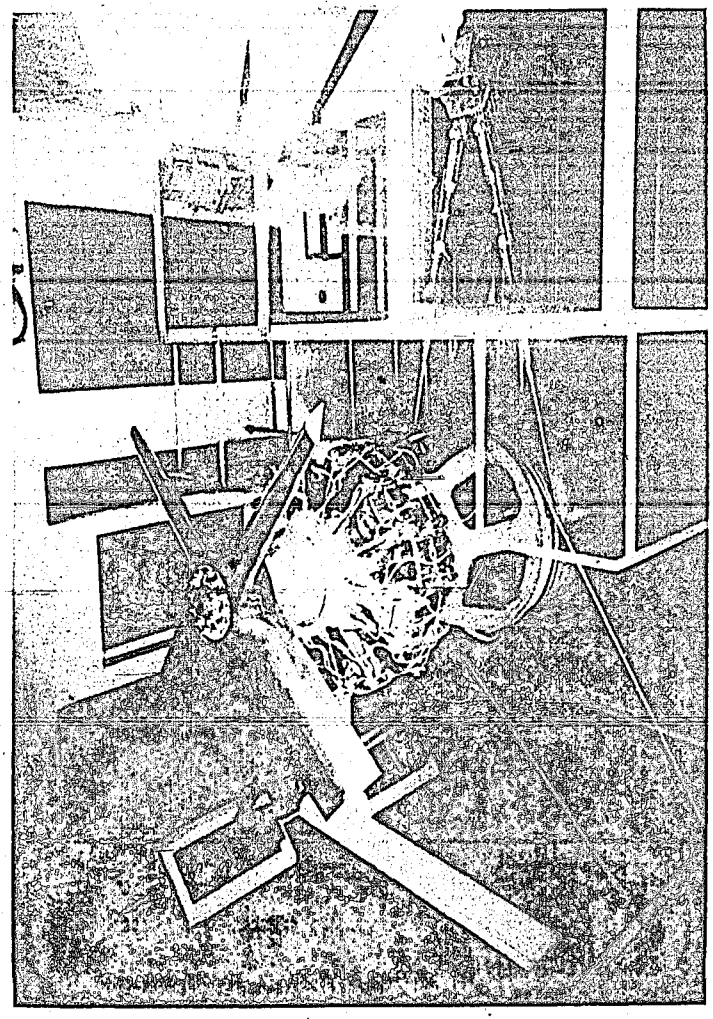


Figure 17(F)
FULL-SCALE AIRCRAFT ENGINE TEST STAND

ENCLOSURE (F)

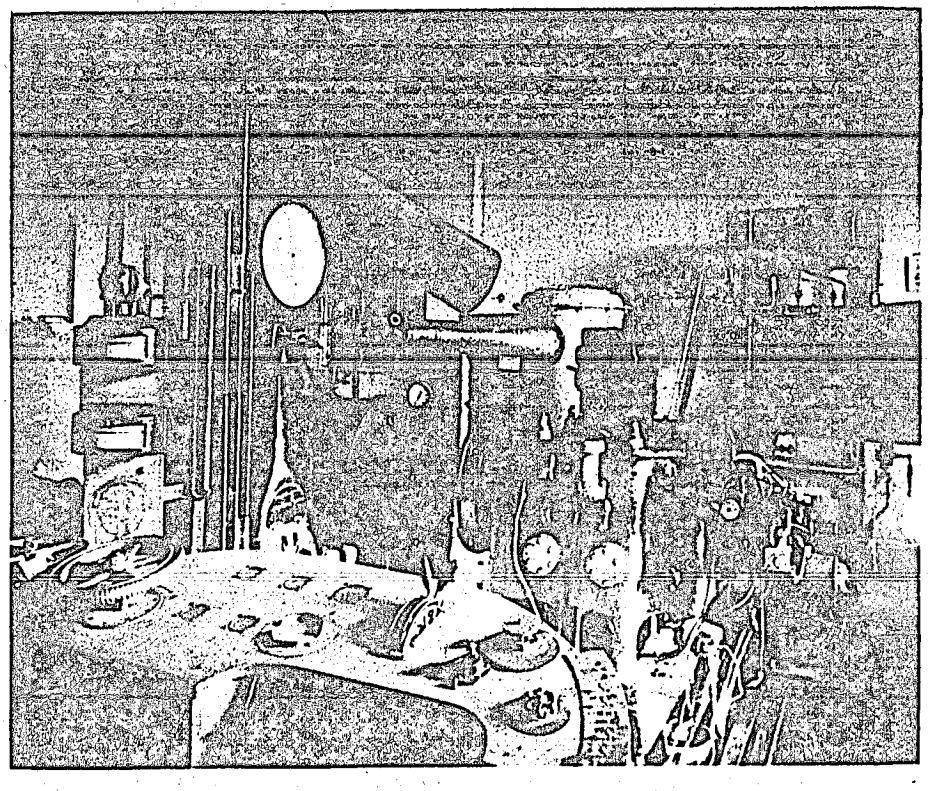


Figure 18(F)

"KINSEI-4" TYPE SINGLE-CYLINDER, VARIABLE COMPRESSION, COUNTER-BALANCED, AIRCRAFT TEST ENGINE

ENCLOSURE (F)

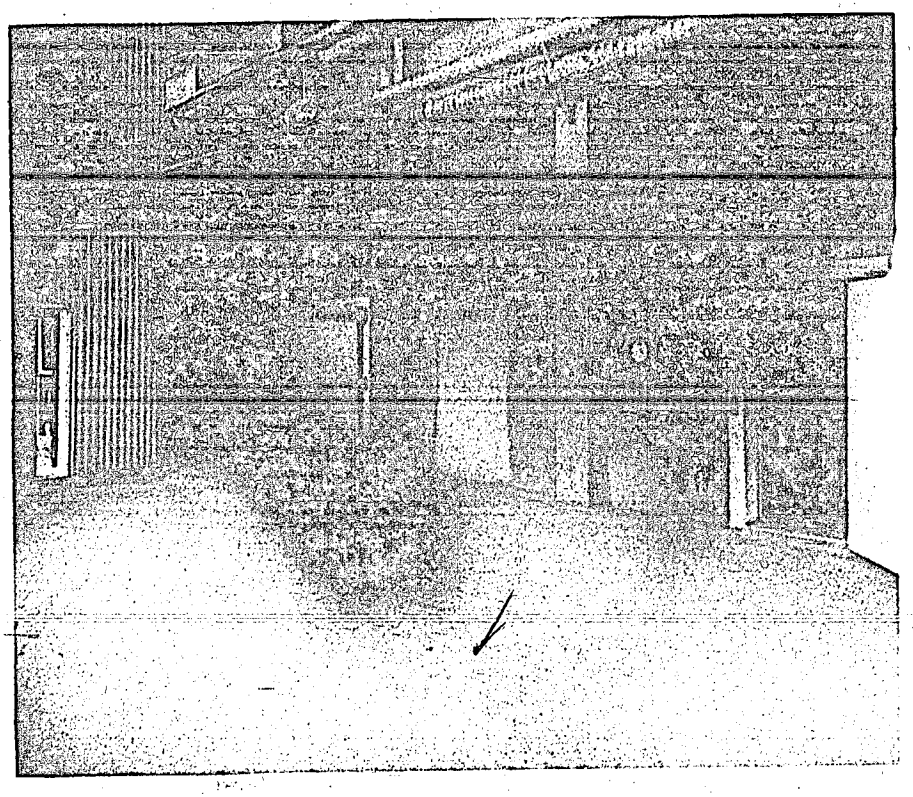


Figure 19(F)

ENTRANCES TO LOW-TEMPERATURE LOW-PRESSURE COLD ROOMS FOR AIRCRAFT FUEL AND LUBRICANT RESEARCH

ENCLOSURE (F)

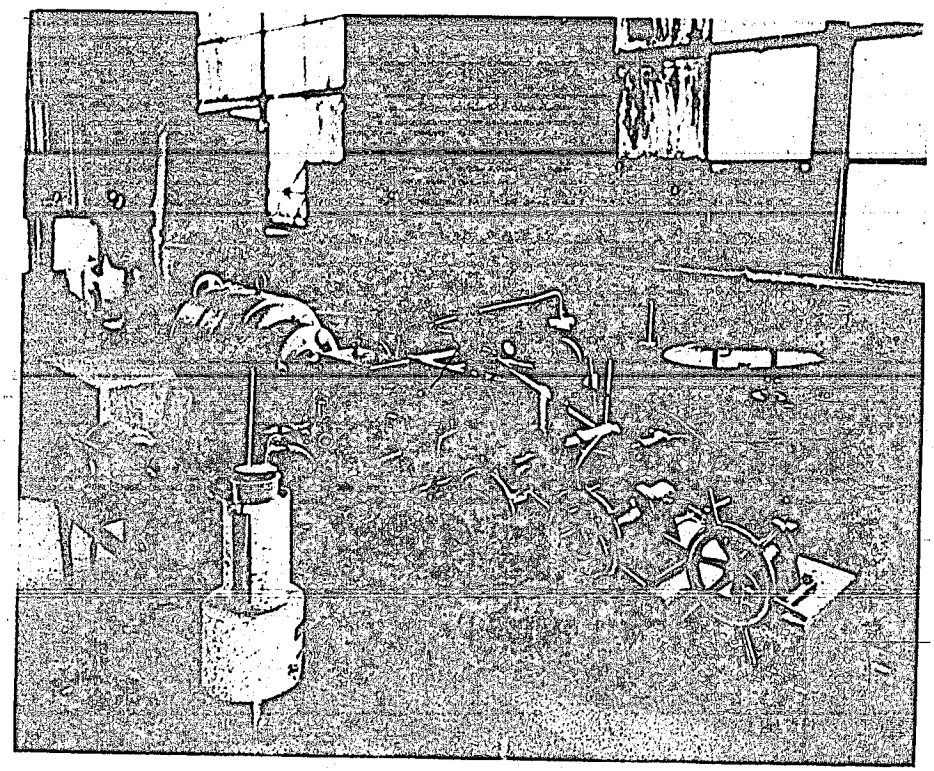
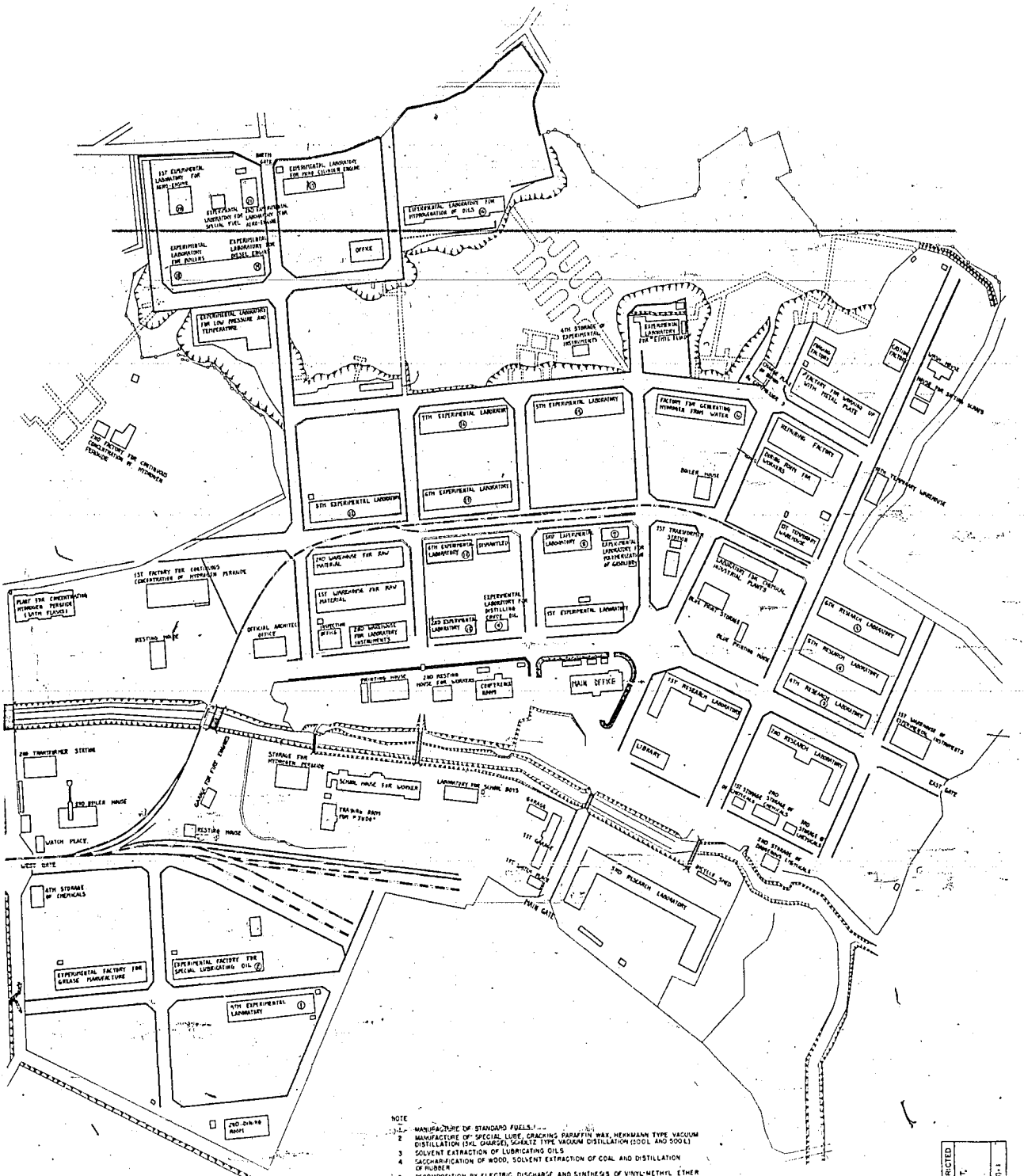


Figure 20(F)

MACHINE FOR TESTING THE OILINESS CHARACTERISTICS OF LUBRICANTS



NOTE

1. MANUFACTURE OF STANDARD FUELS.
2. MANUFACTURE OF SPECIAL LUBE, CRACKING PARAFFIN WAX, HERRMANN TYPE VACUUM DISTILLATION (5KL CHARGE), SCHULTZ TYPE VACUUM DISTILLATION (500L AND 500L)
3. SOLVENT EXTRACTION OF LUBRICATING OILS
4. SACCHARIFICATION OF WOOD, SOLVENT EXTRACTION OF COAL AND DISTILLATION OF RUBBER
5. DECOMPOSITION BY ELECTRIC DISCHARGE AND SYNTHESIS OF VINYL-METHYL ETHER
6. WATER ELECTROLYSIS PLANT (20CM³ HYDROGEN PER HOUR)
7. POLYMERIZATION OF GASOLINE
8. SMALL CATALYTIC CRACKING PILOT PLANT
9. CRUDE OIL DISTILLATION UNIT
10. SO₂ EXTRACTION
11. MANUFACTURE OF LUBRICATING OILS
12. MANUFACTURE OF CATALYSTS, HIGH-PRESSURE HYDROGENATION AUTOCLAVES
13. HYDRATION OF ACETYLENE
14. SYNTHESIS OF AVIATION GASOLINE BY ISOMERIZATION AND ALKYLATION
15. CATALYTIC AND THERMAL CRACKING PILOT PLANT
16. SEMI-COMMERCIAL PLANT FOR LIQUEFACTION OF COAL (60 KL/M)
17. COMBUSTION RESEARCH UNDER HIGH PRESSURE, LUBRICANT TESTING ENGINE
18. KAMPON TYPE BOILER
19. 31 TYPE MONO-CYLINDER DIESEL ENGINE AND 91 TYPE HIGH-SPEED MONO-CYLINDER DIESEL ENGINE.
20. AIRCRAFT ENGINE TEST STAND (FULL SCALE)
21. TESTING ROCKET FUELS.

U.S. NAVAL TECHNICAL MISSION TO JAPAN	RESTRICTED	
LAYOUT MAP — 101 NAVAL FUEL DEPOT, OFUNA		
29 Nov 1945	PLATE I	X-38(N)-1

ENCLOSURE (F)

APPENDIX (II)

ORGANIZATION CHART OF THE FIRST NAVAL FUEL DEPOT

15 August, 1945

SUPERINTENDENT
Vice Adm. YAMAGUCHI

DEPARTMENT OF GENERAL AFFAIRS

DEPARTMENT OF FUEL RESEARCH
Capt. SASAKI
Advisor, Dr. KOMATSU

Section 1 - ROUTINE WORK
Eng. Lt. Comdr. MOMOTARI

Engineering Officers	11
Technicians	1
Workers	45

Section 2 - COAL AND DRY DISTILLATION
Eng. Comdr. FUJIMOTO

Engineering Officers	4
Technicians	0
Workers	15

Section 3 - DIESEL AND BUNKER OIL
Eng. ITAKURA

Engineering Officers	2
Technicians	1
Workers	37

Section 4 - CRACKING AND PINE ROOT OIL
Eng. Comdr. FUJIMOTO

Engineering Officers	16
Technicians	10
Workers	99

Section 5 - HYDROGENATION
Eng. Lt. Comdr. YAMAMOTO

Engineering Officers	15
Technicians	2
Workers	72

Section 6 - BLENDING GASOLINE
Eng. Lt. Comdr. YAMAMOTO

Engineering Officers	6
Technicians	0
Workers	56

Section 7 - FERMENTATION
Eng. Lt. Comdr. UMEMURA

Engineering Officers	8
Technicians	1
Workers	44

Section 8 - LUBRICANTS
Eng. MATSUO

Engineering Officers	6
Technicians	2
Workers	44

DEPARTMENT OF FUEL RESEARCH (continued)	Section 9 - DOPES Eng. Lt. Comdr. WAKANA Engineering Officers Technicians Workers	 2 0 23
	Section 10 - GREASES Eng. Lt. Comdr. DANN Engineering Officers Technicians Workers	 3 0 7
	Section of EXPERIMENTAL MANUFACTURE Eng. MATSUO Engineering Officers Technicians Workers	 6 5 203
	Section of INSPECTION AND PLANNING Eng. Capt. KAGEHIRA Engineering Officers Technicians Workers	 3 3 38
	Section of GENERAL AFFAIRS Lt. Comdr. UEMATSU Engineering Officers Technicians Workers	 6 1 46
DEPARTMENT OF PROCESS ENGINEERING Capt. MIYAZAWA	Section 1 - DESIGN Eng. SHIBASAKI Engineering Officers Technicians Workers	 7 5 128
	Section 2 - PROCESS ENGINEERING Eng. Lt. Comdr. SANKA Engineering Officers Technicians Workers	 15 1 55
	Section 3 - MATERIALS Comdr. KATABUCHI Engineering Officers Technicians Workers	 6 1 24
	Section 4 - REPAIRING Eng. SHIBASAKI Engineering Officers Technicians Workers	 4 5 207
	Section of CONCENTRATION OF H_2O_2 Eng. Lt. Comdr. YAMAMOTO Engineering Officers Technicians Workers	 15 2 121

ENCLOSURE (F)

DEPARTMENT OF PROCESS ENGINEERING (continued)	Section of GENERAL AFFAIRS Comdr. KATABUCHI Engineering Officers 4 Technicians 2 Workers 27
DEPARTMENT OF FUEL EXPERIMENT Capt. SASAKI	Section 1 - AVIATION GASOLINE Eng. Comdr. NAKATA Engineering Officers 8 Technicians 1 Workers 63
	Section 2 - DIESEL FUEL Capt. NORITAKE Engineering Officers 2 Technicians 0 Workers 18
	Section 3 - LUBRICATION Eng. Lieut. FUJIMOTO Engineering Officers 2 Technicians 1 Workers 18
	Section 4 - SAMPLING Eng. Lieut. SONODA Engineering Officers 4 Technicians 4 Workers 52
	Section of GENERAL AFFAIRS Capt. NORITAKE Engineering Officers 1 Technicians 1 Workers 33
DEPARTMENT OF FINANCE	
DEPARTMENT OF MEDICINE	

ENCLOSURE (F)

APPENDIX (III)

JAPANESE PATENTS HELD BY THE FIRST NAVAL FUEL DEPOT

Patent No.	Date	Subject
No. 43758	21 Oct. 1922	A manufacturing method of liquid fuel from coal.
No. 65661	10 Sept. 1925	A method for transforming fatty oils to petroleum oil and the simultaneous dry distillation of shale rock.
No. 68856	8 July 1926	Improvement of the method for the dry distillation of shale rock.
No. 70770	21 Jan. 1926	A method of manufacturing naphthalene which contains no sulphur.
No. 70804	24 Jan. 1926	A dehydration method for oils.
No. 73117	26 Aug. 1926	A method of manufacturing transformer oil, having a high flash point and low viscosity.
No. 79898	18 Jan. 1928	A method for refining petroleum pitch.
No. 80842	7 Mar. 1928	A method for the liquefaction of coal.
No. 80928	13 Mar. 1928	A method of manufacturing paints for ships' bottoms.
No. 82025	5 June 1928	A method of denaturing ethyl alcohol.
No. 82580	16 July 1928	A method of manufacturing hydrogen and carbon monoxide from methane.
No. 83198	11 Sept. 1928	A method of improving the properties of lubricating oils.
No. 88565	2 Oct. 1930	A method for the dry distillation of coal.
No. 88905	28 Dec. 1930	A method of preparation for some important liquids from coal tar and mineral oil.
No. 95140	24 Mar. 1932	A method of manufacturing hydrogen from hydrocarbons.
No. 96461	29 June 1932	Preparation of useful liquids from coal.
No. 96772	29 July 1932	Preparation of some important liquid hydrocarbons from coal tars, pitch, asphalt, bitumen, etc.
No. 97032	23 Aug. 1932	Recovering of oil from waste liquid containing oil.
No. 97569	30 Sept. 1932	Washing of coal.
No. 97962	26 Oct. 1932	High pressure charge pump.
No. 98957	9 Jan. 1933	Decomposition of gaseous hydrocarbons.
No. 99729	23 Feb. 1933	Improved centrifuge.

ENCLOSURE (F)

Patent No.	Date	Subject
No. 101999	17 July 1933	Decomposition of tar in the complete gasification of coal.
No. 103427	27 Oct. 1933	Complete gasification of coal.
No. 103921	30 Nov. 1933	High Pressure stop valve.
No. 105588	2 Apr. 1934	Decomposition of carbon dioxide and gaseous hydrocarbons.
No. 109263	24 Oct. 1934	Synthesis of aromatic hydrocarbons such as benzene and toluene from acetylene.
No. 109413	2 Nov. 1934	Method of separating acetylene gas.
No. 109412	5 Nov. 1934	Preparation of formaline and formic acid from methane.
No. 108434	12 Nov. 1934	Preparation of raw material for synthetic rubber containing isoprene and compounds similar to isoprene.
No. 110026	29 Mar. 1935	Method of producing bunker oil containing coal.
No. 110728	13 May 1935	Synthesis of diformic-peroxide hydrate from methane.
No. 111614	19 July 1935	Production of bunker fuel containing coal.
No. 113705	12 Dec. 1935	Automatic pressure reducing pump.
No. 120618	7 June 1937	Synthesis of peroxides from higher hydrocarbons.
No. 122099	7 Oct. 1937	Aviation gasoline from coal tar.
No. 122579	4 Nov. 1937	Production of bunker fuel containing coal.
No. 125244	6 June 1938	Method of improving the cetane number of diesel fuels.
No. 127201	7 Nov. 1938	Synthesis of aromatic hydrocarbons from acetylene.
No. 128995	27 Feb. 1939	Fractionating column for hydrocarbon gases.
No. 128813	15 Feb. 1939	Production of ashless coal.
No. 129493	29 Mar. 1939	Electric discharge tube.
No. 137461	18 July 1940	Total gasification of coal.
No. 134770	13 Feb. 1940	Fractionating column for acetylene.
No. 134649	8 Feb. 1940	Production of diesel oil from oils, waxes, and fatty acids.
No. 165732	26 July 1944	Acetylene separator.
No. 155090	23 Feb. 1943	Method of gas separation.

ENCLOSURE (F)

Patent No.	Date	Subject
No. 155714	30 Mar. 1943	Separating apparatus for removing traces of acetylene from gases.
No. 141116	20 Jan. 1941	Fractionating column for hydrocarbon gas separation.
No. 149983	14 Apr. 1942	Liquefaction of coal by solvent extraction.
No. 154802	29 Jan. 1943	Liquefaction of coal by solvent extraction.
No. 157155	19 June 1943	n-Hydrocarbons from aliphatic ketones.
No. 166282	10 Aug. 1944	Solvent extraction of coal.
No. 149984	14 Apr. 1942	Method of distillation for heavy oil.
No. 153748	16 Nov. 1942	Separation of unsaturated hydrocarbons from cracked oils.
No. 148223	13 Feb. 1942	Continuous distillation of crotonaldehyde.
No. 143892	3 June 1941	Synthesis of lubricants for aeroplanes and automobiles.
No. 146652	17 Nov. 1941	Method of improving lubricating oils.
No. 160368	26 Nov. 1943	Synthesis of high grade lubricants.
No. 143893	3 June 1941	Treating method of oil sludge.
No. 144363	5 July 1941	Method of improving diesel oils.
No. 146053	10 Oct. 1941	Treating method of oil sludge.
No. 157156	19 June 1943	Production of coal binding material from asphalts.
No. 164862	14 July 1944	Method of separating carbonecous matter from heavy bituminous oil.
No. 139913	20 Nov. 1940	Synthesis of alcohols from unsaturated hydrocarbons.
No. 140032	27 Nov. 1940	Synthesis of higher alcohols from unsaturated hydrocarbons.
No. 140581	18 Dec. 1940	Synthesis of alcohols from unsaturated hydrocarbons.
No. 144180	21 June 1941	Apparatus for producing acetaldehyde from acetylene.
No. 149231	16 Mar. 1942	Acetaldehyde from acetylene.
No. 150950	4 June 1942	Acetaldehyde from acetylene.
No. 138948	5 Oct. 1940	Method of producing low pour point castor oil.
No. 157900	23 July 1943	Synthesis of pure a-methyl naphthalene.
No. 167502	13 Oct. 1944	Synthesis of ethyl chloride.

ENCLOSURE (F)

PATENTS WHICH HAVE BEEN USED COMMERCIALLY

Patent No.	Date	Subject
~~No. 118760~~	~~13 Jan. 1937~~	~~High-temperature-pressure terminal~~
No. 134650	8 Feb. 1940	Cetane from whale wax.
No. 129971	3 May 1939	Methods for hydrogenation of oils.
No. 168035	30 Oct. 1944	Synthesis of pour point depressants for lubricants.
No. 164476	15 June 1944	Method of treating oil sludge.
No. 166284	10 Aug. 1944	Synthesis of n-paraffin hydrocarbons from aliphatic ketones.