

ENCLOSURE (B) 23

UTILITY TEST OF AROMATIC FUELS
(AIRCRAFT ENGINE TESTS)

by

Eng. Captain T. KONDO and
Eng. Lt. Comdr. S. SOMA

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SUMMARY

Two kinds of aromatic fuel, "Benzex" and Solvent Naphtha produced in the First Naval Fuel Depot and sent to the First Naval Technical Depot for utility tests, contained a large amount of free carbon in the exhaust gas, contaminating the ignition plugs after few hours operation. Moreover, because of its heavy specific gravity, the fuel distribution to each cylinder of an aircooled radial engine was not satisfactory. The tests were suspended without detailed data.

I. INTRODUCTIONA. History of Project

In October, 1943, in order to obtain high octane number aviation gasoline, two samples of aromatic fuel were produced in the First Naval Fuel Depot and sent to the First Naval Technical Depot for utility tests which were discontinued in May 1944.

B. Key Research Personnel Working on Project

Eng. Captain T. KONDO; Eng. Lt. Comdr. S. SOMA.

II. DETAILED DESCRIPTIONA. Description of Test Apparatus

Homare 20 type (aircooled radial 18 cylinders with carburetor)
Kasai 20 type (aircooled radial 14 cylinders with solid injection)
Atsuta 30 type (watercooled inverted Vee type 12 cylinders with solid injection)

B. Test Procedures and Experimental Results

The two kinds of aromatic fuel, "Benzex" and Solvent Naphtha, 15% gasoline 85% toluene and xylene etc., produced in the First Naval Fuel Depot and sent to the First Naval Technical Depot had the following properties:

	"Benzex"	Solvent Naphtha
First drop	70°C	70°C
10% pt.	90°C	90°C
50% pt.	120°C	140°C
90% pt.	150°C	155°C
97% pt.	170°C	180°C
Vapour press	0.15 kg/cm ²	0.15 kg/cm ²
Leaded	0.1% Octane number (91)	0.1% Octane number (91)
Specific gravity	0.80	0.82

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An attempt was made, at first, to obtain performance curves of several engines with these fuels, on the performance test benches with Frond dynamometers. But operating conditions were very unsatisfactory, and investigations were discontinued. That is, fuel distribution to each cylinder in a radial engine, such as Homare 20 type, was not satisfactory because of heavy specific gravities and rather high 50% distillation temperatures of the fuels.

The tendency of irregular fuel distribution was great in high power operation because of the very rich mixture ratios, and before detailed data could be obtained, investigations were discontinued using Homare 20 type engine.

As the fuels had low volatility and were rather viscous, combustion conditions in the combustion chamber were unsatisfactory even when the fuels were applied to solid injection engines, such as Kasei 20 type and Atsuta 30 type. Moreover, as the exhaust gas of these fuels contained a large amount of free carbon, the ignition plugs of the solid injection engine were severely contaminated, and had to be renovated even after few hours operation.

Thus there was no prospect of using these fuels in solid injection engines and the investigation was discontinued. Flight tests were of course not attempted.

III. CONCLUSIONS

Investigations on these aromatic fuels showed unsatisfactory results and were discontinued.