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Q.36

INSTRUCTIONS FOR THE INVESTIGATION OF FUELS WITH JENTZSCH'S TESTER FOR IGNITION QUALITY.

(D.R.P. 408,475). Undated publication (post 1936)

Ref. No. Q.36 Contents: 32 Text Pages

SUMMARY

The tester is described with a view to its use in warships. The apparatus is that described in Report No. 277 (Our Ref. I.34 q.v.).

The pamphlet gives a detailed explanation of the calculation of various properties of fuel oils which can be carried out in the Jentzsch's tester.

(1) Estimation of self-ignition point (Tu); the lower ignition temperature as described in I.34.

(2) Estimation of the Lower Ignition Value (Zu). This is calculated from the equation:

$$Zu = \frac{Tu}{b + 1}$$

where Tu = lower ignition temperature (°C.)

b = the lowest O_2 flow rate at which ignition occurs for the lower ignition temperature.

(3) Estimation of the Upper Ignition Value (Zo) is identical with the upper ignition temperature (To) with no O_2 flow, i.e., the air-ignition temperature.

(4) Estimation of the Ignition Index (Zu), as in I.34, this is calculated from the equation:

$$ZK = \frac{To - Tu}{b + 1}$$

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Q.31.

ANALYTICAL REPORT ON A CRUDE BENZINE SAMPLE.

Report No: P.5502.

Author: signed "Roth".

Date: 12/11/41.

Index No: Q.31.

Origin: Central Bureau for Mineral Oil, Berlin.

Contents: 1 sheet data.

The sheet contains data on a sample of crude benzine (Grundbenzin) taken from a tank ship.

On the back of the report are some written notes on the self-ignition temperature of coal-dust (dated 2/1/45).

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Q.23

ACCEPTANCE INSTRUCTIONS FOR INSPECTORS APPOINTED BY INDUSTRY.

Report No:

Author:

Date: 15/8/43.

Index No: Q-23.

Origin: Oppau.

Contents: 5 pages text.

The instructions refer to representatives of the contracting firm who have been empowered by the latter (in agreement with the Air Ministry) to examine and test their fuel deliveries.

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M.24.

ALKOXY - ALKYLCHLORIDES Etc.

Report No: Index No: M-24.

Author: file bears the name of Dr. Roth. Origin: I.G.

Contents:

Date: 1935 ? (on cover)

The folder contains a photostat of U.S. Patent 2,024,749 (Preparation of Halogenated ethers) and a mass of handwritten experimental data of a very scrappy nature dealing with attempts to synthesize such ethers.

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X4.

KNOCKING BEHAVIOUR OF AN AMERICAN AVIATION SPIRIT.

Report No:

Index No. X4.

Author: Singer.

Origin: Oppau.

Date: 10/3/44.

Contents: 1 page data and 1 graph.

A report is made on knocking boundary curves and octane numbers of a sample of captured American aviation fuel (Br.3666) measured by the Oppau method.

Comparisons are made with German aviation spirits B4, C3 and C2.

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X.10

TESTS ON TWO CREAM COLOURED LACQUERS FOR PROTECTION AGAINST TETRA ETHYL LEAD.

Report No: Index No. X.10.

Author: Origin: I.G. Ludwigshafen.

Date: March 1944. Contents: Two typed letters.

Two samples of lacquered sheet-metal ('Desmophen' with 'Desmodur and 'Plastopal AT') were examined for behaviour towards concentrated ethyl fluid. After 24 hours, both samples remained unaltered, being merely coloured blue in places by the drying up of the ethyl fluid. The dye could be easily removed from the "Desmophen-Desmodur" lacquer with trichlorethylene or similar solvents, but its complete removal from the "Plastopal AT" was not possible.

The lacquers were intended for fuel-mixing apparatus. Three other samples were sent but do not seem to have been tested (Phenytal, Luphen H oxide-red, Luphen H black).

A synthetic insulating material for spark-plugs is also mentioned (Luphen H and mealed asbestos).

reel 105.

X.11.

REPORT ON THE EXAMINATION OF THE COMPOSITION & LUBRICATING BEHAVIOUR OF AN AMERICAN AERO-ENGINE OIL.

Report No:

Index No: X.11

Author: Glocker.

Origin: Kaiser Wilhelm Institute for Metallurgical Research, Stuttgart.

Date: 22/3/44.

Contents: 2 pages typescript.

This report refers to the spectrographic examination of the oil from a Boeing bomber (presumably the same oil dealt with in X.13).

The spectrographic work was done by Dr. Pfeilsticker. Bromine lines were found in the spectrum of the residue from the oil left on standing. The percentage was estimated at about 1%. No phosphorus, sulphur or chlorine were found. The fat content of the oil was found to be about 1%. It was hence concluded that the markedly better performance of the oil compared with well-known German oils (including fatted "Aero-Shell-Mittel") was due to addition of a brominated fatty derivative. Oil from an Allison engine, under examination at the time also showed better behaviour than the German oils.

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X. 13.

COMPARISON OF A SAMPLE OF CAPTURED AMERICAN AERO ENGINE OIL WITH A GERMAN AERO ENGINE OIL.

Report No: Index No. X.13.

Author: Brocksiedt & Wellingen. Origin: Technical Highschod, Stuttgart.

Date: 20/3/44. Contents: 2 pages text & 1 sheet diagrams.

The experiments were made in connection with work on chemical additives to lubricating oils. The purpose of the additives is to allow increase in the permissible pressure between the surfaces in contact.

The two German Oils * came from the Daimler Benz firm, Untertürkheim, in a used state. The captured oil came from a four-engined Boeing bomber.

The following were the experimental conditions:-

Metals in contact:- piston alloy EC.124 & steel 60.11.
Rubbing speed: 1 metre/sec.
temp. of lub. oil: 120°C.
Length of run: 2 km. (corresponding to about ½ hr.)

When the coefficient of friction was plotted against pressure the American oil gave better results. The same was found to hold as regards wear and tear under the more severe conditions of test.

* SS - 1060 Oil. (84 hrs. in aero-engine)
"Rotring" Oil (100 " " " ")

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X. 15.

ENGINE TESTS USING AN ADDITIVE GIVING PROTECTION AGAINST CORROSION (Hö 1/136.)

Report No:-281-687/44. Index No: X.15.

Author: Seroka & Schum. Origin: E'Stelle Rechlin.

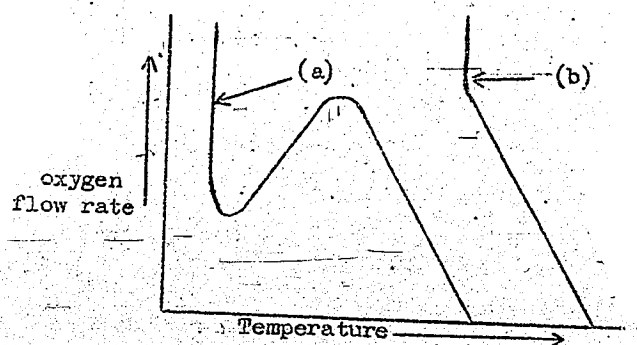
Date: 17/3/44. Contents: 4 pages text, 4 sheets of curves, 1 photograph.

The cyclohexylamine salt developed by I.G. as a protective against corrosion was submitted to engine tests. The octane number (C.F.R. engine, Oppau method) was not adversely affected. However, the rich-mixture test (DVL-Famo-Engine) showed that the additive caused a considerable falling off in rich-mixture behaviour, especially with C3 fuel, even with so small a quantity as 0.1%. A forty hour endurance run was made with a BMW 132 single-cylinder, as well as a final "ring-sticking" run of $8\frac{3}{4}$ hours, both under normal test conditions.

During the endurance run, the spark-plugs had to be changed several times. Deposit-formation was considerable and sticky deposits were found on the fuel and oil-filters as well as on the inlet-valve.. No influence on the ring-sticking time was found.

It was concluded that the compound was unsuitable for use in its present form and concentration (0.1% added to the fuel).

(5) The Ignition Curve. There are two characteristic curves:- (a) for aliphatic hydrocarbons (gasoline, gas oil, lubricating oil, brown coal tar oil, etc.), and (b) for aromatic hydrocarbons (benzene, toluene, bituminous coal tar oil, etc.), viz:-



(6) Ignition Delay. If, in the determination of Tu, ignition does not occur at a high oxygen flow rate within a given time interval (shown below), the flow rate is increased until ignition does occur within the prescribed time interval. The value of Tu is determined at this flow rate.

Time interval for good diesel oil @ 300°C/120 drops/min = 1-3 secs
" " " benzine " " " " " = 3 secs.

(7) Distillation Number (Sz) and Time/distillation curve. The Jentzsch tester is maintained at 300°C. (for gasolines) and the percentage of material which is evaporated over a given time interval (1½-2 min.) is determined. This percentage is called the Distillation Number. For heavier fuels appropriately higher temperatures and times are used.

(8) Duration of Evaporation (V) is the time in seconds for 0.2 grams of the material, maintained at 500°C. with occasional passage of air to evaporate. For good diesel oils V = 30 seconds: for good lubricating oils V = 80 seconds.

(9) Estimation of Carbon Residue. The sample is maintained at 500°C. in the tester for at least 2 minutes, when the residue is weighed.

(10) Estimation of the tendency of the fuel to choke filters and cause similar operational troubles is made from the quantity of residue left after vapourisation at 350°C.

(11) Comparison of the ignition quality and octane number for gasolines. It is claimed that there is a simple relationship between octane number and the Ignition Index (ZK) of iso-octane/n-heptane mixtures, giving a method for calculating octane numbers from Ignition Index, (but see Report 277, Our Ref. I.34).

(12) Comparison of ignition quality and cetane number - similar procedure as in (11).

(13) Quick method for testing fuel oils. It is suggested that the fuel should have the following properties:-

(a) Self ignition point = 250°-280°C.
(b) Lower ignition value = 10-6 (depending on engine speed).
(c) Time interval (see (b)) = up to 4 seconds.
(d) Residue at 350°C. = a trace.
(e) Residue at 500°C. = a trace.
(f) Duration of evaporation (at 500°) = up to 60 secs.
(g) Distillation number after 4 mins. at 500°C. = not below 33.

(14) Flash Point. Agreement between flash point determined in the Jentzsch tester and in the Pensky Martens apparatus is claimed.

(15) Fire Point.

(16) Determination of water in oil - agitation with calcium chloride.

(17) Examination of small drops of oil in cylinders, exhaust pipes, etc. to determine if the source is fuel oil or lubricating oil. Jentzsch has shown that if the supply of oxygen is passed sporadically over a drop of oil which has been heated above the self-ignition point, a characteristic difference between fuel oil and lubricating oil arises. Fuel oils can be brought to ignition about 3 times, whereas for lubricating oils 12-50 ignitions to a drop can be observed. If the number of ignitions is between 9 and 12, it is clear that the material consists of fuel oil with a considerable quantity of lubricating oil.

(18) Examination for specific substances. A weighed sample of the fuel is heated for 15 minutes, with an oxygen flow rate of 300 bubbles/min. at 120°C., 350°C., and 500°C. respectively. The weight of the sample after the first heating gives information on the moisture content; the second heating on gum content; and the third on other combustible materials. Examination of residue 3 should be made for asbestos-packing.

(19) Examination for fire-resisting materials by determining the Upper Ignition Index.

(20) Jentzsch's apparatus for measuring ignition pressure - an apparatus which can be connected to the ignition quality tester.

J.A.E.M.