FILM STUDY GROUP

SUBJECT INDEX AND REPORT

T.O.M. REEL NO. 95

Prepared by

STANDARD OIL COMPANY (INDIANA)

TECHNICAL OIL MISSION

MICROFILM REEL 95

SUBJECT INDEX

Prepared by Standard Oil Company (Indiana)

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Microfilm Reel 95
(Original Identification Reel 5G)

TECHNICAL OIL MISSION
U. S. BUREAU OF MINES

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Bag 3966
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Several unnumbered frames at the beginning of this reel list the documents on automotive research and engineering which include the material collected from F.K.F.S., Unterturkheim, ZWB reports from the Technical School at Stuttgart, diploma theses, reports on automotive research at the Technical College, Dresden, and miscellaneous reports.

The list of documents is reproduced a second time before the actual German material begins on Frame 1. The reports which are included in Reel 95 are those which are listed on page 7 (of the unnumbered frames) beginning with "SK5-22 High Command of the German Air Force..." and ending with "SN-2 Direct indicators..."

SK-5

Frame 1-16 Results of the evaluation of booty: Special report 22. Bearings of the British airplane engine Bristol "Hercules XI" by Dr. Perret and Engineer Endres. August 30, 1944

The bearings of a captured British Hercules XI Bristol engine were studied. The materials, mounting, and lubrication of bearings on crankshaft, transmission, pumps, accessories are discussed. Numerous drawings and photographs illustrate the report. This may be of interest to designers of aircraft engines, although it may also be a German description of an engine which has already been described in British publications.

SK-6

Frame 17-29 Production of valuable lubricating oils from domestic crude oils. By L. Ubbelohde. March 1, 1937

An assignment was made to produce good lubricating oils - particularly motor oils - from domestic crudes by means of treatment with selective solvents. Two typical German oils distillation residues from topped Menhagen and Wietz crude petroleums, were available.

The first task was the construction of apparatus in which the resids could be deasphalted with propane. This apparatus was a pressure vessel constructed to withstand 30 atmospheres. A stirring device, belt-driven by a motor, was disposed in the pressure vessel. At the top of the vessel was an inlet connection for the oil and one for propane, as well as safety and release valves; below, at the lowest point and a little higher on the side, draw-off valves were located.

The asphalt which had been propane-precipitated was filtered in a pressure filter.

The deasphalted oil, which still contained propane, was collected in a steel bomb from which the propane could be distilled back into the pressure vessel.

A description is given of the apparatus which was used for distilling the lubricating oil fractions. It comprised a vacuum still in which distillation would occur at about 480°C under 5-7 mm pressure.

In treating these distillates with selective solvents, 1 liter of oil was shaken with 1 liter of solvent in a separatory funnel, at room temperature. When two layers had formed upon standing, the lower layer - the extract - was drawn off. The solvent is distilled from the extract and also from the raffinate. The raffinate was treated with 3% H_2SO_4 and 2% bleaching earth. Physical constants of the raffinate were determined.

When furfurol was used as the solvent, the raffinate and the extract separated readily at room temperature. With repeated treatment, the color of the raffinate became brighter and its stability to aging improved.

Viscosity pole height was scarcely improved by repeated treatment.

For the German oils which were studied, furfurol was decidedly superior as a solvent to nitrobenzol; chlorex could also be used, and several other solvents were tested.

Schematic drawings of the propane apparatus, the distillation assembly, and the extraction equipment are given. Frames 28 and 29 consist of tables which report the results from treating the two stocks.

SK-7

Frame 30-59 The influence of air pressure upon fuel testing in the Ignition Prover. Report by the Navy Chemical Physical Testing Laboratory. (Undated)

When laboratories at different locations tested motor fuels, they found disagreement, not only between laboratory and road values, but also between the laboratory values obtained by different testing groups.

The high values obtained at Stuttgart were of interest, since the average barometric pressure there was 725 mm Hg. Accordingly, experiments were made to ascertain numerically the relationships between conditions of surrounding atmosphere and ignition values of fuels.

The following possible sources of error were excluded: 1. Dependence of bubble size upon jet position; 2. Dependence of bubble size upon bubbling speed; 3. Dependence of oxygen density upon temperature in the bubble counter; 4. Dependence of temperature indicator upon room temperature.

Results of preliminary tests showed such close connection between ignition behavior and barometric pressure that more intensive tests were made. In order to avoid contamination of the air space by combustion fumes and fuel vapors, the tests were made in different geographic locations at varying elevations, namely, Kiel, Braunlage, Brocken and Riffebriez. Values obtained in the tests are summarized in Tables 3 and 4.

Perceptible effects were noted in all constants determinable in the ignition tester. A series of curves and tables represent: 1. Calibration curve for bubble counter of the ignition tester at speeds from 0-300 bubbles per minute; 2. Table for determining the reduction factor for converting bubble size to 20° and dryness; 3. Ignition values of spark ignition fuels; 4. Ignition values of diesel engine fuels; 5. Influence of air pressure on the self-ignition curve of a spark ignition fuel; 6. Influence of air pressure on the self-ignition curve of a diesel spark fuel; 7 and 8. Position of lower oxygen bubble number of diesel and spark ignition fuels, dependent on atmospheric pressure; 9. Oxygen requirement in the origin of the curve, dependent on atmospheric pressure; 10. Lower ignition value of diesel and spark ignition fuels, dependent on atmospheric pressure; 12. Ignition train of diesel and gasified motor fuel, dependent on pressure; 13. Time - boiling curves, dependent on pressure; 14. Comparative ignition value indexes, dependent on pressure. Some of these curves have been reproduced twice.

SK-8

Frame 60-100 Fundamental principles of temperature measurements and their defects.

This is a 30 page pamphlet, not dated, and showing no indication of author or source. The divisions of the material are: I. Fundamentals of temperature measurement, the thermometer as a foreign body in the temperature field, retardation of indicator and half-time value, temperature scales, conversion from one scale to another, tolerances and errors; II. Mechanical contact thermometers; liquid, gas, mercury, construction and accuracy; vapor pressure thermometers, contact thermometers, resistance thermometers, thermocouples; IV. Construction of temperature measuring instruments and measurement of temperatures in solid bodies, at the surface of solids surrounded by gas, in liquids, gases and vapors. V. Calibration and testing of contact thermometers. VI. Radiation thermometers. VII. Special methods of temperature measurement - Seger cones, etc. VIII. Bibliography (frames 96-100).

SK-9

Frame 101-116 Improving the cold starting performance and winter efficiency of motor vehicles. July 31, 1942

The general specifications for cold starting of an engine are drawn up for an outdoor temperature of -15°C, however it was found that temperatures as low as -40°C were encountered on the Eastern Front, therefore emergency measures had to be devised. Among these were: 1. Warming the storage battery by means of a lamp when the vehicle was standing, and keeping the battery warm by shielding against wind through the use of suitable wrapping or covering; 2. Adjusting the starter motor to operate at the lowest temperature; 3. Dilution of the motor oil; 4. Facilitating mixture formation in gasifying engines; 5. Increasing the amount of fuel injected during the starting of diesel engines; 6. Warming the engine block and cylinder heads; 7. Starting with independent starting means; 8. Decreasing oil friction in drive shaft and rear axle; 9. Adjusting aggregates having different cold sensitivity, to temperatures down to -40°C.

Frame 107. Drawing of storage batteries provided with means for preheating; Frame 108. Drawing of heating lamp and clamps for attaching it to the battery; Frame 109. Photograph of heating the starting motor; Frames 110-112. Improvement of mixture formation; Frame 113. Injection into diesel engine.

Frame 118-227 Starting tests with road transport diesel engines. February 20, 1940.

These tests were made during the period from January 3 to February 2, 1940. Preliminary tests were made at the shops of the postal motor works, and the principal tests in the cold room of the Armored Troop School at Wunsdorf.

A detailed report is made describing the methods used to heat storage batteries, or to keep them warm, in cold weather, in order to facilitate starting in severely cold weather. The engines tested are listed, and a series of tables and charts reproduces the results.

The following conclusions were drawn from the results of the tests: Starting diesel engines in the cold, without auxiliary means, is impossible, and the use of unsuitedmeans may lead to serious damage. Certain methods cause undue wear on the driving mechanism; a strong battery may overload the starter motor. Various precautions and instructions are listed which should be observed in operating road transport diesel engines at low temperatures.

SK-16

Frame 293-295 FKFS rapid method for determining the lead content of aviation gasoline. B.O. Widmaier

The FKFS (Forschungsinstitut für Kraftfahrwesen und Fahrzeugmotoren, Stuttgart) method is based on an iodometric analysis, wherein the lead tetraethyl is converted into lead triethyl iodide and ethyl iodide. This is according to the reaction:

$$Pb(C_2H_5)_4 + 2I = Pb(C_2H_5)_3I + C_2H_5I.$$

The technique of making the determination is noted, and it is stated that such determinations can be made within 15 minutes.

Frame 295-299 An approximation method for the plane potential flow of a compressible fluid. By Wolfgang Grobner

Frame 300-307 Two articles on profilometers

Report 426

Frame 309-326 Ignition delay measurements with the FKFS ignition delay measuring apparatus. By Schuch. July 30, 1940

The possible methods for measuring ignition delay are noted, and a brief description is given of the FKFS device. This makes use of a photoelectric cell. Another method, which uses a piezo-electric indicator, gives higher values. A bibliography, 2 sheets of curves, and a drawing of the arrangement of the apparatus on an engine cylinder head, conclude the report.

Report 440

Frame 327-334 Reference fuel Z as secondary reference fuel for determining knock value. By Singer. Nov. 22, 1940

Under the designation "Reference Fuel Z", a highly knock-resistant paraffinic fuel is used for knock determination. It offers several advantages over pure benzol. The testing station at Oppau stated its intention to propose its general use in Germany as a secondary reference fuel.

Frame 228-252 Relations between lubrication and wear in lubricated sliding friction. By E. Heidebrock. 1944

The conditions which produce boundary friction and lubrication are discussed in the beginning of this report. A critique of the apparatus used in testing lubrication, friction and wear, describes the most commonly used apparatus, including Boerlage's Four-Ball machine, the Almen-Wieland apparatus, the chain device of the I.G. testing laboratory at Oppau, the abrasion rod of I.G., and the needle devices of PTR.

SK-12

Frame 253-260 Spherical piston KVP 0501 + 0505. (undated)

Brief descriptions are given, followed by schematic drawings of the piston rings for spherical pistons.

SK-13

Frame 261-273 List of reports received from the Rechlin, Travemunde and Peenemunde testing stations. March 18, 1941

SK-14

Frame 274-289 Measurement of wear in the BMW oil-testing engine. By Dr. Wenzel. Oct. 27, 1944

Attempts were made to ascertain the properties of various aviation oils which would prevent engine wear. Several series of tests were made on the BMW testing engines. These tests were limited to a determination of the loss in weight of the piston rings. 13 tables show the results of the experiments.

SK-15

Frame 290-293 Resistance properties of high strength, arc welded joints of steel. By Heinrich Cornelius and Franz Bollenrath. (Photocopy of "Luftfahrt-Forschung 20,6 (June 30,1943)

A study was made of the strength and other properties of arc welded steel, pictures show the microstructure of the steel at various stages of the tests.

Report 439

Frame 335-358 Comparative tests on knock engines (V.V.82) by Singer. Nov. 21, 1940

In an attempt to improve the precision of knock measurements, comparative tests were made using as secondary reference fuel mixtures of calibrated benzine and component Z. The method of testing, a list of the fuels studied, the cooperating laboratories and the results of the tests are shown. Seven tables give numeric results; six charts give graphic representation.

SL-4

Report 462

Frame 359-375 Semiannual comparative tests on knock engines (VV92) April 1941. By E. Singer May 29, 1941

Octane numbers were determined on four motor gasolines and four aviation gasolines; the motor gasolines were tested by the Research Method and the aviation gasolines by the Motor Method. The results of the tests are represented in 8 pages of tables and charts.

SL-5

Report 476

Frame 376-384 Comparative experiments on the I.G. diesel test motor 1941. By Kohler. Aug. 25, 1941

Four diesel fuels were examined by 12 testing stations, with results which were in satisfactory agreement with each other. Every I.G. Diesel test engine is carefully checked before delivery with regard to the accuracy of its measurements, and the results of the check are given in a protocol. The personnel of each testing station are schooled in the correct manipulation of the engine.

The fuels selected for testing were a brown coal middle oil, with a cetane number of about 25, a gas oil with cetane number of 45 and another gas oil with cetane number of 60, and a Ruhrchemie diesel oil with cetane number of 80.

Analytical data on these oils are shown, as well as the results of the tests.

SL-6

Report 480

Frame 385-405 Semiannual comparative tests on knock engines (VV95) October 1941. By E. Singer. Nov. 1, 1941

Experiments showed an increase in the number of participating test stations and an improvement in the accuracy of measurement. Tables and charts reproduce the results.

SL-7

Report 530

Frame 406-423 Semiannual comparative tests on knock engines, 10th series, October 1942. By E. Singer. Nov. 25, 1942

708 knock value determinations were made by 65 testing stations, using a total of 107 engines. These tests showed an average precision of about 0.6 (0.7) octane numbers, which is the same for both Motor and Research Methods. Ten sample fuels were tested, with octane numbers ranging from 60.7 to 89.6. Excellent agreement was obtained in the results from the different testing stations.

SL-8

Frame 424-444 Report on the conference of the cooperating group on knock testing, Nov. 25 and 26, 1941, in Oppau

A list of the representatives of the participating organizations is given. The following papers were presented: Results and conclusions from the experiments of October 1941, by Dr. E. Singer; Knock measurement of synthesis naphtha, by W. Dannefelser; Synchronizing knock test motors at the Front with the average values of 7 motors at German testing stations, by H.H. Neumann; Testing methods and octane number, by W. Witschakowski; Knock test installations, by E. Singer; Experiences in motor supervision, by W. Dannefelder; Experiences in operation with the Oppau line charts, by L. Kohler.

SL-9

Frame 445-465 Report on the Fifth session of the operating group on knock measurement Feb. 16 and 17, 1943, at Oppau

This is a report of a conference similar to the one just preceding. The following papers were presented: Report on the completed comparative tests of the cooperative knock test teams by E. Singer;

Observations on the testing of synthesis gasoline, By W. Dannefelder; Experiments on the determination of the octane number of licuefied gases, F. Rush; Influence of operating conditions on the knock behavior of motor fuels, by E. Singer; Block test experiments on the applicability of Research and Motor Octane Numbers in practical operation, by H. Unverhau; Motor or Research Method for mineral fuels, by H. Waldemann. Addition of lead tetraethyl solutions for producing loaded gasoline in the laboratory.

SL-10

Report 420

Frame 466-494 Comparative tests on knock engines (VV75) April 27, 1940

During March 1940, eight different gasolines were tested by 23 laboratories; using 27 I.G. test motors, 458 knock determinations were made, 230 by the Research and 228 by the Motor method. The numeric results of the tests are shown in 11 tables and 8 charts.

SL-11

Report 458

Frame 495-452 Effect of air intake temperature and compression ratio upon the course of the knock limit curves in supercharging. By Witschakowski. May 20, 1941

During a study of the effect of air intake temperature and compression ration upon four aviation gasolines, it was found that the influence of compression ratio was greater than that of air intake temperature upon the knock limit curve. It was found that the loss in effective pressure was least with a compression ratio of 1:6.5 and an air intake temperature of 130°C; it was greatest with the same air intake temperature (130°C) when the compression ratio was increased to 1:8. The results of the tests are represented by 20 sheets of graphs and curves.

SL-12

Report 470

Frame 521-535 Fuel evaluation in the small single-cylinder engine (Oppau method). By E. Singer, Aug. 7, 1941

An eight-page report is followed by a picture of the experimental apparatus at Oppau, a schematic diagram of the arrangement and 3 pages of curves.

SL-13

Report 478

Frame 536-561 Apparatus for testing the lubricating capacity of oils by determination of wear. By R. Holder. Oct. 10, 1941

Experiments were made to determine whether it was possible to evaluate lubricants by measuring wear. The influence of sliding speed, oil temperature and specific surface were determined.

Two wear-test machines were available which had been developed at Oppau. These machines are described in considerable detail, and diagrams indicate the layouts.

Brass rods with a Brinell hardness of 135 were used in the tests; these rods were 10 mm in diameter and shaped to form a blunted cone.

A table (frame 541) lists the oils tested and their viscosities in centistokes at 20°, 30°, 50°, 100° and 150°C.

It was found that wear increased with decreasing rotation speed; that it is largely dependent upon the temperature of the oil. Esters produce less wear than hydrocarbon oils, and the addition of esters or of oleic acid can be perceived through the variation in wear. An oil which was aged in the motor caused less wear than a fresh oil. 15 pages of curves represent the results of the tests.

SM-1

Frame 562-603 The starting of airplane engines in winter. Apparatus Handbook, September 1944. Prepared by the Central Office for Flight Apparatus.

Measures are described by which airplane motors can be started when cold, without the aid of heat sources, and - except for starting with acetylene - without the use of ground apparatus.

The paper consists of 3 parts. The first indicates the difficulties which occur in starting airplane engines in winter, and the increased responsibility of the supervisor for carrying out the proper measures to achieve performance. The second part contains alternate and auxiliary means for eliminating winter starting troubles. The third part comprises all regulations which must be thoroughly mastered by the operative personnel if a satisfactory starting of the engines is to be accomplished. This is a pamphlet with 77 pages of text and 2 sets of curves.

SM-2

Frame 604-628 Scientific test and advisory branch, Stuttgart Technical College, Feb. 1939

This compilation gives a survey of the technical-scientific tests and advisory service available through the Institution. The sections of the Technische Hochschule are: Library, mathematics seminar, physical institute, X-ray laboratory, laboratories for inorganic chemistry and chemical technology and for organic chemistry and chemical technology, laboratory for physical and electrochemistry, Kaiser Wilhelm Institute for metal study, applied metallurgy, metal physics, physical chemistry of metals, mineralogical-geological section communications division for aviation, and many more.

For each division or section, information is given concerning the director, location of the division, and the scope of its activities.

SM-3

Frame 629-633 The scope of the ZWB Zentrale fur Wissenschaftliches Berichtswesen (By H. Dominke. Reprint from Technische Berichte v.8, (1941) No.2)

The ZWB had a twofold responsibility, namely the care and distribution of confidential material and the issuing of public information concerning aviation research.

Confidential information included the research reports (FB series) and investigations and communications (UM series). These reports were to be distributed to the various institutions where aviation research was in progress. Technical reports, industrial reports a methods "ring book", and confidential card records were included in the confidential series.

General published information (not restricted) included the magazine "Luftfahrtforschung", whose 18 volumes comprised the recognized periodical for the publication of German scientific aviation material, the Yearbook of German aviation, and an evaluation of foreign literature. Another function of the ZWB was the procurement of publications, and the collection and distribution of pertinent pictures and films.

SM-4

Frame 634 Construction group of Engine A, FKFS 540. A plate showing 5 photographs of the details of the engine.

SM-5

Frame 635-636 Two manuscript pages give an outline of the work on engine tests.

SM-6

Frame 637 A typed list of reports on lubrication and engine wear.

Frame 638-639 Directions for filing and finding coded material in an alphabetic filing system.

Frame 640 Special instruments, drawings and details.

Frame 643-657 Apparatus for power measurement

The apparatus serves for measuring mechanical power transmitted in shafting. Instructions are given for operating the instrument, as well as pictures, an electrical circuit and several sets of calibration curves.

SN-2

Frame 658-666 Direct indicating recorder of electrical torsional oscillation on the principle of a counter-induction measurement. Dissertation by Kurt Staiger. (Reprint from Luftfahrtforschung 18, 10 (Oct. 1941)

The use of electrical methods for measuring mechanical vibrations is made difficult by the necessity for frequent calibration of the built-in amplifier. It may happen that the calibration constant varies during a single series of measurements. This report shows, with the example of a torsional oscillation meter, how this disadvantage can be avoided, so that direct measurements can be taken without frequent calibrations.

After a discussion of the theory which underlies the instrument, the device itself is described and illustrated by means of photographs, drawings and charts.

Frame 667-956 Electrical indicator diagrams and drawings.

Frame 667 Inductive pressure transmitter b. SKSF Drawing 90978, sheet 000.

Frame 668 Inductive transmitter b, Drawing 90978, sheet 001.

Frame 669 Transmitter b diaphragm. Drawing 90978, sheet 002.

Frame 670 Separation ring. Drawing 90978, sheet 003.

Frame 671 Coil. Drawing 90978, sheet 004.

Frame 672 Coil core. Drawing 90978, sheet 005.

Frame 673 Thumbscrew, Drawing 90978, sheet 006

Frame 674 Inertia indicator, coil supports. Drawing 1021-11-003

Frame 675-676 Instructions for using electrical indicators.

Frame 677 Inductive pressure measurement with simple direct current.

Frame 678 Inductive pressure measurement with rectifier bridge.

Frame 679 Calibrating curves for the alternating current bridges used.

Frame 680 Curves showing measurement by distortion of pickup diaphragm.

Frame 681-683 Photographs of the instrument.

SN-3

Frame 684-699 Test reports and specifications on a series of photocells.

Frame 700-703 Instructions for operating oscillographs, from Seimens-Halske, A.G.

Frame 704-740 Specifications and instructions for mechanical oscillographs with pressure magnets.

Frame 714-748 Oscillograms.

Frame 749 Quartz pressure chamber. Drawing 923/100

Frame 750 Alteration of the modern diesel pickup for the insertion of new quartz. Drawing 923/200

Frame 751 Pickup for quartz indicator. Drawing 1.

Frame 752 Quartz pickup. Drawing 90.

Frame 753 Alteration of modern diesel pickup to insert new quartz. Drawing 923/203

Frame 754 Alteration of diesel pickup to insert new quartz. Drawing 923/204

Frame 755 Drawing 923/201.

Frame 756 Quartz pressure chamber. Drawing 923/115

Frame 757 Alteration of diesel pickup to insert new quartz. Drawing 923/202

~~Frame 758 Pickups modified according to Kluge and Linckh.~~

Frame 759 Quartz pressure chambers. Index of drawings and materials, March 22, 1938

Frame 760 Quartz pressure chamber. Drawing 923/001E

Frame 761 Quartz pressure chamber - diaphragm mounting. Drawing 923/013E

Frame 762 Quartz pressure chamber. Press ring. Drawing 923/011E

Frame 763 Quartz pressure chamber. Diaphragm screw cap. Drawing 923/016E

Frame 764 Quartz pressure chamber. Insulation block. Drawing 923/006E

Frame 765 Quartz pressure chamber, copper rings. Drawing 923/020E

Frame 766 Quartz pressure chamber. Insulating shell. Drawing 923/035E

Frame 767 Quartz pressure chamber. Separation plate. Drawing 923/012E

Frame 768 Quartz pressure chamber. Separation ring. Drawing 923/022E

Frame 769 Cylinder head, quartz holder. Drawing 923/003E

Frame 770 Housing, Drawing 923/021E

Frame 771 Lens head screw; diaphragm press rod. Drawing 923/024E

Frame 772 Diaphragm, Drawing 923/024E

Frame 773 Connection box. Drawing 923/007

Frame 774 Water connections, Drawing 923/025E

Frame 775 Coil; Drawing 923/008; Vane. Drawing 923/027E

Frame 776 Pressure plate. Drawing 923/026

Frame 777 Quartz pressure chamber assemblage. Drawing 923/110

Frame 778 Diaphragm matrix. Drawing 923/111. Repeated on Frames 782 and 800

Frame 779 Pressure ring. Drawing 923/112. Duplicated on Frames 783 and 802

Frame 780 Diaphragm contact slide. Drawing 923/113. Duplicated on Frames 784 and 803

Frame 781 Diaphragm. Drawing 923/121. Duplicated on Frame 792 and 804

Frame 782 See Frame 778; Frame 783, see Frame 779

Frame 784 See Frame 780

Frame 785 Separation shell. Drawing 923/114

Frame 786 Cylinder head screw; contact spring. Drawing 923/115; also Frame 801

Frame 787 Jacket, Drawing 923/116

Frame 788 Spring mounting. Drawing 923/117

Frame 789 Separator shell. Drawing 923/118

Frame 790 Spring attachment. Drawing 923/119

Frame 791 Housing. Drawing 923/120

Frame 792 See Frame 781

Frame 793 Gasket. Drawing 923/122; repeated on Frame 799

Frame 794 Contact part. Drawing 923/123; repeated on Frame 805

Frame 795 Resistance. Drawing 923/125

Frame 797 Insulation member. Drawing 923/127

Frame 798 Lock screw. Drawing 923/129

Frame 799 See Frame 793

Frame 800 See Frame 778

Frame 801 See Frame 786

Frame 802 See Frame 779

Frame 803 See Frame 780

Frame 804 See Frame 781

Frame 805 See Frame 794

~~Frame 806 Shell Drawing No.6~~

Frame 807 Pickup for gasoline engine. Drawing 13

Frame 808 Quartz pickup. Drawing 10

~~Frame 809 Quartz pickup connector~~

Frame 810 Quartz pressure chamber. Drawing 923/001

Frame 811 Quartz pressure chamber housing. Drawing 923/002

Frame 812 Diaphragm tension ring. Drawing 923/004

Frame 813 Quartz receptacle. Drawing 923/003

Frame 814 Diaphragm pressure rod. Drawing 923/005

Frame 815 Insulating piece. Drawing 923/006

Frame 816 Worm gear. Drawing 923/009

Frame 817 Insulation tube. Drawing 923/010

Frame 818 Separation piece. Drawing 923/012

Frame 819 Contact box. Drawing 923/007

Frame 820 Contact leaves. Drawing 923/017

Frame 821 Quartz plates. Drawing 923/015

Frame 822 Quartz plate. Drawing 923/014

Frame 823 Diaphragm clamp. Drawing 923/013

Frame 824 Diaphragms. Drawing 923/019

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Frame 827 Cover plate

Frame 828 Lock screen. Drawing 923/016

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Frame 835 Expansion meter, housing

Frame 836 Expansion meter, tongue

Frame 837 Protected cable connection

Frame 838-840 Quartz pickup for fuel test motors

Frame 841-846 Quartz pickup, individual details

Frame 847 Reduced pressure pickup

Frame 848-854 Reduced pressure pickup, individual details

Frame 855-866 Spark plug pickup, and individual details

Frame 867 Inset screw for pickup

Frame 868 Quartz pickup for fuel test engines, Details

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Frame 870 Quartz pickup

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Frame 887 Montage: Pickup for quartz indicator, Drawing 2

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Frame 890 " " , Drawing 48

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Frame 898 Quartz pickup lower section

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Frame 903 Quartz pickup, Drawing 35

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Frame 931 Quartz pickup, Drawing 3/3

Frame 932 Quartz pickup

Frame 933 Quartz indicator

Frame 934 Calibrating device, pickup

Frame 935 (not decipherable)

Frame 936 Calibrating apparatus, details

Frame 937 Calibrating device, details

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~~Frame 939 Needle jet pickup~~

Frame 940 Needle jet pickup

Frame 941 Needle jet pickup, Drawing 39

~~Frame 942 Needle jet pickup, Drawing 32.~~

Frame 943 Needle jet pickup, Drawing 30

Frame 944 Needle jet pickup

Frame 945 Needle jet pickup, Drawing 28

Frame 946 Needle jet pickup, Drawing 29

Frame 947 Closed thermoelement

Frame 948 (No legend)

Frame 949 Adjustable needle jet

Frame 950 Adjustable needle jet

Frame 951 Adjustable needle jet

Frame 952 Screw insert

Frame 953 Details

Frame 954 Details

Frame 955 Switch diagram of Schnauffer indicator

Frame 956 Detail items of the Schnauffer indicator

End of Reel 95. The Indicator drawings are continued in Reel 96 (already reported)

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