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Bibliography on Ignition and Spark-Ignition Systems

George F. Blackburn

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Preface

This bibliography presents more than 425 references to published sources of information on ignition and spark-ignition systems. A majority of these references were assembled in the course of investigations sponsored by the National Advisory Committee for Aeronautics, the Navy Bureau of Aeronautics, and other national defense agencies. The scope and arrangement of the bibliography are discussed in the introduction.

A. V. Astin, Director.

Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>III</td>
</tr>
<tr>
<td>1. Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2. Bibliography</td>
<td>2</td>
</tr>
<tr>
<td>2.1. Books</td>
<td>2</td>
</tr>
<tr>
<td>2.2. Ignition of combustible mixtures</td>
<td>2</td>
</tr>
<tr>
<td>a. Electric ignition</td>
<td>2</td>
</tr>
<tr>
<td>b. Ignition by hot surfaces</td>
<td>6</td>
</tr>
<tr>
<td>2.3. Spark-ignition systems and components</td>
<td>7</td>
</tr>
<tr>
<td>a. Exclusive of spark plugs</td>
<td>7</td>
</tr>
<tr>
<td>b. Spark plugs</td>
<td>10</td>
</tr>
<tr>
<td>2.4. Miscellaneous</td>
<td>14</td>
</tr>
</tbody>
</table>
Bibliography on Ignition and Spark-Ignition Systems

George F. Blackburn

Approximately 425 references to books, papers, and reports are listed, on ignition of combustible gaseous mixtures and ignition apparatus. The ignition of gases includes ignition by electric sparks and arcs and by hot surfaces. The references on ignition apparatus are for the most part on ignition systems and components for internal-combustion engines, with spark plugs listed separately from other components.

1. Introduction

This list of publications supersedes National Bureau of Standards Letter Circular LC476, Bibliography on Spark Plugs, and is wider in scope than that publication. It covers the initiation of combustion in explosive gaseous mixtures by means other than compression ignition, as well as electric equipment for spark-ignition engines.

Part 2.1 lists books in which ignition or ignition equipment is either the main topic or is given fairly extensive treatment.

The references to other publications are presented under three main heads. The first concerns ignition of combustible mixtures of gases and vapors, and is subdivided into two parts, according to whether ignition is effected by an electric spark or arc or by a heated surface. Part 2.2.a includes references to work on measuring spark energy. Part 2.2.b covers both fundamental investigations of ignition by heated surfaces and ignition by hot spots in internal-combustion engines.

Although ignition is an essential stage in the combustion process, papers dealing primarily with the kinetics of combustion, flame propagation, and detonation, or with the flammability limits of composition, temperature, and pressure of gases, have not been included in this bibliography unless they were found to contribute also to an understanding of ignition phenomena.

Part 2.3 lists references on spark-ignition systems for internal-combustion engines, and their components. It includes work on testing and test equipment. Because there are so many references to spark plugs, these are listed separately as part 2.3.b.

Part 2.4 contains miscellaneous references on ignition that do not fall within the category of part 2.2. Included are a number of papers and reports concerning explosion hazards.

Within each topical subdivision the references are given in chronological order, and within each chronological subdivision, alphabetically by author, followed by anonymous references.
The journal abbreviations used are those employed in Chemical Abstracts, except that the abbreviation NACA is used for the National Advisory Committee for Aeronautics. An unpublished paper presented before a technical or professional society is designated by the abbreviation M. P. for "Meeting Paper." Volume numbers are in boldfaced type, and the date of issue is given in cases where page numbers do not run consecutively through a given volume.

In general, the reports and papers listed are available only in libraries, and none can be supplied by the Bureau. The Federal Specification for Spark Plugs, W-P-506a (listed in part 2.3.b), may be obtained for 5 cents from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Information as to the availability of other reports should be obtained from the author or from the sponsoring organization.

2. Bibliography

2.1. Books


Fourth symposium (International) on combustion. Williams and Wilkins, Baltimore, 1953.


2.2. Ignition of Combustible Mixtures

a. Electric Ignition


P. J. Kirkby, The union of hydrogen and oxygen at low pressures through the passage of electricity. Phil. Mag. (6) 9, 171 (1905).


W. M. Thornton, Least energy required to start a gaseous explosion. Phil. Mag. 28, 734 (1914).


B. F. Bailey, Underlying principles of electrical ignition. S. A. E. Journal 8, 570 (1921).


H. A. Thornburgh and E. B. Weaver, A calorimeter for determining the heat of ignition sparks. Automotive Inds. 45, 523 (1921).


J. D. Morgan, Some observations on the ignition of combustible gases by electric sparks. (Phil. Mag. (6) 45, 968 (1923).


J. D. Morgan, Some further experiments on the combustion of inflammable gases by electric sparks. Phil. Mag. (7) 11, 158 (1931).


J. D. Morgan, Experiment relating to the thermal and electrical theories of spark ignition. Phil. Mag. (7) 18, 827 (1934).


A. E. Hoerl, Jr., Ignition of gases and vapors by sparks. Gas 23, 60 (1947).


H. Mache, Increasing ignition power of electric sparks by locally changing the gas mixture. Österr. Ing.-Arch. 1, 275 (1947).


C. C. Swett, Jr., Investigation of spark gaps subjected to altitude and air-velocity conditions. NACA Research Mem. ES17 (Nov. 1948).


C. C. Swett, Jr., Effect of gas stream parameters on the energy and power dissipated in a spark and on ignition. Third symposium on combustion, flame and explosion phenomena, p. 353, Williams and Wilkins, Baltimore (1949).


H. Lötsc, Ignition of flowing propane-air mixture by an electric spark. Monatsh. 82, 714 (1951).


[b. Ignition by Hot Surfaces]


R. C. Spencer, Preignition characteristics of several fuels under simulated engine conditions. NACA Rept. 710 (1941).


A. Hundere, No harmful preignition from lead deposits. Automotive Inds. 103, 50 (Sept. 1, 1950).


2.3. Spark-Ignition Systems and Components

a. Exclusive of Spark Plugs

H. Armagnat, Magneto for electric ignition. Rev. élec. 23, 321 (1915).


E. A. Watson, Effect of hydrocarbon vapors on contact points of ignition apparatus. Automobile Engr. 18, 347 (1928).
Coil ignition at 10,000 rpm. Automobile Elec. 10, 6 (1934).
Coil ignition testing. Automobile Elec. 10, 38 (1934).
Temperature increase of ignition coils. Automobile Elec. 10, 68 (1934).
Effect of the design and installation of high tension ignition cables on ignition system performance. Ethyl Gasoline Laboratories, Eng. Labs. Rept. 100 (1938).
C. P. Kidder, Synthetics. Automobile Engr. 31, 455 (1941).
C. E. Swanson, Supercarged aircraft ignition harnesses. S. A. E. Trans. 48, 107 (1941).
Ignition problems. Automobile Engr. 36, 413 (1946).


### b. Spark Plugs


C. S. Cragoe, Temperatures in spark plugs having steel and brass shells. NACA Rept. 52 (1919).

L. B. Loeb and F. B. Silsbee, Effect of temperature and pressure on the sparking voltage. NACA Rept. 54 (1919).


G. D. Boerlage and A. C. Cattaneo, Thermocouple spark plug. Automotive Inds. 76, 114 (1937); Automobile Engr. 27, 64 (1937).


H. Rabezzana and H. Kalmar, Benefits from longer gaps in spark plugs. Automotive Inds. 76, 222; Automobile Engr. 27, 260 (1937).


Sparking plug endurance tests. Automotive Inds. 78, 87 (1938).


V. Cronstedt, Shortcomings of mica insulation for aviation spark plugs. S. A. E. Journal 46, 233 (1940).


F. H. Riddle, Ceramic insulators for spark plugs. S. A. E. Journal 46, 236 (1940).

H. C. Chandler, Ceramic insulators for aviation spark plugs. NACA OCR Rept. 3 (1941).


Effect of low and high values of capacitance on spark plug electrode erosion. Ethyl Corp. Rept. A. R. 100 (1943).


Method of measuring the resistance of spark plugs while the plugs are firing in an engine. Ethyl Corp. Rept. A. R. 104 (1944).


W. A. Bychinsky, Factors affecting the functioning of spark plugs. S. A. E. Quart. Trans. 2, 254 (1948).


Federal specification for spark plugs, W-P-506a (1948).


G. R. Furman and B. Corrigan, All-important spark plug. Aero Dig. 59, 20 and 92 (Oct. 1949).


Cold tests with arctic oil at temperatures ranging to —40°F. Delco-Remy Division, General Motors Corp. Eng. Rept. 2918-B (Oct. 28, 1949).


C. Cipriani, Modern spark plugs permit wider gaps. S. A. E. Journal 58, 65 (June 1950).


Annular electrode spark plug. Aero Dig. 60, 58 (May 1950).

Comparative cold starting characteristics of resistor and non-resistor type spark plugs. The Electric Auto-Lite Co., Eng. Rept. 3 (Jan. 19, 1950).


D. N. Harris, F. R. Watson, and T. Frame-Thompson, Pre-planned tests exemplified by flight research. Shell Aviation News 168, 14 (June 1952).


V. E. Yust and E. A. Droegemueller, Aviation spark plug fouling—its cause and control. S. A. E. Journal 60, 65 (May) and 37 (June 1952); Shell Aviation News 164, 14 (Feb. 1952).

Four ways to combat auto spark plug fouling. S. A. E. Journal 60, 66 (July 1952).

Spark plug testing. Automobile Engr. 43, 113 (1952).

R. J. Greenshields, Spark plug fouling studies. S. A. E. Trans. 61, 3 (1953).

Experts study misfiring, fouling; Champion’s aircraft spark plug and ignition conference. Aviation Week 59, 58 (Oct. 26, 1953).


High-altitude spark plug. Aero Dig. 68, 48 (Apr. 1954).

Improved ceramic insulating material. Engineer 197, 289 (1954); Engineering 177, 253 (1954); Flight 65, 207 (1954).


Standard methods of testing electrical porcelain ASTM Designation D116-44.


2.4. Miscellaneous


The possible causes of fire in an aeroplane crash and the means that can be taken to lessen the fire risk. Rept. of the Fire Prevention Sub-Committee, Gt. Brit. Aeronaut. Research Comm., Repts. and Mem. 796 (1922).


J. W. Horton, Present status of the problem of preventing anesthetic explosions. Anesthesiology 2, 121 (1941).


F. B. Silsbee, Static electricity. NBS Circ. 438 (1942).


Washington, April 30, 1956.