COAL GASIFICATION - SELECTED ABSTRACTS AND TITLES

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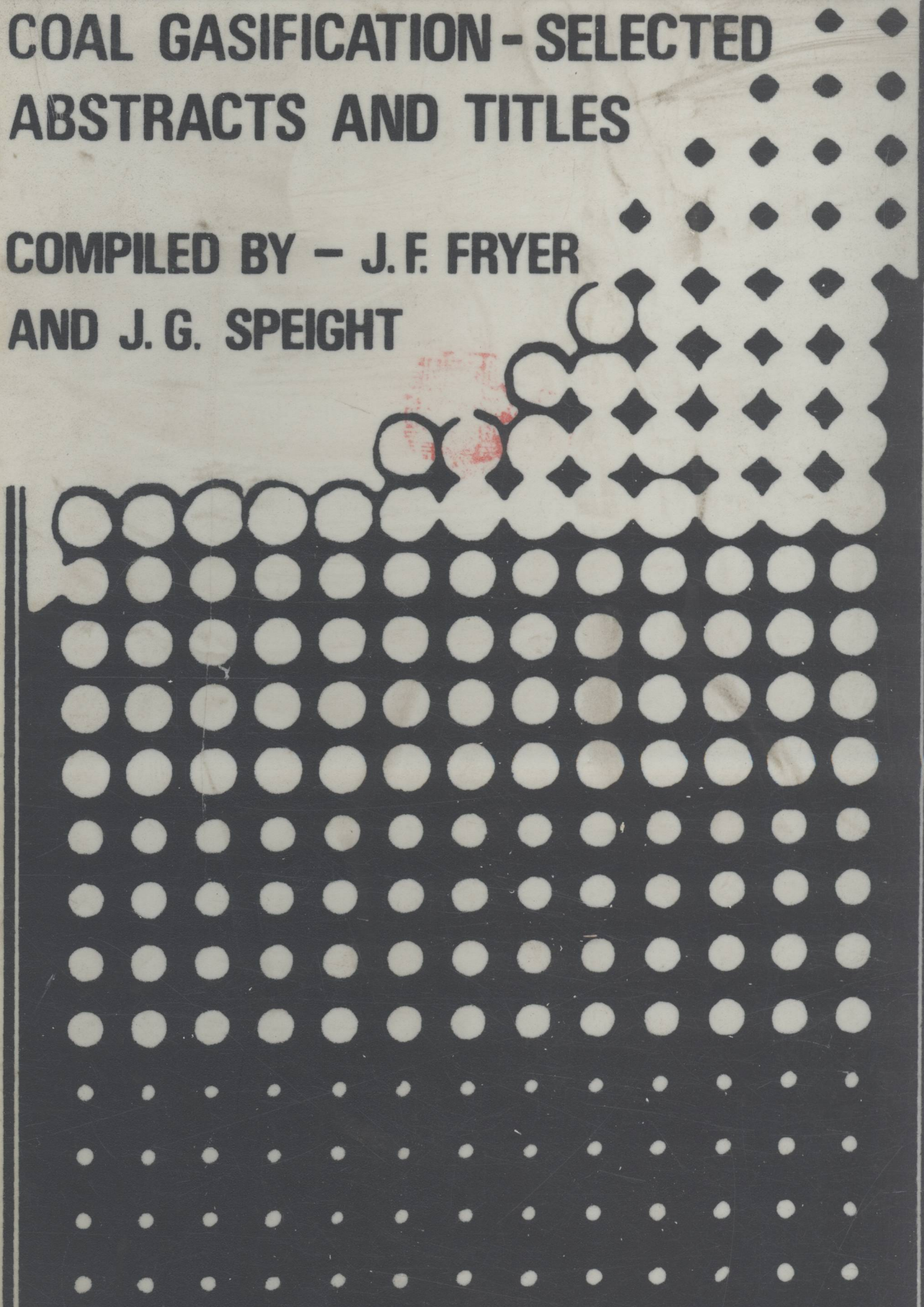

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FOREWORD

Recent "energy crises", concerns over secure future supplies of gaseous and liquid fuels, and greater recognition of the abundance of coal in North America are serving to direct increasing attention to the gasification of coal. Technology for producing a variety of fuel gases as well as feedstock for petrochemical operations, including production of synthetic liquid hydrocarbons, is for the most part well established through commercial coal gasification schemes in other countries. Indeed, the events of the past three or four years are now beginning to make similar schemes economically feasible in Canada and the United States.

Real difficulties are, however, commonly experienced in gaining access to much of the voluminous scientific and technical literature on coal gasification - especially material published before 1971. This material is not usually encompassed by currently active information services. We have therefore thought it timely to compile a collection of abstracts covering the period to 1970, and present it with the hope that it will assist individuals and agencies with active or developing interests in coal gasification.

The work is divided into three volumes. Volume 1 deals with gasification of unmined coal, i.e. in situ gasification. Volume 2 contains abstracts of literature pertaining to gasification of mined coal. Volume 3 concerns itself with gasification of peat, lignite and carbonaceous solids not classifiable as coals.

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VOLUME 2

GASIFICATION OF MINED COAL

PART III : GENERAL PROCESSING, 1951-1970

1501

BRITISH COAL UTILIZATION RESEARCH ASSOCIATION RESEARCH ON COAL GASIFICATION
G. W. C. Allan and S. A. Burke
Coke and Gas 13, 437 (1951)

A short description of some of the work on gas producers, automatic control, mobile laboratory, and gasification of slurry.

1502

PRODUCTION OF GASES
M. H. M. Arnold
Canadian Patent, 479,307, December 11, 1951

A process is described for the production of hydrogen by reacting steam with metallic iron in a vessel substantially in accordance with the equation: $4H_2O + 3Fe = 4H_2 + Fe_3O_4$, *with subsequent reduction of the oxide for re-use by the action of a reducing agent in another vessel. The steps involve carrying out the hydrogen producing reaction by passing steam concurrently with a continuously replenished bed of particles of iron which is maintained at reaction temperature, the steam being passed through the bed at a rate sufficient to maintain the bed vigorously boiling. The oxide formed in the hydrogen producing vessel is continuously transferred to a moving bed of iron oxide in another vessel which is maintained at a reducing temperature, while passing a reducing gas into the oxide bed counter-currently with the movement of the particles and at a rate to maintain the bed in expanded state. The reduction product thus obtained is continuously removed and returned to the bed of particles of iron.*

1503

METHOD FOR PROCESSING CARBONACEOUS SOLIDS
M. H. Arveson
United States Patent, 2,560,403, July 10, 1951

A process of producing carbon monoxide and hydrogen and recovering hydrocarbons is described, which comprises maintaining a body of finely divided carbonaceous solids within a first zone in a dense turbulent solids phase. The body is maintained at a high temperature by introducing hot solids into the zone, reacting water vapor with the carbonaceous solids whereby carbon monoxide and hydrogen are produced. Gaseous products are continuously separated and solids withdrawn from the dense turbulent solids phase. The withdrawn solids are introduced into a second zone in an amount sufficient for heat requirements, and raw finely divided carbonaceous solids are introduced into the zone, and maintained within the zone in a dense turbulent solids phase. Withdrawn solids are transferred to a third contacting zone, an oxygen-containing gas is supplied to the zone and passed through at a rate sufficient to maintain a dense turbulent solids phase. The temperature of the solids is maintained at a high level by burning a portion of the carbonaceous solids with the oxygen-containing gas.

1504

COAL-GASIFICATION PROCESS AND APPARATUS
R. G. Atkinson
United States Patent, 2,572,928, October 30, 1951

A process for gasifying a carbonaceous material in a reaction chamber of generally circular transverse cross section is outlined, which comprises introducing into the reactor in a direction parallel to the longtitudinal axis through a reactant inlet port in one end of the reactor a mixture of the finely divided carbonaceous material, free oxygen, and steam. The reactor temperature is maintained above 750°C., and a suspension of the finely divided carbonaceous material and an endothermic gas-making fluid containing oxygen is simultaneously passed into the reactor. The gaseous reaction products and the mixture of finely divided carbonaceous material are removed from the chamber.

1505

IMPROVEMENTS IN THE PRODUCTION OF FUEL GASES FROM GRANULAR TO PULVERULENT FUELS
Badische Anilin- and Soda-Fabrik
British Patent, 659,379, October 24, 1951

A process for the production of fuel gases from granular to pulverulent fuels is described, which consists in carrying out part of the gasification by heat produced by partial combustion with an oxygen-containing gasifying agent in a preliminary chamber arranged directly at the inlet opening of the gasification chamber proper. The mixture of ungasified solid fuel, fuel gas and any unspent gasifying agent leaving the preliminary chamber is led into one end of a rotation-symmetrical gasifying chamber (centrifugal gasifying chamber) tangentially, where it is kept in rotation, if necessary by the tangential introduction of further gasifying agent, while the solid fuel is practically completely gasified, and the gases, produced through an axial opening in the other end of the chamber, are discharged.

1506

IMPROVEMENTS IN THE PRODUCTION OF FUEL GAS IN PARTICULAR SYNTHESIS GAS IN GAS PRODUCERS
Badische Anilin- and Soda-Fabrik
British Patent, 661,148, November 14, 1951

A process is described for the continuous production of fuel gas, in particular synthesis gas, in gas producers with the use of granular to pulverulent fuels and fuels in the form of lumps, in particular coke, coal or briquettes, which consists in carrying out the gasification by exothermically gasifying the granular to pulverulent fuel with oxygen and small amounts of water vapour or carbon dioxide in a dust gasifier and gasifying the lump fuel with the gases leaving this gasifier in a run-off gas producer, surmounted, if convenient, with a low-temperature carbonisation attachment. The hot gases leaving the dust gasifier are led through the run-off gas producer so that their heat content is utilised to satisfy the heat demand in the endothermic gasification in the run-off gas producer.

1507

PROCESS FOR PRODUCING GAS MIXTURES
F. T. Barr
United States Patent, 2,556,835, June 12, 1951

An improved process for converting hydrocarbon gas to hydrogen and an oxide of carbon is described, which comprises compressing air and burning the fuel with the air in at least one or more than two heat regenerative zones for alternate combustion and reforming cycles both operated at substantially the same pressure within the range of 3-50 atmospheres. The combustion is continued until the respective regenerative zone is raised to a reforming temperature, and the combustion products withdrawn under pressure. The energy of such combustion products is utilized to compress the air, then combustion is discontinued, and hydrocarbon gas is passed along with a reforming agent through the respective regenerative zone under substantially the same pressure whereby hydrogen and an oxide of carbon are produced. The passage of the hydrocarbon and the reforming agent is discontinued when the temperature of the respective zone falls below the reforming temperature, and thereafter alternative cycles of combustion and reforming are continued under substantially the same pressure. The same cycles are conducted in all of the zones, and operated out of phase with respect to different zones, in such a manner that a substantially continuous and constant flow of heating exhaust gases is maintained at the utilizing stage.

1508

EXPERIENCES WITH THE KOPPERS RECIRCULATED GAS PROCESS
F. Bieger
Brennstoff-Chem. 32, 331 (1951)

Brown coal briquets are dried and carbonized in a refractory-lined steel retort. Heat for the process is supplied by recirculating gas which is heated in a regenerator, the heat for which comes from producer gas made from the coke. The gas from the retort is used for hydrocarbon synthesis.

1509

THE DEVELOPMENT OF GAS PRODUCTION IN BELGIUM, 1900-1950
M. Brabant
Inst. Gas Engrs., Copyright Pulb. No. 383 (1951)
Gas World 133, 567, 608 (1951)
Gas J. 266, 757 (1951)

Although the coke oven will remain one of the chief sources of gas, because of the importance of coke to the steel industry, valuable supplementary sources of gas will prove to be the gas obtained from petroleum refineries and the methane obtained from coal mines.

1510

LOW-PRESSURE HYDROCARBON SYNTHESIS PROCESS
F. J. Buchmann and A. Voorhies, Jr.
United States Patent, 2,552,308, May 8, 1951

An improved process for converting carbon monoxide and hydrogen to normally liquid hydrocarbons of high olefin content is described, which comprises contacting carbon monoxide and hydrogen in synthesis proportions under synthesis conditions comprising pressures of from about 50 to about 100 p.s.i.g., with a dense turbulent fluidized mass of finely divided synthesis catalyst. The catalyst comprises an activated carbon support carrying as active component iron promoted with not less than 0.4 and not more than 1.0 percent by weight of the total catalyst, of an alkali metal promoter.

1511

LURGI PROCESS: USE FOR COMPLETE GASIFICATION OF COALS WITH STEAM AND OXYGEN UNDER PRESSURE
J. Cooperman, J. D. Davis, W. Seymour and W. L. Kuckles
U.S. Bur. Mines, Bull. No. 498 (1951)

Results of an investigation of the Lurgi process for gasifying Alabama coals are given.

1512

THERMAL EFFICIENCY OF COAL DISTILLATION AND GASIFICATION
F. J. Dent
Gas J. 267, 230, 240 (1951)

Processes for the complete gasification of coal, which are now in the early stages of development, appear to offer opportunity to achieve higher thermal efficiencies than do existing carbonization or water-gas production processes. Efficiencies of 80% should not be out of reach. The new processes may also extend the range of coal available to industry and minimize plant charges.

1513

CALCULATION OF COMPOSITION OF PRODUCTS OF COMPLETE GASIFICATION
H. Deringer
Schweiz. Ver. Gas Wasserfach Monatsbull 31, 181 (1951)

Assuming equilibrium conditions composition of gases have been calculated from complete gasification on the basis of stoichiometry and the principal gas equilibrium data.

1514

PROCESSES OCCURRING IN THE GASIFICATION OF FUELS AND THEIR PRESENTATION IN TERBECK DIAGRAMS
P. Dolch
Brennstoff-Chem. 32, 193 (1951)

The Terbeck diagram for water gas generation is of wide application to chemical conversions involving carbon monoxide and water vapor as well as carbon dioxide and hydrogen, and is of considerable use for the plant man. An example is given of its use in the gasification with oxygen and steam of a bituminous fuel.

1515

CALCULATIONS IN FUEL GASIFICATION PROCESSES
P. Dolch
Brennstoff-Chem. 32, 232 (1951)

Methods of calculating the products of gasification or for the composition of the fuel if the composition of the products is known, are shown.

1516

ANNUAL REPORT OF RESEARCH AND TECHNOLOGIC WORK ON COAL, FISCAL YEAR 1950
A. C. Fieldner and S. Gottley
U.S. Bur. Mines, Inform. Circ. No. 7618 (1951)

1517

THE GASIFICATION OF POWDERED FUELS BY THE "PANINDCO" PROCESS
P. Foch
Chimie and Industrie 66, 639 (1951)

An account is given of a trial run of the "Panindco" process in a demonstration plant at Rouen, France. The process is particularly suitable for the gasification of lignites and similar fuels, especially when they are finely divided.

1518

IMPROVEMENTS RELATING TO THE MANUFACTURE OF CARBURETTED WATER GAS
The Gas Machinery Company
British Patent, 654,575, June 20, 1951

A process for the manufacture of carburetted water gas is described, in which an ignited fuel bed is periodically blasted with air to increase the temperature thereof, and steam is passed through the ignited fuel bed to produce water gas. The steps comprise directing all of the blast air to the central portion of the bottom of the fuel bed and upwardly therethrough, whereby the heat in the fuel bed is substantially evenly distributed across the bed, and supplying secondary air to the zone above the fuel bed, while supplying the blast air to the central portion of the bottom of the fuel bed. The secondary air is mixed with the combustion products of the air blast and are burned to supply heat to the top of the fuel bed. A hydrocarbon oil is subsequently supplied to the top of the fuel bed for vaporization to form a carburetted water gas.

1519

CARBON MONOXIDE AND HYDROGEN FROM POWDERED COAL
L. P. Gaucher
United States Patent, 2,558,746, July 3, 1951

Oxygen and steam react with pulverized coal to produce synthesis gas.

1520

IMPROVEMENTS IN THE MANUFACTURE OF CARBURETTED WATER GAS AND IN CARBURETTERS FOR USE THEREIN
Humphreys and Glasgow Ltd.
British Patent, 654,281, June 13, 1951

The manufacture of carburetted water gas involves collecting unevaporated oil and carbon residues on a bed or layer of refractory material or coke, passing uprun gas in one direction and back run steam in the other direction through the bed. During the course of the blow period, air is passed through it in the same direction as the back run steam whereby the bed or layer is maintained at a high temperature and oil residues reaching it are evaporated and carbon deposits combine with the steam or are burned with the air preheated in passing through the first-encountered portion of the bed or layer.

1521

IMPROVEMENTS IN AND RELATING TO THE MANUFACTURE OF CARBURETTED WATER GAS
Humphreys and Glasgow Ltd.
British Patent, 654,282, June 13, 1951

A carburetted water gas apparatus is described, comprising a generator, a carburetter of the "empty" type and a superheater so connected that the blast air passes upwardly through the generator and the blast gases pass down through the carburetter and up through the superheater, and the uprun gas follows the same course. The carburetter comprises upper and lower chambers, the upper chamber having a gas inlet from the generator entering the chamber tangentially to its wall or substantially so, and the lower chamber having in it oil spraying means. The two chambers are in communication through a throat located at such a distance below the inlet as is consistent with imparting rotational or spinning motion to the gases and maintaining it through the throat and down the wall of the lower chamber.

1522

IMPROVEMENTS IN AND RELATING TO CARBURETTING WATER GAS
Humphreys and Glasgow Ltd.
British Patent, 654,283, June 13, 1951

In carburetting water gas by oil in an "empty" carburetter, the walls are heated by combustion of blow gases which pass therethrough with a rotating or spinning motion. Carbon burning air is admitted, additional to that required for burning the blow gases, peripherally at a point, or a restricted number of points, which are situated so as not to thoroughly mix with the gases but preferentially with that part of the gas stream which contacts the carburetter wall.

1523

IMPROVEMENTS IN AND RELATING TO CARBURETTING WATER GAS
Humphreys and Glasgow Ltd.
British Patent, 654,284, June 13, 1951

A water gas carburetter of the "empty" type is used, in which gases from the generator enter the carburetter through a tangential or substantially tangential inlet or inlets and pass therethrough in either an upward or a downward direction with a rotational or spinning movement. Means are provided for varying the rotational or spinning motion of the gases to suit the requirements of the blow and uprun phases of the water gas cycle.

1524

IMPROVEMENTS IN AND RELATING TO CARBURETTING WATER GAS
Humphreys and Glasgow Ltd.
British Patent, 654,285, June 13, 1951

A water gas apparatus is described, which comprises a carburetter of the "empty" type, into the carburetting chamber of which gases from the generator enter through a substantially vertical pipe having in its wall slots, ports, vaned openings or the like formed or adapted to give a tangential or partly tangential motion to the gases passing through them into the axial pipe, so that the gases flow therethrough and through the "empty" carburetting chamber with a spinning or rotational motion.

1525

IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF HYDROCARBONS, OXYGENATED HYDROCARBONS AND THE LIKE FROM SOLID CARBONACEOUS MATERIALS
Hydrocarbon Research, Inc.
British Patent, 659,002, October 17, 1951

A process for converting solid carbonaceous material into valuable hydrocarbons and the like is described, which comprises subjecting the carbonaceous material in solid form to the action of oxidizing gas in a gasification zone wherein combustible constituents of the material are converted into gas comprising, at least in substantial amount, compounds containing both carbon and hydrogen atoms in the same molecule. The resulting gas, containing the compounds from the gasification zone are withdrawn, and the compounds are passed, at least in part, to a separate reforming zone. Oxygen is then introduced to the reforming zone, effecting conversion of the compounds into carbon monoxide and hydrogen. The resulting carbon monoxide and hydrogen are subsequently passed to a synthesis zone where they are subjected to contact with a synthesis catalyst under conditions effective to convert carbon monoxide and hydrogen into higher molecular weight compounds, and an effluent stream containing the desired products is removed from the synthesis.

1526

HYDROCARBON SYNTHESIS
P. C. Keith
United States Patent, 2,558,760, July 3, 1951

A process for the catalytic production of hydrocarbons from carbon monoxide and hydrogen is described, which comprises generating a synthesis gas containing carbon monoxide and hydrogen, but substantially no oxygenated hydrocarbons, in a gas-generation zone under conditions involving partial combustion of hydrocarbonaceous material at a temperature of 2100°F. and higher with oxygen, which result in a generator effluent gas having particles formed in the generation zone. The particles from the effluent gas are scrubbed with liquid obtained at a subsequent point in the process, and the resulting scrubbed gas is passed to a synthesis reaction zone containing a synthesis catalyst maintained under conditions effective for the reaction of carbon monoxide with hydrogen. A product containing hydrocarbons, water, and some oxygenated hydrocarbons is removed from the synthesis zone, a liquid fraction consisting essentially of water containing dissolved oxygenated hydrocarbons is separated therefrom, and scrubbing with the separated liquid fraction is effected.

1527

THE PRODUCTION OF TOWN GAS FROM WEAKLY CAKING COALS
J. G. King
J. Inst. Fuel 24, 147 (1951)

1528

PROCESS DEVELOPMENT IN THE HYDROCARBON SYNTHESIS TO 1951
S. Kodama, W. Funashashi, G. Hashimoto, T. Hiraos, H. Tahara, A. Matsumura, J. Kato and V. Tarama
U.S. Bur. Mines, Inform. Circ. No. 7593 (1951)

Besides coal, the Japanese investigated a large variety of sources for conversion to oil including orange peel, rubber and pine needles. They extensively studied the hydrogenation of coal.

1529

PROCESS AND APPARATUS FOR GASIFYING FINELY DIVIDED SOLID FUELS
Koppers Company
British Patent, 656,045, August 8, 1951

A process is described for the gasification of finely divided solid fuel in suspension with oxygen, or air enriched with oxygen with the simultaneous reaction of other gasification media, which are heated by combustion of a fuel and admixture with the hot combustion gases and, after introduction into the reaction chamber, react endothermically with the non-oxidised carbon of the finely divided fuel originating from the zone of the exothermic reaction. The process is characterised in that the combustion gases heating the endothermically reacting gasification media are introduced separately from the oxygen but together with the endothermically reacting gasification media into the reaction chamber. The finely divided solid fuel is injected into the reaction chamber by means of a stream of oxygen which is preferably not preheated, i.e. relatively cold.

1530

PROCESS FOR THE PRODUCTION OF COMBUSTIBLE GASES
Koppers Company
Australian Patent, 144,425, December 7, 1951

A process for the continuous production of combustible gas containing carbon monoxide is described, which involves continuously introducing finely-pulverized solid fuel into a flow of oxygen and thereby forming a suspension of the former in the latter; continuously introducing so-formed suspension directly into a gasification chamber that is preheated to a temperature above the ignition temperature of the oxygen-fuel suspension and thereby reacting its components and forming combustible gas that is at an elevated temperature and contains carbon monoxide; and continuously simultaneously introducing into reactants of the gasification chamber in the region adjacent the gasification chamber outlet a quantity of combustible gas independently of the gasifying media and under conditions adapted to retain the temperature of the resultant admixture above its ignition point with oxygen. Independently-introduced combustible gas is thereby reacted with oxygen that may have escaped reaction with solid fuel in the gasification chamber and development of explosive mixtures in the produced combustible gas after it is cooled is prevented.

1531

A CONSIDERATION ON THE PULVERIZED COAL GAS PRODUCER
K. Kurosawa
J. Fuel Soc. Japan 30, 7 (1951)

The pulverized coal gasification plant has advantages over the Winkler producer--any kind of coal can be gasified, the capacity is large and flexible, and construction is simple. Although construction costs are high, because of the special firebricks required for the high temperature, the increased throughput lowers the unit cost of gas.

1532

PRODUCTION OF OIL FROM COAL
P. N. Lategan
Coke and Gas 13, 385 (1951)

Methods, hydrogenation and Fischer-Tropsch processes, synthesis, etc. are covered by this report.

1533

PERFORMANCE OF CONTINUOUS VERTICAL RETORTS
C. H. Lewis
Gas J. 265, 223, 229, 357 (1951)
Gas World 133, 185, 214 (1951)

Results over 27 years of performance tests on Woodall-Duckham continuous vertical retorts are summarized. Test results and design of retorts are discussed.

1534

LOW TEMPERATURE CARBONIZATION OF BITUMINOUS COAL
G. Lorenzen
Brennstoff-Chem. 32, 324 (1951)

Bituminous coals are more economically converted into liquid fuels by low temperature carbonization rather than by hydrogenation. Ovens of iron construction have relatively longer life and the capacity is high because of the relatively short carbonization times.

1535

GASIFICATION OF PERCHORSK BASIN COAL
K. V. Malikov and P. F. Moiseeva
Za Ekon. Topliva 8, 16 (1951)

The semi-coke and gas yields are given for a number of coals fed into a gas generator. Composition of output gases and of coals are also given.

1536

SOME ASPECTS OF THE MECHANISM OF GASIFICATION OF CARBON BY CARBON DIOXIDE AND STEAM
J. D. F. Marsh
Inst. Gas Engrs., Copyright Pub. No. 393 (1951)

Laboratory tests were made on carbon samples. Reactions with carbon dioxide after reduction of carbon with hydrogen were investigated. The surface areas of four carbons were determined by BET method.

1537

PRODUCTION OF LIQUID AND GASEOUS FUELS BY SYNTHESIS FROM COAL
I. Mayer and H. J. Ogorzaly
United States Patent, 2,543,795, March 6, 1951

An improved method is given for the production of a gaseous fuel of high heating value (500-700 B.t.u. per cu. ft.) from coal. The principal new features involve the use of a low-grade iron catalyst in the carbonization zone to increase the yield of methane and the separation of that catalyst from the carbonized coal without passage through the gasification zone. The separated catalyst is returned to the carbonization zone, after temperature adjustment.