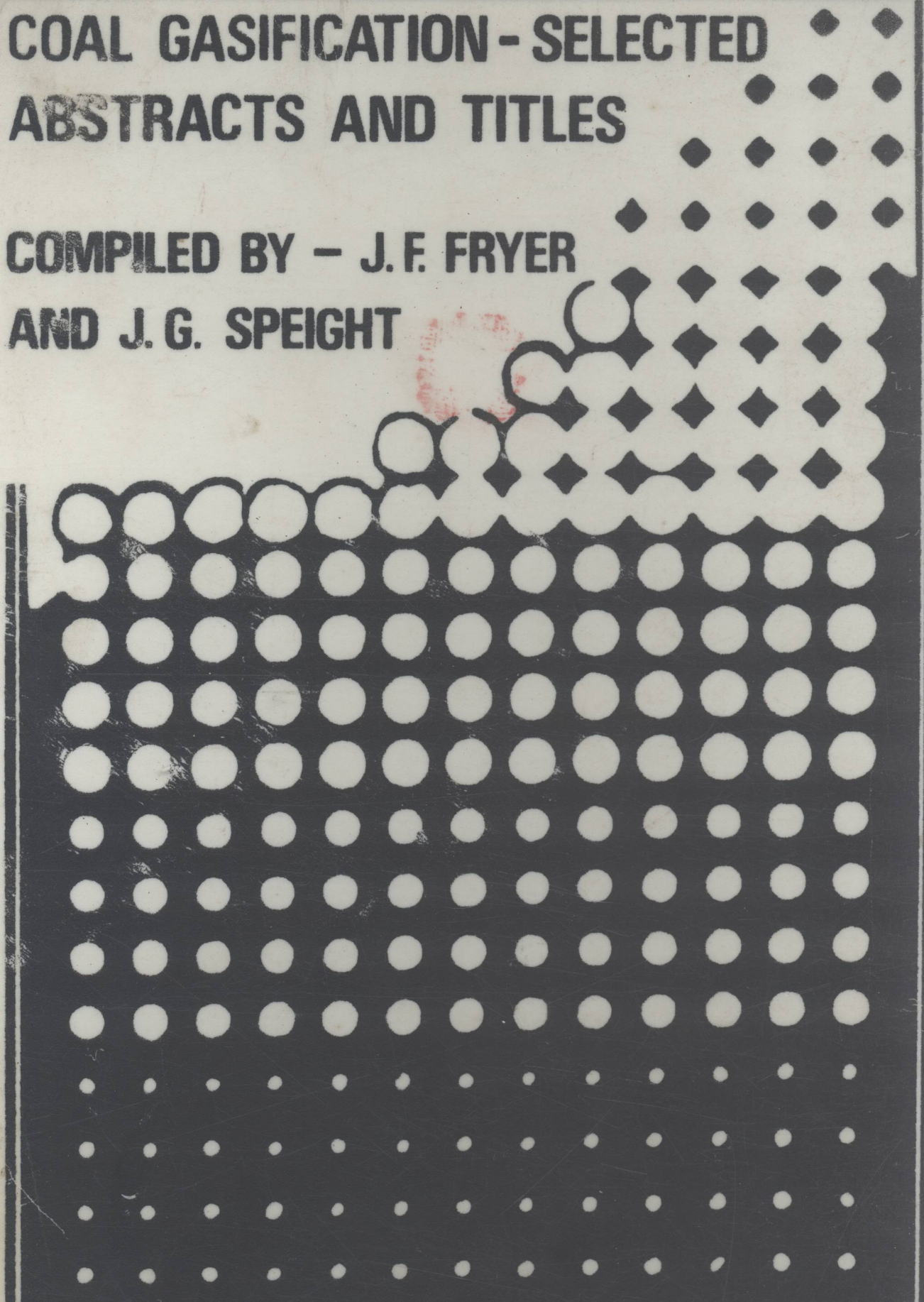
COAL GASIFICATION - SELECTED ABSTRACTS AND TITLES

COMPILED BY – J. F. FRYER
AND J. G. SPEIGHT



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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.

We are indebted to Dr. N. Berkowitz, Head of the Fuel Sciences Division of the Alberta Research Council, for his advice and encouragement throughout the preparation of this work.

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VOLUME 2

GASIFICATION OF MINED COAL

PART I : GENERAL PROCESSING, 1905-1930

0001

PROCESS OF OBTAINING PRODUCER GAS
A. Desgraz
United States Patent, 790,113, May 16, 1905

A process of obtaining producer gas free of tar and of high calorific value, consisting in introducing combustible gas and an excess of air into a producer above the fuel, igniting the mixture of combustible gas and air, and burning it in the said parts of the producer, passing the products of combustion and the excess of air from above downward through the coal, and leading off the produced gas from the lower part of the producer, substantially as described.

0002

PRODUCTION OF ILLUMINATING GAS
J. Guillet
French Patent, 361,909, November 13, 1905

In the distillation of coal for the production of illuminating gas, steam is employed in the retort to prevent the decomposition of the preferred gaseous compounds.

0003

PROCESS OF MAKING GAS
D. McDonald
United States Patent, 796,670, August 8, 1905

The process of making gas, which consists in providing, in a suitable generator, a body of coke and a superposed body of coal in contact with the coke, of a width at its bottom as great as the width of any place in its height and of a height to permit the passage therethrough of heat from the coke beneath; passing a blast through the coke while the coal is above it, but not through the coal, causing the coke to become incandescent, and the coal to give off some gas by heat radiated from the coke; passing steam through the body of coke to produce water gas; passing all the water gas thus formed through the body of coal in order to enrich the water gas; passing the enriched gas through a superheater to fix the gas; mixing the coal gas first given off with the enriched water gas that has passed through the superheater; and when the coke becomes cooled on its under side then passing steam downwardly through the coke forming water gas, which is passed through the superheater and mixed with the other gas.

0004

PROCESS AND APPARATUS FOR THE CONTINUOUS PRODUCTION OF ILLUMINATING GAS
K. Meitzler
German Patent, 214,661, January 6, 1906

Carbonaceous material is introduced into a vertical retort, and the coke, after distillation is removed from the lower end. Gaseous products are drawn off between the gas-generating zones so that the two kinds of gas flow counter but do not mix within the retort.

0005

METHOD OF MANUFACTURING GAS
P. G. Schmidt
United States Patent, 836,054, November 13, 1906

A method for the continuous and uniform production of gas which consists in blasting, heating, and distilling a bed of fuel; drawing the distilled gases and vapors from the upper part of the generating chamber; heating the withdrawn gases and vapors by the outgoing blast gases to prevent condensation; introducing the heated gases at one side of the generating chamber into the glowing fuel; and leading off the finished gases at the side of the generating chamber opposite to that where the heated gases and vapors are introduced to the generator.

0006

MANUFACTURE OF ILLUMINATING GAS AND WATER GAS
H. Strache
German Patent, 205,252, July 21, 1906

In the manufacture of a mixture of illuminating and water gases, the generator gas serving to externally heat the coal gas retort, while the water is led through the latter, effects the distillation of the coal by means of its high temperature. Appropriate pressures obviate the necessity for a separating device between the generator and retort.

0007

PROCESS FOR MANUFACTURING ILLUMINATING GAS
E. E. P. M. Blanc and P.-A. Caton
British Patent, 17,154, July 26, 1907

A process for manufacturing illuminating gas is described and consists of introducing into the gas from the retorts, air mixed with the light hydrocarbons, and adding benzine or a substance rich in hydrocarbons prior to further heating.

0008

METHOD FOR TREATING DISTILLATION GASES
W. Field
British Patent, 28,390, December 24, 1907

Treating distillation gases by adding steam, or other vapors, to the gases in such amount and at such a temperature as to lower the dew point of the gases and allows the more desirable constituents to be retained in the gases.

0009

PROCESS OF MANUFACTURING POWER GAS
E. Fleischer
United States Patent, 841,499, January 15, 1907

In the process of manufacturing power gas from bituminous fuel and the like with top and bottom air supply and exhaust of the gases at the mid height of the charge, the auxilliary step of supplying an additional body of air below the point at which the top air supply takes place and in or in the neighborhood of the vertical axis of the charge.

0010

GAS MANUFACTURE
H. I. Lea
United States Patent, 873,250, December 10, 1907

The method of manufacturing gas, which consists in passing air through a fuel bed in such quantities as to support only partial combustion, then in enriching the resultant gas by introducing hydrocarbon oil into it, then in burning enough of the gas in the presence of the hydrocarbon oil so that the heat resulting from the combustion, together with the sensible heat of the gas, will be sufficient to break up the hydrocarbon oil into vapors and fix the vapors into permanent gases, which are mechanically mixed with the remainder of the gas, thereby producing a permanent gas of relatively high thermal value.

0011

PROCESS FOR THE PARTIAL DESTRUCTIVE DISTILLATION OF COAL
R. Parker
British Patent, 18,118, August 9, 1907

Retorts of an internal diameter from 4 to 6 in. are used in a process for the partial destructive distillation of coal at a low temperature which is arrested at the stage when illuminating gases cease to be evolved. The retorts are placed so that uniform heating is achieved.

0012

PROCESS OF PARTIAL DESTRUCTIVE DISTILLATION OF COAL
R. Parker
British Patent, 18,856, August 21, 1907

Process of partial destructive distillation of coal in long vertical retorts, at a low temperature is halted at the stage when illuminating gases cease to be evolved and new additions, which insure the compression of the charge during its destructive distillation, are described.

0013

METHOD OF MAKING AND UTILIZING GAS
A. L. J. Queneau
United States Patent, 865,727, September 10, 1907

The method of making and utilizing gas, which consists in generating producer gas, consuming the gas in a suitable furnace, preheating the air blast for the producer to a high degree by waste heat from the products of combustion, and simultaneously rendering latent the dangerous excess of temperature of the preheated air blast, by co-mingling with it sprays of water, substantially as described.

0014

APPARATUS FOR PRODUCING COMBUSTIBLE GAS FROM MINERAL CARBONATES
C. H. Rider
German Patent, 214,726, October 3, 1907

The apparatus comprises several retorts arranged obliquely one above the other, of which the lower ones serve to receive the mineral carbonates and the top one to receive the coal. The retorts are inclined to the same side and are connected at their lower ends so that the carbon dioxide generated in the lower retorts reaches the uppermost retort by the shortest way where it is there reduced to carbon monoxide by the glowing coal.

0015

GAS MANUFACTURE
H. Ries
British Patent, 26,593, December 1, 1907

In the manufacture of gas, gas produced in a retort during the latter stages of distillation is used to expel the richer gas produced in another retort during the earlier stage of distillation. The introduction of the poorer gas prevents the richer gas from being decomposed.

0016

PROCESS OF MANUFACTURING PRODUCER GAS
W. H. Adams and F. Powell
United States Patent, 840,861, January 8, 1908

The improvement in the manufacture of producer gas consisting in establishing a horizontal zone of incandescence in the lower portion of a long horizontal body of fuel, admitting air to one end only of the body and giving exit to the gas at the other end, the admission of the air and the exit of the gas taking place at the same level and in the plane of the zone, and such exit being the only exit provided for the gas, whereby the rear portion of the incandescent fuel is caused to decompose the products of combustion from the front portion.

0017

METHOD OF PRODUCING GAS
F. Bauke
United States Patent, 887,058, May 12, 1908

The process of producing gas for power and heating purposes, which consists in preheating the fuel, then spreading it into a shallow burning layer of such dimensions that of itself it would produce a gas too rich in carbonic acid to be available for power or heating purposes, withdrawing gas from one of the broad surfaces of the shallow burning layer, and projecting against the other broad surface of the layer and at an angle to the surface, an intimate mixture of air and carbonaceous material.

0018

PROCESS OF MANUFACTURING GAS
H. W. Benner
United States Patent, 899,690, September 29, 1908

The process of manufacturing gas consisting of forming water gas, passing the water gas through powdered coal falling through a distilling chamber, and collecting the products.

0019

FURTHER EXPERIMENTS UPON GAS PRODUCER PRACTICE
W. A. Bone and R. V. Wheeler
Engineering, 86, 837 (1908)

The experiments described herein demonstrate the practicability of high rates of gasification with low steam saturation temperatures, and a gas rich in carbon monoxide. In a theoretical discussion of the results obtained, the authors state that the influence of successive increments of steam with consequent lowering of the temperature of the incandescent fuel, is that the reaction $C + 2H_2O = CO_2 + 2H_2$ *comes more and more dominant at the expense of the reaction* $C + H_2O = CO + H_2$. *Furthermore, the equilibrium point of the reversible reaction* $CO + H_2O \rightleftarrows CO_2 + H_2$ *tends more and more towards the right hand; the reversible reaction* $2CO \rightleftarrows C + CO_2$ *is also similarly affected.*

0020

MANUFACTURE OF COAL GAS
J. Bueb
United States Patent, 904,043, November 17, 1908

Coal is introduced into retorts previously heated to temperatures at which the coal is quickly coked. Gas is formed and the tar which is distilled through the charge is unusually free from carbon.

0021

ESSENTIAL FACTORS IN THE FORMATION OF PRODUCER GAS
J. K. Clement, W. H. Adams and C. N. Haskins
United States Depart. Interior, Bur. Mines, Bull. 7 5 (1908)

The results indicate that not all the methane of producer gas results from destructive distillation of the fuel but a portion arises from the action of steam on carbon. Many graphs are given illustrating the experimental results on the relation of yield and composition of gas to temperature and time of contact. Equilibrium conditions in the four main possible reactions during water-gas production are discussed. In applying the results to gas-producer practice it is seen that in the reaction between steam and carbon, if the time of contact is 1/4 sec., 8% of water vapor is decomposed at 1,100°; 15% at 1,200°; 32% at 1,300°; and about 60% at 1,400°.

0022

STUDIES ON THE GASIFICATION OF THE PRINCIPAL KINDS OF BITUMINOUS COALS
E. J. Coustam and E. A. Kolbe
J. Gasbel, 51, 669 (1908)

The authors describe a thorough investigation of 11 different French and Spanish coals and show that the chemical composition and the combustion heat of the combustible matter in coke from bituminous coals, is a function of the time and temperature of heating and is not influenced by the chemical composition of the distilled coal. They also report that the distillation of coals with an increasing amount of oxygen causes an increase in the amount of the condensation products as well as the sum of the oxygen constituents of the gases.

0023

PROCESS OF MANUFACTURING COMBUSTIBLE GASES
E. N. Dickerson
United States Patent, 888,969, May 26, 1908

A process of producing combined coal and water gas consisting of blasting a bed of fuel to incandescence by means of a fluid and at the same time heating externally by the blast gases a retort containing coal thereby distilling the coal gas and at the same time utilizing the blast gases to heat a checkerwork chamber and simultaneously heating the blast fluid passing through the chamber, then producing water gas in the usual way, and then combining the water gas with the distilled coal gas.

0024

PROCESS OF PRODUCING GAS
B. E. Eldred
United States Patent, 901,232, October 13, 1908

The process of producing gas, which comprises forming a flame of finely divided suspended fuel in the presence of substantially enough air to cause complete combustion, and subsequently distributing a further supply of finely divided fuel in the hot flame gases.

0025

PROCESS OF GENERATING AND DELIVERING GAS UNDER UNIFORM PRESSURE
W. C. Finck
United States Patent, 886,289, April 28, 1908

The process for generating and delivering gas to a point of consumption under a uniform pressure, which consists in creating a partial vacuum on the inlet side of a pressure pump, connecting such inlet with a fuel chamber whereby air is sucked through the fuel chamber, the air having previously passed across the surface of warm water, the gas being delivered from the pressure pump against a weighted valve so that the valve is not operated unless a certain pre-determined pressure at the outlet side of the pump is exceeded, the stream of gas being then divided in case such pressure is exceeded, by the operation of the valve so that part of the stream passes to the point of consumption under a fixed pressure, while the remainder returns to the inlet side of the pump, and finally adding air to the gaseous stream at a point beyond the valve and at a pressure greater than the pressure of the gas at the outlet side of the pump.

0026

PROCESS FOR PRODUCING GAS FROM HYDROCARBONS
W. H. Frost and J. J. Nix
British Patent, 16,623, August 6, 1908

A process for producing gas from hydrocarbons is described and consists of continuously generating gases in a chamber in the presence of air at or below atmospheric pressure. The gases are then passed into the hydrocarbons in an elastic fluid medium and gases produced are withdrawn from the chamber by suction.

0027

PROCESS OF MAKING GAS
A. M. Gow
United States Patent, 884,655, April 14, 1908

The process of making gas which consists in blowing to incandescence the exterior portion of a body of fuel, forcing fresh fuel into the interior of the body, utilizing the sensible heat of the incandescent fuel in the destructive distillation of the fresh fuel, introducing steam into the interior portion of the body of fuel and causing it to pass, first through the fresh fuel and then through the heated portion of the fuel bed.

0028

THE MOST RECENT IMPROVEMENTS IN THE GAS INDUSTRY
W. Koenig
J. Gasbel., 51, 744 (1908)

The author reports improvements made on the distillation of coals, the construction of retorts, the application of the gas for illuminating and heating purposes and the construction of incandescent gas burners. Comparative data on the consumption, costs and illuminating power for electric and gas lamps of various kinds are given.

0029

CHEMICAL CONSTITUTION AND HEATS OF COMBUSTION OF THE GASES EVOLVED FROM COAL
E. Kolbe
Inaug. Diss., Zurich (1908)

0030

ON GASIFYING AND COKING OF COALS
A. Peters
J. Gasbel, 51, 1114 (1908)

The author attempts to trace the fate of oxygen in coal during the gasification process. Whilst the course of the gasifying is still obscure, the author attempts to offer plausible explanations for the origins of the various products and the effects of various conditions on their yields.

0031

METHOD OF MANUFACTURING GAS
H. M. Pierson
United States Patent, 882,908, March 24, 1908

The method herein described of manufacturing gas, the same consisting in forcing air into and heating a body of fuel and making therein producer gas, passing the producer gas on and directly through a body of bituminous coal superimposed upon the body of fuel and forming an uninterrupted continuation and thereby extracting the chemical substances and distilling the bituminous coal and conveying the hot gases produced away for immediate use.

0032

METHOD OF MANUFACTURING GAS
H. M. Pierson
United States Patent, 882,909, March 24, 1908

The method herein specified of making illuminating gas, the same consisting in blowing up a body of fuel to substantial incandescence and making producer gas, passing the producer gas through a body of bituminous coal, which forms a substantially vertical continuation of the heated body of fuel, and heating up the fuel, adding air to the producer gas beyond the body of bituminous coal and burning the same and so heating up a fixing chamber; closing off all the air and introducing steam and passing it through the body of incandescent fuel, decomposing the steam and forming water gas and passing the water gas through the body of bituminous coal for the extraction of the chemical substances therefrom and the production of a fuel coke, simultaneously supplying liquid hydrocarbon to be vaporized and taken up by the decomposed steam or water gas in transit through the coke and bituminous coal and conveying the gases and co-mingling and fixing them in the presence of the stored-up heat of the fixing chamber, and then conveying away the gases to a suitable receptacle.

0033

TOWN GAS, PRODUCER GAS, AND ELECTRICITY
P. W. Robson
Am. Gas Light J., 90, 318 (1908)

The relative position of town gas, producer gas, and electricity as alternatives to the community for the respective purposes of lighting, heating, and power is reviewed. The author suggests that future success in these fields will be attained along natural lines of development rather than by continued antagonism and overpressed competition and modifications in the nature of the public supply of gas may be expected which will enable every householder to enormously increase his demand for gas to be used for heating and cooking.

0034

NOTES ON THE MANUFACTURE OF CABURETTED WATER GAS BY THE LOWE PROCESS
C. F. Schoen
Chem. Eng., 10, 113 (1908)

The author outlines the history and development of the Lowe process and describes the apparatus and its operation. Tabulated results of the testing of two different machines are given and the effect of pressure on gas formation and composition is discussed.

0035

GENERATING WATER GAS
H. Strache
United States Patent, 898,803, September 15, 1908

An air-containing gas is conducted into glowing coke until the combustion gases contain 12% carbon dioxide and at least 15% carbon monoxide. When the fuel is light-red a blast of steam is passed into the fuel.

0036

VERTICAL RETORTS AND OTHER SYSTEMS OF COAL CARBONIZATION
J. H. Taussig
Am. Gas Light J., 89, 884 (1908)

The author recognises that the two great struggles in the development of coal gas apparatus during the last 100 years have been to reduce the bench fuel and lessen the amount of severity of retort house labor. A sketch of the progress in this line is given followed by descriptions of the Woodall-Duckham, Lyons and Marseilles, Seattle, and comparative tests of various types are given. In conclusion the author states that the Dessau system has been tried to a greater extent than any of the rest and has proven itself a success and superior to any other previously devised system.

0037

COALS AVAILABLE FOR THE MANUFACTURE OF ILLUMINATING GAS
A. H. White and P. Barker
Dept. Interior, Bur. of Mines, Bull. (1908)

The results of the testing of coals from different parts of the United States show that certain coals from which good yields of gas had been expected cannot be considered as available for illuminating gas manufacture. Data is given showing the progress of distillation by 1/2 hour intervals for each coal, also the internal and external retort temperatures, heating value of the gas and the variation in the percentage of "illuminates", hydrogen and ethylene. The total yields of tar and ammoniacal liquor are shown as is the yield of ammonia and weight of naphthalene vaporized in the gas and dissolved in the tar at the outlet of the tar separator.