Food, Oil, Gas From Coal

Chemistry—Engineering

Following are reports from the Second International Conference on Bituminous Coal, held at Pittsburgh, November 19 to 24.

Soap fats, edible fatty foods, lubricating oils, gasoline, kerosene, light and heavy oils, and anti-knock motor fuel of high value are among the commercial products that coal has been made to yield through the skill of the chemists of the German Dye Trust in their research laboratories and immense plants at Leuna, Ludwigshafen and Oppau in Germany.

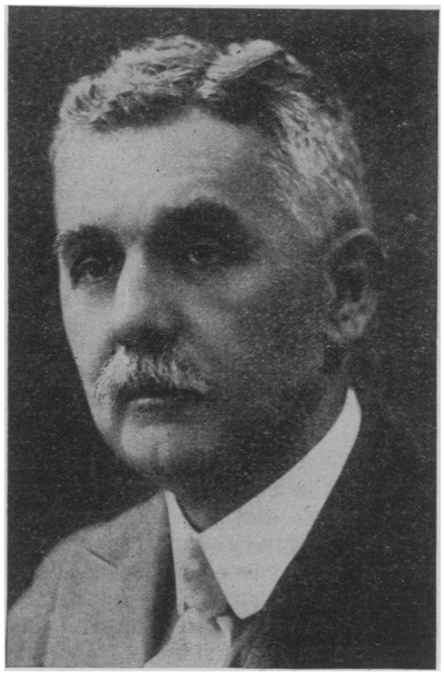
Seldom does information on their new chemical achievements emerge from the carefully guarded walls of this great industry, but before the Conference, Dr. Karl Krauch, director of the I. G. Farbenindustrie Aktiengesellschaft, discussed the mechanism of catalysis and hydrogenation, the chemical processes that have allowed the production of such diverse and valuable materials from coal as raw material.

The synthetic chemical production of basic materials from coal is of utmost importance to Germany's economic future. That country is made practically independent of parts of the world that have prospered from monopolies of rich natural resources. But the German research has immediate application to American conditions. The president of the Standard Oil Company of New Jersey, Walter C. Teagle, introduced Dr. Krauch and in his address the German chemist revealed that the Dye Trust processes, controlled in America by the Standard Oil Company, can be used effectively in the refining of crude oil.

Catalysis Banishes Sulphur

Refined by the catalytic process, crude Mexican oil, containing 5 per cent. of sulphur, produces gasoline with only a small amount of this undesirable element. Catalysis and hydrogenation also allow the refinery to make from crude oil the material bringing the highest market price. Gasoline, kerosene, gas oil, lubricants and other products can be produced in quantities varying with the catalysts used. Research applying these new German developments to American refinery practice is understood to be underway in Baton Rouge, La.

At the Leuna chemical plant in Germany, an annual production of 70,000 tons of synthetic gasoline has been achieved and by the end of 1929 it will equal 250,000 tons. The processes used in this and the other synthetic productions are combinations of catalytic methods developed by the I. G. chemists and the hydrogenation methods developed by Dr. Friedrich Bergius, the German chemist, whose patents were acquired last year by the German Dye Trust.



GEORGES CLAUDE froze air; made ammonia—now he seeks power at the bottom of the sea

The close resemblance that synthetic gasoline and other products obtained in the hydrogenation of coal bear to their natural counterparts suggests to Dr. Krauch a new theory of the origin of crude oil.

"Peat and coal layers, after getting into greater depths, combine with hydrogen under pressure, thereby being partially converted in liquid hydrocarbons," said Dr. Krauch. "The presence of hydrogen in the interior of the earth is deduced from the fact that both rocks and volcanic gases contain it. Apart from the generally accepted views of its formation, its origin might be attributable also to the action of water vapors at high temperature upon coal."

The basis of catalysis, the chemical phenomenon that causes two substances to react more effectively in the presence of another that does not undergo chemical change, is believed by Dr. Krauch to be electromagnetic. He conceives the molecules and atoms as having two poles like a bar magnet. The catalytic agent places them under an electric spell and makes them more receptive to chemical action.

Credit was given by Dr. Krauch to American chemists for the fundamental theoretical research upon catalysis. Discoveries by chemists of this country were often used in making the industrial application in Germany.

Water In Fuels of Future

Setting the Thames afire is one of the proverbial impossibilities; yet the householders and factory owners of the future will be doing exactly that when they light up the fluid fuel in their furnaces.

This in effect was the prophecy of A. T. Stuart, consulting engineer of Toronto, uttered before the Conference. He based his look ahead on the ever-increasing use of liquid and gas fuels in industrial and domestic power and heating plants, and on the increasingly practicable processes for converting coal and other solid fuels into fluid forms.

The essential of making coal into a liquid or gas fuel without waste is the adding of hydrogen to its carbon. Hydrogen is obtained commercially by breaking up water with electricity. Hence, said Mr. Stuart, "it is not unlikely that more water than coal will be used as raw material and that perhaps half of the energy of future fuel will come from the combustion of hydrogen obtained originally from water."

Water yields oxygen as well as hydrogen when it is broken up, and the disposal of the surplus of oxygen will present considerable engineering problems, Mr. Stuart continued. Some oxygen can be combined in the fuel-making process, but a great deal will be left over. The best disposal of this, he believes, will be to find some place in the process where it can be separated out, and dispose of it as a commercial gas.

Water power sites and coal mines will not be looked upon as rivals when the fluid fuel economy of the future has been worked out. The most efficient means for breaking up the water to get its combustible hydrogen is to be found in the electricity generated by hydroelectric plants, which already have far higher capacity than the market justifies. This is because their market at present makes use of their maximum production during only a part of each day—the so-called "peak- (*Turn to next page*)

International Coal Conference—*Continued*

load" period. But if the power can be used for the generation of hydrogen and oxygen from water during the slack periods, the plants can be run at full efficiency continuously; and what was originally water power will appear, sometimes at long distances, as fuel power.

"Coal Improvement"

"Coal improvement" plants—industrial developments for pulverizing, carbonizing, liquefying or otherwise increasing the fuel value of coal—are likely to pay the investor better than electric power plants. This was the thesis set forth by F. zur Nedden, Secretary of the Fuel Committee of the National Fuel Council, of Berlin.

Herr zur Nedden has made a study of the economics of fuel and power production in Europe, and is convinced that "the higher the quality of the bearer of energy into which you transform coal the greater is the amount of capital which you must invest per ton of annual throughput." The lower costs of coal improvement plants as compared with electric power plants are in accordance with this generalization, he declares.

While his studies apply mainly to European conditions, Herr zur Nedden feels that even in America, where power investors are "wading in oil", certain attractions may be found in coal improvement plants: "As the supply of energy in all its various forms, which are constantly becoming more refined, is the basis of modern civilization and industry, it always requires long-term foresight so that the building of plants for the improvement of coal is more or less a matter independent of the fluctuations of business trends. This kind of investment, therefore, acts as a *stabilizer* ironing out the fluctuations in the occupation of industry and labor."

Coke Used in Homes

Coke may become an important fuel for home use with the aid of a new boiler described by Dr. Charles W. Brabbée, director of the Institute of Thermal Research at Yonkers, N. Y.

The coke is supplied to the grate from a large water-cooled magazine, which holds enough fuel to keep it going for eight hours at greatest heat. In ordinary winter weather, and in the average home, said Dr. Brabbée, it should not require attention more than twice a day.

One important outcome of the use of such a boiler will be in the use of large supplies of coke, which are coming into the market as a result of the increasing consumption of gas. The coke is a byproduct in the manufacture of gas from coal.

Half Ton to Start Train

It takes half a ton of coal to start a freight train and bring it to running speed, W. L. Robinson, superintendent of fuel and locomotive performance of the Baltimore and Ohio Railroad, told members of the Conference. On that account it is important to eliminate unnecessary stops.

He also emphasized the importance of keeping impurities out of the coal.

"A difference of only one per cent. between the ash content of prepared seam sample and shipment sample is of such ordinary occurrence as to attract only casual notice" he said, "but let us illustrate the importance of this variation to our railroads alone, as coal consumers. One per cent. is equivalent to 20 pounds per ton. Our railroads use in round numbers 125 million tons of coal per year. Twenty pounds of extraneous material in each ton of this annual consumption amounts to one million and a quarter tons which, if loaded into 25 thousand 50-ton capacity coal cars, would make up 213 trains each a mile long. End to end the cars would reach from Pittsburgh to Cleveland and 65 miles beyond.

"This waste material is not only paid for at the average price of the fuel but is hauled to consumption points loaded onto tenders where it imposes a further handicap upon combustion efficiency and fuel economy, and finally has to be hauled away from ash pits, a total loss from beginning to end."

Seeks Power From Sea

An engineer working on an invention that will not be any good until a couple of centuries after he is dead, but will be urgently needed then—such was the phenomenon which was presented by Georges Claude, noted French worker on gases, in his appearance before the Conference. And M. Claude was not directly concerned with coal at all, but with what the world will do for power after the coal is all burned.

He proposes to harness the potential power involved in the difference between surface and bottom temperatures in the sea. The array of eminent chemists, engineers, inventors and industrialists who heard his address listened with respect, because the speaker's record was not that of a mere visionary. M. Claude invented the first successful process for making liquid air and liquefying other gases; he pioneered in the field of making ammonia out of the atmosphere; he is the inventor of the glowing neon lights that shine on our street signs at night.

The difference between surface and bottom temperatures in the sea, which M. Claude proposes to turn into kinetic energy, is not great. Bottom temperatures hover near the freezing point of water; surface temperatures are only thirty or forty degrees above them. This is only a fraction of the temperature difference utilized in the ordinary steam plant, where the degrees are counted by hundreds instead of by tens. The French inventor proposes, however, to get around this by exhausting the air from his boiler. In the vacuum thus created water will boil at very low temperatures, provided the vapor thus generated is removed fast enough and condensed after being passed through a turbine. A working model of such a hydrothermal plant has been built by M. Claude and his associates, which has been successfully demonstrated before a number of scientific bodies in both Europe and America.

Science News-Letter, November 24, 1928