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ARTIFICIAL GASOLINE

By Dr. Edwin E. Slosson.

One of the most pressing problems of the present time is: What are we going to do when the oil runs out? If that question is not answered within the next ten or twenty years, the pressure on parking space will automatically be relieved through the growing scarcity of automobiles, aviation will remain a rarity and the small shop will tend to extinction through loss of its handy engines.

Already the question has become acute in countries less oily than ours. In England, Germany and France chemists are hard at work trying to invent ways of making something to match the natural petroleum that is still being so recklessly wasted with us. The three countries are pursuing different ways toward the solution of their common problem, and all have recently reported some measure of success in getting gasoline from coal.

The British Department of Scientific and Industrial Research is experimenting in low temperature carbonization and has worked out a process that gives a gaseous fuel for local use, a liquid fuel suitable for motors, and a solid smokeless fuel, which they call "coalite", for household and industrial purposes.

In Germany the Bergius process of treating powdered coal with hydrogen under high temperature and pressure is said to be capable of converting low-grade lignite into a synthetic petroleum equal to the natural.

In France, a Rumanian chemist, Georges Olivier, in collaboration with a French mining engineer, Charles Andry-Bourgeois, has invented a process claimed to be capable of converting coal, wood or any kind of carbonaceous material into gasoline of higher heating value than that obtained from petroleum. This is accomplished by the aid of certain catalysts which have the power of effecting the desired combination of carbon with hydrogen at high temperatures. Exactly what these catalysts consist of is not revealed in the account of the process given in the October issue of "La Science et la Vie" but they are stated to be made of certain metallic powders spread upon infusorial earth, pumice, clay charcoal and other porous bases.

The first stage of the process is similar to the familiar method of making coke and illuminating gas. The coal or lignite is mixed with from five to twenty-five per cent of lime, soda or alumina and heated in tight retorts. The distillate of tar, ammonia and light oils is condensed and utilized. The coke remaining in the retort is converted into water-gas by the well known method of passing steam over it while red hot. Water-gas is a mixture of hydrogen and carbon monoxide, both excellent combustibles and both employed in later parts of the process.

The gaseous output of the coke oven consists of free hydrogen methane and

more complex compounds of hydrogen and carbon. It is essential for the next step that there should be an excess of hydrogen. If the mixed gas contains less than fifteen or twenty per cent of hydrogen by weight more must be added. This additional hydrogen may be obtained from the water-gas or, if necessary, by decomposing water by the electric current.

The second stage of the process consists in passing these gases through an electrical furnace heated to 3,000 degrees centigrade. This transforms the methane into acetylene and changes the other hydrocarbons into forms more active and ready for combination.

The gaseous mixture so obtained is next conducted under pressure through tubes containing the catalyzing agents. The temperature at the beginning of this, the third, stage of the process is about 150 degrees centigrade at first, but rises to 400 degrees at the end. Contact of the gases with these finely divided metals somehow causes the smaller molecules to hook up together and form larger molecules, and the colorless gas that entered the tube comes out as a colored oil, which, like the distillate of natural petroleum, looks red by transmitted light and green by reflected light. It contains about 75 per cent of very light gasoline.

In the fourth and final stage this colored oil is again passed over metallic catalyzers with an excess of hydrogen at a temperature of 180 degrees. The finished product is a light limpid colorless liquid having a very agreeable odor. It consists largely of what the chemists call the "hydrogenated compounds of the benzene series", such as cyclohexane. In composition it consists of about 86 per cent of carbon, 13.5 per cent of hydrogen, with very little oxygen and less sulfur.

The process seems pretty complicated but according to figures of M. Olivier gasoline can be manufactured from the French lignites at a cost of twelve cents a gallon, which is less than a third the present price of gasoline in France. The initial plant constructed at Asnieres is expected to turn out a thousand tons a day. Twenty-five per cent of the carbon in the original coal comes out in the form of gasoline. The rest is mostly employed in heating the gas and apparatus and running the engines.

NEW BRAIN DISEASE CAUSES JAPANESE EPIDEMIC

A mysterious and unidentified disease has caused a severe epidemic in Japan which appeared first in provinces bordering the inland sea and then spread over the whole island empire. The first reliable reports of the outbreak have recently been received by the Health Section of the League of Nations at Geneva.

The new disease was at first reported unofficially as cerebro-spinal meningitis and then it was thought to be encephalitis lethargica, the so-called "sleepy sickness" which has been troublesome here and in Europe since the War. Finally it was found to be a hitherto unidentified epidemic disease involving the central nervous system, including the brain.

The explosive character and the intensity of the new disease that appeared in July and continued in epidemic form at last reports surpass even the outbreaks of encephalitis and acute poliomyelitis, or infantile paralysis, which have been particularly acute in recent years. The incidence was nearly 3 per 1000 inhabitants in the most seriously affected province, Kagawa, and the mortality is reported as 60 per cent.

This level of mortality is higher than that met in other serious disease such as encephalitis and poliomyelitis and approaches the fatality rate of deadly epidemic cerebro-spinal meningitis.

The new disease is more likely to attack old people, particularly those over 50 years of age, than young, and more men than women are affected. Another remarkable feature is that more than one case per family or house occurs but rarely.

The central sanitary service of the Japanese Government, and various medical colleges have investigated the new disease but no causative micro-organism has been found. No successful treatment has been evolved although the disease has been produced experimentally in rabbits.

The onset of the new disease is sudden and accompanied by a high temperature; after one or two days, loss of consciousness and a slightly maniac condition occurs. Either death comes in five to ten days or recovery is effected with a falling of temperature and regaining of consciousness.

Reports of a new and serious disease affecting the spinal cord and brain and appearing in epidemic form in Japan have caused U. S. Public Health Service officials to be apprehensive of danger lying in its spread to this country. So far, however, the disease has not appeared here, Dr. G. W. McCoy, director of the Hygienic Laboratory, declared.

Acute poliomyelitis is the principal disease of the central nervous system that has been unusually prevalent in this country this year. The number of cases of this disease at the height of the outbreak in September was double the number at the same time last year.

NEW RUSSIAN ALPHABET PRAISED BY ETHNOLOGIST

Spelling reform, for which President Roosevelt, Andrew Carnegie, and many prominent American scholars struggled vainly a dozen years ago, has been accomplished for the Russian language by the Soviet administration.

The reforms in the Russian alphabet, shortening the written language by one-twelfth and making its spelling twice as logical, announced by the Russian Ministry of Education, are declared by Dr. John P. Harrington, ethnologist of the Smithsonian Institution, to be of material advantage in the study of this difficult Slavic language.

Dr. Harrington also pointed out that it is fortunate for Russia that this reform has been declared at just this time. "Spelling reform failed in American largely because practically all Americans could read and write already, and were reluctant to change what they had learned," he said, "But in Russia it is different. Illiteracy is still common in Russia, and the great mass of the people have nothing to unlearn. When education becomes universal among them, as it is finally bound to, it will be based on the new spelling.

"The changes should effect a saving of about four years out of the education of every Russian child," he says, "and they will reduce the cost of printing in Russia by something like \$15,000,000 a year. Five of the letters of the alphabet have been thrown out bodily, reducing it from thirty-seven letters to thirty-two.

"The spelling of Russian has remained unaltered since it was standardized by Peter the Great and the grammarian Lomonosov, in the eighteenth century. No change was allowed, though in many ways the orthography was most whimsical.

"For instance, the Russians were using two kinds of "e". One word might require the variety of "e" known as "ye", and another would call for the "e" known as "yat". There were also two kinds of "i", one written like our own "i" and other like our "u". The "dotted" kind was written before a vowel, and the "double" before a consonant. And no word was allowed to terminate in an unpalatalized consonant, a "hard sign", as useless as the mute "shewa" of Hebrew, having to be written at the end. All this nonsense has been eliminated, and Russia is now the most scientifically spelled language of Europe.

"The question was raised in the Ministry of Education of introducing the Roman alphabet, which is the one we use in writing English, instead of the modified Greek character in which Russia has always been written. Psychologists claim that the Roman small letters, with their projections above and below the line, present a contour more readily grasped by the eye than the solid blocks of Russian lower case characters, which are practically all the same height and correspond to our small capitals. Thus "malchik" which is the Russian word for "boy", in Russian type is a rectangle, while "boy" in Roman type has projecting signals. But the advocates of retaining and "scientificizing" the Russian alphabet prevailed."

Russian is now written without the dotting of an "i" or the crossing of a "t", which cause the lifting of the hand from the paper in writing English.

Dr. Harrington also told of the history of the Russian alphabet. "In the ninth century two alphabets were introduced among the Slavs in the vicinity of Salonika," he stated. "They have since become known as the Glagolitic and the Cyrillic alphabets. They were founded on the curivse Greek alphabet of the time; but much as the Slavs may wish to deny it, two of the letters "sha" and "shcha" were supplied by the Jews. They are merely the three-pronged "shih" of the Aramaic alphabet.

"The Glagolitic form is now used only in Croatia and Dalmatia, while the Cyrillic is employed by all Russians, Servians, and Bulgarians. It is the form in which the earliest Russian New Testament translation was written in 1057 A.D., and to which the Russian Ministry of Education has now given the benefits of scientific improvement."

NEW SYNTHETIC PROCESS HALVES FERTILIZER COST

Nitrogen fertilizer, captured from the air at half the former cost, is the promise, held out by the Fixed Nitrogen Research Laboratory of the U. S. Department of Agriculture. The new developments which have been announced by Dr. F. G. Cottrell, director of the Laboratory, may eventually make American independent of foreign sources of nitrates for farm use and explosives.

One of the principal methods of fixing atmospheric nitrogen involves its combination with hydrogen from water-gas or coke oven gas to form ammonia. This process obviates the necessity for the large amounts of very cheap electric power which were essential in earlier processes, thus freeing the nitrogen fixation industry from its former dependence upon water power developments and transfers its natural associations from there to the coal mines and coke oven plants. These newer processes depend to a large extent upon a sort of chemical go-between, called a catalyst.

The Laboratory's researches have produced catalysts of increased efficiency as well as other equally important improvements in the processes which have greatly helped in adapting them to American conditions.

One commercial plant in which many of these new developments will be used is already under construction in the West, and when completed within the next few months will produce three tons of ammonia per day. A number of already existing plants are modifying their methods and equipment to take advantage of the new discoveries.

Another line of research now in progress is expected to develop methods by which cyanogen, which is a compound of nitrogen and carbon, can be recovered from blast furnace waste. It is known that cyanides are produced during the smelting of iron, but it is not known yet in what quantity, nor whether their recovery would be a paying proposition. The Fixed Nitrogen Research Laboratory and the U. S. Bureau of Mines are attacking this problem cooperatively.

In addition to the research problems aiming at artificial fixation of nitrogen by chemical means, workers in the laboratory in cooperation with the Bureau of Plant Industry, are endeavoring to discover the chemical processes employed by the nodule bacteria of clover and other leguminous plants, which cause the fixation of nitrogen spontaneously in nature. This knowledge, it is hoped, may eventually enable the chemist to compete directly with the bacteria at their own game.

HIBERNATING ANIMALS SLOW TO AWAKE

What happens when a hibernating animal - a bear, squirrel, or chipmunk that has slept all winter long - awakens in the spring? Dr. George E. Johnson of the Kansas State Agricultural College has undertaken to find out.

Bears would obviously be unsuitable animals for such experiments; Dr. Johnson chose a striped ground squirrel. In its winter nest the sleeping squirrel was a limp ball of fur, which felt cold, did not move at all, and breathed only a few times a minute. When handled, its breathing was a little more rapid; taken into a warm room it breathed still more rapidly, and trembled a little. Later it slowly straightened out, got up on its forelegs, and finally on all fours, and was able to fight a little on being handled.

A thermometer showed that its body temperature rose from a few degrees above freezing to normal while waking. The normal temperature of a ground squirrel has a range of several degrees and is not nearly so constant as that of a human being. This may be one reason why it can hibernate. Its temperature may gradually sink while it is asleep in a cold place.

The heart beat of a hibernating ground squirrel is too faint to be heard with a stethoscope, but in the normal animal it could be heard clearly and rose to nearly 400 per minute sometimes. The lowest heart rate found was 13.5 per minute.

In order to learn whether hibernation would occur at other times than in the winter some animals were put in a refrigeration room at the Kansas State Agricultural College in the summer. Sooner or later nearly all the animals went into hibernation, and several of them would go back into it after being waked up. If the temperature got a few degrees below freezing the animals in hibernation were likely to die, suggesting that a very severe winter accompanied by freezing of the ground to unusual depths may kill the animals. Hibernation resembles death much as being

under an anaesthetic does. Neither prove fatal usually, but if either go too far life may cease. One ground squirrel escaped death by a narrow margin. After it had been taken to a warm room and had lain without breathing for nearly an hour it twitched slightly. It was not awake enough to bite for several hours and it took about a day for it to become normal in its actions.

MOTHER'S VITAMIN SUPPLY CONTROLS VIGOR OF YOUNG

Possibility of decreasing materially the death rate among infants has been greatly enhanced by the discovery of the relation of the newly discovered reproductive vitamin to certain vegetable oils, according to Dr. Barnett Sure of the University of Arkansas.

The new vitamin, named Vitamin E by Dr. Sure, has been traced to certain vegetable oils in recent investigations. Earlier experiments by Dr. Sure, and Dr. H. M. Evans and Dr. Katherine Bishop of the University of California, who label the vitamin "X", had shown that animals fed on complete rations, including necessary amounts of all known vitamins, grew normally but failed to continue the race. A new "reproductive vitamin" was therefore indicated.

It was established that certain kinds of oil-containing seeds retained normal powers of reproduction, wherefore the investigator undertook to find what part of the seeds contained the vitamin. He separated the oily substances from the starchy bulk of the seeds by extracting with ether, benzene, or acetone, and then distilling off the solvents. Animals fed on starchy residues were unable to reproduce, but others fed on a diet containing the extracted oils had normal offspring.

The oil extracts thus far used by Dr. Sure in his experiments have been taken from yellow corn, wheat embryo, and hemp seed. From work, so far completed, the vegetable oils are tentatively divided into the four following groups:

1. Those oils that do not even produce fertility. In that group belong commercial linseed, coconut, and sesame oils.
2. Those that produce fertility, but fail in lactation, or milk secretion and nursing of young. In this group belong commercial olive oil, the oil of the peach kernel; and peanut and soy bean oils directly expressed.
3. Those oils that produce fertility, and are only partly successful in lactation. In this group so far studied cotton seed oil belongs.
4. Those oils that are potent for both fertility and successful lactation. In this group belong wheat germ oil, corn oil, and hemp seed oil, prepared by extraction with ether, benzene, or acetone.

Vitamin E is indispensable for both fertility and lactation, but in the same series of experiments Dr. Sure reports that Vitamin B, in addition to being essential for growth, also performs a significant role in milk secretion after the young are born.

This recent addition to the vitamin family appears to be the most potent of all, as it has been found that as little as three-quarters of a milligram of E, or 1/480,000 of a pound, per rat per day is sufficient for fertility. The latest

experiments show that the supply of vitamin E controls in a quantitative way, the volume of milk secretion, and the vigor of the young; and it has proved possible to grade the age to which young rats will live by controlling the supply of the fertility vitamin which their parents receive.

Dr. Sure declared that the greatest proportion of mortality among human beings takes place between the ages of one and three and among infants the greatest losses of babies occur during the first year of life - during the nursing period.

"Undoubtedly the cause of such fatalities among human babies must be attributed to either insufficient milk flow or poor quality of milk or both," he declared. "Heretofore the relation between faulty lactation and the diet has not been appreciated. Insufficient milk flow in the human mother is not the unusual thing. It is rather the usual thing, and, therefore, the medical profession has been, in the majority of cases, absolutely handicapped in its efforts to help mothers successfully to nurse and wean their children because of a lack of a scientific understanding of the dietary needs during the nursing period."

Dr. Sure hopes that it will soon be possible to help many mothers along this line,

NATURALIST SAYS MICE OFTEN BENEFICIAL TO MAN

Mice are often useful to man, Vernon Bailey, naturalist of the U. S. Biological Survey, told the American Nature Study Society meeting recently.

There are many species of small mammals commonly known as mice, said Mr. Bailey, of which one well-known group, the European house mouse, has been so odious that it has given an undeserved bad name to all the rest. While many of the native American wild mice are also destructive to crops, and some to orchard and forest trees, there are some species that are friends of man. Notable among these is the grasshopper mouse. Their natural food consists largely of insects and other small animals, such as grasshoppers, crickets, beetles, scorpions, and a great variety of such earth-dwelling forms, as well as other small rodents of their own size or smaller. These little tigers of the mouse world supply the place of the useful mole and shrews, which do not to any extent inhabit the arid regions where these mice live.

PLAN OF OLD ROMAN TOWN TRACED IN WHEAT FIELD

Lines of the walls and streets of an ancient Roman town, Magna Castra, near Hereford, England are plainly visible in the wheat fields near there. The crops grow shorter where there is less depth of soil and show the entire plan of the town.

Excavations have been made there and the foundations of the old forum have been discovered. Magna was one of the smallest of the British-Roman towns, having an extent of only 25 acres, and was probably used for a stopping point for troops on the way to the great wall.

The complete skeleton of a British woman has also been unearthed there, together with much dateable material. Pottery dating from the time of Antoninus Pius,

138-161 A.D. to Valens, 364-378 A.D., with the stamp of the potter has been found. A perfect bronze bracelet for a child, with its catch complete, was among the discoveries.

There is a tradition that Magna was burned, either by Saxons or by native tribes.

----- TREES BEAR RECORDS OF OWN EVOLUTION

Plants as well as animals carry about with them bits of evidence of their own evolution, according to Prof. E. C. Jeffrey of the department of botany at Harvard University. Most people are familiar with the evidences of evolutionary history in animals. Prof. Jeffrey points out; for example, the vermiform appendix, and the vestigial tail at the end of a man's spinal column - structures that were probably once fully developed in our remoter ancestors.

Trees also, he states, have similar reminders of the youth of their race. It is fairly well established that primitive evergreens bore their needles singly, like the modern firs and spruces. Present species of pine bear their needles in clusters of from two to five. But baby pine-trees bear their needles singly, and develop the cluster habit only when they begin to grow up.

Again, the larches have developed the habit of shedding their needles in the fall, in contrast to the evergreen habit of most of their relatives. Seedling larches, however, are evergreen for several years - once more a recollection of ancestral conditions. And in addition to these external signs there are, according to Prof. Jeffrey, numerous microscopic internal details of the wood that show to the botanist the family tree from which fell the ancestral seed of the trees with which he works.

----- ASTRONOMERS MAKE EXTENSIVE PLANS FOR TOTAL ECLIPSE

Extensive plans are under way in astronomical circles to assure the successful observation of the total eclipse of the sun on Saturday, January 24.

The greatest shadow ever thrown on the world, extending from west of Duluth to New York City and the Rhode Island coast, will include ten astronomical observatories and barely miss thirteen others. Practically every other astronomical observatory in the country will send expeditions or representatives into the zone of totality of the eclipse.

High above the ocean the great Navy dirigible, the Los Angeles, will carry a party of astronomers from the U. S. Naval Observatory on the first eclipse expedition to be conducted by dirigible. Airplanes will fly over New York during the eclipse.

New Haven and Middletown, Conn., and Foughkeepsie, N.Y. will be centers for scientific observation of the eclipse.

The telescopes and apparatus of Yale University Observatory will be in operation at New Haven, in charge of Prof. E. W. Brown, and parties from the Sprout Observatory, Swarthmore College, under the direction of Dr. John A. Miller and from

Allegheny Observatory, under the leadership of Dr. Heber D. Curtis, will, establish temporary eclipse stations on the Yale campus.

At Middletown there is the Van Vleck Observatory of Wesleyan University, under the direction of Dr. Frederick Slocum. At this point there will also be located the McCormick Observatory, University of Virginia party under Prof. S. A. Mitchell, a group from the Harvard College Observatory under Prof. H. T. Stetson, a party from the Mount Wilson Observatory under Prof. J. A. Anderson and an expedition from Brown University under Prof. C. H. Currier.

Vassar College at Poughkeepsie, where the observatory is in charge of Prof. Caroline E. Furness, will also attract astronomers, and Maria Mitchell Observatory at Nantucket, Mass. will also be the location of several parties. Other observatories within the path of the eclipse are; University of Toronto, Canada; Fuertes Observatory, Cornell University, Ithaca, N.Y.; Bausch and Lomb Observatory, Rochester; Smith Observatory, Geneva, N. Y.; Elmira College Observatory, Elmira, N.Y.; Columbia University Observatory, New York City.

Extensive plans are also under way for a cooperative investigation by large radio stations and laboratories to determine what effect the eclipse may have on radio communication. The U. S. Naval Observatory will also cooperate with telegraph companies in observing any disturbances on land wires.

Special magnetic and allied observations will be made at stations in or near the path of totality by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington and various cooperating agencies.

WHITE INDIAN LANGUAGE HAS MANY NORSE WORDS

Did the White Indians of Darien have Norse teachers? Werethere any Vikings among their ancestors? Or are the many Norse and other European words in their language simply coincidences? These startling and puzzling questions have been raised by the discovery of a large group of apparently foreign words in the vocabulary of the "Tule" language, spoken in the San Blas region, wherethe White Indians come from.

Dr. John F. Harrington, linguist of the Smithsonian Institution, and R. P. Vogenitz, chief translator, U. S. Postoffice Department, who have been reducing this hitherto unstudied language to writing, do not answer the questions they have raised. They smile and shake their heads - and point out more Indian words that resemble Norse almost identically in both sound and meaning.

For example, "arbaiddi" means "world" in the Indian language; in Norse it is "arbeide". The pronunciation is practically identical. The Indian word for "call" is "kale", and the Norse is "kalle". The Norse word for "plate" is almost like English; "platte"; the Indians drop one letter and have "patte". The Indian word for "color" is "parbatti"; Norse lisps the "p" into "f" and the "b" into "v", and has "farvet".

A widespread identity occurs in the word for "sack". The Indian word is "saki" and the Norse is "sæk"; but this word-form runs through many European and Semitic languages, including the Hebrew "saq" and Old Egyptian "sok". For "say", the two languages are again wholly identical, both Norse and Tule Indian having it "säge",

which is also cognate with German "sagen". For "sappi", the Indian word for "tree", the Norse have a word for what comes out of a tree, "sappe"; with which may be compared the English word "sapling". For "howl", the Indian say "ulue", the Norse "hule", and the Germans "heulen". For "boat", both Norse and Indian words are curiously like "howl"; Indian is "ulu", Norse is "hulu", and modern English supplies "hull".

For "know" the Indian word is "witsi", as compared with Norse "vete", Old English "witan", and modern English "wit". The Indian word for "cat" is "misi"; both Norse and modern German have it "mietze". For "ask", the Indian says, "ekise" and the Norse "eiska"; with these may be compared the colloquial English "to axe". To drink, or "quaaff", in Indian is "kobe", in Norse "kvabe". "Sit" in Indian is "sige", in Norse "silde". The Latin language has "sede", and French has "siege". Pig, or "swine" is "sine" to the Indians and "svin" to the Norsemen. For "dig" (compare also "ditch") the Indian is "tige" and the Norse is "dige". To "hide" is "tukke" in Indian and "dukke" in Norse. German "decken", and English "duck" and "tuck" are similar.

Foreign words of other derivation are less numerous, but a few surprising coincidences turn up. A Russian Jew sat in at one of the language meetings, and nearly fell off his chair when he heard one of the Indians, on being asked for the translation of the very important personal pronoun "I", give without hesitation the Hebrew word "ani", with exactly the same sound and inflection as that used by the Jews!

Then there is French. When one of the two White Indian boys bids the other to "blowhard", he applies to his nose what he calls a "mashwe". Compare this with "mouchoir", which is French for "handkerchief".

To find Spanish words in the language is to be expected, from their long contact with Spanish-speaking people. Spanish "oro" means "gold". Lisp the word a little and the result is "olo", the Indian term for the metal.

They have had but little contact with Americans and other persons of Nordic speech in modern times, and correspondingly few English words are to be found in their vocabulary. For "American" their name is "Merikki". Only those who live along the coast know what money is, but the Indian word for this important commodity is "mani", which they pronounce "mahni".

UNDERSEA PESTS GROW FAST

Teredos, or shipworms, the boring molluscs that ruin piling and unprotected wooden structures in sea water, have an exceedingly rapid rate of growth, according to Prof. Benjamin H. Grave of Wabash College.

A month and a half after wooden structures were placed in the water they contained mature shipworms. The burrows at that time measured from one and one-half to two inches in length. The teredo begins its operations as a microscopic speck, and so much growth in so short a time shows the destructive ability of the worms.