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THE USE OF SOLAR ENERGY

METHODS of creating "sun power" by converting solar energy into a form in which man can use it as a source of power will be the goal of a comprehensive program of chemical, electrical and mechanical research to be undertaken in the near future at the Massachusetts Institute of Technology.

Enabled by a $647,700 gift from Dr. Godfrey L. Cabot, of Boston, the research will be devoted specifically to a search for direct means of converting the sun's radiant energy into useful power or storing such energy for future use. Under the terms of the gift the income from the fund must be used in these studies for at least fifty years, after which it may be diverted to other purposes at the discretion of the corporation of the institute.

At the institute investigators will concentrate on direct physical and chemical methods of using solar energy. Research workers at Harvard University, which received a similar grant from Dr. Cabot last year, are making a pioneering study of the possibilities of speeding up the growth of trees, and thus "streamlining" the conversion of sunlight into forms suitable for human use.

In announcing the gift, Dr. Karl T. Compton, president of the institute, commented on the enormous potential power of solar energy, pointing out that heat from the sun reaches the earth in the temperate zones at an average rate of approximately four million calories per square yard daily. In the three months of greatest sunshine an acre of land, he estimated, receives directly from the sun an amount of heat equivalent to that which would be produced by the burning of about 250 tons of first-class coal. "The store of energy in our familiar fuels, while great, is not inexhaustible," he continued, in pointing out the importance of such research.

A primary object of the project will be to determine whether use of solar energy is economically feasible and practical. Solar energy devices already proposed and studied elsewhere will be evaluated with this point of view in mind. The second aspect will consider chiefly the feasibility of developing new conversion equipment using phenomena now under study which hold promise of ultimately being useful in the solution of this problem.

LIGNIN AS A SOURCE OF CHEMICAL RAW MATERIALS

CHEMISTRY is at last learning a way to convert lignin, great waste product of the nation's forests, into highly valuable raw materials. In a report issued jointly by the U. S. Forest Products Laboratory and the University of Wisconsin, a laboratory method is described of converting lignin into useful materials. They include: a well-known organic solvent, wood alcohol; a new compound, propylcyclohexanol, which appears suitable as a lacquer solvent and which has also possibilities as a wood preservative; two compounds having possible use as thickening and toughening agents for varnish; and a clear, glassy resin, extremely adhesive, which has excellent potentialities as a plastic material.

The process of hydrogenation, already used to make petroleum oils out of coal and cooking fats out of vegetable oils, is the one employed in turning lignin, once a waste, into a valuable forest resource. Atoms of hydrogen are added to the ligning in solution by means of heat and pressure. By this severe treatment the dissolved ligning is changed from a dark-brown color to transparency. The different compounds created are removed by distillation.

The work, still in the experimental stage, is the latest development in the long course of research, seeking valuable uses for lignin, which has been carried on by Drs. E. C. Sherrard and E. E. Harris, of the Forest Products Laboratory. The present hydrogenation experiments were performed in cooperation with Dr. Homer Adkins, of the University of Wisconsin, who discovered the effectiveness of the copper-chromium oxide, used as a catalyst in the tests.

Lignin comprises from 20 to 30 per cent. of the stems of trees and other woody plants. In the current research it is estimated that more than 70 per cent. of this lignin can be converted into chemical raw materials having industrial possibilities. The yield of wood alcohol obtained is several times as great, by the new process, as it is from the usual distillation of wood alone. One ready source of large supplies of lignin is the 1,500,000 tons of the material annually discarded by factories making pulp for rayon and for the better grades of white paper. Research is now in progress to free these waste liquors of their sulphur content. If this can be done on a commercial scale, such plant wastes will turn into valuable raw materials for chemistry.

DISADVANTAGES IN THE USE OF ACID TO INCREASE OIL WELL PRODUCTION

THE use of acids to increase production from oil wells has brought in its wake a major trouble for the petroleum industry in the form of thousands of miles of ruined pipelines and hundreds of ruined refinery units, according to reports by petroleum engineers. Fifty million pounds of salts, produced largely as by-products of the acid "dosing" of wells, are eating the walls of expensive pressure piping and plugging refinery tubes, exacting a stupendous economic toll. They are in addition lowering the value of residual oils and tars, eating up in waste a considerable portion of the increased income earned by use of the acid process which increases the wells' yield. Greater even than the cost of replacement parts and labor is the loss caused by equipment being out of service while repairs are made.

Petroleum engineers are turning increasing attention, however, to this problem and report a number of desalting methods. Heat, pressure and the addition of fresh water remove some of the salt from commercial crude oil, greatly increasing the life of piping and refinery equipment at a low cost. A Michigan installation, described in *Petroleum Technology* by Dr. Gustav Egloff and a group of petroleum engineers of the Universal Oil Products Com-

pany, reduced the salt in incoming crudes from 220 to 5 pounds per thousand barrels. Incoming oil was mixed with about 10 per cent. of water, then heated to 250 degrees under a pressure of 60 pounds. The salt removal, 212 pounds for each 1,000 barrels of oil handled, reduced corrosion from a continual cause of breakdowns to a very minor maintenance factor. Chemicals to break up the shell of emulsion which protects brine globules from the surrounding oil have been used with some success. Once this protective coating is destroyed, water particles settle out of the mixture very rapidly, carrying the salt with them. Different chemicals are needed in each oil-producing area, and the search for a general desalting chemical agent, suited to all types and mixtures of oil coming to a refinery, is still going on.

Electrical desalting, in one plant, decreased the salt content of the crude oil from 200 to 8 pounds per 1,000 barrels. This particularly corrosive crude oil, from an Arkansas field, was mixed with water, then subjected to an alternating potential of 16,000 to 32,000 volts. Before the desalting equipment, still tubes were completely blocked with deposits of solid salt after turns of only three to six days, and corroded excessively. After desalting, runs of 60 to 70 days without shutdowns were the regular thing, with less corrosion per run. Whirling an oil-salty water mixture to remove the salt water offers considerable future promise, the engineers report. In test runs, centrifuges have removed all but a half pound of salt from oil originally containing 160 pounds per 1,000 barrels.

A NEW PULVERIZER

FINER face powder, made at less cost, is one immediate application of a new super-pulverizing device which has been introduced to the chemical engineering profession. The new pulverizer will grind particles to a size finer than the finest sieves. Particles can be obtained, economically and on a commercial scale, which correspond to 2,500 theoretical mesh, or only 5 microns in size. A micron equals a thousandth of a millimeter, or about four one-hundred-thousandths of an inch. The new machine blows particles of a material together until they attain minute size by mutual fracture. Besides finer face powder, the device makes better mineral fillers for writing paper, finer insect and fungicide powder, paint and rubber pigments and the powders which are turned into the useful and beautiful plastic products.

A sealed pancake-shaped container is the grinding unit. One eighth inch diameter particles enter this unit for pulverizing. Multiple jets, around the peripheral wall of the chamber, shoot in streams of compressed air, or superheated steam, at pressures of from 100 to 500 pounds to the square inch. The direction of the jets creates a rapid whirling motion of the material within and a small amount of material, placed in the air jet stream, does the grinding, by impact, as it strikes the inner mass. Because of the whirling motion centrifugal forces are set up in the chamber which move the larger particles out to the peripheral region and into the severe blasts of air. As the particles become smaller they gradually work toward the center and fall, downward and off, into a collecting receptacle. Surprisingly enough, the tremendous pulverizing action is obtained almost without action by the confining walls of the chamber. The grinding is between particles themselves. The new device, known as a "Micronizer," was developed from the invention of Norwood H. Andrews by the International Pulverizer Corporation of Camden, N. J. It is not sold, but is used under license. The first technical description of its design and operation, outside of the original patent specifications, appears in the current issue of *Chemical and Metallurgical Engineering*.

A NEW TYPE OF AIRPLANE ENGINE

FINAL acceptance tests for a U. S. Bureau of Air Commerce rating have been completed at the Massachusetts Institute of Technology for a radically new type of airplane engine declared by its designers to be smaller and lighter than comparable engines of conventional type. Developed by Heraclio Alfaro in cooperation with engineers of the Engine Laboratory of the Massachusetts Institute of Technology and of the Indian Motorcycle Company, the new engine is of the so-called "barrel" type. It is believed to be the first engine of this design able to meet performance requirements of the Air Commerce Bureau.

With its cylinders parallel to the crankshaft on which the propeller turns, instead of perpendicular to it as in radial and V-type engines, the "barrel" engine is one of the most compact ever designed. Its diameter, exclusive of small protruding parts which may possibly be eliminated in later models, is but 15½ inches. More powerful models will still be much narrower than to-day's great radial engines, with consequent decrease of wind resistance in aviation use. The model built by Mr. Alfaro with the help of Professors C. F. and E. S. Taylor is a four-cylinder crankless engine. It developed 115 horsepower at a speed of 2,000 revolutions per minute. Built of cast iron and without any special effort at constructing a light-weight assembly, the engine weighs 240 pounds. Larger models with more cylinders grouped closer together and manufactured from lighter materials will produce a liquid-cooled engine weighing slightly more than one and a quarter pounds per horsepower. A unit which he believes will develop up to 2,000 horsepower and weigh less than 2,000 pounds is projected. "Wobble-plates," curving fins attached to the crankshaft, are pushed by rods on the piston rods to transmit the power developed in the cylinders. Compactness of the compression chamber and absence of hot valves allow a much higher compression ratio, making for great fuel economy. Further development of this type of engine, which is considered to hold promise of successful application, is expected.

A NEW WHOOPING COUGH VACCINE

BETWEEN 800 and 1,000 children somewhere in the United States, all born since July, 1935, are going to show scientists within the next two years whether or not a new whooping cough vaccine prepared at the U. S. Public Health Service's National Institute of Health gives better protection against this serious childhood

plague than the vaccine now in use. Dr. W. T. Harrison, Senior Surgeon, U. S. Public Health Service, who is in charge of this new disease-fighting venture, has just returned to Washington from an unnamed city where he superintended the vaccination of from 400 to 500 of the children. He said that the name of the city must be kept secret or the test will be spoiled because mothers of unvaccinated children will insist on having their children vaccinated.

Since there is no test for immunity to whooping cough like the Schick test for diphtheria, the only way to learn the effectiveness of the new vaccine is to watch two large groups of similar children, one vaccinated and one unvaccinated, and see how many in each group gets whooping cough or fails to get it in the natural course of events. This will require about two years' time. Very encouraging results were obtained with the new whooping cough vaccine in its first trial in Cumberland, Md. Reporting these results in the current issue of the Public Health *Reports*, Dr. Harrison and associates, Dr. Joseph A. Bell, of U. S. Public Health Service, and Dr. Joseph P. Franklin, Deputy State Health Officer, Maryland, were extremely conservative because of the small number of children in the group. Among 82 vaccinated children, 10 cases of whooping cough developed during the year, while among 109 unvaccinated there were 21 cases of whooping cough. This is considered too small a difference to give conclusive evidence of the vaccine's value and that it why the larger trial has been started.

The new vaccine is prepared by precipitating the Sauer whooping cough vaccine now used with alum, a process something like that used to prepare diphtheria toxoid for diphtheria immunization. The alum precipitation treatment makes it take much longer for the vaccine to be absorbed by the body. This gives a chance for more whooping cough antibodies to be formed in the body and should therefore give greater protection against the disease. Another advantage is that only two doses of the new vaccine are used, whereas with the old type six doses must be given.—JANE STAFFORD.

ITEMS

WOLF 424 has been demoted from its recently proclaimed position as the nearest fixed star in the heavens. A short time ago Dr. G. P. Kuiper, of the Yerkes Observatory of the University of Chicago, found from the star's spectrum that it had the very large parallax of eight or nine tenths of a second, which meant that it was relatively close to the earth. Now Dr. D. Reuyl, of the Leander McCormick Observatory of the University of Virginia, using photographs of 1925 and 1926, has found by the trigonometric method a preliminary parallax of only one quarter that determined at Yerkes. This means that instead of Wolf 424 being the nearest star, there are more than 30 stars which are our nearer neighbors in space. A year from now a better parallax will be obtainable through continued observations at the McCormick Observatory.

ACCORDING to a report by Ralph Keeler, mining engineer, sooty black rocks from many places in the Philippine Islands may become a new source of wealth as this rock is found to contain manganese, important steel-hardening agent. With the initial production of 255 tons in 1936, output increased to 12,206 tons in 1937, and production is increasing daily as more deposits are located and developed. Occurring in lens-shaped deposits of hard black psilomelane, a mineral that assays 50 per cent. metallic manganese, the ore bodies are worked by hand labor. After preliminary purification the ore is shipped to the seacoast, for eventual sale to Japan, the United States and Italy. Japan is the largest buyer of Philippine manganese at present. Mechanized mining is expected greatly to increase the output in the near future.

MOUNT MITCHELL in North Carolina and Mount Washington, popular vacation spot in New Hampshire, retain their titles as the highest mountains in North America east of the Rockies. Reports of a chain of mountains in northern Labrador topping the two-mile-high peaks are finally disproved with the publication by the American Geographical Society of the first detailed map of the region. It shows that the highest peak in this supposedly sovereign range is less than 5,500 feet high. The map accompanies "Northern Labrador Mapped from the Air," the record of three aerial survey expeditions to inaccessible northern Labrador. Aerial survey photographs covering 5,000 square miles of inaccessible territory were made by the three expeditions, under the direction of Dr. Alexander Forbes, professor of physiology at the Harvard Medical School. Old surveying methods would have required much more time and money, it was stated.

A MAGNETIC telephone requiring no battery or other source of outside electric current for its operation has been developed by engineers of the Bell Telephone Laboratories, according to G. E. Atkins, of the staff. Depending on voice vibrations to move an armature placed in the field of a permanent magnet for generating the current which carries speech, the same unit may be used as receiver or transmitter. The instrument recalls early telephone receivers and transmitters which likewise were magnetic and used no outside source of current. They had, however, too low an output to be practical. It is only in recent years that knowledge of highly magnetic materials and structures has enabled practical use of this type of circuit. Independence of batteries or other outside power source makes the instrument portable and suitable for use in places such as construction camps. A special portable unit weighs less than two pounds. A wall unit contains separate receiver and transmitter.

DR. A. H. B. KIRKMAN, of the London University Animal Welfare Society, reports that the African elephant is being killed off at a rate faster than it can reproduce itself. They are being killed off at the rate of 36,500 a year. Between one and two thousand hippotami are being killed annually in their last remaining haunts in Tanganyika and the great Central African lakes. The introduction of modern methods of killing in the last 130 years has had disastrous results. The generation now being born will see the last of the African fauna in the wild state if the mentality of European nations occupying territory in that continent remains unchanged.