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THE AMERICAN PATENT SYSTEM

Two thousand American chemists gathered at Milwaukee on Labor Day for their fall convention, at which the progress of a summer of research in the laboratories of the nation was described. Most important from the standpoint of every-day folks was perhaps the special session on the American Patent System, on September 6.

Mention patents and most people think of either eccentric inventors or patent lawyers. But, with a bit of thought, it will be realized that whole sections of American industry are built up on the seventeen-year period of monopoly which a patent grants to an inventor as the time in which he may exploit his discovery as best he can. Basic idea behind this monopoly grant is that it is a reward for disclosing, publicly, the facts of the invention which otherwise might be kept secret and, hence, lost to the public.

If applied to a better mousetrap this basic idea is relatively simple. The inventor can manufacture the article himself if no one else will. But, in the case of elaborate inventions and particularly in the case of chemical inventions, the process is frequently not so simple. A discovery in a test tube, or in a laboratory, is in many cases a long way from large-scale commercial production. First a small-scale plant must be created. This "pilot" plant, as it is called, serves to iron out the countless kinks which often appear under the less rigidly controlled conditions of commercial operations. And finally launching of the large-scale commercial plant must be undertaken. Then, and only then, are many discoveries given to the public after years of effort and many hundreds of thousands of dollars' investment in research and plants.

Among the proposals for improvement in the present patent system are plans for a quicker granting of patents, less costly patent litigation, fewer infringement lawsuits and some solution to the "frozen" invention problems. Frozen inventions are those covered by patents taken out solely for future legal protection without any present idea of putting the discovery in use in the immediate future. It was against this practice that the proposal for the licensing of an invention after three years was aimed in the legislation still under consideration.

Proposals regarding changes in the patent system touch the life of every one in the nation. Probably the leading news during the convention of the chemists will concern Hitler's hijacking maneuvers in Europe, Japan's jockeying in China and the scramble of the forces in Spain. But none of these touch the basic life of America as do discussions of the American patent system.—ROBERT D. POTTER.

THE CONVERSION OF COAL INTO PETROLEUM

THE Pittsburgh plant of the U. S. Bureau of Mines for converting coal into petroleum is now able to obtain from 70 to 75 per cent. yields of oil convertible to gasoline, according to a report made to the American Chemical Society, by an eight-man research team of government scientists.

Thus, potentially, the Pittsburgh area of the coal mining region could produce some 12,000,000,000 tons of oil that could be made into gasoline if the time ever comes when it is needed. This estimate is based on the best and latest calculation of the amount of recoverable coal in the Pittsburgh coal bed, which is placed at about 16,020,000,000 net tons.

In a small, experimental plant at Pittsburgh, having a capacity of 100 pounds of coal a day, chemists of the U. S. Bureau of Mines are taking coal in the powder form, mixing it with heavy oil, squeezing it to pressures of over 3,000 pounds to the square inch and heating it to 824 degrees Fahrenheit. Under the heat and pressure, extra hydrogen atoms are added to the coal molecules. Out of the treatment comes an oil suitable for conversion into gasoline. This hydrogenation process, as it is known, was invented in 1915 by Dr. Friedrich Bergius, Nobel Prize-winning German chemist. It is said to have taken 13 years, working with 150 men and at a cost of about $6,000,000, to turn the initial laboratory discovery into a commercial process which would work on a large scale.

Turning coal into oil is, for America, a process not now needed because of the plentiful supplies of petroleum available on this continent. But in Germany and in England—lacking oil within their boundaries—the process is widely used. Dr. H. H. Storch, of the Bureau of Mines, in presenting the report, said that in Germany five huge plants are making 900,000 tons of gasoline a year by coal hydrogenation. In England a single plant is turning out 150,000 tons of gasoline yearly in the same way.

At Pittsburgh the Bureau of Mines is clearly looking to America's future when the natural reserves of petroleum will have dwindled and science must turn to the much larger reserves of coal to produce oil and gasoline. By studying now the properties of American coal and its best hydrogenation treatment, preparations are being made for this distant day.

The report on the percentage yields of coal from Pittsburgh seam coal was prepared by Dr. L. L. Hirst, C. O. Hawk, R. L. Boyer, P. L. Golden, I. I. Pinkel, J. R. Schaeffer, R. H. Kallenberger, in addition to Dr. H. H. Storch.

The work at the Pittsburgh hydrogenation plant is directed by Drs. Hirst and Storch, under the general supervision of Dr. A. C. Fieldner, chief of the technologic branch of the U. S. Bureau of Mines, in Washington.

SUBSTITUTE MOTOR FUELS IN EUROPE

FEAR of war is a basic reason behind the amazing growth of synthetic and substitute fuels for motor vehicles in Europe, according to a report made by Dr. Gustav Egloff, of Chicago, to the American Chemical Society.

Fuels, not justifiable economically, are being ingeniously

applied to motor transport, behind the protection of direct monetary subsidy and excessive customs taxes placed on imported gasoline. For example, the tax per gallon on imported gasoline is 51 cents in Italy and 36 cents in Germany.

Behind this protection have developed amazing technical achievements which otherwise could not be placed in use on a commercial scale. In Europe, about a quarter of all motor vehicle transportation is accomplished with fuels of a substitute or synthetic variety at the price of hundreds of millions of dollars to consumers and governments above that which American gasoline would cost.

Gasoline made from coal and fuel gases from carbon monoxide are being widely used. Gas, generated from coal and wood on auto trucks, is used to run their engines. Alcohol made from vegetables is blended with straight gasoline in other cases. Scientists are even experimenting with motor cars which will operate on ammonia and acetylene. These substitute fuels seek to conserve the petroleum supplies against the day when war may come and gasoline supplies may be cut off.

Moreover, in the case of alcohol blend fuels there is an important but little-mentioned motive in keeping alcohol plants working to full capacity in peacetime so that when war comes large amounts of this basic material will be available for use in making munitions. During 1937 the countries of Europe suffered monetary losses of over $100,000,000 by their subsidies on alcohol blended fuel alone. Behind such protection the European use of alcohol blended gasoline rose rapidly from 59,000 metric tons in 1930 to 646,000 metric tons in 1936.

But in 1937, when war scares were gaining prominence, the use of the alcohol-gasoline blend declined to 510,000 metric tons. This loss, according to Dr. Egloff, can not be attributed to beet crop failure in France and Italy, but rather to the diversion of alcohol to other uses which probably are connected with increased activity in the munitions industries.

Germany, Dr. Egloff states, is the principal user of compressed gases as fuel with some 25,000 vehicles using bottled gas in their engines. Depending on whether city gas, methane or propane-butane is used, the vehicles have to "regas" every 25, 85 and 225 miles, respectively. The cost of these three gases, compared on a gallon of gasoline basis, comes out to be 43, 41 and 61 cents, respectively. Gasoline, in Germany, sells for about 60 cents a gallon.

In France there are some 4,500 wood-burning vehicles, while Germany has 2,200 and Italy about the same. These machines burn wood, take the combustion gases and burn them in their motors. Wood is sold in packages of from 30 to 60 pounds, at many stations in Europe, for such vehicles. It is estimated that it takes 25 pounds of wood to yield the same number of miles of travel as can be secured on a gallon of gasoline. The cost is 16 cents. This is cheap contrasted with 60 cents a gallon for gasoline.

THE USE OF HIGH-SPEED MOTION PICTURE PHOTOGRAPHS IN THE STUDY OF CHEMISTRY

HIGH-SPEED motion picture photography is revealing new and little-understood facts about chemical happenings, it was reported at the opening sessions of the American Chemical Society. The chemists opened their convention by going to the movies, but the movies showed something never seen before. And the "stars" of the show were tiny air bubbles rising through water.

As shown in the motion pictures, taken by Dr. Gustavus J. Esselen, consulting chemist of Boston, the bubbles were not spherical as is ordinarily thought. When their formation and upward movement were shown at a speed of 1,200 pictures a second, and their action slowed down 80 times, it was found that, often, each air bubble contained tiny drops of water inside. These drops were in contant motion and bounced back and forth across the bubble and off its walls as if the latter were of rubber. The bouncing of the water drops inside an air bubble could be seen to create little waves in the bubble's surface.

The bubbling of gases through a liquid is a commonplace phenomenon, but one which is of vital importance in the flotation of ores, the formation of soap lather in washing, the formation of gaseous emulsions and many other places in industrial processes.

While the use of motion pictures to study the happenings in such processes is still so new that immediate changes in procedure are yet unrealized, it is believed that the use of high-speed photographs may bring changes.

SULFANILAMIDE AS A PREVENTIVE OF GONORRHEA

A HINT that sulfanilamide, a chemical remedy which has already proved successful in treating many cases of gonorrhea, may some day play a part as a preventive of the disease appeared in the report of Drs. Grant Morrow and George Packer Berry, of the University of Rochester School of Medicine and Dentistry, to the Society of American Bacteriologists meeting in San Francisco. The use of sulfanilamide for prevention of gonorrhea was only hinted at and the Rochester scientists said nothing of such practical application of their research. They succeeded, however, in growing gonorrhea germs on the chorio-allantoic membrane of the chick embryo. This is an achievement in itself. The study of gonorrhea and search for a cure have been hampered heretofore by lack of any animal other than the human which is susceptible to the infection. With the germs of the ailment growing on the living tissues of chick embryos, various remedies and possible preventives can now be tested. Drs. Morrow and Berry reported that when a bit of the drug was dropped on the embryo 24 hours before inoculation of the gonorrhea germs, no infection occurred. In other words, the drug prevented infection with gonorrhea germs. The drug "cured" the condition, eradicating the germs, in other embryos inoculated before the drug was given.

Physicians have already found sulfanilamide useful in treating gonorrhea, and many spectacular cures have been reported. The reason for its success as a remedy now appears to be its ability to act somewhat as an antitoxin, inactivating the so-called toxin of gonorrhea germs. This inactivation of gonococcal toxin was reported by Drs. C. M. Carpenter, G. M. Barbour and P. L. Hawley, of the

University of Rochester School of Medicine and Dentistry. "Toxin" prepared from gonorrhea germs isolated from the knee joint of a patient suffering with gonococcal arthritis was injected into 116 mice. All these mice died. Then some of the "toxin" was mixed with sulfanilamide. Of 295 mice given this mixture, only one fourth died. The others apparently were protected by the antitoxic action of the sulfanilamide.

SYNTHETIC "VACCINES"

A REVOLUTION in disease prevention methods, which may make unnecessary in future the use of horses or other animals for vaccine preparation, appeared in reports to the Society of American Bacteriologists at San Francisco.

Instead of shooting germs into horses, and using their blood for a source of disease-fighting substances for human protection, scientists of the future may be able to confer this protection by chemical means. One step in this direction is the preparation, apparently for the first time, of a synthetic "vaccine" which protects rabbits against pneumonia. This was reported by Dr. Walter F. Goebel, of the Hospital of the Rockefeller Institute for Medical Research. No human trials were reported, but these presumably will be made after further animal studies.

A similarly synthetic "vaccine," this time against streptococci, which are the germ causes of scarlet fever, childbed fever and other dangerous ailments, was reported by Professor Stuart Mudd, of the University of Pennsylvania. This new type of vaccine was prepared by Drs. M. G. Sevag and D. B. Lackman, of the University of Pennsylvania.

These synthetic "vaccines," which technically should be called antigens, are chemicals. Ordinarily the germs produce such chemicals, and the body fights them off by producing other substances called antibodies. Dr. Goebel succeeded in preparing chemicals without benefit of the germs which call up the pneumonia antibodies just as the germ chemicals do. Drs. Sevag and Lackman obtained the chemicals from the streptococci or germs themselves. Such chemicals have been obtained from streptococci before, but never before in a state in which the chemicals had any practical, disease-protecting possibilities.

Another new pneumonia vaccine was reported by Drs. René J. Dubos, also from the Hospital of the Rockefeller Institute. This was prepared from pneumonia germs that had lost their disease-producing ability. Small amounts of this vaccine protect mice against one type of pneumonia only, but larger amounts give protection against others of the 32 types of pneumonia. No human trials were reported.

ITEMS

ANCIENT Americans who lived in Oregon caves and were harrassed by volcanic eruptions long ago have been discovered by a joint expedition of the University of Oregon and the Carnegie Institution of Washington. Some of these cave dwellers who suffered from an American Pompeii lived more than 10,000 years ago, which lends new evidence to the argument over antiquity of mankind in the New World. When these caves first were homes, this continent was recovering from the retreat of the last great ice sheet. Some believe the first inhabitants of America may have come during the Glacial Period; others hold out for a much later discovery of America by Asiatic Columbuses. Layers of pumice above man-made articles tell the story of ancient cave life interrupted by the volcano. Professor L. S. Cressman, of the University of Oregon, who led the expedition, states that in one cave near Fort Rock an eruption evidently caused hot pumice to fall from the air, setting fire to straw and inflammable objects in the cave. In this cave, he found over 75 sandals made of shredded sage-brush bark, all charred. The disaster occurred between one and three thousand years ago.

AN Ice Age in the Twentieth Century: that is what the Alaska glacier field just discovered by the Harvard University-National Geographic Society Expedition turns out to be. It is the largest non-polar cap on earth—a latter day piece of the Pleistocene. It stretches over a distance of 235 miles, or as far as from Washington to New York. It has never been seen before because it is cupped in a vast nest of mountains which include some of the loftiest and most difficult peaks in North America. Only the coming of age of the airplane as an instrument of exploration has made its discovery possible.

THE Northern Lights do not cause the rustling or swishing sounds frequently attributed to them, according to Dr. A. S. Eve, of McGill University, in a new publication of the Smithsonian Institution. It is physically impossible for them to make sound, he explains, because the 60-mile-high atmosphere where they surge and flare is so rare as to be a fairly high vacuum, and sounds can not exist or travel in a vacuum. The noises heard and reported by many aurora observers, Dr. Eve suggests, are more probably due to electrical disturbances such as brush discharges occurring on the earth's surface near the observers, who fail to notice them because the Northern Lights are absorbing all their attention.

OUT of great tubes of glass, longer than the width of five city lots, quantities of heavy nitrogen isotope which are sufficient to supply many of the nation's laboratories with this hitherto rare gas, are being produced at Columbia University, under the direction of Professor Harold C. Urey their discoverer. Dr. Harry G. Thode has designed the new "factory" for the heavy nitrogen isotope. The device consists of 170 feet of glass column housed in three sections in the chemistry laboratory. Starting the gas containing heavy nitrogen only to the concentration of four tenths of one per cent., about two grams of heavy nitrogen having a concentration of over 70 per cent. can by produced in 24 hours. This recovery is equivalent to about three quarts of heavy water a day. Physicists and chemists in many laboratories now will be able to extend greatly their research on the structure of atoms and molecules. The same equipment can be used to concentrate the heavy sulphur isotope of mass 34 and the heavy carbon isotope of mass 13.