SCIENCE NEWS

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SYNTHETIC PHENOL

SYNTHETIC phenol, needed in manufacture of plastics and of some explosives, can now be made in large quantities from air and two common chemicals, benzene and hydrochloric acid, in a new plant at North Tonawanda, N. Y. It assures American manufacturers of an independent and controlled source of the important compound.

Built in the past two years, costing more than $2,000,000, the plant is housed in several large buildings, with towers and distillation units connected by forty miles of pipe. Three miles of the piping is made of glass, porcelain or rubber, to withstand the corrosive action of hot acids. Its capacity is 15,000,000 pounds of phenol per year. Yet the most modern control methods are employed, so only six men and a supervisor are required for its operation.

The new plant is part of Durez Plastics and Chemicals, Inc. It uses the so-called Raschig process of phenol manufacture, invented in 1930 by Dr. W. Prahl and Dr. William Mathes, of the Raschig G. m. b. H., Ludwigshafen a/Rh., Germany. The Durez firm owns exclusive United States rights to the process.

Though quite complicated, the Raschig process has two important advantages over older methods for the preparation of phenol, which is another name for carbolic acid. Its product is of high purity, greater even than that approved for medical use. Unlike older methods, which yield at least several pounds of by-product for each pound of phenol, this gives less than a tenth of a pound of by-product for each pound of the desired chemical.

The process has two main stages. In the first, a vapor mixture of benzene, hydrochloric acid and air is converted to mono-chlor-benzene. In the second stage this is mixed with steam which is converted into phenol and hydrochloric acid. The latter can then be used over again with a new batch of benzene. Also, the catalysts, materials which themselves are not changed, but which make certain of the reactions possible, are used many times.

In 1921, only 2,000,000 pounds of synthetic resins were produced, compared with more than 200,000,000 pounds last year. Those made from phenol have had the fastest growth, and were the first to be made on a mass production basis. Cameras, radios, brake linings, binders for plywood, telephones, paints and adding machines are a few of the common articles now made from them.

THE ELECTRIC POWER OF PASSENGER AIPLANES

AT the National Aircraft Production Meeting of the Society of Automotive Engineers P. Sandretto, superintendent of the Communications Laboratory of United Airlines, stated that fifteen kilowatts of electrical power, as much as required for a row of small houses, is used in the modern passenger airplane. Planes of the future, weighing 50 tons, carrying 100 passengers and a crew of 7, will take twice as much.

Lacking suitable magnetos, Mr. Sandretto said, early planes used storage batteries for ignition. This is no longer done, but other demands have raised power requirements from 2 kilowatts, in 1929, to 15 at present in the Douglas DC–3, the most popular transport plane now in use. Only 7.2 per cent. is actually used for operating the ship; 73 per cent. is for navigation, including radio, de-icers, etc., and the rest for service, mainly lighting for the passengers. Two generators, attached to the engines, provide the current, at 12 volts, which is used to charge storage batteries. In the future 100-passenger plane he predicted that there will be four engines, and each will drive a 7.5 kilowatt generator delivering alternating current at 115 volts. This permits much simpler control than with lower voltage direct current, but it can be converted to 24 volts, direct current, for charging batteries and for actual use.

In a paper presented on "Auxiliary Power Equipment," C. C. Shangraw, of Eclipse Aviation, agreed that "further consideration will be given to alternating current systems on larger aircraft being laid out for the future. Airplanes which are now under construction do not justify further consideration of this system."

For the immediate future, he suggested, "there is a definite trend towards the use of high-output engine-driven generators in 24-volt direct current systems. Auxiliary power plants are available which will operate in parallel with the engine-driven generators to supplement them or to furnish the required power for ground operation."

AIRPLANES AND MASS PRODUCTION

AIRPLANES can not now be made with the mass production methods used for automobiles, according to Paul G. Zimmermann, of the Douglas Aircraft Company, who spoke recently at Los Angeles before the National Aircraft Production Meeting of the Society of Automotive Engineers. However, he expressed the belief that a modified assembly line, such as he has previously employed in yacht building, might be applied to advantage.

"It is difficult to think of the airplane as a manufactured product," he said; "more reasonably it may be thought of as being built in the same sense as the large printing presses or hydro-presses.

"An order of five hundred bombers is really a very large order from a dollars and cents standpoint, representing a sale of around fifty millions of dollars. Of the fifteen thousand odd parts which go to make such a bomber, there are many where the requirements are for but one per ship, and still more for ten or less per ship.

"An order of five hundred parts, or even five thousand, can hardly be thought of as mass production, and yet these quantities of individual parts must be taken into consideration in the building of our order for five hundred airplanes. No one would think of rearranging a shop to make five thousand detail parts.

"This order of five hundred airplanes will start in all

good faith as being a firm order for five hundred exact duplicates of the original sample, but either the customer or the engineering department will think up some change which must be put into effect after the first hundred. Then another change will take effect on the one hundred and fiftieth, and the two hundredth, and so on through the building of the five hundred. Every one knows this condition exists, and in deciding any program either takes it into consideration or suffers a tremendous loss in scrap. The changes must be put into effect or progress will not be made.

"A few added miles to the top speed, or a few extra pounds added to the pay load, is so essential to airplane efficiency that no one can criticize the engineering department for making these changes.

"Right here we must come to a full realization that airplanes wouldn't be what they are to-day if the engineering departments did not have this freedom of action; they probably wouldn't cost so much either!"

A modified assembly line might be used, according to Mr. Zimmermann, similar to the scheme used successfully in building yachts, with the result of "labor costs being reduced 40 per cent. over the hit and miss production previously employed." With such a line, he said, "the less work done on the airplane proper the more easily the line can be speeded up. In yacht building, I was able to rig up a jig by which all the bulkheads were put on at one time, an overhead crane being used to drop them in place. Likewise the cabin top, with all assemblies installed, including windows, light fixtures and even curtain rods, was put on in one operation."

Careful erection lists, each one of which represents an assembly "which may be put together on the bench and assembled on the airplane as a unit," are needed to carry this out successfully.

THE STANDARDIZATION OF AIRPLANE PARTS

GREATER standardization of parts going into airplanes, particularly agreement between the Army and Navy for their respective orders, and exchange among aviation manufacturers of certain processing tools and engineering information, was urged as a means of speeding the production of planes for United States defense. These recommendations were contained in a paper presented at Los Angeles by John T. Thompson, standards engineer of the Glenn L. Martin Company.

"Since the Army and Navy each maintain separate aircraft design and experimental divisions and since the conditions of operation are somewhat different in these two services, it is quite understandable that a difference in opinion regarding the standardization of certain parts should exist," he said. "However, from the point of view of the manufacturer building aircraft for both services, it has been difficult to understand the reason for the inability of the Army and Navy to reach an agreement for standardization in the cases of many important items. Since the origination of the Permanent Working Committee of the Aeronautical Board, this situation appears to be improving; but there are still many delicate subjects to be attacked by this committee, and it will be interesting to observe the action which will be taken in regard to these items."

Mr. Thompson stated that a pool had recently been established among manufacturers of the dies used in making certain metal parts widely used in plane manufacture, and that this should be extended to other tools and equipment. Two other recommendations made were:

"To provide means for the cooperative establishment of new aircraft standard parts which will supplement the Army-Navy Standards for use on both service and commercial aircraft and which should result in a reduction in prices and an improvement in deliveries for parts heretofore standardized only by individual companies.

"To provide means for the exchange of certain unrestricted engineering information (such as test reports, research data, etc.). Such information, originally obtainable at considerable cost, and through years of experience, is usually traded for information of corresponding value thus eliminating the necessity for duplication in this work."

A NEW INSECT POISON

CHINA may furnish this country with new ammunition for defense against insect hordes that devour our crops, in a plant known as the Thunder God Vine, a botanical second cousin of the bright-berried bittersweet now flaunting its orange fruits along miles of autumn roadsides.

The insect-poisoning substance is found in the bark of its roots, and is used to a considerable extent in powder form by farmers in the interior of China. Its chemical nature, still unknown, is being intensively investigated by the U. S. Department of Agriculture in the hope that it may become possible to produce it synthetically, relieving the United States from the uncertainties of supply of the natural material from the war-clouded Orient. At the department's plant introduction garden at Glenn Dale, Md., thousands of cuttings sent from interior China by a plant explorer are now being grown, to furnish more material for experimental purposes.

Preliminary experiments are regarded as promising. Powder prepared from the vine roots proved effective against the codling moth, most destructive apple pest in this country, and against two species of cabbage-eating caterpillars. However, until many further tests are made the material will not be recommended for commercial use. Cuttings are not available for distribution at present.

In actual growth habit, the Chinese Thunder God Vine is not really a vine, but a sprawling bush that grows three or four feet high, with long, drooping branches that trail on the ground, like some species of raspberries and wild blackberries. Although related to the common American bittersweet, its fruits are not so bright-colored and ornamental. Botanists identify it by the technical name *Tripterygium wilfordii*.

THE FOLSOM MAN

EVEN Ice Age America, back in the days of a mammoth and bison hunter "population," had its economic ups and downs. This is the latest revelation of this country's past, unearthed in Colorado by Dr. Frank H. H. Roberts, Jr., of the Smithsonian Institution.

Finding a stratified corner at the now-famous Lindenmeier site, a camp and workshop occupied by Folsom Man in the Ice Age, Dr. Roberts has charted about 1,000 years of very early American prehistory. The story, told in gradually accumulated layers of earth, each containing a typical kind of stone weapon point, reveals Folsom Man as first and oldest at this convenient camping ground. Folsom hunters arrived some time between 10,000 and 25,000 years ago, and more likely it was 25,000, Dr. Roberts infers from the geologic evidence.

Following bison herds through rich pastures south of the retreating ice sheet, Folsom hunters returned to this camp many summers. Their weapons were the beautifully shaped and grooved Folsom dart points, and they had time for careful work, an eye for beauty—judging by simple efforts to decorate belongings—and they even sewed their garments with eyed needles. Folsom Man's —or Woman's—needles are pronounced by Dr. Roberts evidence that early America used true needles when they were a sign of progress also in cave homes of Europe.

Harder times or more uncouth people followed within a few centuries, judging by the next distinct layer of earth above, containing a degenerated sort of Folsom weapon, hastily made. If the new arrivals were not Folsom descendants, they did at any rate have some of the advantages of Folsom culture. Before they came, the camp had lain abandoned and blanketed with débris. The newcomers made brief stays only at the camp, and it looks as though they lacked the comparative ease of "better times" in America. The campsite eventually lay vacant again, until a third wave of hunters arrived, leaving a quite different dart point.

The stratified find establishes the sequence of early Americans using these strange old weapons, and will aid archeologists in judging the relative age of such weapons found in other parts of western United States.

Dr. Roberts believes that still another type of Folsom weapon, which has been found scattered in eastern states, represents a still later chapter of this little-known era of American prehistory.

THE CUNNINGHAM COMET

CONCLUSIVE evidence that the new comet discovered recently by Leland S. Cunningham, of the Harvard College Observatory, will be the most conspicuous since 1910 is contained in his latest calculations of its path. These have been made public by Dr. Harlow Shapley, director of the Harvard Observatory.

They show that in early January, the comet will be easily visible in the western sky for an hour or two after sunset, as it passes south of the bright star Altair in the constellation of Aquila, the eagle. At that time, it will be about as bright as Altair, and possibly even more brilliant, though it is somewhat uncertain just what brilliance it may attain.

Its distance from the earth, at the beginning of 1941, will be about 60,000,000 miles, and from the sun about 50,000,000 miles. It will be at its closest to the earth about January 10, when some 54,000,000 miles away, and to the sun, with 33,000,000 miles, on January 16. Between these dates it will be the most brilliant. However, it will then be so close to the sun as to be seen, if at all, only in the evening twilight. Consequently, it will not be as conspicuous as earlier, when it has a dark background. In the closing days of December, the moon, in a crescent phase, will pass to the left of the comet.

Though several comets in recent years were just barely visible when one knew where to look this will be the first conspicuous naked-eye comet since 1910. In that year there were two: Halley's, making one of its 75-year visits, and another which appeared earlier in the year, and was so bright that it was discovered independently in the southern hemisphere by a number of persons. Later it was visible in North America.

ITEMS

OCTOBER'S final week upheld the record for unusual warmth established during the rest of the month over the country generally. Only in the northeastern states, from Maryland and West Virginia, were there subnormal temperatures for the season, and real freezes. Elsewhere temperatures ran up to as much as 8 to 20 degrees above normal for the period. Large areas that normally have freezing weather or killing frosts at this time of year are still frost-free. This has proved an embarrassment in some sections of the Corn Belt, where a good frost would help materially in drying out the ears, which are still too moist for safe cribbing. Elsewhere, however, corn picking goes on apace, and the soybean harvest is also making rapid progress. Cotton is practically all in, over the Texas area, and is being rapidly finished in Oklahoma.

A SPECIES of soil bacteria discovered on the campus of the University of Wisconsin is proving useful in the development of industry in Puerto Rico. It is a germ that has high capacity to convert molasses into butyl alcohol, much in demand as a commercial solvent, especially in the paint industry. The organism was discovered by Professor Elizabeth McCoy, of the university, and named *Clostridium Madisonii* for the place of its discovery. One of the severe problems of butyl alcohol production in Puerto Rico has been a germ-killing virus or bacteriophage that seriously reduced production. The difficulty was solved by developing a strain of the new bacterium that is resistant to the virus.

THE healing of cancers by treatment with fast neutron rays from the cyclotron given to forty-seven cancer patients who were too far advanced to be helped by x-rays, radium or surgery, has been reported by Dr. Robert S. Stone and Dr. John C. Larkin, of the University of California. The cancers themselves, both primary and those that had spread from the original one to other parts of the body, regressed. The primary cancers that ulcerated under the treatment "healed remarkably well." Whether or not the patients can be considered cured or whether the cancer will come back can not be told yet, as it is only two years since the first patients in the group began treatment. Better results are predicted when the method of giving the treatment can be improved. Normal tissues are apparently not damaged irreparably by the doses of fast neutron rays necessary to produce regression of the tumors.