

CHEMISTRY and YOU

PART 3

TWO contrasting examples of chemistry's contributions to civilization—an ammonia plant in West Virginia and a rayon frack. Note both the dull and bright effect in the same fabric.



CROWNLESS "hat" of Cellophane made by braiding strips of the cellulose film after drawing them through a twister or button-hole to give the crushed or crinkled appearance. Below, the use of plastic material for furniture is demonstrated in this transparent cosmetic cart. It is light in weight, strong and virtually unbreakable.



By DR. C. M. A. STINE

Vice-President E. I. du Pont de Nemours and Company

IN the rise of the petroleum industry, an impelling force has been the modern chemist. The general use of high-compression motors in automobiles, a development of depression years, was only made possible by the chemical improvement and stabilization of gasolines to give them and enable them to retain anti-knock qualities, and to inhibit the formation of gum. In recent tests motors have been run up to 100,000 miles without having to be overhauled for carbon removal.

Cracking became commercially practicable in 1912. Improvements in the process have resulted in sensational increases in the yields of gasoline from crude oils, and have probably extended the life of our oil deposits by many years. Late in 1932 two plants for cracking by hydrogenation began operating in this country. This process makes possible

yields of as high as 104 barrels of fuel from 100 barrels of low crudes that under old methods yielded as little as five barrels, a feat that sounds like black magic.

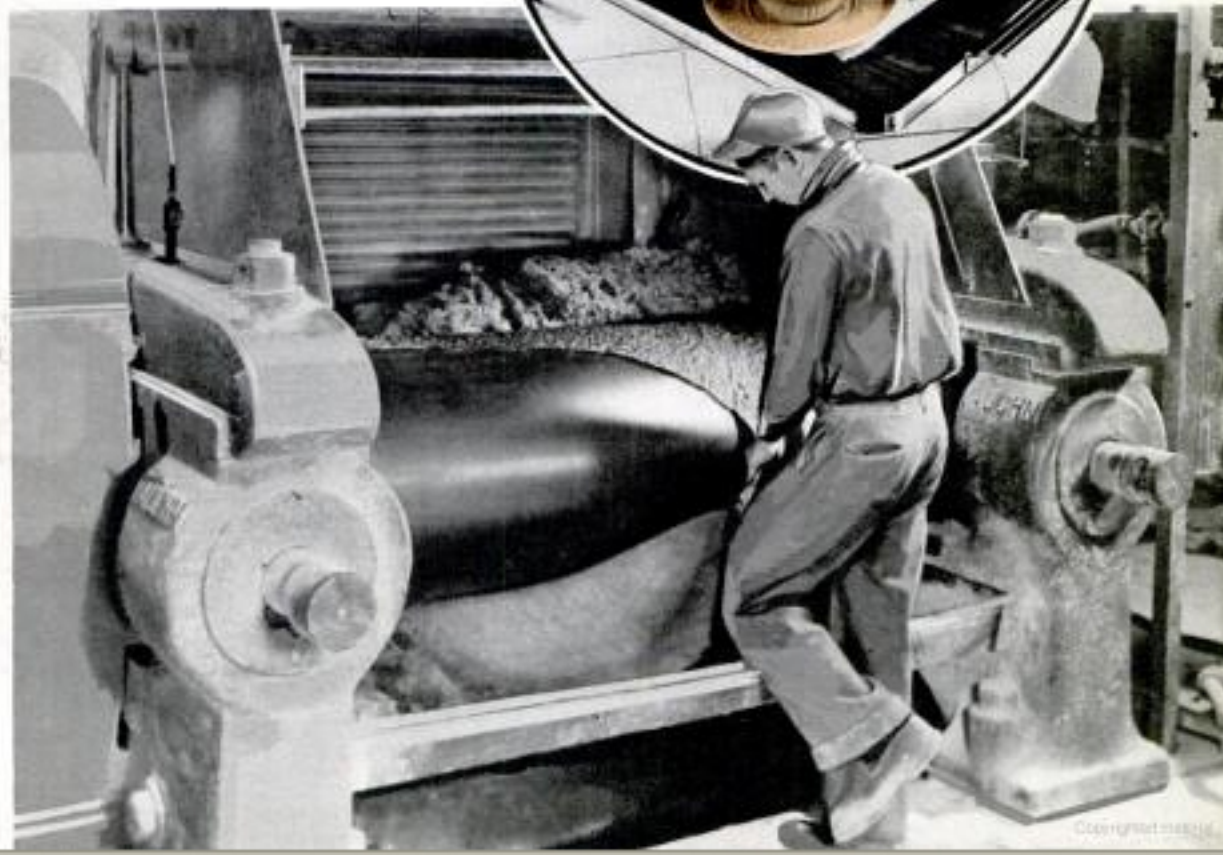
The rapid deterioration of cracked gasoline in storage now has been eliminated largely by the use of antioxidants which retard gum formation, and high test fuels may be stored for six months or longer as against the one-time limit of two or three weeks. Lubricating oil has been treated chemically and improved through the addition of extreme pressure lubricant bases. This has fitted it for gear loads double and quadruple what the untreated oil of a few years ago could carry, and made possible the use of im-



TRANSPARENT piano case, above, and bench made of cellulose acetate plastic. Right, transparent tea bags of perforated Cellophane. Below, standard rubber mill used in blending Neoprene or man-made rubber.

proved gears in the transmission of power.

Uncounted millions have been saved the daily consumers of oil by the chemical development of a host of petroleum by-products once wasted. The number of such by-products was estimated in 1928 to be about 1,000. Today it is double or treble that figure and includes detergents and lubricants for the textile industry, solvents of great importance in the lacquer industry, raw materials for synthetic resins, and chemicals for influencing the





CHEMISTRY on a huge scale. At top of a coke-oven battery, the coal is charged into ovens and volatile matter is distilled off, leaving coke used in making "blue" water gas.

ripening of fruits and destroying insects on farm crops, to say nothing of various oils for medicinal use.

Ever since 1913 there have been discussions on making oil from coal. In that year Bergius, a German chemist, startled the scientific world by his discovery that this could be done. And Germany now actually is producing from coal about 300,000 tons of gasoline yearly, at a cost, however, of three or four times the cost of petroleum gasoline. England too is manufacturing the "liquid coal." In the United States with our vast oil reserves we have been only casually concerned in this development, but recently the Bureau of Mines opened an experimental plant in Pittsburgh to make oil and gasoline from American coals by the Bergius process. This is a step in preparedness, because while experts disagree widely on the probable life of our oil deposits, they all agree that they will not last indefinitely. In the opinion of the Bureau of

Mines expert, Dr. Arno C. Fieldner, "the nation's proved oil supply can be depended on for only the next fifteen years," and he adds that about one-half of the world's coal reserves are in the United States and Canada.

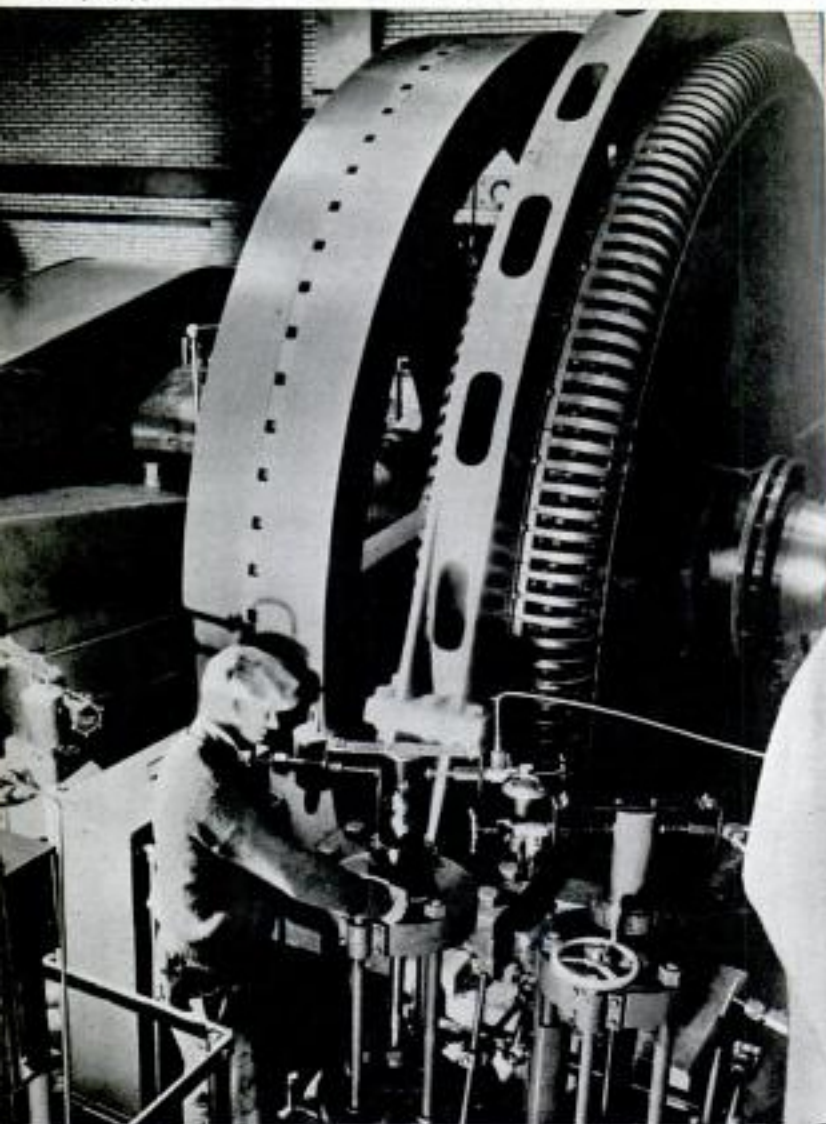
Bergius also demonstrated that oil can be made indirectly from wood through first converting the wood into coal, which he did in a test tube. This suggests the possibility that oil might be made directly from wood, which is a replenishable resource. Still another possibility is that common plants grown on the farm might become the source of our motor fuels when petroleum deposits are exhausted; and research is going ahead in this field. It is extremely doubtful, however, as long as we have petroleum in abundance, if any substitute for it can be developed that will be able to compete with the low prices at which petroleum products are sold in America.

Closely associated with petroleum in

THERE'S a special kind of the man-made fabric called rayon for any style or design of dress. Below, toilet-ware, the handles of which are made of Lucite, a crystal-clear plastic developed recently by the du Pont company. The oval body is of Pyralin.



daily use are the various metals, and so closely associated are the sciences of metallurgy and chemistry that it is difficult to draw a sharp line between them. In our generation so many changes have been brought about in metals that today most of the metals in use seem new. Yet such "new" metals as tantalum, molybdenum, tungsten, platinum, cadmium and others have been known for a hundred years and more, usually in some form, however, that made them as unavailable as the moon and as costly or even costlier than gold. Modern science has not only made such rare metals available for innumerable uses but it also has created hundreds of alloys that in effect are wholly new metals.



DRIVE for a gas compressor, left, in an ammonia plant. Below, hydrogen peroxide bleaches have revolutionized the textile field. The pure white of this swagger suit and of the hat and gloves was made possible by peroxide bleaching.

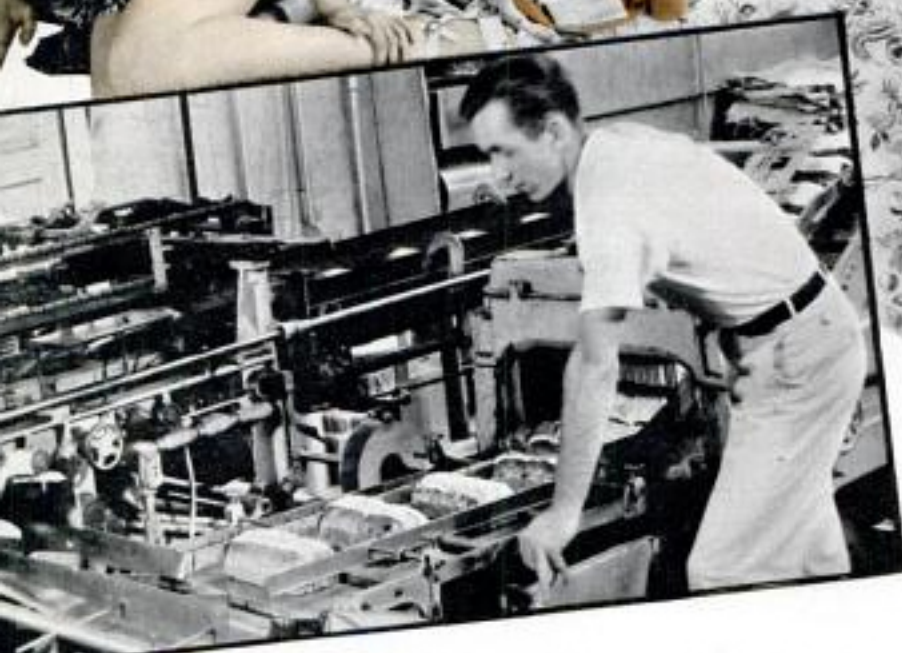


The past fifteen years have been marked by metallurgical developments that are little short of the miraculous in compounding light metals of great strength and high resistance to rust and other forms of corrosion. The past five years have seen these new alloys applied in a revolutionary way to railroading in new fast, light-weight trains, to automobiles and aircraft, to tanks and other containers for storing and transporting foods and chemicals, to building construction, to machinery. The art of metal plating with chromium, cadmium, nickel and lately aluminum has been carried forward in striking manner, and we have learned how ordinary metals can be clad with coats of costlier metals, such as silver and stainless steel, to give them new surface properties.

So obvious are these changes in metals—you find them in profusion as close by as the kitchen—that it seems almost unnecessary to mention



CHEMISTRY at the beach. Bathing suits are of acetate rayon. Tablecloth is lacquered fabric. Food bags are Cellophane.



MOISTURE-proof Cellophane keeps food fresh and sanitary. Here a machine is wrapping bread in this transparent cellulose film—a chemical product.

them until one recalls that as recently as 1929 stainless steel, for instance, was little more than an industrial curiosity, and that the first lightweight streamline railroad train dates only from 1934. Entirely apart from the utility added by these new metals and the new operations they are making possible, they have a tremendous significance to our economy in supplying a direct means of reducing losses from rust that have been estimated at \$3,000,000,000 annually.

The elements, caesium and rubidium, were known to our scientific grandfathers, but only within recent years have they come into their own in a field so startling in its potentialities that the opening of it alone would stand as a gigantic achievement of our generation. An alkali metal such as caesium or rubidium is used as the essential element in the photoelectric cell or electric eye. This element might be called the retina of the electric eye. Such metals possess

Every State Supplies Materials Used in Automotive Industry



PORCELAIN book ends and statuettes decorated with American ceramic colors. Top, every state in the Union contributes something to your automobile.

a sensitivity to light rays and colors that, in certain cases, is similar to and in some respects even superior to that of the human eye.

The photoelectric cell has an almost infinite range of actual and possible uses—in counting, sorting and in inspecting units, colors, and materials; in automatic alarm, signal and safety systems and, in fact, throughout **mechanics**; in photography, in communications, and notably in that fast developing new wonder of the air waves, television. They are being used in astrophysical and astronomical investigations to uncover the mysteries of stellar radiation. And some experimenters see in photoelectric cells the means by which man will in time convert to his use the vast and inexhaustible energy given off by the sun.

The vacuum tube is a triumph in the creation of new materials and the practical utilization of old materials such as tungsten and tantalum. Tubes are limited as yet in the amount of power they can handle, but work in progress with another rare metal, columbium, now indicates these limits may be extended to where tubes will be able to handle thousands instead of tens of kilowatts of power. Columbium is being put to other uses too, notably in alloying with stainless steel to give the property of cor-

(Continued to page 132A)

WHERE THERE'S SMOKE
THERE MAY BE FIRING!



THE OLD BOY got a whiff of Joe's stinky pipe—swore that Joe was stealing ink erasers to fill it—and fired him like *that!*

THEN JOE SWITCHED
TO THE BRAND
OF GRAND AROMA



THE BOSS RELENDED, saying: "Any man with sense enough to find a burley blend that fragrant and mild can stay on my payroll forever. Get me a two-ounce tin!"

HOW TO
TAKE CARE
of
YOUR PIPE

FREE BOOKLET tells how to make your old pipe taste better, sweeter; how to break in a new pipe. Write for your copy today. Brown & Williamson Tobacco Corporation, Louisville, Kentucky. Dept. P-82.

TUNE IN Tommy Dorsey and his orchestra. Every Friday, 9:30 P. M., E. S. T., coast-to-coast NBC Blue Network.

Chemistry and You

(Continued from Coloroto Section)

rosion resistance to welded joints without subsequent expensive heat-treating.

A radically new process known as "powder metallurgy" is responsible for our commercial use of these valuable metals that only yesterday were beyond our reach. Instead of being melted up like all metals have been for centuries, they are reduced by electrochemical methods to fine powders, which are then purified, pressed into bars and heat-treated electrically under a high vacuum. The powdered grains are thus literally welded together. A single bar of tungsten produced by this process will yield hundreds of miles of filament wires such as you find in ordinary electric-light bulbs. Applied to older metals, such as copper, the powder process has made it possible to fabricate bearings that are self-lubricating and will outlast the machine they serve. Graphite is simply mixed with the powdered metal and the mixture is heated and compressed into a hard, semi-porous body capable of

(Continued to page 134A)

MADE \$102500

in 9 Months with the



FOLEY LAWN MOWER SHARPENER

"A substantial increase in grind jobs each year, proves beyond any doubt that Foley Grinders do very satisfactory work. We have ground 723 mowers since February 1 to date, November 9. Our total receipts on lawn mower service alone during that period has grossed us \$1,625.00. The prevailing price of grinding and adjusting service is \$1.00 and \$1.25—repairs and parts extra."—W. A. Tulip, Phoenix, Ariz.

You Too Can Make Big Money

Five plan tells you how to start. The Foley Lawn Mower Sharpener turns out perfect work quickly and easily, no experience needed. Simply put the mower in the machine and turn on the power. One size system as lawn mower factories. Sharpness of steel and types in 15 or 20 minutes.

Special Offer: Attachment for grinding axes, hatchets, knives, etc. included FREE with Foley Lawn Mower Sharpener on our Special Offer. Inaugurate your business the first week. Send postcard today!

FOLEY MFG. CO. 207-1 Main St. N. E., Minneapolis, Minn.

the DUAL COMBINATION
WOOD & METAL LATHE

12-INCH SWING 47 to 3000 R.P.M.

Larger, heavier but costs no more. TIMKEN BEARINGS

CLAUSING MFG. CO. OTTUMWA, IOWA.

WHY PAY Fancy Prices?

1938 CATALOG FREE

Quality Radios—Save up to 50%.

FREE home trial. MONEY-BACK if not satisfied. ONE YEAR GUARANTEE on best priced models. 2 to 12 tubes. AUTOMATIC tuning models. Radio that sets KITCHEN. New battery radio for garage. Auto radio—best present for FREE outside—just call present.

WORLD-WIDE RADIO CO.
3812 ELSTON AVE., DEPT. P-2, CHICAGO

FREE HOME TRIAL \$6.95
Order Now, Send 41 Dept. Popularities Co. N. Y.

SCALE MODEL TRAINS

"0" Gauge 17/64" Scale

MIN-I-SCALE MODELS

Perfect, die cast scale models, accurate to the smallest detail. Absolute scale accuracy. Sturdy construction. Precision workmanship. All locomotives "run-in" under power. Both kits and assembled units—Pullmans, Box Cars, Combination Baggage and Day Coaches, Tank Cars and Hoppers. Kits easily assembled without drilling or machining. Castings prime coated. Ask your dealer or send name and 3c stamp for full information.

CONGRESS TOOL & DIE CO.
3628 Lumpkin Ave., Detroit, Mich.

FREE FOLDER

(Continued from page 132A)

absorbing oil, which is retained by the finished bearing throughout its life.

Artificial ice-making has been practiced almost fifty years, and as early as 1914 the Santa Fe railroad was trying to achieve air conditioning in passenger cars that would make travel more comfortable. Not long after the close of the World War we were becoming definitely aware of the huge market opening for mechanical refrigerators in the home. However, a serious lack worried the industry and jeopardized its whole future. It was without a refrigerant that was safe under all conditions, regardless of leakage, fire or other accident, a gas that was non-toxic, non-explosive, non-inflammable and non-corrosive.

Chemists were frankly dubious when they tackled this problem. To compound a refrigerant possessing any two of these properties was a feat in itself; to compound one possessing all four, which at the same time would be equal in effectiveness to the refrigerants in use, seemed a feat in the realm of the miraculous. Nevertheless in 1932 the prescribed new material emerged from the laboratory under the trademark of "Freon." Not only is "Freon" safe, but it is superior to the older refrigerants as such, and it requires a much lighter condensing equipment, a fact of importance in the air-conditioning of transportation units.

The paradox is that this utterly safe new refrigerant is compounded from three of the most ill-omened of gases, namely, methane, the deadly and explosive fire-damp of mines; chlorine, one of the poison gases used in the World War, and fluorine, which is highly corrosive to most metals. This chemical near-miracle is only one of many important chemical contributions to the modern revolution in refrigeration.

(Concluded next month)

Twelve Billion Tin Cans a Year Produced in U. S. Alone

Can makers in the United States produce 12,000,000,000 tin cans every year—one hundred for every person. Only sixty per cent of the cans are used by the food-packing industry. The other forty per cent are used to ship moth balls and tennis balls, neckties and aspirin, paint, tobacco, and even roller skates. In 1933 the can industry used more steel than the railroads.