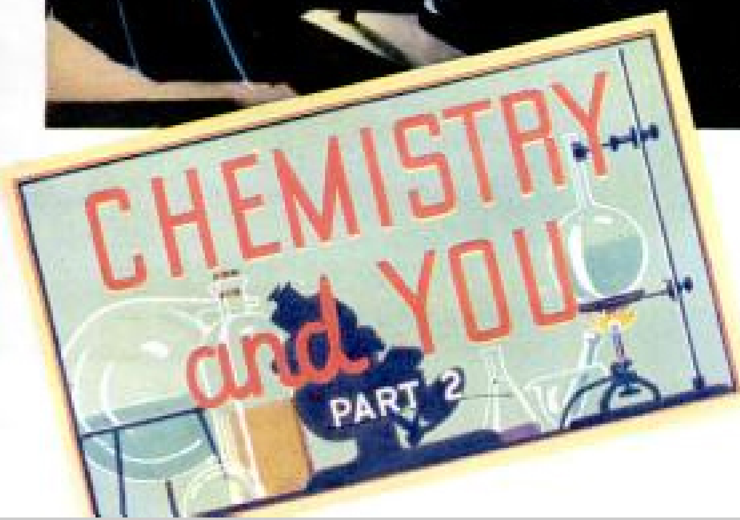


ONE of a battery of huge gas compressors in an ammonia plant. Today nitrogen is extracted from the air and fixed directly with hydrogen to form ammonia.

DEMONSTRATING the durability of a synthetic resin finish by subjecting it to temperature of "Dry Ice" and then to boiling water.

By Dr. C. M. A. Stine

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

THE textile industry is literally being made over with the aid of chemistry. Its sensation, of course, has been rayon. As late as 1910 no rayon was made in this country. As late as 1925 it was looked upon as a poor imitation of silk and its faults were many. Today rayon stands on its own legs as a unique new fiber, with a yearly consumption more than four times that of silk and more than half that of wool. Most of its Cinderella-like transformation dates from 1930.

The chief fault of all natural fibers is that their quality varies with climate, season and state of health of the producing animal, insect or plant. Then, too, man has practically no control over the length, strength and size of fibers grown on a sheep's back, or produced from the soil or spun by a worm. These two facts limit the range of fabrics that can be fashioned from natural fibers. On the other hand, rayon is mechanically produced under rigidly exact scientific control. Its quality may be maintained uniformly year in and year out. Its filaments may be made even finer than those of silk, or as fine, or heavier; they can be made of any desired degree of luster or dullness, can be short or long, rough or smooth, or even alternately thick and thin. No other fiber has such versatility or can be changed so readily, with the result that rayon's possible range in fabric-making is almost unlimited.

The smart modern woman little realizes her dependence on rayon. It has become a dominant material in textiles, indeed is setting new higher standards for all dress, drapery and upholstery fabrics. The finest of transparent velvets are made of rayon. It may be found in the costliest creations of Paris, because in no other fabric can designers achieve such a wealth of original effects. Two years ago a survey of gowns worn at one of the most famous of New York City's balls revealed that ninety per cent were of rayon, wholly or in part. Rayon is being used in men's lightweight suits and widely for men's coat linings. In this unique material man has mastered many of the most important elements required for the perfect yarn, and rayon's future is limited only in so far as the field of scientific research is limited.

However, chemistry's contribution to the textile industry is going far beyond rayon. The sheerest of dresses may now be rendered water-repellent and spotproof, and so may hosiery, hats, suits, sports clothing, and in fact most fabrics of silk, wool, rayon, linen or cotton wherever used, as in awnings, tents, the outer covering of mattresses and in window drapes. The waterproofing chemical is applied to the fabric in a single operation, whereupon it becomes an invisible and odorless part of the fabric itself, shutting out water but not air. Raindrops run off without wetting the fabric

Wrinkleproof fabrics for shirts and dresses, fabrics that stay "starched" without restarching in the laundry, others that will "hold a crease" in daily wear, and still others for use in home furnishings that are fire-retardant are already on the market or soon to be,

Running test on extreme-pressure lubricants, developed through the wizardry of the chemist. Above, inspecting rayon, a man-made fabric produced by chemistry.

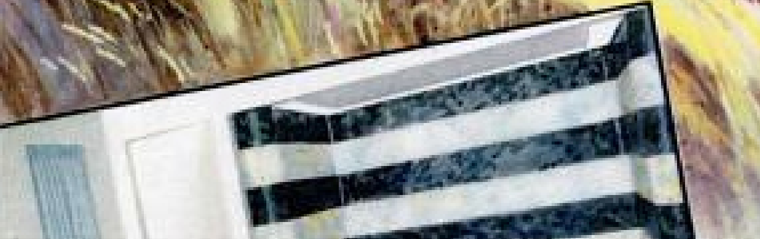
A RESEARCH worker in the General Motors plant intent on solving a chemical problem. The work of such men results in the year-by-year improvement of the many kinds of metal, the fabric, the glass and the other materials which make up an automobile.

introduced. A wealth of new dyes, wetting agents, detergents and kindred textile assistants has been evolved, the general purpose of which is improvement of quality, and new comfort, beauty and new utility, all at less cost both to producer and consumer.

It is well to emphasize the all-prevalent creed of the new chemistry, which is to give more for less. You see it at work in the shoe industry, in textiles, in motor cars, wherever the science is applied. The practical result is a steadily growing distribution of wealth in terms of usable things; not alone the production of two blades of grass where one grew before, or perhaps where none grew at all, but production of two at the cost of one, a feat in economies that chemistry is fast making a commonplace.

Business depressions lower prices temporarily, usually at the cost of employment and profits and often of quality as well. Chemical science aims to lower prices permanently, and to keep on lowering them, even as it creates more opportunities for work and insures a fair return to the labor and capital concerned. In every store in the land today you find manufactured goods that are superior to those of five or seven years ago, or that did not exist five or seven years ago, and if you will compare prices, you will find that in most cases those of today are substantially less than you once paid for inferior articles of the same kind, if you could buy them at all.

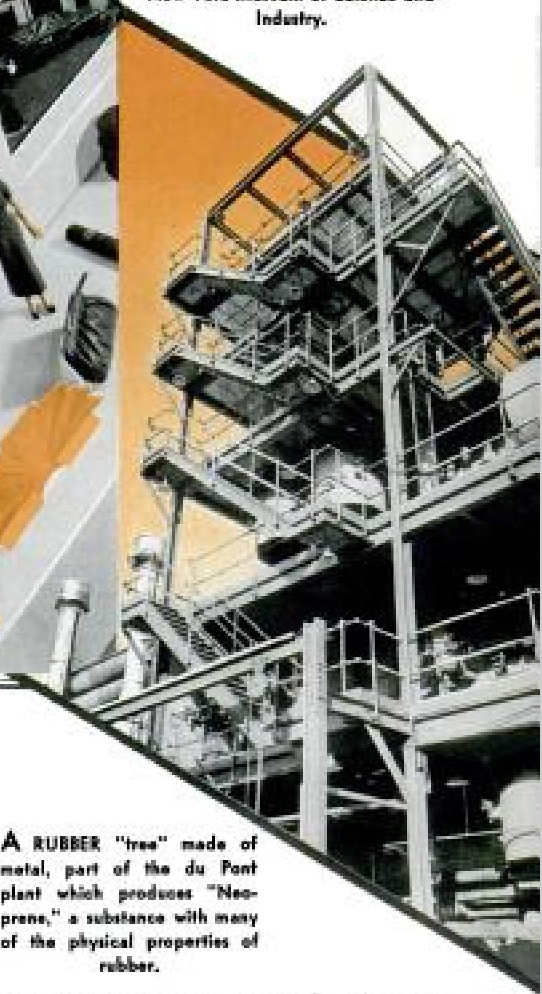
Fluctuations in the costs of raw materials affect retail prices, of course, but the present phenomenon in retail prices is not a mere passing phase of our economy brought about by low raw material costs; nor is it the result of sweating labor. It is a fundamental change, fostered by man's own ingenuity in creation, that points a way to an ever better and more



HARVESTS such as this would be impossible today, except for the fertilizers supplied by chemistry. Below, pigments developed by the chemist give this bathroom its colorful appearance. Note the hand-cut inset of the seahorse in the linoleum floor covering to give a marine atmosphere.

Lower photo courtesy Congoleum-Nairn, Inc.

DYESTUFFS made from coal tar and some of the uses for the dyes are shown in this exhibit at the New York Museum of Science and Industry.



A RUBBER "tree" made of metal, part of the du Pont plant which produces "Neoprene," a substance with many of the physical properties of rubber.

abundant life. And it is change that has come to stay, for it is rooted in a scientific creed that does not admit the word retreat.

No less than shoes and textiles, the rubber industry has been revolutionized by chemistry. Indeed in no other industry is the influence of chemistry more marked. Recent tests of automobile tires made by a governmental agency and published by the Consumers' Union show the useful life of the best-made tires to be well in excess of 25,000 miles. When these mileages are compared with the three-to-five thousand miles of haphazard travel furnished by the tires of wartime, which cost from two to three times more and were only about half the size of modern tires, we can appreciate the extent to which tires have been improved. And rubber in all of its more than 30,000 uses has been similarly improved, with the chemist leading its amazing advance.

One of the several shortcomings of rubber is its susceptibility to oxidation. In its natural form it rapidly deteriorates on exposure to air, particularly in the sunlight, and loses its elasticity. Nature did not put latex in the rubber tree for us to use in making rubber boots, hot-water bottles, tires and garden hose. The latex is in the tree to provide it with a means of healing wounds inflicted by insects and other enemies. As such it is a perfect material, but like so many materials satisfactory for nature's purposes, rubber must be altered to suit it to the artificial purposes of man.

Goodyear's process of vulcanizing rubber improved its strength and elasticity, and enabled it to resist wear within limits, but the process consumed from three to four hours. The chemist set out to reduce this time by the use of chemical agents known as accelerators. Finally he found ultra-accelerators that made vulcanization possible in three minutes or less, and which simultaneously increased the strength, elasticity and abrasive resistance of the finished rubber.

Anti-oxidants were introduced that further extended the life of rubber by inhibiting oxidation and cracking caused by flexing.

ONE of steps in manufacture of "Pyralin," a plastic. Below, research chemist at work in laboratory.

PLASTIC materials used in Hudson car, including wheel, ignition parts, timing gear and washers, interior fittings and radiator ornament.

Spraying to reduce the damage of codling moths in a Pennsylvania apple orchard. Chemists are constantly searching for better controls for insect pests.

The cotton fabric used in tires was improved. So tough was crude rubber when it reached the manufacturer from the plantations that it had to be masticated in heavy machines until it was plastic enough to be compounded. Chemical plasticizers were developed, a very recent contribution that is another step toward more economical production.

The rubber in common use today is a much superior rubber to that of five years ago, and incomparably superior to the rubber of twenty years ago, but it still has certain deficiencies. It disintegrates when in contact with oil, grease and gasoline. It still falls victim in time to oxidation. In the automobile, where it is most extensively used, it falls short of the ideal of all earnest engineers, which is a motor car wherein every part, as in the deacon's one-horse shay, will serve throughout the car's life without need of replacement.

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Chemistry and You

(Continued from Calorota Section)

For years chemists sought to create rubber independently of the rubber tree. Governments and men, including Edison, tried to produce it from plants and weeds, such as the common goldenrod. One reason for these feverish efforts was that rubber production is practically a monopoly of the Far East—the United States, user of more than half the world's rubber, gets ninety-nine per cent of its supply from that source. Another reason was rubber's inherent shortcomings which science had mitigated but not removed.

Finally, in 1931, the world-sought material was successfully synthesized by du Pont chemists. Fortunately, however, the product was not true rubber—chemically it was not rubber at all! If it had been, it follows that the synthetic substance would have had all of natural rubber's weaknesses. This new material, built up by intricate processes from coal, limestone and salt, looks like rubber, acts like rubber, serves wherever rubber serves, but it is many times more resistant to oil, grease and gasoline, and to alkalies and acids; it offers far superior resistance to sunlight, oxygen, heat and age, and it is less permeable to gases.

This material has been named neoprene. It is produced in quantity and is being used in a wide variety of products—for gaskets, washers, and packings in all industries, for printing rollers, gasoline hose lines, for pistons and cups in oil slush pumps, in covers of transmission belts operating under greasy and oily conditions, in hospital sheeting, balloon fabrics, and on through an ever-growing list. Much mechanical progress that was retarded because of the lack of a rubberlike material without rubber's faults, is now under way, thanks to the synthesis of neoprene.

The price of neoprene is three and one-half times that of the present price of rubber, but on the basis of utility it is cheaper than rubber for many purposes even now, and, although nature may be able to grow rubber at a lower cost than we can make neoprene, if history should repeat itself we may yet see the day when neoprene costs no more per pound than rubber. In the meantime the price of neoprene stands as a limit beyond which the price of planta-

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Chemistry and You

(Continued from page 132A)

tion rubber cannot go. Neoprene has an enormous immediate value in industry, but compared to its potential value its present status is relatively trivial.

Other new rubberlike materials also have been developed here and abroad. Each of them has one or more special properties that make it valuable, and a broad new field in the use of such materials, as well as in the wider use of rubber itself, is opening. Rubber-tired railway and subway trains are now a subject of experiment. In view of the rising opposition to the continuous din of noise that makes our large cities like so many bedlams, it is highly probable that all vehicles such as milk wagons and streetcars will be fitted at no distant date with rubber tires. Carriages were rubber-tired forty years or more ago when rubber was costlier and far less durable than it is now. Developments are pending that may double and even treble the life of motor-bus and truck tires at enormous savings in the aggregate to operators.

(Continued next month)