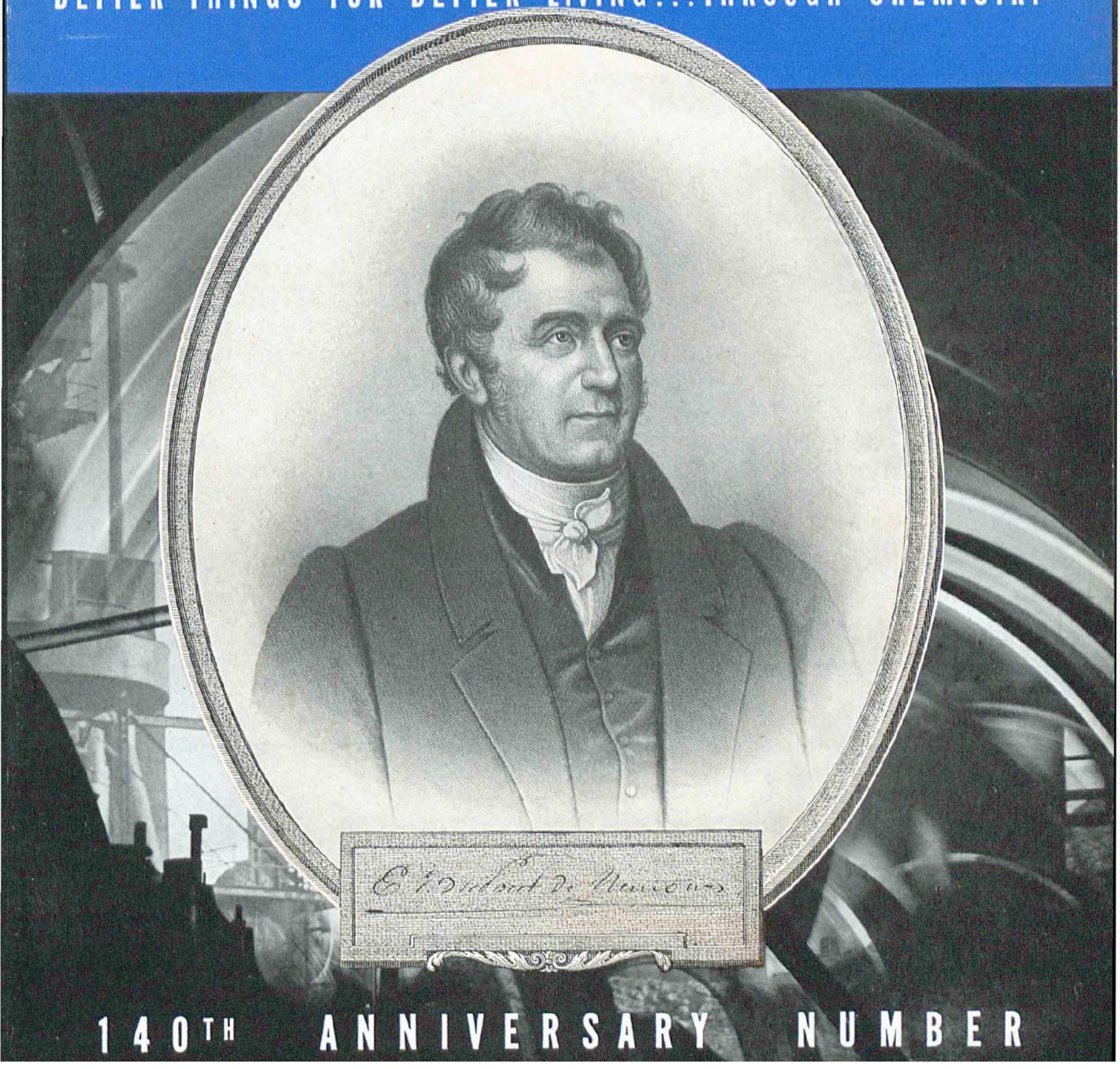
THE DU PONT MAGAZINE

BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY



140TH ANNIVERSARY NUMBER

IT has always seemed to me a good idea to take some special note of a passing anniversary. It is an opportunity to appraise the present, review the past, and perhaps speculate a bit on the future.

Our present task is clear-cut. Du Pont must help win this war. A program of staggering size has been entrusted to us. It must be carried out.

It is not enough that we do a good job. That would be merely accomplishing the expected. The great war plants encharged to our building should be completed ahead of schedule; they should produce beyond their planned capacity; both in rendering service and in producing goods we should do more than is asked.

With satisfaction I can report that the Du Pont organization is achieving these goals. The unsolicited comments on the Company's performance that come to me and other members of the management from men in high official positions are gratifying indeed.

However, looking upon the present alone gives a distorted picture. A century and a quarter of Du Pont's 140 years of business has been devoted predominantly to peaceful activities and less than fifteen years to wartime activities. This nation's history is overwhelmingly one of peaceful industry. It has been in that environment that the Company has grown and prospered. Very obviously, therein lies our hope of continued growth and prosperity in the future, when this war—this passing illness of civilization —will be behind us.

As individuals we can play but a small part in influencing broad economic and political trends of the future. We must in large part accept the conditions under which we live and work. We can, however, be more effective in taking stock of our own position in this broad economy and in endeavoring to shape our affairs in a manner best calculated to thrive under the conditions which we may anticipate.

I feel we have much about which to be encouraged in speculating on the future development of the Du Pont Company. In chemistry we have a field of endeavor that the future no doubt will prove has been but sparsely explored. The prospective demand for accomplishments in that field, and for the creation and discovery of "better things for better living" is unlimited.

Of course, we will be the first to realize that our past record cannot be counted upon to insure our future fortunes. On the contrary, unusual initiative and effort will be required of us, but this will be true of all industry. Only extraordinary developments will survive the burden of future competition and high costs. Our industrial scientists must endeavor to penetrate those more difficult areas into which, up to now, few have dared venture to explore.

The course ahead is beset with difficulties for our country and company alike. No doubt it holds many discouragements. But I feel there is nothing awaiting us of America, either in business or on the nation's battle lines, that we cannot overcome with fundamental study, effort, initiative, vision and daring.

Do we have the courage and confidence to win through? I believe we do. The momentum of America will not be stopped. The war and the peace will both be victories.

W. S. CARPENTER, JR., PRESIDENT
E. I. DU PONT DE NEMOURS & COMPANY (INC.)

1802–1942

ANNIVERSARY NUMBER THE DU PONT MAGAZINE

To All Du Pont Employees:

This special Anniversary Issue of "The Du Pont Magazine," marking the 140th year of the Du Pont Company, carries in general terms the story of this Company and its products in the war effort. Detailed discussion of many of our materials—some of which you may be helping to produce—has not been given, because of the strategic and confidential nature of the services of those materials in the war effort. But in general, this story does show the important contribution made by every du Pont employee to the war effort and how the entire resources of this Company have been thrown into the fight and placed at the command of our Government.

We are sure that you will want to read it for the inspiration we know you will find. We are sure also that it will be of more than passing interest to members of your family. May we suggest when you and your family have finished reading it, that you pass your copy along to your friends or make it available for use in the science and economic classes of your local school.

This is the opening chapter in the continuing story of Du Pont in this the greatest crisis our country has yet faced. It is an important chapter in the history of Du Pont, and in the history of America's industry as a defender of our way of life.

E. R. Manchester

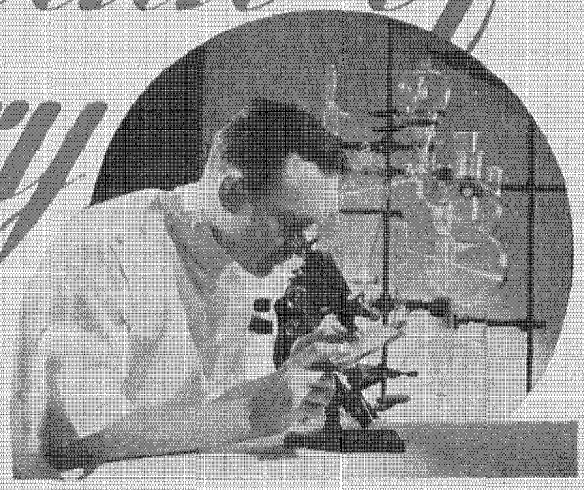
Editor

THE DU PONT MAGAZINE

VOLUME XXXVI AUGUST-SEPTEMBER-OCTOBER, 1942 NOS. 8-9-10

THE Cavalcade of Chemistry

. . . A GUARANTOR OF PEACE



THE time-honored march of the sciences, that long procession of progress in which chemistry has its honorable place, today is merged with columns of marching men in a war such as the world has never known. That the road to victory for the democratic nations will be costly in "blood, sweat and tears," we know. But there is one fact from which we may draw courage. The United States is the strongest of all nations.

Twenty-five years ago that could not be said. While we did a lot of talking in 1917-18, our A. E. F. in France was forced to depend upon French planes and French cannons. American industry simply did not have the resources with which to equip and transport overseas an armed force of the needed size in a short time.

Our soldiers often wore raincoats that leaked, uniforms that faded and shrank. They lacked many of the supplies that later on were needed for effectiveness. And at home, as the war checked the supply of raw materials and goods which ordinarily came to us from abroad, we learned bitterly that we were a dependent nation. Our Government, for instance, before entering the war, had to ask Great Britain to permit Dutch ships to bring us some German dyes. Without them we could not even print our postage stamps and paper money.

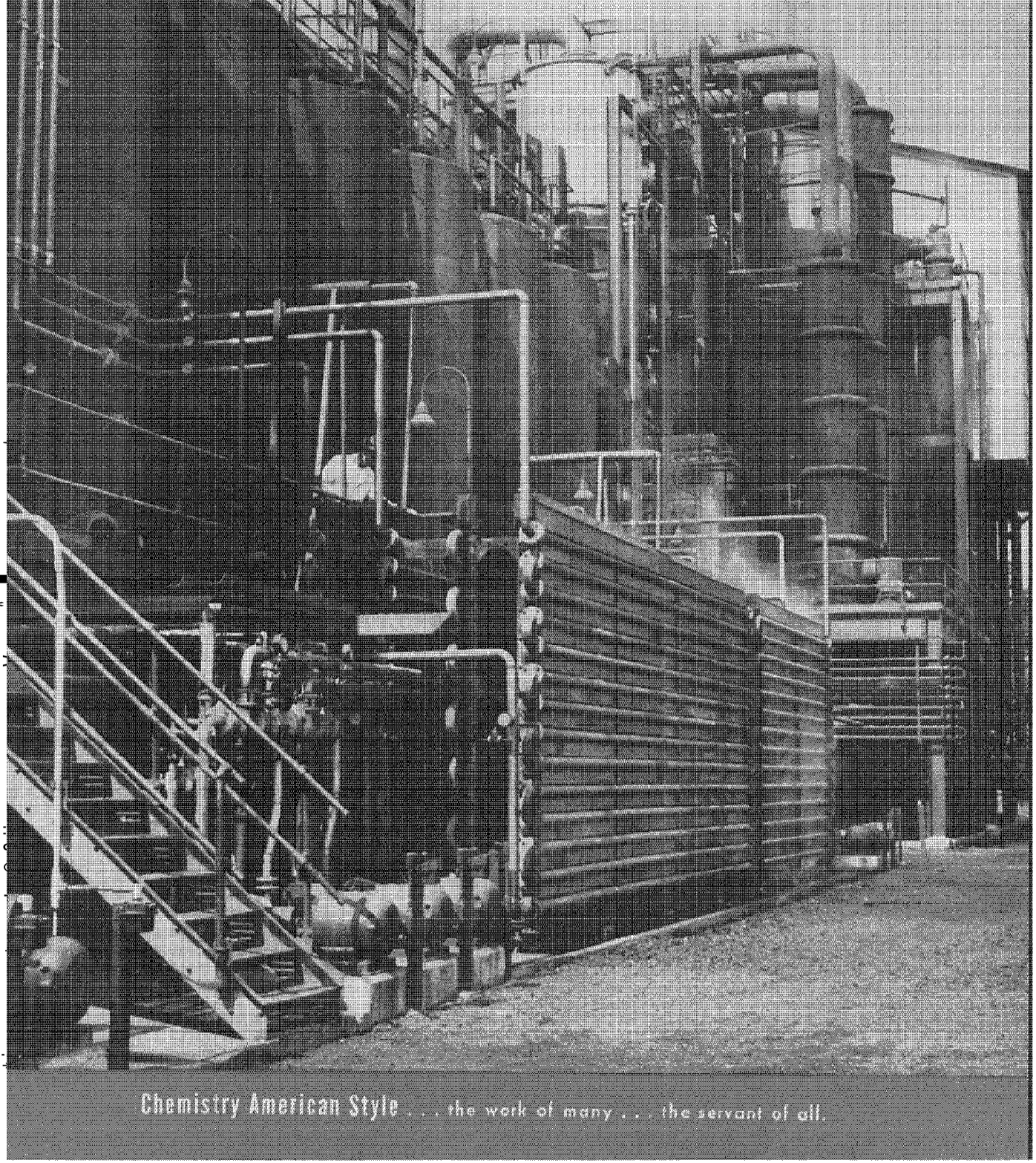
Then, we were forced to ask for help. Now, our Allies turn to us. *We* are the strong nation.

A single example—nitrates—points this growth from weakness to strength. Nitrates go into fertilizers for the farmer. They go into explosives for coal and metal mines. Too, they go, in time of war, into bombs and shells. In 1918, we had to import our nitrates from natural beds in Chile—four billion pounds of them. Today, while Chilean nitrates are still used, they no longer spell the difference between defeat and victory. The chemical industry now manufactures nitrates in huge quantities from the air—the free air over America.

Nitrates are but one of many instances of a new independence won by this nation in a short span of years. Through science we have become, in sober truth, the "Arsenal of Democracy."

In 1920, there were only 300 laboratories doing industrial research in the United States. By 1940 there were 2,200, and the amount of money spent on research by American industry exceeded $200,000,000 a year! Therein is the key to our new strength!

The present has been called, with good reason, the Age of Chemistry—because chemistry makes possible modern living. If we still had to rely wholly upon animal


Chemistry American Style . . . the work of many . . . the servant of all.

skins and horns, upon plant seeds and fibers, upon mineral ores and ashes, our lives would be vastly different and more difficult. Indeed, it might be difficult for our planet to support its present population of two billion souls.

The chemist is a maker and re-maker of materials to specification. When physicians were reluctant to prescribe morphine, because it is habit-forming, the chemist shifted a few atoms in the drug's molecular pattern and created amorphine—a morphine that is less habit-forming. The chemist looks at coal tar—to us only a sticky black mass—and envisions atoms, fastened together in six-sided molecules like the tiles of a bathroom floor. Then, by taking away an atom here, by adding an atom there, he creates literally hundreds of new materials valuable to all mankind. To him, every basic product of nature stands as a challenge to his ingenuity to better what is, and in so doing to make life easier and pleasanter.

Molecules are the chemist's raw materials—molecules so small that, if you wanted actually to see them, you would have to shrink until you were one-billionth of an inch tall. And scientific knowledge is the tool with which the chemist works. To this knowledge was added, increasingly between 1920 and 1940, the technical "know-how" of the engineer. He took the fractionating tower—a fragile column of delicate glass—from the chemist's laboratory bench and rebuilt it as a great steel tower reaching higher than many a factory chimney. Chemist and engineer together turned chemistry into an industry, with astonishing results.

In 1920, our country produced nearly five million pounds of synthetic plastics. In 1940, it produced 276 million pounds! In two decades, chemical industry created 200,000 compounds new to mankind. It wrought changes, for the better, in the work and lives of millions of Americans. When the Second World War began in 1939, the United States was manufacturing half of the world's total of chemical products.

Chemistry allied with mass-production also sent costs spinning downward. In 1920, the estimated cost of a set of automobile tires, for each 10,000 miles traveled, was $168. In 1940, it was around $35. In 1920, camphor imported from Formosa sold for $3.55 a pound. In 1940, camphor chemically-made in America sold for from 35 cents to 60 cents a pound for the finest grades. The prices of scores of products followed a similar course under the hammer blows of chemical knowledge and engineering technique.

Industrial chemistry is a new means of quantity production that aids and supplements the machine in a manner capable of enriching vastly the daily life of all of us. And, as the fourth decade of this century drew to a close, that is exactly what chemistry was doing. It was pouring out, at least in this country, an ever-expanding number of "better things for better living."

One avenue of research opened another avenue. One product brought forth another product. Medical men, in 1939, were beginning to speak hopefully of a day when disease would finally be conquered. Architects were promising us improved and less costly homes. Engineers were designing automobiles that would make those we knew seem like ox-carts. One could feel change in the air! People sensed that at last the race was getting somewhere; that it was not too much to hope that in time poverty and disease might be classed as decadent ailments of another period.

Then, Hitler's legions attacked Poland, and Europe marched to battle. Across the blue skies over Hawaii there drummed a flight of bombing planes carrying on their wings the red circles of another destroyer aiming at conquest by might. Now America, too, has turned to total war as her own weapon.

President Roosevelt says: "Great progress has been made in the battle of production, but in terms of what will be required to defeat our enemies we have only just begun to get into our stride. To win this war, an unceasing flood of weapons and materials must pour forth from the factories, shipyards and mines of our country."

More planes, more tanks, more ships, more guns! That is what we as a nation are making today!

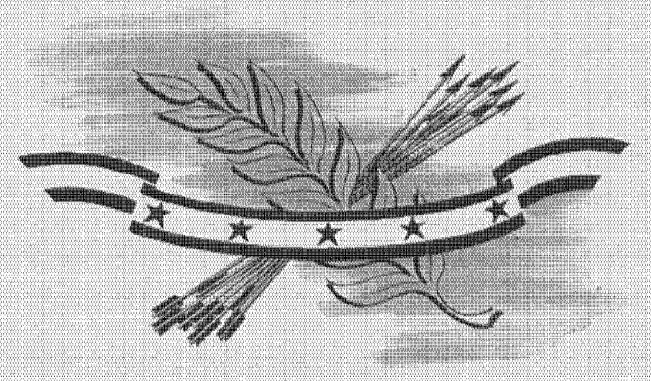
What we once knew as everyday life is vanishing. The raw materials that went into dishpans, clothing, homes and automobiles now float, fly and roll as units of America's vast engine of war! This is as it must be. Industry's—and chemistry's—single objective now is to provide the nation with everything it needs for victory.

Part of the story of this change in direction, as experienced by the Du Pont Company, is told in the following pages. Much of it may not be revealed until victory is won. Even so, what can be related now is stirring evidence that the challenge of the enemy is being met with his own best weapon—science.

For our victory will be hammered out, in part, by the products of America's scientific and industrial heritage. Americans have every reason to be proud of the achievements of American research. And mass-production is an American development—going back to the American inventor, Eli Whitney. The telegraph was invented by an American artist; the airplane, by a couple of American bicycle repairmen; the electric motor, by a machinist; the roll-film camera, by a bank clerk. The president of one great American corporation has said: "I predict that some bold idea, hatched in the mind of an American, will write the final pages of this war." Our nation has only begun to fight.

Du Pont is a unit in that fight, an important unit. Founded in 1802, in this, the 140th year of its service to America, the Du Pont Company is proud that for the sixth time, in a grave emergency, it can march with the Flag, as a free enterprise in a free nation.

Chemistry in this Hour



MODERN war is no David-and-Goliath combat on an open field with spectator armies on the sidelines. Millions of combatants fought World War I, for the most part in trenches within the "cordon of steel" set up by the Allies in Continental Europe. And the present war, truly world-wide in scope, has almost every nation under the sun embroiled in it. The fighting forces are equipped with mechanized equipment far more mobile and destructive than that used in 1914-1918.

At the outset, we were slow to sense the power and resources of the Axis nations and their designs for world conquest. Dunkirk, the fall of France, the air raids over Britain opened our eyes to grim realities. Pearl Harbor projected us into the war—a desperate war.

Even before the United States became the "Arsenal of Democracy" defensive preparations were under way. But the task outlined in the war-production quota for 1942 staggered popular imagination when the President first called for—

60,000 planes!
45,000 tanks!
20,000 anti-aircraft guns!
8,000,000 deadweight tons of merchant ships!

It was foreseen that changing from a peacetime to a wartime economy would require the united and sustained efforts of Government, industry, labor and agriculture. The entire nation would have to get behind the program and work as never before. Government called millions of citizens to the colors and began training them to fight. Industry and labor settled down to produce what the United Nations so urgently needed. At first, progress was slow, until America's factories and plants were re-tooled. Then mass-production, applied to the job in a fashion Axis spokesmen declared impossible even for a nation as resourceful as ours, yielded almost miraculous results. As helpful as those results have been, America must contrive by some means to produce further "miracles"—and if we must, we can.

Du Pont's contribution to this effort has been substantial. When war flared in Europe only a single, and relatively small, Du Pont plant was supplying smokeless powder for sportsmen's rifles and shotguns. Only enough military powder was being made to meet, in part, the then moderate needs of the Army and Navy. Seventy-odd other Du Pont plants were manufacturing chemicals and chemical products for peacetime industries. The diversion of the "better things for better living" made by Du Pont to war and essential civilian uses was achieved progressively in some cases, abruptly in others, but it explains why many familiar goods have disappeared or are no longer to be had in quantity.

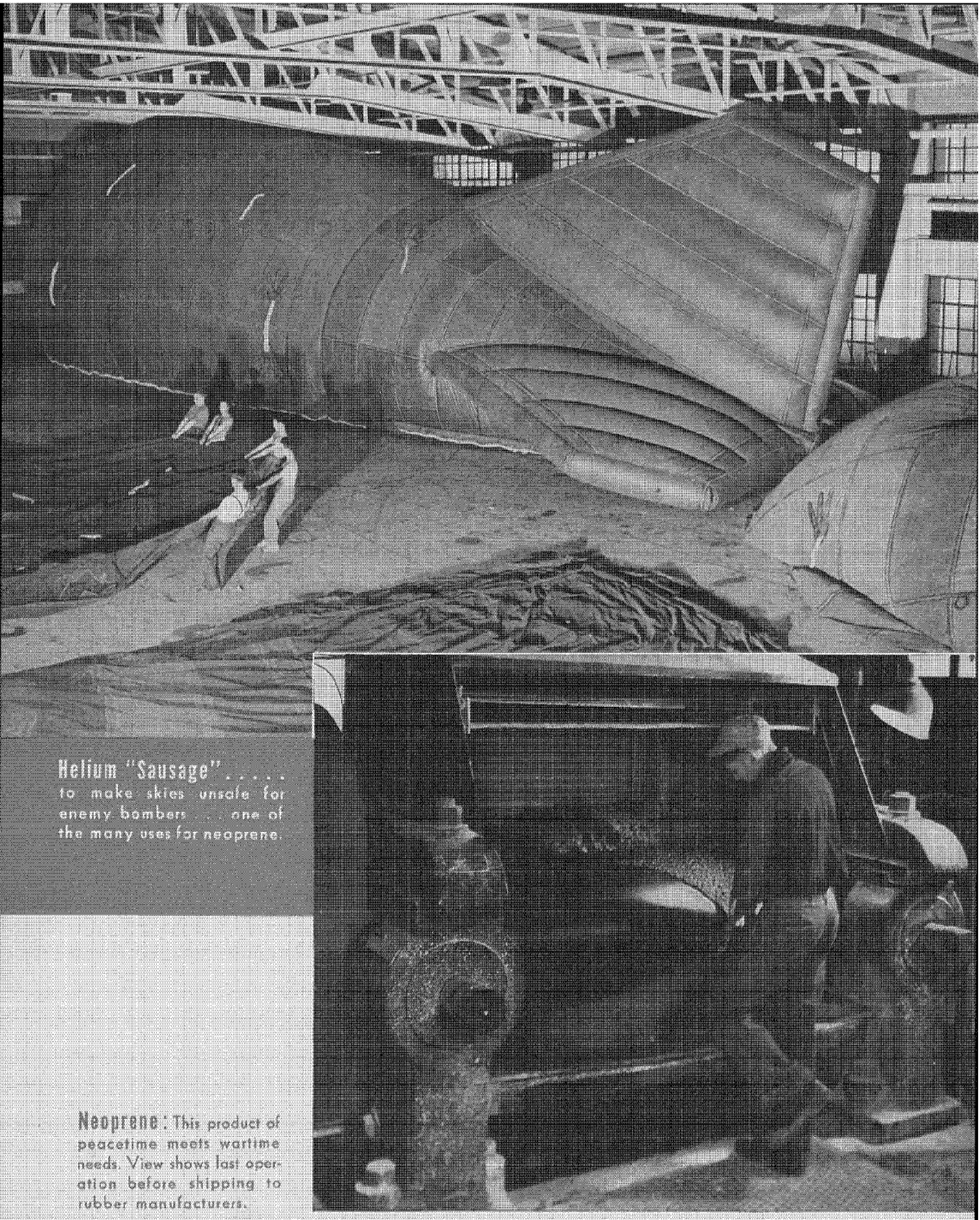
Nylon offers one example of what took place within the chemical industry.

On the day the United States was attacked, Du Pont men believed that they would be turning out some millions of pounds of nylon yarn for peacetime uses during 1942. Nylon stockings were being manufactured by more than 200 hosiery mills—100 million pairs a year. On the market were nylon foundation garments, underwear, dress goods, neckties, gloves, fishing lines, sewing threads, surgical sutures, tapes and webbings. Twenty-two industries were using brushes bristled with nylon monofilament. Still newer uses were just over the horizon—nylon filter cloths, typewriter ribbons, handbags, bathing suits, diaphragms for industrial valves, window screens and others.

War changed the outlook overnight.

In times of peace, Japan supplies us with most of the raw silk for our textile industries, but after Pearl Harbor, naturally this source was cut off. Nearly six months previously, existing stocks of silk had been "frozen" by Government order. But accumulated supplies were not enough to carry through our defense program. When events forced us into a fighting war, we knew that our now-precious silk on hand would eventually be exhausted.

Fortunately, nylon was being manufactured com-



Helium "Sausage" . . . . . to make skies unsafe for enemy bombers . . . one of the many uses for neoprene.

Neoprene: This product of peacetime meets wartime needs. View shows last operation before shipping to rubber manufacturers.

mercially for peacetime uses. It could serve as an alternate material for silk. And early in 1942, every pound that could be made was earmarked for war uses. Since then, Du Pont nylon plants, greatly expanded, have operated full time to supply a variety of vital military needs. The many ways in which the yarn is being used cannot be discussed now, but at the right time the real story of the major purposes for which nylon is being employed will be told. The important and significant thing for the moment is that nylon, a product of chemistry, was ready.

Another story that cannot be told in detail concerns the polyvinyl resins and their derivative products. Like nylon, these resins were also ready. Developed for peacetime uses, they have fitted into the wartime program and are serving as alternate materials in many industries.

Textile Finishes

The story of chemistry and textiles only begins with yarns. Many types of Army clothing, such as field jackets treated with "Zelan" water repellent, now shed rain. Special Du Pont chemical treatments help guard workmen's clothing, airplane cushions and other valuable military goods against fire. Wetting agents speed textile scouring and dyeing. "Soapless soaps" speed war production by cleaning faster and better, saving soap itself, and water-softeners badly needed elsewhere.

Plastics

Plastic materials are so vital to the war that half of the amount Du Pont produces is required by the Government for military uses, and this percentage is rapidly growing. Production has been increased to keep pace with a similar increase in airplane production.

These products, well known to you by such trademarks as "Lucite," "Pyralin," "Plastacele" and "Butacite," serve military needs in more ways than can be mentioned here. In the form of molded or cast sheets, rods and tubes, plastics are essential in making parts for planes, tanks, ships and trucks. In military equipment alone there are a great variety of applications.

For example, here are a few uses of "Lucite:" salt-water filters for marine engines; electric insulation on radio and other field equipment; transparent enclosures for aircraft; tank windows; gauge windows and electrical equipment; parts for ordnance equipment; face shields; windows and windshields for naval ships; airport landing lenses; signal lenses; gas-mask lenses and accessory parts for airplanes.

The chief wartime use of "Pyralin" sheeting is in the manufacture of parts for training planes. Other uses are optical frames, shoe-lace tips, toothbrush and shaving-brush handles, and tool handles.

From "Plastacele" sheets are made transparent enclosures for military planes and gliders; shields for battleship lighting units; landing-field and blackout inspection units; military truck windows and cab lights; other military vehicle lamp lenses and windshields.

"Butacite" vinyl resin in special laminations finds use in safety glass for airplanes, military trucks and other vehicles. The vinyl butyral resins are taking the place of rubber for gaskets; these resins also find use in Army raincoats and in the manufacture of pressure-sensitive adhesives.

Nylon bristles are made into paint brushes for wartime use. Rotary brushes with nylon bristles are now polishing crankshafts and other motor parts in our aircraft factories. Toothbrushes and hairbrushes with nylon bristles are made for America's armed forces. This plastic, too, is prepared for surgical sutures and catheters.

These are only a few of the uses of Du Pont plastics on the military and industrial fronts.

Chemical Rubber

Still another example of a peacetime product converted to war and war's associated uses is Du Pont's chemical rubber, neoprene. Before the war, neoprene served chiefly the petroleum industry and the mechanical equipment field. Makers of automobiles found many spots for it, where no other existing material, including rubber itself, could serve so well. The 1941 model of one famous car had 114 neoprene parts, and neoprene had a growing parade of users.

Even before Japanese battleships and occupation troops in the Far East cut off America's imports of natural rubber, neoprene was on the first official priority list as the only non-metallic material included in it. Largely expanded production facilities were operating at capacity and a big new plant was under construction at emergency speed. Long before the rubber crisis became so critically acute, this offspring of coal, limestone and salt was "vital to defense."

And today neoprene is doing its part to win the war. It is replacing rubber in many special tasks for which it is well suited. Little affected by grease, oils and heat, it is serving indispensably in many of America's battle planes. Because it resists sunlight better than rubber and is less permeable to gases, neoprene fabric goes into barrage balloons. Oil tankers are loaded through neoprene hose. In American war-production plants, breakdowns are fewer and production totals are higher, thanks to neoprene diaphragms, gaskets, cables, mountings and a long list of other parts.

Too, neoprene goes into warships and combat tanks. One important advantage it enjoys over rubber here is that it does not support combustion. Like the bulk of Du Pont products in the war effort, this one continues to serve in the specialized field for which it was chemically designed before the war came.

Nitrates

So far we have mentioned merely a few of the materials which, because they are vital to the war effort, have been absorbed into it. But chemistry totals up to more than the sum of its products! It is a science; a force; an industry dedicated to betterment and change. Chemistry not only creates new products, it invents new ways of creating them.

In this sense, chemistry may be thought of as a helper. In May, 1918, these words appeared in a magazine: "The manufacture of explosives on the vast scale required by the Allies in the present war is made possible only by the nitrate of soda imported from Chile. . ." How many nitrate-laden ships could safely make that hazardous voyage today, in this era of long-range submarines, is a question.

Yet the United States' supply of nitrates for munitions, mining, metal-working, fertilizers and other purposes is secure. From the most plentiful of all substances —air—the chemist today draws the nitrogen we need. Thus is solved the problem of nitrate supply that might have beaten us twenty-five years ago had submarines been better, or that might easily have meant defeat in the present war but for America's inventive chemists and engineers. This is a contribution of chemical industry.

High-Pressure Synthesis

High-pressure synthesis, the name given to one method employed to take nitrogen from air, is one of the most richly-productive chemical techniques known. The Du Pont version of it utilizes pressures as high as 15,000 pounds to the square inch. More than 100 products are produced in the highly complicated apparatus from such basic raw materials as coal, water and air. And again, one thing leads to another. The first results are "mother" compounds, or, as the chemist calls them, intermediates. Ammonia, for instance, is an intermediate. Alcohol is another. Combined, under pressure, with other chemicals, these intermediates yield many products vital to peace and war alike.

For example, the first step in making "Lucite" plastic is a 6,000-pound-per-square-inch pressure operation in which methyl formate is made from methanol and carbon monoxide. The same two substances, at 10,000 pounds' pressure, yield a cooling fluid for automobile and aircraft radiators. Another chemical transformation yields nylon polymer, from which all forms of nylon are made.

By high-pressure synthesis is produced urea, used in plastics, fertilizer compounds and medicine. Physicians believe that the use of synthetic urea in treating certain types of wounds may save the lives of many soldiers and sailors in this war.

Chemicals by the Carload

Then there are the heavy chemicals required in such quantities that they come from the plants in carload lots. Their part in helping win the war is as vital as that of steel or aluminum, but they quickly lose their identity in the back stage of industrial processing. The spotlight rarely discovers them, yet lacking sulfuric and other acids, soda ash, caustic soda, sodium silicate and some scores of equally important chemical wheel-horses, the nation's whole war program would groan to a stop. They serve in pickling steel, making dyes, tanning leather, refining petroleum, in alloying metals and in a-thousand-and-one ways. Closely related are such special chemicals as chlorine.

On the day the United States went to war Du Pont chlorine was bleaching textiles and paper, treating sewage, purifying water, filling fire-extinguishers, taking spots out of John Smith's suit, and handling scores of normal peacetime jobs. Today, Du Pont chlorine goes into smoke bombs as hexachlorethane. In another form it "degreases" or cleans the metal parts of planes, tanks and guns preparatory to finishing. It helps to make magnesium for metal parts and incendiary bombs; synthetic rubber for hose; vinyl chloride for insulation; ethylene glycol for the cooling systems of motors and machine-guns; tetraethyl lead for high-octane aviation gasoline and resins for plastic parts. It finds its way into lubricating oils, flares, smoke screens, explosives for shells and special waxes for waterproof tarpaulins.

Formaldehyde is needed to make war plastics; peroxide, for bleaching. Sodium cyanide is demanded dually to harden parts for tanks, machine-guns, trucks and planes, and also in electroplating where it enables iron and steel to be covered with a thin protective coating of cadmium, copper, zinc, gold or silver.

Dyes

In dyes, chemistry has created a whole new industry —an independently American industry. Suppose you were to pick up a newspaper tomorrow morning and read: *Dye Shortage Threatens Jobs of Half-Million Textile Workers . . . Single Keg of Rhodamine B Dye Sells in New York for $5,000 . . . Women Mob Stores in Rush to Buy Last Colored Dresses . . . Color Hoarding Sends Prices Skyrocketing.*

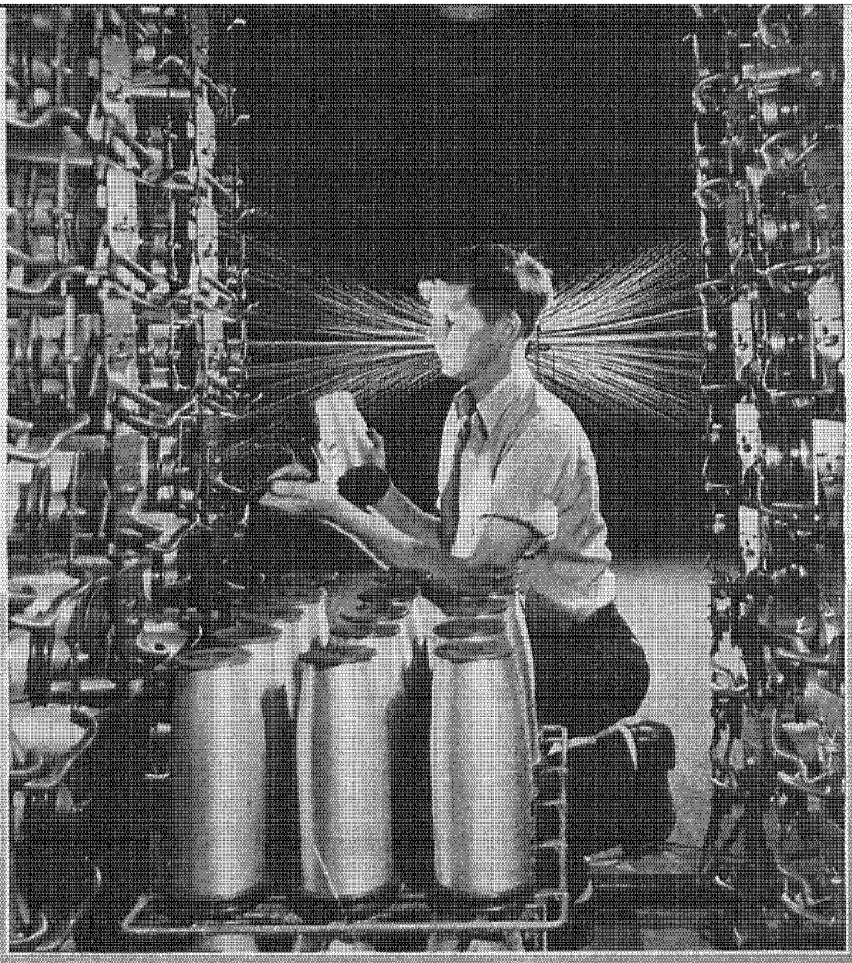
Do such headlines sound fantastic?

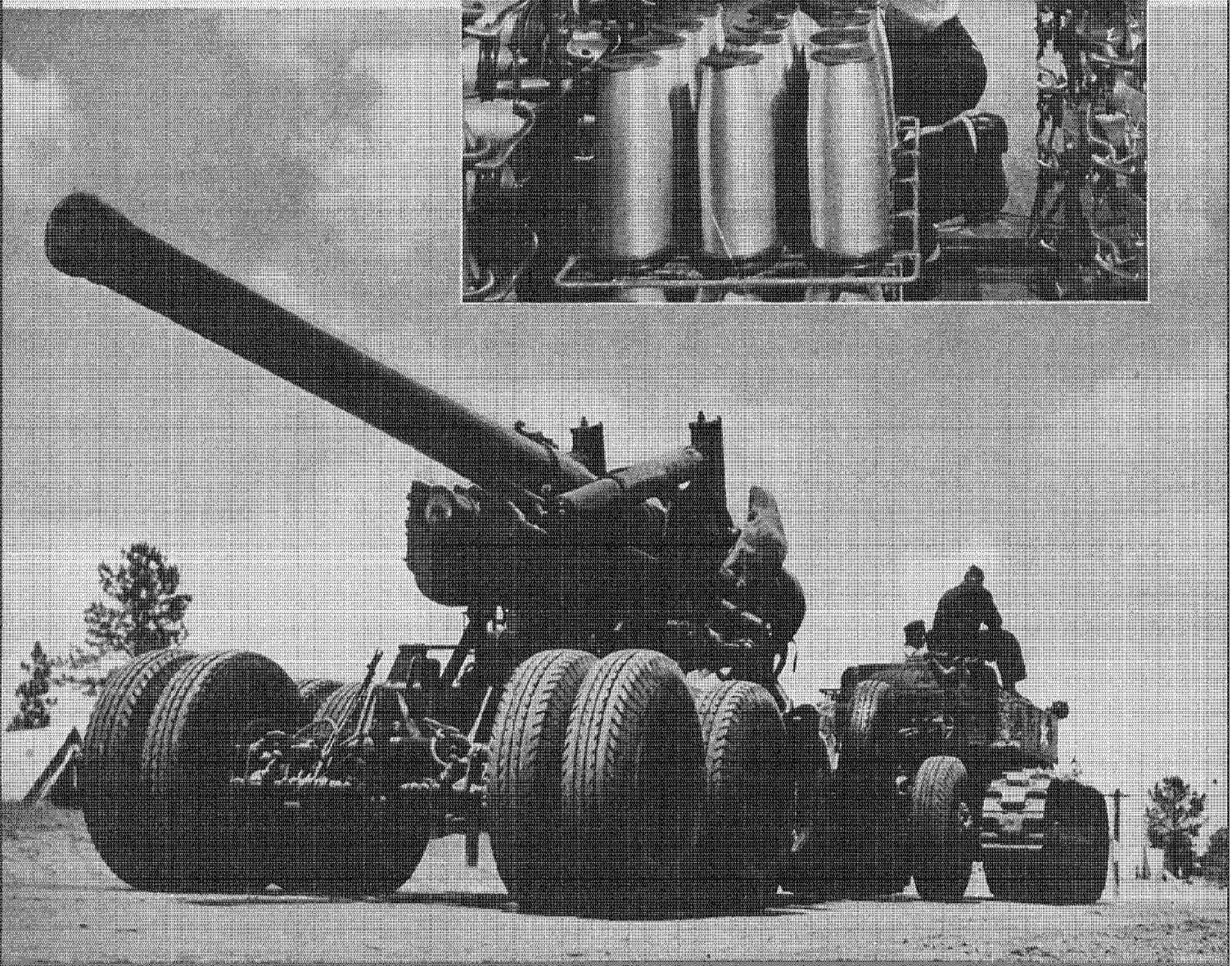
They were not at all fantastic a quarter-century ago! When the First World War cut off our supplies of chemicals made in Germany, the United States was left stunned and helpless. We could not even supply our Army and Navy with fast-dyed khaki and blue uniforms; for 90 per cent of the dyes we used were imported. Workmen in dye rooms scraped the floors to salvage precious ounces of color.

But a year ago, before the present war began, the United States was making 95 per cent of its own dyes! Du Pont has played a substantial part in bringing about this change.



"Cordura" Rayon Yarn: It was developed specifically for the heavy-duty tires of a nation on wheels. This yarn is twice as strong as the rayon employed for ordinary textile fabrics, and has the ability to maintain its strength at elevated temperatures.





This yarn, a peacetime product, helps to keep heavy field-guns rolling wherever they are needed.

The American fighting man needs four times as much cotton as he does wool in his equipment. So, as long ago as 1920, the Government drew up specifications for the best cotton fabrics and for the best cotton dyes—the anthraquinone vat colors. Today, Du Pont production of these dyes is five times what it was two years ago. The Company is supplying more than half of all the anthraquinone vat dyes used in service uniforms. And production will be increased again this year. In addition, Du Pont is supplying a considerable part of the dyes for wool uniforms, blankets and similar goods. Thus, thanks to a farsighted program in which Government and industry cooperated, American service uniforms are now dyed with colors as good as any nation can produce.

Camphor

While working on dyes, chemists learned to create many new and seemingly unrelated compounds, like ethyl fluid for gasoline and the sulfa drugs, which have made modern life so much safer, more comfortable and efficient. Too, they learned how to make camphor from southern pine stumps. Camphor formerly was imported from Formosa at whatever price the Japanese monopoly chose to decree, which made an important segment of the American plastics industry dependent upon Japan. That dependence has become complete independence. A wartime threat to our industrial machine from the Orient has been averted by chemical "know-how."

"Know-How" Follows the Flag

The material requirements of the War Production Board are divided into twenty-three broad classifications. Significantly, Du Pont products have a place in all of them. A single manufacturing department of the Company recently roughly listed the military purposes to which the products of just one Du Pont plant had been adapted. It found that a battleship cleared for action may have as many as forty-six of that one plant's products aboard in one form or another; an army tank might have thirty-two; an airplane, forty-one.

The Du Pont Company has ten manufacturing departments, all operating in the nation's service. The many chemicals they produce fit into the WPB chart like the parts of a gigantic jig-saw puzzle—and Du Pont is only one corporate unit of the chemical industry!

It was inevitable in the change-over from a peacetime to a wartime economy that many Du Pont customers should need to make drastic readjustments. Critical materials were covered by priority regulations. When manufacturers could no longer obtain their usual materials they had to find alternates for them, and other chemicals with which to process them. Many of these manufacturers turned to the chemical industry for help. And, wherever possible, Du Pont supplied the help that was asked. Never has chemical "know-how" been of greater service to American industry!

However, in all instances, Du Pont has met Government requirements first.

When Every Minute Counts

TIME may well be the decisive factor in winning this war. So, on the industrial front, chemistry is doing its best to stretch time, to make one hour do the work of two or three hours. For example:

Bombers such as the North American B-25 or the Martin B-26 may have as many as 250,000 rivets. Two-man crews swarm all over such a plane in a factory. One man seats rivets with a pneumatic hammer, the other "bucks" from the other side. And when a fastening point can be reached from only one side, the production line is slowed. There may be as many as 5,000 to 10,000 of these "blind" points in a single bomber.

So, today, a rivet with a small explosive charge in its shank is pushed into the hole which can be reached only from one side. The charge is detonated by heat from an electric "gun" and—*bang!* No more bottleneck!

The explosive rivet offers a fascinating story of research and chemical precision. Du Pont chemists have developed it to the point where the explosive action—the ballooning-out of the shank—is controlled within twenty thousandths of an inch.

Now, the nation's great airplane industry is consuming explosive rivets by the millions.



Commercial Explosives

One of the greatest time-savers man has ever known—indeed, some call it the very greatest—is dynamite, of which the Du Pont Company alone manufactures more than 150 different types and grades. In peacetime, America's average annual output of commercial explosives is considerably more than 300,000,000 pounds. In this war year both production and consumption totals will be substantially increased. And everybody knows why. Never before in history has it been so important to produce quickly, and in large volume, iron, copper, lead and zinc ores or those from which nickel, molybdenum, vanadium, manganese and chromium are obtained. The non-metallic materials, such as coal, limestone, potash and sulfur, must also be produced quickly, and explosives are required for that work. Dynamite has speeded the construction of cantonments, airports, highways, railways and harbor projects. It has aided in building huge hydroelectric dams to supply our war industries with power, and has served the petroleum industry in the work of seismic prospecting for oil.

Accelerated Bleaching

A million fighting men require as much cloth of all types as would normally be needed by fifteen to twenty million civilians. The major share of this cloth—millions and millions of yards of it—must be bleached before it is dyed. And to make sure that the cotton fabric for making the khaki uniforms of our armed forces would be in condition to be dyed in accordance with exacting color specifications, a speedy, uniform bleach was necessary.

How to speed bleaching presented a man-size problem. Under the old method, batches of gray goods were steeped in one tank, removed, placed in another, and so on. Eight hours was considered fast for a batch; ten to twelve hours was the average time.

Out of Du Pont research came the answer to the plea for speed. The process is called the continuous peroxide bleach. Continuous, because Du Pont experts showed textile men how they could get better results by tying the cloth into a long, endless belt and running it through the special bleach over and over. Today, the cloth comes out of the bleach at the end of 130 minutes.

The same endless-belt idea has been adapted to the degreasing of woolen piece-goods. Textile mills for decades had been removing the dirt and spinning oils from woolens with soap and water; then, the time factor was not so important. Now a Du Pont solvent applied in another endless-belt technique turns out woolens at the rate of a mile an hour—enough for ten uniforms every minute!

Next, Building Materials

The volume of industrial construction hit an all-time high last winter. Plants grew, or were projected on blueprints, with the speed of growing mushrooms. The need for structural steel became so acute that contractors tore down old buildings for the steel they contained.

Builders asked: "How can we get quickly seasoned wood for construction?" Chemists had an answer—the use of synthetic urea to speed the kiln-drying process. Timber is now seasoned in a few weeks. Du Pont chemists went still further; they gave to wood properties it never had before. Impregnating it with chromated zinc chloride, they made lumber fire-retardant and resistant to decay and termites.

Spotlight Vision

Paint, used scientifically, is another time-saver. Three-Dimensional Seeing, developed by Du Pont, is a proved technique of painting mill and factory machinery in such a way as to emphasize danger spots. Thanks to two especially-developed colors, Spotlight Buff and Horizon Gray, workers are able to perform their tasks more efficiently, and—because they feel safer—more quickly. Fast, accurate vision is assured.

Three-Dimensional Seeing combats the increased accident rates which followed the influx of new workers into war plants. Army Ordnance has tried it, and in one arsenal alone the development is given credit for a production increase of ten to fifteen per cent.

Du Pont paint technicians are now working with engineers of naval shore establishments, with lower accident rates and increased production in view. Five areas of a huge factory turning out range-finders and precision instruments were given the Three-Dimensional Seeing treatment some time ago with outstanding results, the manufacturer reports. One of the largest manufacturers of Army training planes has adopted the technique throughout its entire plant system. And Spotlight Buff and Horizon Gray adorn every piece of machinery in plants operated by the country's largest builder of ships.

Metal-Cleaning Speeded

The delicate precision parts of war planes, the motors and instruments, and the armor plate, must be cleaned thoroughly before finishing. The quickest way to do that is by the solvent-degreasing process.

If old-time methods of cleaning were used today, it would slow up wartime assembly lines. A single thumbprint will hang a red "reject" tag on the delicately-machined cylinder-head of a radial plane motor. And we need those motors as fast as we can build them. They are the reason why a Flying Fortress can get up to 35,000 feet, above "ack-ack" range and where pursuit planes cannot maneuver effectively! So today the metal parts are hung in a hermetically-sealed tank over a pool of a special Du Pont solvent. Vapor rises from the heated solvent and condenses on the metal. The fluid falls back into the bottom of the tank, carrying with it every bit of grease and oil, together with stray metal chips and fil-

ings. This degreasing process is one reason for the high rates of production being achieved today by American plane manufacturers.

Another related development that is being put to excellent war use is high-speed copper plating. Its military adaptations are secret, but it may be revealed that the process is four times faster than older methods.

Microfilm Serves, Too

How would you quickly copy the thirty tons of blueprints that are necessary before the keel of a battleship can be laid?

The answer is microfilm, the secret of which is an ultra-fine-grain emulsion—giving the film what experts call high resolving power. In short, it can record extremely fine detail. Even this page of type can be reduced to 1/900th of its area and then be projected to full size without serious loss in legibility. In practice, entire drawings are now photographed with precision accuracy on tiny pieces of film no larger than a postage stamp. And the whole operation can be done as fast as the sheets can be turned by hand.

Motion pictures made on Du Pont film are also effective aids in teaching new recruits, both military and industrial, their wartime jobs. Educational films, such as "How a Ship Is Built" or "How to Deal with Incendiary Bombs," can present the facts so clearly and completely that hours, once spent in the classroom, can now be saved.

War has brought strange uses to many a peacetime product. For instance, nobody would think of shot-shells for skeet guns as time-savers. Yet many of the gunners in our air fleets become good shots thanks to preliminary training on skeet grounds. When skeet-shooting was first made a part of the training course for gunners, it was regarded as revolutionary. But the training has paid. Several of our high-score aerial gunners, with the greatest number of Japanese planes to their credit, first learned how to shoot with skeet guns and shot-shells made by Remington, a Du Pont affiliate.

Refrigerant Aids X-Ray

Steel has today relinquished its last bit of personal privacy. Engineers now look through huge castings—five or six inches thick—as if the metal were glass. For scientists have been able to make million-volt X-ray machines "portable."

Quoting the *Science News Letter* of November, 1941:

> "Two developments are mainly responsible for the new unit. Enclosed X-ray equipment has previously used oil in the casing to insulate the parts from the high voltages. Now it was found that 'Freon' gas, developed for use in electric refrigerators and known chemically as dichlorodifluormethane, could be pumped in under pressure and was more effective."

Briefly, by using Kinetic "Freon-12" refrigerant instead of oil as an insulator, the weight of these million-volt machines was reduced by a third. In an industrial plant turning out tanks or battleship turret-armor, this means increased portability. No one charged with keeping production at a peak underestimates the value of the industrial X-ray machine. It ferrets out and records faithfully defects in steel and iron that could mean the difference between winning and losing a battle—or a war. And it saves time!

Chairman Donald M. Nelson of the WPB recently declared: "We have got to find every possible way of making one hour's work do the work of two."

Chemistry is doing just that.

Conservation of Materials

CHEMISTRY is saving materials as well as time. Textile mills weaving woolen cloth for uniforms and blankets must degrease their wool. For many generations this has been done by washing the wool in soap and water. Now, however, Du Pont is supplying many mills with trichlorethylene. One textile manufacturer, who used 250 drums of this Du Pont cleaning solvent, reports that he has saved:

250 drums of ammonia
20,000 gallons of naphtha
650 drums of spinning oil
50,000 pounds of sulfonated castor oil
150,000 pounds of soda ash
75,000 pounds of soaps

In addition, he has saved most of the fuel oil formerly required to heat his water and soaps. The 250 drums of chemical cleaning fluid, used over and over, released literally tons of materials to other manufacturers engaged in other phases of war production.

Paint Does More Work

A new Du Pont pigment, rutile titanium dioxide, has enabled paint manufacturers to make 80 pounds of pigment do the work of 100. And it should be remembered that paint itself conserves property. A tank or plane left out in the weather without suitable protective coating soon becomes a prey to rust and corrosion.

Pigment manufacturers have long faced a troublesome problem in removing excess nitrite from certain

basic materials. A few months ago, one manufacturer was using 25 pounds of urea for this purpose. A Du Pont technical man, scenting a possible saving, suggested the use of sulfamic acid, which Du Pont now produces in tonnage quantities. Result: four pounds of sulfamic acid now do the job. Only a few years ago, this acid was looked upon merely as a laboratory curiosity.

Chemical Film Saves Anti-Freeze

Anti-freeze fluids for automobiles are scarce because the chemical ingredients are needed for war plants, and alcohol-type anti-freeze has one disadvantage; it evaporates. Last January, Du Pont obtained patent rights to manufacture a product that reduces this vaporization to a minimum. A "chemical blanket" covers the exposed upper surface of the alcohol, smothering the bubbling reaction that causes fast vaporization. The "blanket" is a compound of kerosene, or petroleum oil, and a chemical known as alkyl-C-betaine. The latter spreads the oil over the anti-freeze, effectively retarding evaporation. Should the film be broken by violent bubbling, the chemical quickly mends it.

How Tin Is Conserved

Tin, like rubber, was imported from distant lands until war shut off supplies. Now it is a metal more precious to industry than gold. Every pound saved is vital to production. And here again chemistry is of service. A Du Pont electro-tinning process known as the sodium-stannate-sodium-acetate bath covers steel strip with a layer of tin controllable to a thinness as fine as .00001 of an inch—releasing tons of the metal for war uses, since it makes the tin go 40 to 65 per cent further. Another Du Pont tinning method known as the Halogen Tin Process shows excellent promise of effecting equal or greater savings. And the deplating and recovery of copper in cyanide solutions by a new Du Pont process is also helping to save thousands of pounds of practically pure copper that once was wasted.

Service to Pulp and Paper Makers

Paper was a critical material not many months ago. It is needed for packaging almost everything from spare plane parts to khaki sewing thread. For instance, every 37-mm. shell is packed in a laminated paper tube. America's pulp and paper mills for a time were in trouble.

One of the frequent causes of paper mill shut-downs is slime—the product of some 600 kinds of bacteria, fungi and algae living in the pulp stock from which paper is made. Slime clogs screens and causes breaks in the half-finished material. Chlorine was used to control this condition, but when supplies of chlorine were diverted to war plants, paper makers called upon Du Pont for help.

The slime problem was solved with a chemical compound trade-marked "Lignasan." First used in lumber mills to control stains in air-dried lumber, this product—four to eight ounces of it—enables the paper industry to protect a ton of paper.

Rayon Helps Keep Them Rolling

America's Army is rolling to war on rubber—and on rayon, which is saving rubber. This is a special type of rayon that is an all-American development using only American raw materials. Tough sinews of this high-tenacity yarn, conceived in a Du Pont laboratory, lie beneath the precious rubber skin of military tires for bombers, combat cars and transport trucks. The yarn, or cord, possesses greater strength than any other tire fiber now in use, and retains its strength under the high friction-generated heat of heavy-duty driving. The result is that tire side-walls may be thinner—less rubber need go into them. And, in turn, the thinner walls assure lower temperatures at high speeds, and thus help conserve the rubber actually used. In addition, weight is saved, which counts in a pursuit plane or in a bomber where less weight means more bombs, more speed and longer range.

Scrap

The national campaigns to save scrap steel and rubber and tin are necessary because of war needs. Years ago, industry learned on its own account that it pays to salvage and reclaim materials that can be used again. Du Pont set up its organization for that purpose in 1907—thirty-five years ago—and since then it has been functioning continuously. The management of one of the Company's New Jersey plants was recently commended in a Government publication for having collected 122 tons of scrap metal and more than a half-ton of rubber in one month. Materials recovered at all Du Pont plants in a year represent, altogether, a large tonnage. So much for another sidelight on the war effort.

Packaging in Cellophane

As far back as ten years ago, Du Pont technicians envisioned possibilities of cellophane replacing metals in the packaging of many foods, in addition to the broad packaging service it was already performing. Research was inaugurated to see just how many packaging needs the sparkling film might meet, if and as those needs arose. The result was that cellophane was ready when war shortages arose in packaging. Moistureproof cellophane laminated to paperboard was ready to replace the metal bodies of cans, and also to form entire containers that provide adequate protection for certain types of food, drugs and chemicals. Millions of these new packages are already in successful commercial use. Du Pont cellophane is also doing its bit to conserve tin and other essential metals that are needed for war uses.

Saving Shipping Space Helps, Too

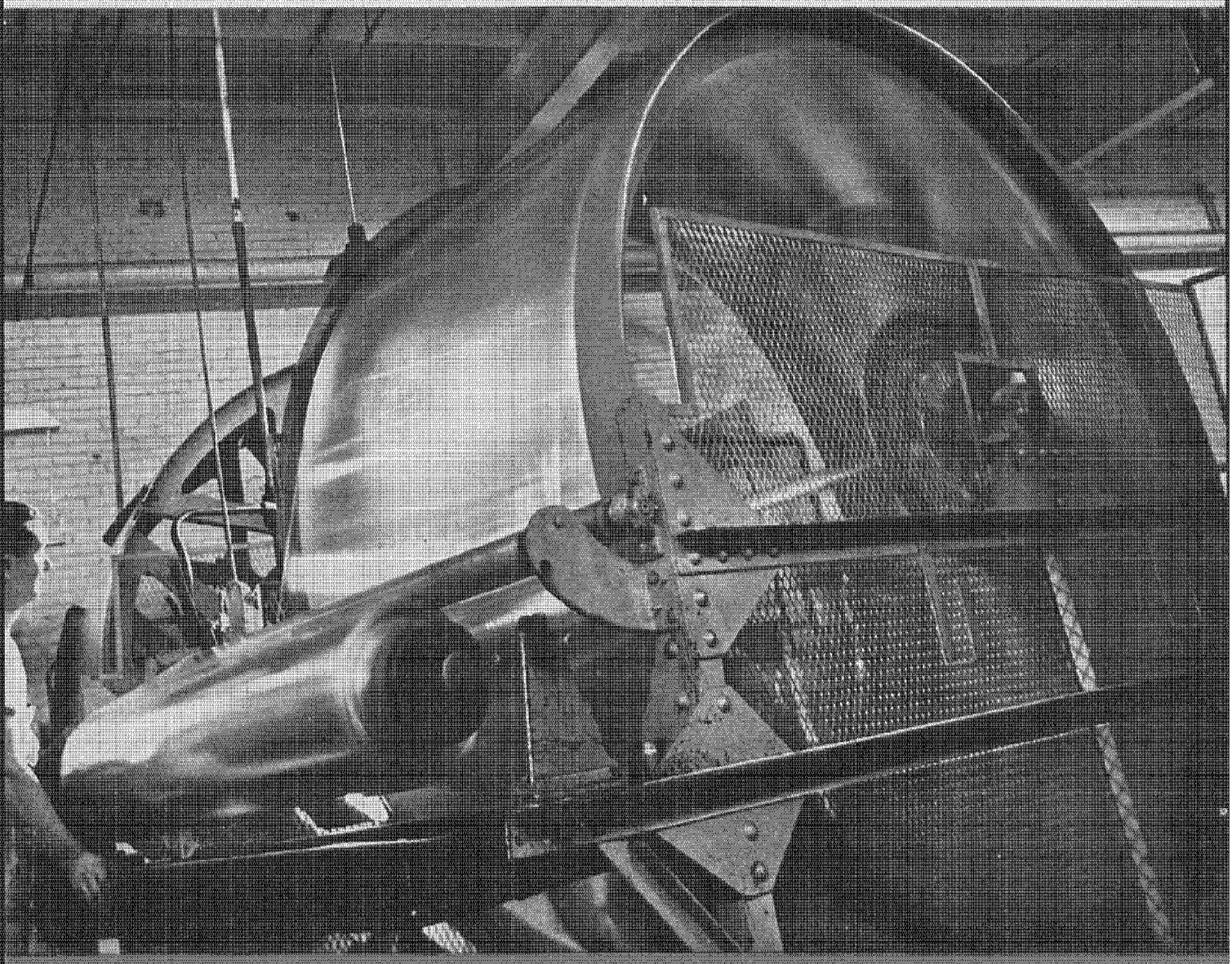
A bridge of ships spanning the Atlantic, spaced only a trifle over one mile apart, would be needed to bring to America in one trip just five of the many vital war products the chemical industry has developed since 1917.

The five new products are nitrates for explosives and fertilizers; rubber; dyestuffs for uniforms, military equipment and your clothing; fibers such as nylon and rayon; and last, camphor, used medicinally and in the manufacture of many chemical products essential to the war. To bring them to America from abroad in the quantities we are using this year, or in the quantities we used to import, would call for 2,700 cargo vessels. From New York to Queenstown, Ireland, is roughly 2,800 miles. So if you spaced the ships a little more than a mile apart between the United States and Europe, across the entire Atlantic, you would have the number of cargo vessels chemistry has set free to carry other much-needed war materials to our Allies overseas.

And, vital as those ships are to the war effort, they constitute only the beginning of the story. For even if we had 2,700 ships to spare today, we could not get—with the single exception of nitrates from Chile—the raw materials to fill them, because those foreign sources of raw materials are no longer available to us.

Ninety-five per cent of our rubber came to us from territory now controlled by Japan. If it were not for chemical rubbers, in which Du Pont was a pioneer with neoprene, tomorrow we might not have any rubber at all. If it were not for the American dyestuffs industry, in which again Du Pont was a pioneer, we would have virtually no dyes at all. If it were not for nylon, once our national stock pile of silk was used up, we would have no satisfactory materials for vitally essential needs. And if it were not for synthetic camphor made from southern pines there would be no camphor today—unless some happened to be left over from peacetime stocks.

Fortunately, domestic production of these chemical products has cushioned a blow that might have been much more severe under other circumstances.



Cellophane: This structurally-strong film fills a new role in packaging . . . conserves vital metals needed for the war effort. New packages also save shipping space and weight.

FROM THE

DU PONT



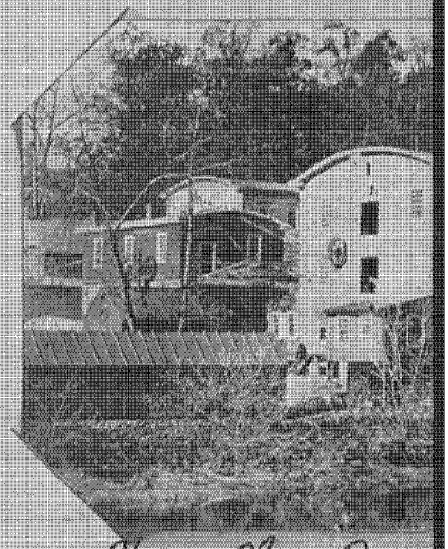
Original unit of Powder Mill built in 1802



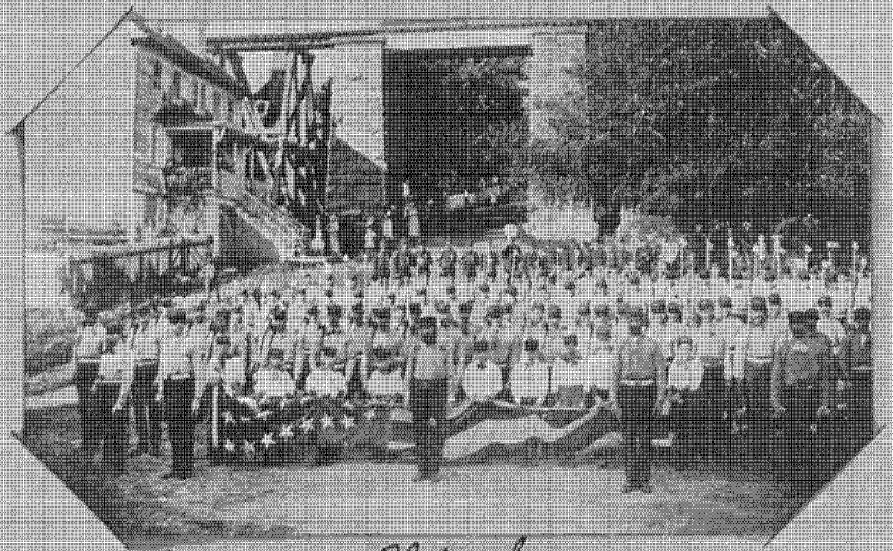
First DuPont Smokel



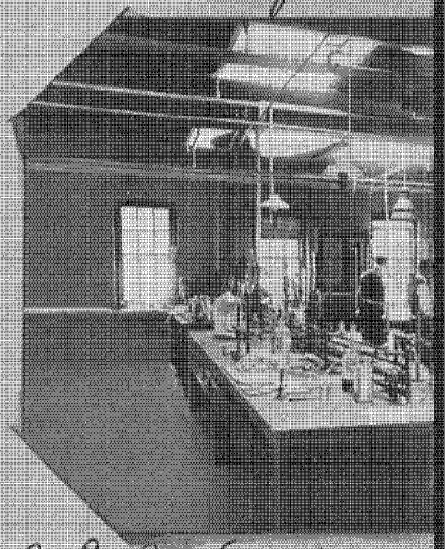
Hauling DuPont Powder, about 1880



Henry Clay Iron

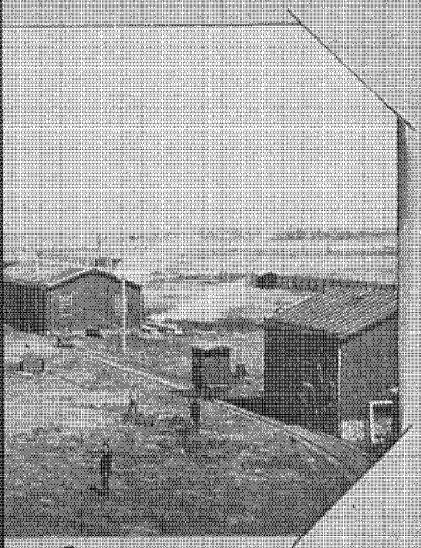


Tippecanoe Club, Sept. 27, 1888

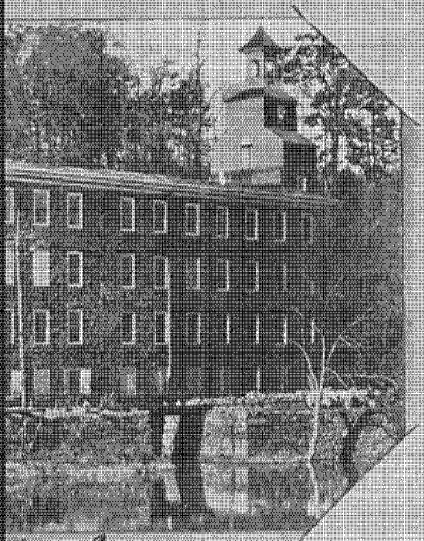


A DuPont Experimental

ALBUM



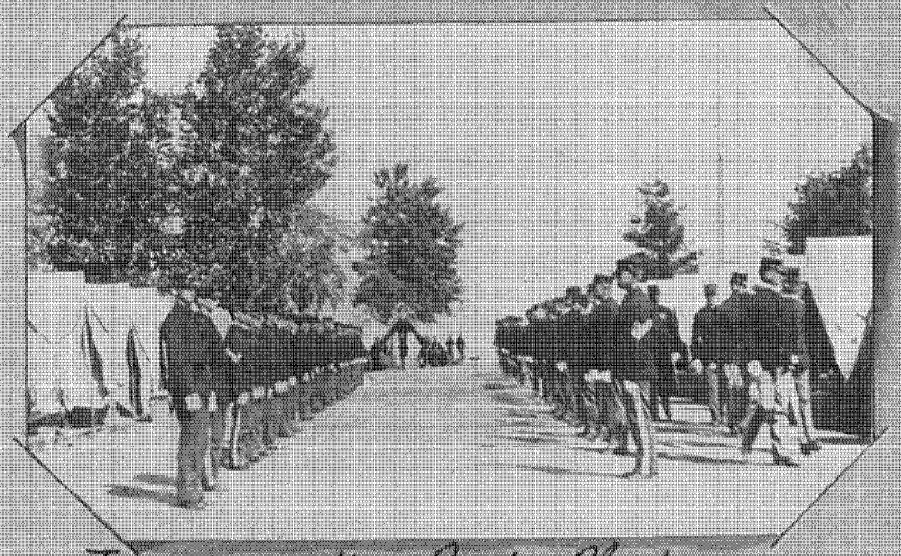
e Powder Plant, 1894



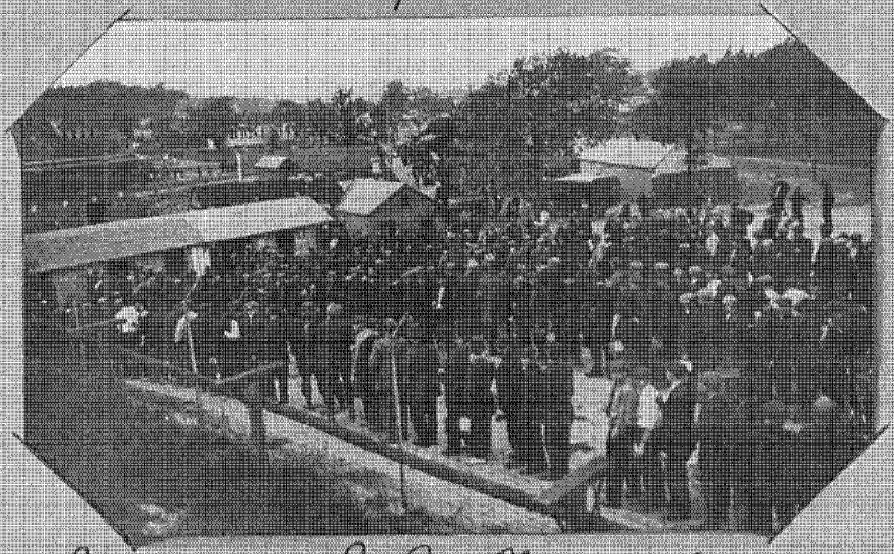
eg Factory, 1885



Station Laboratory, 1906



Troops guarding Powder Plant,
Spanish-American War



Pay day at a DuPont Plant - World War I



Brandywine Club House, 1892



Chemistry and Civilian Needs



Thus far the spotlight has been turned on Du Pont materials and services that are helping to speed the production of war materials. The picture, of necessity, has been incomplete. There is a blackout over many developments for military reasons.

At this stage of world events, with aerial bombs blasting inland cities overseas, with Japanese forces struggling for a foothold in Alaska, with German submarines infesting our coastal waters, with our civilian defenders on the alert for enemy air raids, any home front today may be a fighting front tomorrow.

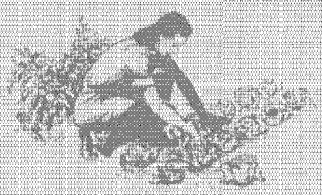
The issues of this war will be settled by our armed forces in the field with the aid of our citizens at home. Until the war is won, both military and civilian forces must be supplied with the essentials of life. For, in this war, everybody fights! The morale of the worker in the chemical plant, in the shipyard, in the railway yard, must be maintained.

Turn now to the part chemistry is playing to supply civilian needs . . .

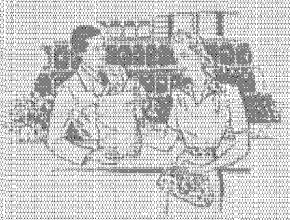
Wheat: Bread for soldiers and civilians stems back to fields like this. Chemical treatments for seed are applied to insure smut-free crops at harvest time.



Pest Control: Food production entails a constant fight on the agricultural front to control insects, fungi, animal and plant diseases. In the Du Pont Pest Control Research Laboratory a trained staff constantly seeks new chemical weapons to combat these foes.



FOOD



AMERICA'S fields, orchards and gardens are setting all-time records this year! More milk, more eggs, more meat, more vegetables, more fruit—more food *now*, was the call to America. And more food our Allies are getting!

Chemistry is helping in a dramatic performance by American agriculture and industry that is rushing a steady flow of food to China, Britain, Australia, Africa, India, Iceland—wherever Americans and their friends are fighting this global war. Dehydrated milk, dried eggs, concentrated fruit juices, frozen meats—the "munitions" that keep the fighting man in fighting trim—are becoming as familiar in many lands as American planes and tanks.

Americans have the "know-how" of foods, both in raising and processing them—"know-how" that has been much advanced by chemical research. The American farmer is a production manager, employing mechanical equipment, scientific methods and technical skill in his production. No coolie labor, no peasant women gleaning grain fields characterize American agriculture.

Food Production Aids

Instead, the citizen farmer of the United States applies chemical compounds to his soil to supply plant foods: nitrates made by industrial chemical plants from coal, air and water; phosphates recovered by sulfuric acid from natural stone; calcium compounds refined from quarried limestone. Before planting, he treats his seeds with chemical compounds to control the smut, scab and rot which would otherwise sabotage his harvest.

Fertilizers are actually responsible, on the average, for 15 per cent of our nation's farm crops. Their effects on maturity, quality and marketability are of the greatest importance. Something like a third of our tomato crop, for instance, simply would not be grown if no fertilizer were used. Without fertilizers, production of citrus fruits in Florida might fall off by as much as 80 per cent, an almost unbelievable figure!

Against insect pests and plant diseases the farmer wages full-scale chemical warfare. He gases the enemies of his citrus trees; sprays and dusts with insecticides to kill the pests of his fields and orchards; uses fungicides to control plant diseases of fruits and vegetables. His harvest is hard-won against a myriad of insect and fungous enemies—but won it is, with a barrage of sprays and dusts marshalled by science from a whole brigade of chemical compounds.

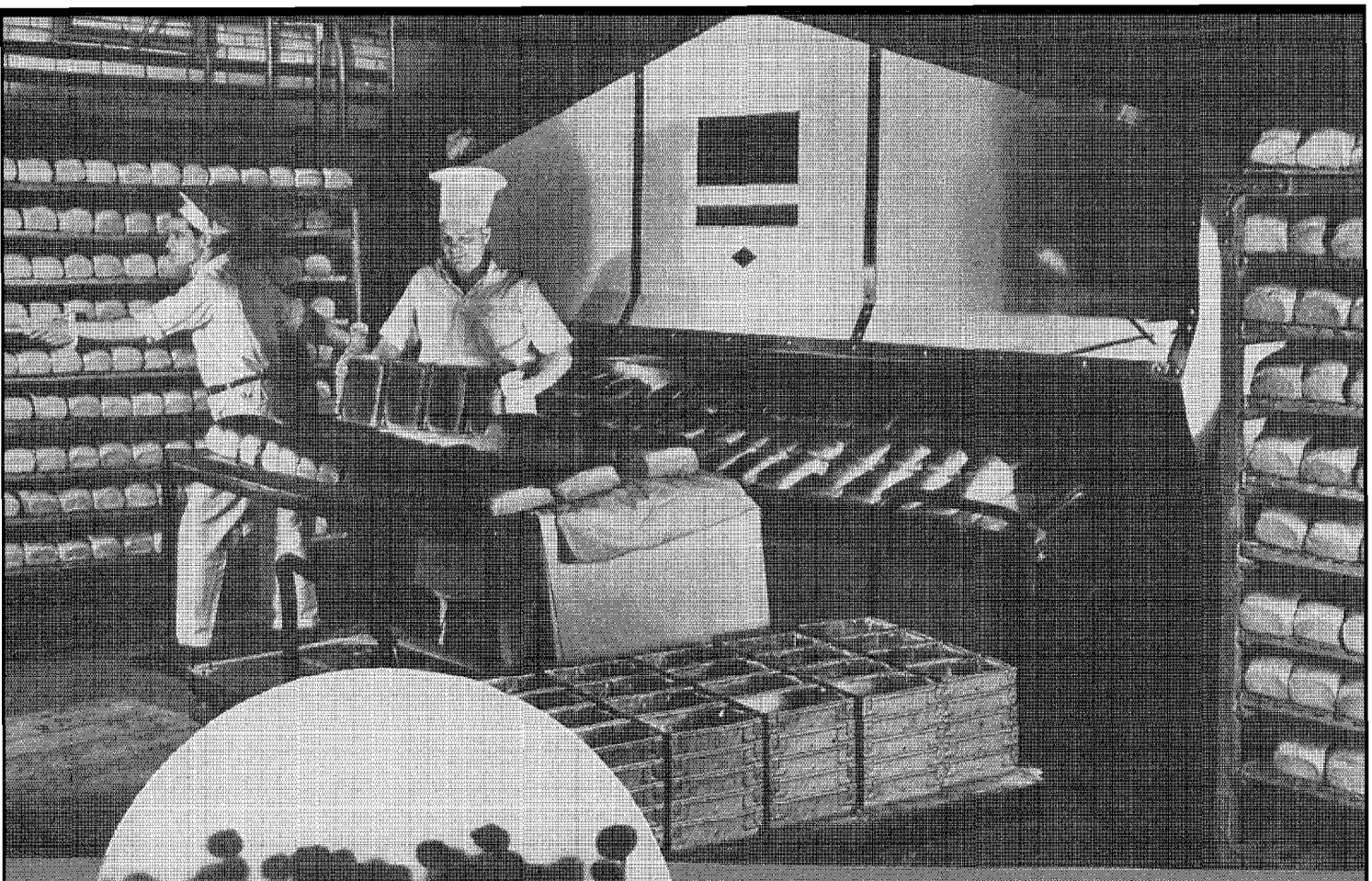
Spectacular as they are, no one of these chemicals is more interesting than the hormone fruit sprays. Du Pont "Parmone," developed only two years ago, now helps to solve a labor shortage for the apple and pear growers whose pickers are busy in war plants or in the services. One pint of this new chemical "Parmone," added to 100 gallons of water, if sprayed on the trees before picking time, will hold apples or pears on the trees! This gives the picking crews ten days' to three weeks' more harvest time. And it reduces windfall wastage and improves color and size.

Another remarkable chemical, phenothiazine, is ranked as one of the ten most valuable veterinary medical developments of the past decade. With phenothiazine, the farmer has the means of controlling more varieties of internal parasites of livestock and poultry than with any other single compound. Higher production of hogs, cattle, sheep and poultry is assured by this product of the laboratory.

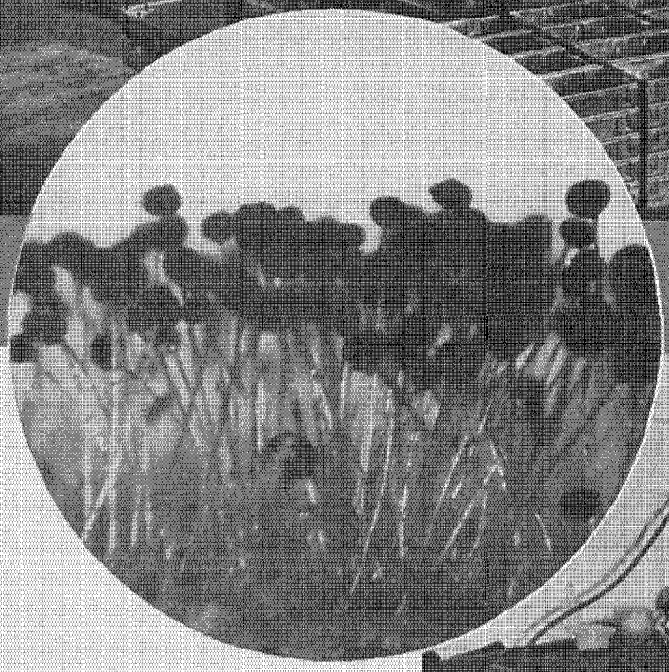
Ten years of Du Pont chemical research resulted in "Delsterol" D-Activated Animal Sterol. "Delsterol" gives poultry raisers a dependable domestic source of Vitamin D—the "sunshine" vitamin that is so necessary for poultry. Such a domestic source is imperative now with normal sources of raw material supply thousands of miles away across submarine-infested seas. With "Delsterol," chemistry contributes to the production this



SPRINGTIME OFFENSIVE: Apple growers applying chemical sprays to control an old enemy—the codling moth.



Oven Fresh: Bread keeps mold-free longer when a little "Mycoban" is added to the mix. About two billion loaves will be protected this year.



Mold Spores: As shown here they are greatly magnified. Inhibiting their growth is one of chemistry's contributions in solving a food-conservation problem.



Facts First: This Du Pont chemist is investigating the growth of mold spores on a wedge of cheese in the Food Research Laboratory.

year of fifty billion eggs for America and her Allies.

Cecal coccidiosis, a disease particularly destructive to chickens, has been prevented experimentally and may eventually be controlled effectively by the use of a chemical compound developed for this purpose by Du Pont. The disease is caused by microscopic organisms known as protozoa which invade and attack the cell lining of the cecal pouches of poultry, causing stunting, weakness, and eventual death.

Eleven sulfur compounds were tried out on White Leghorns, Plymouth Rocks and Rhode Island Reds. Single doses of tetraethyl thiuram monosulfide, which was least toxic to poultry, prevented development of the disease in the tests. Du Pont scientists emphasize that further experiments are necessary to develop a practical method of application of the chemical in the feed or water to prevent infection or produce resistance to it, after which it is hoped to offer the material for general use in the poultry industry.

But the chemical industry offers far more to the farmer than the familiar fertilizers, insecticides, germicides and fungicides. Take, for example, zinc, a simple chemical element. After the chemist has dealt with it, zinc serves agriculture in such items as farm power and equipment, galvanized roofing, sprays, paints, dairy and poultry equipment, sugar refining, fencing and even the humble fruit jar cover which conserves the products of garden and orchard. Or take urea, which differs from zinc in that it is a chemical compound that must be synthesized. Urea, a nitrogen fertilizer, supplies protein feed for cattle, sheep and other ruminants, and also aids in seasoning and bending lumber—an important wartime crop; this, aside from other important uses in the manufacture of plastics and of adhesives for plywood. And, of course, the fumigants, in killing insect and animal pests, save the food that would otherwise be destroyed or contaminated—just as ammonium sulfamate conserves by killing weeds.

This Is a "Package" War

But the challenge to America to provide food is more than a challenge of production. War has brought new problems of processing, preserving, packaging and shipping.

Ships are scarce, so cargoes must be concentrated. Foods must travel to the tropics, to deserts, to Iceland, to Alaska, wherever the Flag flies, and they must be fit to eat at their destination whether it be in dry, wet, hot or cold climates. World-wide war brought a rush of problems to the food industries such as they had not encountered in all their history.

Today, for example, whole milk is spray-dried by a new process so that the fats do not become rancid. One shipload of this spray-dried milk equals four of evaporated milk. And dried eggs are flown to Britain. Orange juice is concentrated into a small fraction of the space needed to ship the whole fruit. Tomato juice is dried. Soup is dehydrated. Lard is frozen; butter is kept firm and wholesome at tropical temperatures.

Chemistry plays its part in all of this. Just as tangibly as ships, it helps to get more and more food where it is needed overseas. And at the same time it helps to feed us here at home.

Food Conservation

Chemistry helps prevent waste by conserving food; some of it in your own kitchen. Chemical refrigerants make possible the widespread use of cold storage in the United States. Our meats, fish, fruits and vegetables come by rail and highway from all corners of the nation to our tables, *fresh* because of refrigeration. We enjoy quick-frozen fruits, vegetables and meats at any season of the year without serious loss of vitamins, flavor or nutritive value. Across America 4,500 cold storage "locker plants" enable hundreds of thousands of families to preserve foods for weeks and months on end. These "food banks," thanks to chemical refrigerants, are an important national asset in wartime.

Chemists restore the vitamins to flour so that we may have healthful, vitamin-enriched bread. A trace of a "Mycoban" propionate in baked foods gives them longer protection against mold fungi and rope bacteria. Two billion loaves of bread are being protected thus by chemistry this year. Seventy-five million pounds of butter will be wrapped in paper treated with "Mycoban." Cheese is likewise being protected.

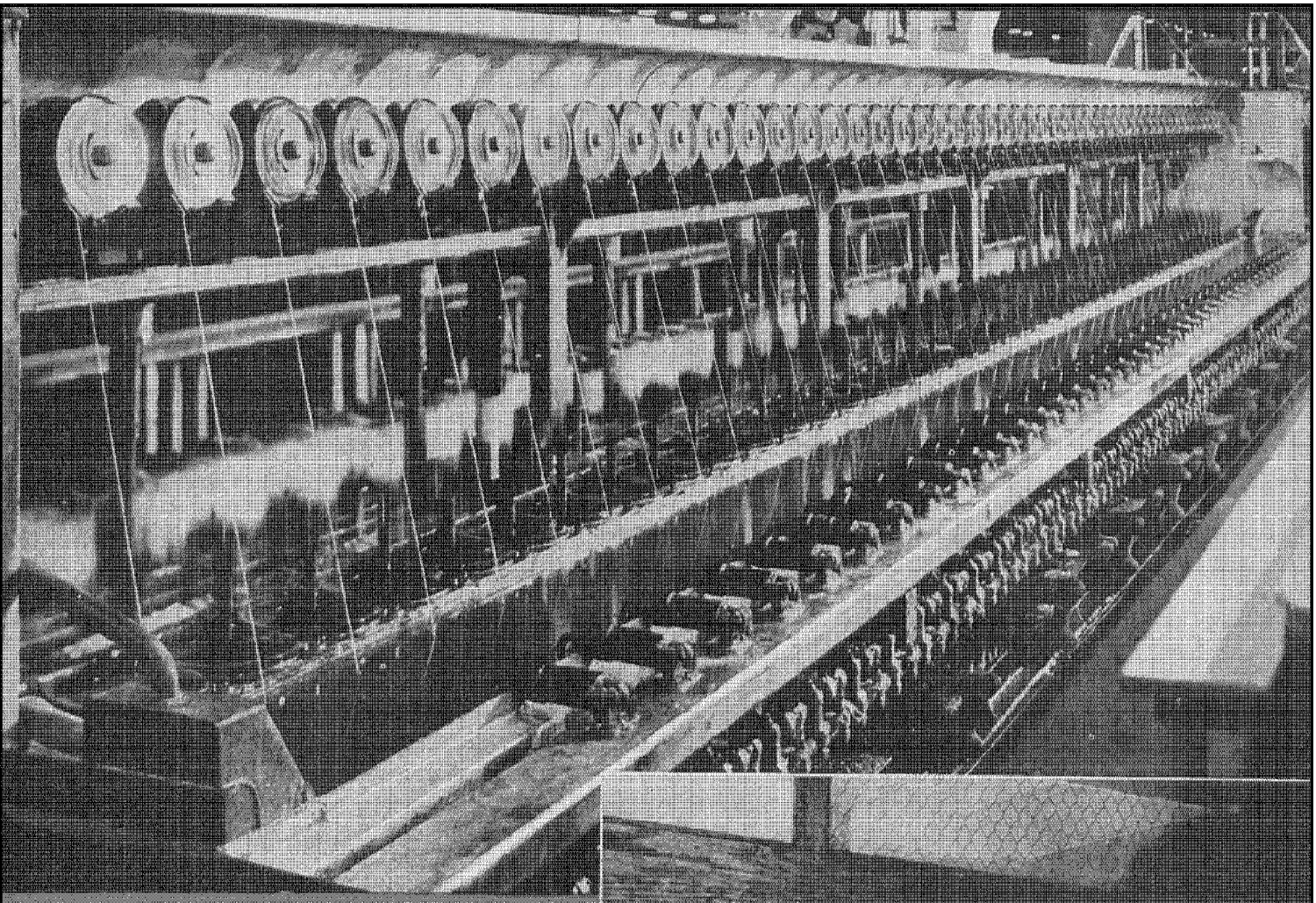
Moistureproof cellophane, still another chemical creation, is helping food packers and processors better to meet the challenge of war. Cellophane wrappings prevent waste, maintain freshness and flavor and keep unsanitary invaders from entering scores of foodstuffs. Cellophane's visible protection assures food quality to the millions of American housewives who feed the workers and families of the nation at war. How cellophane also helps to conserve vital metals and to reduce shipping weight and space has been pointed out under another heading.

Edible lactic acid, acetic acid and a number of other chemicals are today called upon to play more important rôles than ever before. They are helping the food industries to fulfill their wartime program.

Sanitation

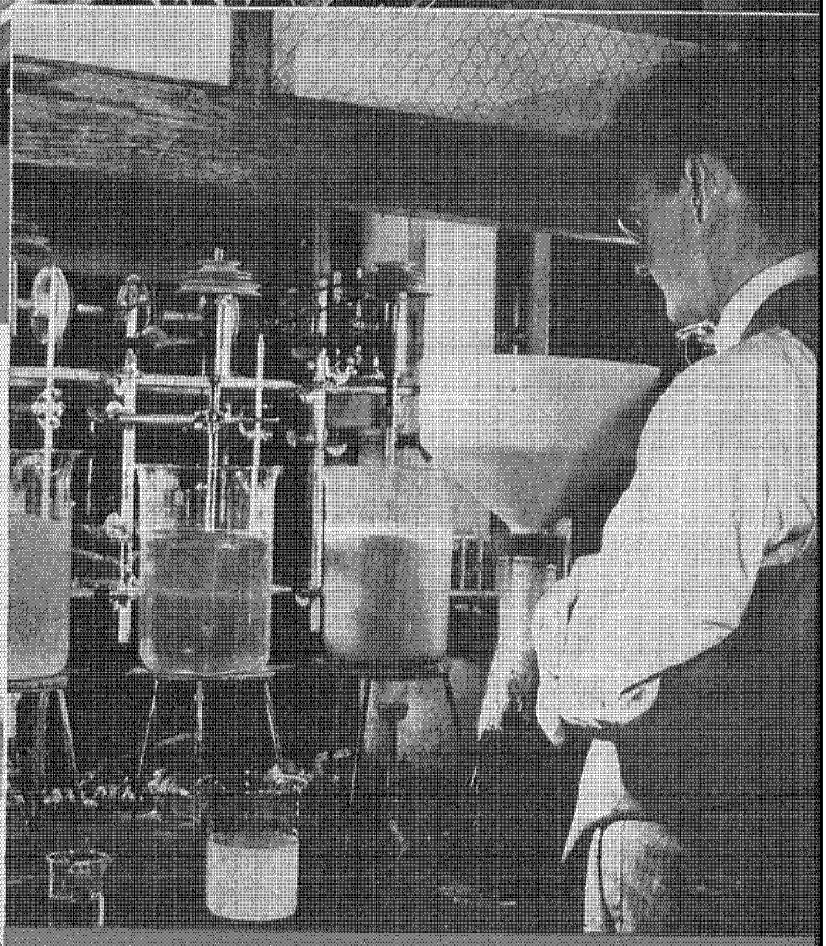
Bactericides, detergents, cleaning compounds and solvents produced by chemistry make sanitation of dairy and food processing and packing plants efficient and effective. Sanitation itself is a science, and an important one for our food industries. Even the cellulose sponges produced by chemistry save invaluable time and labor here. And nylon-bristled brushes by the thousands clean the bottles, containers, pipes and hose used for milk, fruit juices, beverages and liquid foods.

Chemistry is helping our American food industries to meet the challenge implied by the statement: "Food will win the war and write the peace."



Rayon Yarn: A battery of spinning machines in a Du Pont plant where viscose-process rayon is made to help clothe civilians.





Vat Dyes: Chemical control is important in making these fastest of all coloring agents.

Off to School: Thanks to the "Zelan" water repellent finish, her suit will not get wet.

CLOTHING

IN TIME OF PEACE, America's textile industry easily handles the job of clothing the nation; but the task of outfitting a greatly expanded armed force, and civilians as well, has placed a strain on every mill and factory in the country. Millions of soldiers and sailors must be supplied with dozens of garments apiece. And World War II has cut off, or seriously curtailed, many raw materials. Of nature's four principal fibers—cotton, wool, silk and linen—the last three are largely imported from countries overseas.

Fortunately, rayon and some synthetic fibers of chemistry's making are still available to us; otherwise America's civilian population might now be facing an acute clothing shortage. Chemistry has produced during this war period a new fiber that resembles wool. Rayon, too, is made into fabrics with textures simulating wool, linen and silk. Nylon, as you know, was gradually replacing silk for many purposes even before the war, notably in the stocking and garment trade. Because our air forces need equipment more acutely than American women need hosiery and foundation garments, there has been a shortage of nylon for civilian needs. However, rayon in combination with other fibers is being used to knit serviceable wartime stockings.

Chemistry's service to the textile industry goes far beyond the production of synthetic fibers. Cotton, wool, silk and linen all have to be conditioned before they reach the yarn stage. Mention has already been made of degreasing solvents, wetting-out agents, bleaches, dyes and other finishing agents in connection with clothing for soldiers, sailors, marines and airmen. The same chemicals are employed in processing clothing for civilian needs.

"Zelan" durable water repellent finish has been mentioned before as the finish which keeps rain or snow from wetting many of the poplin field jackets issued to our soldiers. This finish also protects the white ski parkas and trousers of ski troopers, and is used as a protective finish on flying suits and parachute troopers' uniforms.

But it must not be forgotten that "Zelan" also serves the civilian on the home front. For it offers enduring protection, even when garments have been laundered or cleaned several times. Mothers find children's clothing protected with "Zelan" a blessing and a time-saver of the first order. Small hands, with the best of intentions, are liable to spill glasses of milk or fruit juice—but a whisk of a dampened cloth is all that is necessary, if clothing has been treated with "Zelan." Laundering need not be so frequent, either, thanks to the resistance to soil which this finish imparts to a garment. And, as anybody who has enjoyed winter sports in a light snow suit treated with "Zelan" will testify, bulky winter clothing is no longer a necessity. "Aridex" water repellent finish is another contribution to the home front. Garments treated with this non-durable type of finish can be easily re-treated when necessary.

So far, there has been no dearth of colorful fabrics for civilian uses. But the situation would be quite different if we still had to depend upon Germany for dyes as we did in 1914. Du Pont's output of anthraquinone vat colors is five times what it was two years ago. Plant extensions both before and since the war began have served to keep supplies moving to dye-consuming industries in large volume.

It goes without saying that civilians, too, must be clothed—war or no war. The textile and related industries were hard-pressed for a time to supply materials for both military and civilian needs. Despite the extra burden of work imposed by the all-out war emergency, these industries have made a creditable record of performance. With respect to coloring agents, American plants can now supply plenty of dyestuffs for all essential needs. Predictions that America might have to wear crude, colorless fabrics have proved unfounded. The American chemical industry can be depended upon to do its part in keeping our soldiers and sailors well clothed for service, and the civilian population, too.

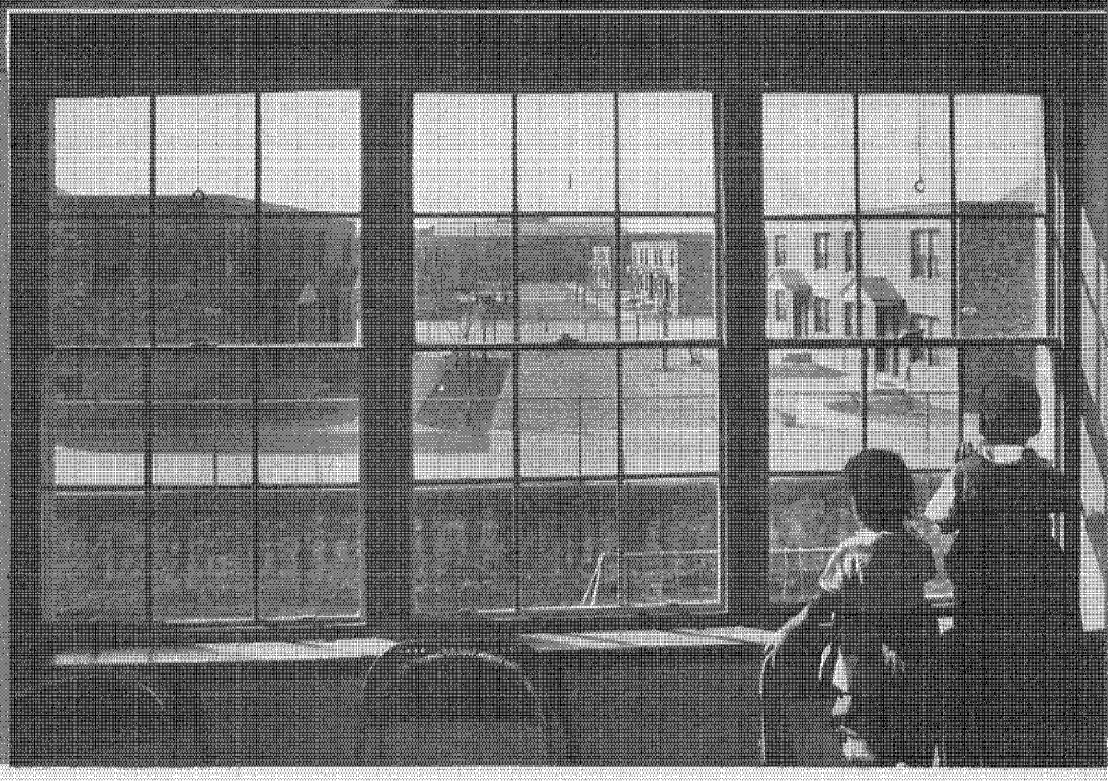
Cotton and rayon goods are now produced in an astonishingly wide range of weaves and textures. And pyroxylin-coated and impregnated fabrics, together with those treated with water-repellent compounds, are "pinch-hitting" for rubberized fabrics quite satisfactorily.

Clothes for men, women and children constitute only a part of civilian requirements. Shoe leather and shoe fabrics also fit into the clothing picture, along with a wide range of clothing accessories in which Du Pont materials are used. Leather chemicals for tanning, dyestuffs, adhesives, plastics for structural reinforcement, quarter-lining materials, pyroxylin-coated and impregnated fabrics, plastic heel coverings, eyelets and shoelace tips, even the pigments used in making the pastes for shining shoes—these, too, are contributions of chemistry.

Hats, gloves, belts and ties are still other articles of clothing in which Du Pont processing chemicals and products are utilized.

Before the war is over it is possible that all of us may have to make this year's suit, or this year's dress, "do" for another season. But that is a small price indeed to pay for victory! And every American will pay it gladly if he is called upon to do so. We must not for a moment forget that the principal task is to make certain that our soldiers, sailors, marines and fliers shall have all the clothing they need—the best we know how to give them. Civilians, too, must be clothed well and as comfortably as conditions in wartime will permit.





Housing: Wartime has brought with it the problem of housing workers and their families. Thousands of homes have been built in the vicinity of industrial centers. Many of Du Pont's "Better Things" are used in constructing, furnishing and decorating these homes.

SHELTER

CHEMISTRY'S products in the home are legion. To list them in detail would demand almost a complete inventory of everything the home contains, because the chemist's hand has touched virtually every material that enters into building and the conveniences and comforts of home life. And properly so, for the home is the very citadel of our national strength. Any weakness in morale at home might be disastrous to the success of the nation's war effort.

We are told that under war conditions America's normal high standard of living cannot be maintained; but, as Government authorities point out, it must not be permitted to sag to an injurious level. Chemistry is helping to keep it as high as possible.

Du Pont has long manufactured paints, varnishes, enamels and lacquers; wood preservatives to ward off fungi, rot and termites; electroplating chemicals for hardware fixtures; pyroxylin coated and impregnated textiles for bookbindings, upholsteries, window shades, washable table covers and wall papers; plastics for structural and ornamental uses; ceramic colors for chinaware and pottery; pigments and dry colors for linoleum; finishes for refrigerators, washing-machines and other home appliances; cellophane for household use; rayon and dyes and finishing agents for rugs, draperies, upholsteries. One might add to these groups the perfumes, adhesives, cellulose sponges, cleaning and polishing compounds, fly-spray ingredients, and the "soapless soaps."

Current shortage of many of these materials is explained in part by the need to provide adequate housing for troops in training; by the construction of huge new plants for making weapons and munitions; by the building of houses for war workers and their families.

But products of chemistry are helping to replace some scarce materials. For instance, ships now carrying military supplies to Australia are bringing back cargoes of wool. If supplies from that source were cut off, there would still be available warm blankets for American beds —blankets made wholly or in part from rayon staple fiber.

If it were not for the durable finishes chemistry had developed long before Pearl Harbor—whites that stay white, synthetic enamels that won't chip, lacquers that are not marred by water-spotting, colors that do not fade—the homes of thousands might not be as attractive as they now are.

Outstanding examples of chemistry's contribution to home-maintenance needs are Du Pont paints. During the past decade, they have been steadily improved. What is more, research chemists did not just test the ingredients they *knew* would make paint better, but they were finding out all they could about alternate materials. They took paints apart and put them together again to determine what could be done with substitute materials. They kept fifty thousand test panels out-of-doors in all kinds of weather. They painted test houses to find out how different mixtures stood up in service.

The good paints available today are the result of these years of research. When the war cut off supplies of raw materials from abroad and military uses called for others, Du Pont researchers were in a position to recommend the use of alternate paint materials that had been thoroughly tested in advance.

The story of Du Pont "Fabrikoid" is one of long service in the home. Used as upholstery, as bookbinding materials or as tablecloths, this chemically-processed fabric has the triple virtues of durability, beauty and washability. "Fabrikoid" gains this distinction from the application of coat after coat of pyroxylin to its fabric base. The coating and impregnating compounds are the result of two decades of study to make them tough, flexible and adherent.

Processing renders fabrics waterproof, resistant to cracking or softening, to scuffing, dirt and soil—requirements in line with what housekeepers consider necessary today.

Armor quality "Fabrikoid" may be cited as another Du Pont contribution to long-life in household goods and equipment. Tough, water-resistant and flexible, this product is highly regarded as an upholstery material for furniture both in offices and homes.

The scientist's touch has brought economy and beauty not only to the upholstery of furniture, but to the wood itself. Those blond finishes achieved in maple, mahogany, walnut and other woods are the result of a new bleaching treatment particularly adapted to create the shades required in the home. The chemical product, trade-marked "Albone," a powerful hydrogen peroxide, is used to bleach woods used by furniture makers.

The wood used in building our homes is protected by chemistry in another way. It is estimated that termites, if uncontrolled, would destroy in a single year some $50,000,000 worth of property. To wage war on these insects, Du Pont supplies chromated zinc chloride, a wood-preservative. Lumber impregnated with this chemical gives dependable protection against termite attack—and against decay and fire as well.

Du Pont fire-retardant chemicals also safeguard against fire in the home. When applied to most fabrics and cellulose materials, they prevent the spread of flame and afterglow. Fabrics treated with ammonium sulfamate will char on contact with flame, but will not blaze.

The few citations made are part of the story of how some products of Du Pont manufacture are helping solve the problems of shelter in this emergency.

SAFETY

WAR has intensified the need for safeguards on both the industrial and home fronts. With spies, saboteurs and fifth columnists a constant threat, with enemy air raids a possibility, the necessity for protection is keeping a civilian defense army on the alert both day and night.

Alert to the needs of industry, Du Pont engineers have developed a fence with "ears" which is protecting many of the nation's war plants. So sensitive is this acoustic fence that the sound of pick strokes in the earth may be picked up, amplified and passed along to alert guards at a central station. It functions as well in darkness, storm and fog as it does in bright daylight.

Another recent development is the emergency truck pictured here. Popularly known as the "fire buggy," it carries fifty-odd pieces of equipment and tools arranged compactly on both sides of a central panel and on each end. This truck was constructed by the Du Pont Office Buildings Division, in collaboration with the Company's Safety and Fire Protection staff. Complete details are supplied on request to building managers and others who are interested.

Low-freezing dynamites and "Nitramon" blasting agents are examples of products made safer for industrial and construction uses. We have already mentioned fire-retardant chemicals for wood, fire-extinguisher chemicals, ammonium sulfamate for flame-proofing textiles and, more recently, for treating work clothing and gloves.

Plastics, too, may be cited: "Butacite" for safety glass shields and goggles; "Plastacele" sheeting for lamp shades and molded "Lucite" reflectors installed along highways to intercept and throw back light beams from your car when you are motoring at night.

These are familiar materials. Others have been especially developed to meet the exigencies of wartime use during blackouts, such as plastic reflector buttons to be worn by pedestrians or used for direction signs, light shields for auto lamps, and blackout window shades. Paints have been specially adapted for camouflage.

Not only do these products contribute to safety, but the processes of their manufacture are surrounded by safeguards at every stage of production. The Du Pont Company has long been on guard against the necessary hazards of many plant operations. In producing and servicing both explosive and chemical products, accident-prevention has been persistently stressed, with outstanding results.

Other Du Pont contributions have a more or less direct bearing on related aspects of safety. All-important in the diagnosis of many diseases is modern X-ray practice, which has been mentioned. Research is continually carried out in Du Pont laboratories to improve X-ray film and make the diagnostician's work more accurate.

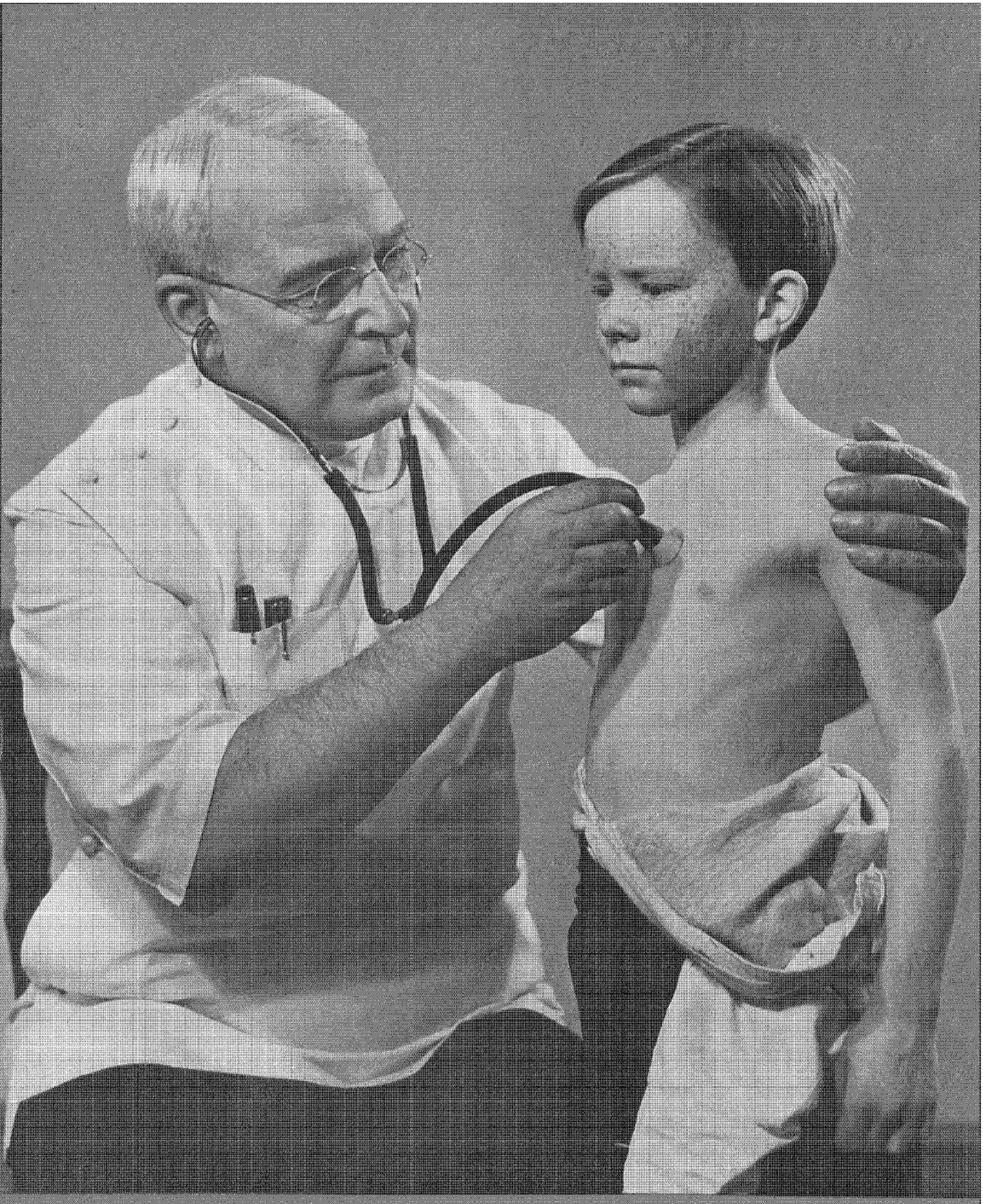
A new safety device invented in a Du Pont laboratory and made available to industry at large is an "electric nose" that works much as does an "electric eye." Industrial workers using volatile solvents are sometimes in danger from the fumes. The "electric nose," an ultra-violet photometer, detects the presence of as little as two drops of solvent in an average-size room by throwing shadows of the vapor on a fluorescent screen.

Recently, news came from the Du Pont Medical Department that its research staff had discovered an additional preventive for heat prostration in plants where employees work in very hot and humid rooms, and perspire freely. Under such conditions, the use of salt tablets with drinking water helps to make workers less susceptible to cramps and heat prostration. But still greater immunity is now provided by the use of additional tablets containing Vitamins B and C. War workers this year in steel mills, ship holds and other hot places will have the benefits of this development for greater efficiency.

The experience accumulated in years of peacetime production and in previous war emergencies has been helpful in training workers for the huge Government-owned war plants now in operation. It is not boastful to say that Du Pont has made a noteworthy contribution in organizing plant personnel to produce, with a creditable safety record, enormous quantities of munitions for our nation's armed forces and those of our Allies.



Protected: Respirators are among the many types of safety equipment used in industrial establishments where workmen are exposed to harmful dusts.



HEALTH

America's armed forces, wherever located, must have the benefits of health safeguards to keep them in fighting trim. And that applies as well to our nation's mill and factory workers and their families on the home front. For in wartime the hazards of epidemic disease are gravely accentuated.

Housing America's Army in training and the millions of men and women who are building guns, planes, tanks and ships in congested centers of industry has thrown upon military and public health officials a greatly increased burden. It is their responsibility to keep our nation physically strong and mentally alert, warriors and workers alike. Every resource of our energy is needed to win this war against the Axis powers. We must not be weakened by those other insidious enemies, the germs and insects that carry infectious diseases.

Many products of chemistry are serving America in the war to control disease. Chlorine, for example, protects water supplies against bacterial infection, and is used to decontaminate sewage at Army cantonments and on the home front.

Sulfate of alumina—alum, as most of us call it—is supplied by Du Pont to municipal water-works for use in sedimentation basins. "Cel-O-Seal" bottle closures, cellophane caps for milk bottles, peroxide of hydrogen and sodium perborate, zinc oxide, formaldehyde, ammonia and special paints—these are some of the products and materials that serve America's health needs.

Your family physician, if asked to cite others, would mention the sulfa drugs with their marvelous ability to kill certain germs in a matter of hours. These comparatively recent contributions of chemistry came to medicine from research in dyestuff materials. In the First World War, 70 per cent of all deaths from wounds resulted from a single type of infection that the sulfa drugs now control. The combined experience of chemist and doctor shows that a great many of the compounds synthesized in the course of research on dyes have medicinal value. And so it is that in making the United States independent of imported dyestuffs, the chemist at the same time greatly enhanced our national security by creating an American source of many necessary pharmaceuticals.

In other lines of research, too, the chemical industry is developing new weapons to aid in the long battle against disease. An example is the part Du Pont research has played in the development of a medicinal-grade zinc peroxide which meets the exacting requirements for surgical use. Certain types of bacteria, not readily reached or destroyed by the usual disinfectants, may develop in wounds. For these, the medicinal-grade zinc peroxide slowly floods the wound with oxygen over a period of hours or days. This delicate, but all-important, chemical timing assures effective treatment in these special surgical cases.

A problem which baffled doctors for years was that of wounds slow in healing. Spectacular progress has been made in treating these slow-healing wounds with carbamide, a compound synthesized by chemists from the nitrogen of the air. Carbamide does not instantly kill germs, yet germs begin to disappear when it is used. It is not a cleanser in the ordinary sense, yet slow-healing wounds treated with carbamide seem to clean themselves. Apparently the chemical works by stimulating the growth of healthy tissue. It has been used with success in treating infected burns and a large variety of skin infections, and has been found to soften scar tissue. Moreover, it is readily available and quite inexpensive, so that people suffering from infections may fill a whole bathtub with carbamide solution and literally bathe in it—of course, according to the directions of a physician.

Plastics are now serving as tools in the medical and surgical professions. Du Pont's "Lucite," for example, offers the surgeon scores of new instruments that "pipe" their own light deep down into the human body—a white, cool light that cannot harm the most delicate tissue. The same type plastic provides light-weight, practically invisible and unbreakable contact lenses for the eyes; they are preferred by some people who do not care to wear ordinary glasses. Still another plastic of interest to dentists is well known as "Lucitone" denture material. This product combines the properties and qualities required for making high-grade dental plates.

"Plastacele" plastic sheeting is used in hospitals in protective face shields, in the window enclosures of oxygen tents, in respirators, and in therapeutic "boots." And, of course, in recent years all surgeons have come to know about the superior merits of nylon surgical sutures in closing wounds. Nylon filaments for this purpose were introduced about three years ago, and since then have won acceptance because of their outstanding advantages over the materials previously used. The details are technical and need not be discussed here. The point is that chemistry provided a product of real value for the surgeon's use.

Not all of these aids to health, medicine and surgery are by any means direct contributions of Du Pont chemical research. But in their development it has fallen to the lot of the Du Pont Company to manufacture many materials that have been helpful to scientific experimenters in putting their ideas to practical uses such as these.

The Present Serves Our Future

AMERICA's planning has not been for war. In the place of vast armament works, tank factories, airplane production lines, we had here in the United States the production lines of a nation working by building the things we wanted and by making them available to as many people as possible. That was the path we had chosen. That was what we wanted. That goal of better things for all was the perpetual target—the far target.

We Americans may look upon the present war as an ugly, threatening interruption of our real work as a nation—an interruption in a way of going to a place we wanted to get, that has resolved itself now into a ruthless fight. The wolf pack is at our throats—and no phrases, no dogma, no ideology of a new world order can offset the mortal challenge of that one fact. This is a struggle into which all Americans must enter in the way that will most quickly bring about our common goal—victory!

In the foregoing pages we have indicated how an aggregation of workers in the field of chemistry—the Du Pont Company—serves this goal.

Our picture of chemistry in this hour is intended, in the main, for our customers and others who have seen sources of supply of materials essential to peacetime business dwindle and disappear. It is intended, too, for all who work with Du Pont. The end use of many of the basic materials produced by Du Pont is not always apparent. However, there is in these pages the assurance that not a pound, not a gallon, not a yard of material is being made by Du Pont which is not, in the opinion of those at the country's controls, essential in the war effort, either on fighting fronts overseas or on the front of home morale.

The picture has been drawn in partial outline. The details of the whole are infinitely too numerous. In any event, many—it may be the larger share—must be kept secret. One Du Pont plant alone lists 400 different chemicals which are the starting points of a huge variety of industrial processes. And there are 70-odd Du Pont plants in 37 states, strategically located to serve industry, the public and the nation.

Most all of these Du Pont products, basic in nature and fundamental in the processing of wood, steel, clay, textiles and innumerable other things, have not, in the main, been changed in formula or in process by the war. What has taken place is a diversion in use, rather than a conversion in plant to make a different type of material. Analogous, in a simple way, is wheat—in peace, a staple of better living; in war, a necessary weapon for the fighting forces.

Some Du Pont plants do make finished items destined to go directly into consumer uses. Here, too, there has been a diversion into different channels of service. An example is Remington shotgun shells. Manufactured two years ago for the hunter, the skeet shooter and the trap-shooter, they are now being used in training members of the Air Force. This program to develop marksmanship in the air is unique among the air forces of the world.

Another example is "Ventube" ventilating duct, used in mine ventilation, now pressed into service in providing ventilation for workers in the holds and closed spaces of cargo vessels being built on the ways.

In other words, Du Pont's "Better Things for Better Living . . . Through Chemistry" are being used in the war effort so that our people—and all men of good will—may, in a brighter future, use them again, in their own way, in a life of their own choosing.

For that matter, the chemical picture can never be complete. Ceaselessly, new materials are being developed, new processes evolved, both in Du Pont plants and in the plants of converters and other manufacturers and processors. New uses are constantly being uncovered for chemical products which save time and which result in better materials at lower costs. Production figures move reassuringly upward. This is the normal story of change and improvement in all industry. In the chemical industry, it unfolds at greatly increased tempo.

The fact that the chemical industry—and most of the other basic industries of America—were able so quickly to change over from peace to war—a change which in some cases involved conversions of heroic scale—is an indication of the excellently-trained and intelligent fabric of men and women upon which American industry rests. What industry is doing today is not the product of today. And, similarly, these trained men and women are the products, not of today, but of yesterday. The highly-specialized technicians who are meeting and solving the production problems of this war were not equipped overnight with the necessary knowledge, training and manufacturing experience.

Although all of industry's brain power, all of its energies, are today devoted to the single purpose of speedily winning the war, its work in the present crisis cannot help but hit the distant target as well.

No one can foretell what changes the future will bring. Perhaps, thanks to safer, higher-speed transportation, nobody will live in cities tomorrow. The wisest cannot say. But it is a foregone conclusion that a much greater amount of passenger and freight traffic will travel by air in giant sky-liners. To such planes of the future chemistry will contribute high-efficiency fuels, coolants, finishes—any number of chemical components that even now, in large part, are ready. The demand of the United Nations for air fleets, and still greater air fleets, has put

the best brains of our time to work on the problems upon which aviation progress hinges. As a result, plastics, lighter metals; precise, plated surfaces of any practical thickness; tough, pliable, lightweight coating agents; high-pressure lubricants; fuels—all carried to a pitch of perfection unknown two years ago—will greet the civilian on the morning of peace. Processes that are quicker and less costly will have their inevitable effect upon making the dollar buy more of the better things we want after the war. This is true not only of planes but of the automobile of the future which, according to some designers, will be manufactured largely of light metal alloys and chemical plastic materials.

As for shelter, architects promise us houses of new beauty, comfort and efficiency after the war, at a fraction of present-day building costs. Such houses are possibilities because of new building materials—plywoods, plastics, insulators, light metal alloys and many others. Chemistry's promise for the future here lies in the fact that many of these new building materials are chemical compounds or are chemically processed.

Clothing is a kind of shelter; and here chemistry's future contributions are implied in the contributions of the past. Thanks to chemistry we need no longer depend for our textile fibers on animals and the humble worm. Rayon, in its brief lifetime, has already become a preferred fabric. Nylon's superiority is already proved. The synthetic fibers are no longer "substitutes." They have won acceptance in their own right, for their own especial —and often superior—qualities. The development of a synthetic wool fiber is even now an actuality. If wool stocks should fail and incoming shipments dwindle, it is there and ready. And it also awaits the days of peace!

Science has learned more about the chemistry of food in the past few decades than had previously been discovered since the days of the Cavemen—who, incidentally, suffered seriously from malnutrition! Diets supercharged with vitamins and necessary minerals have given laboratory-test animals active, energetic life-spans which—for a man—would equal seventy years. Medical science can now relieve most of the diseases which are caused by faulty diets. It remains only to bring that achievement to everybody.

Within recent years medical men have learned an immense amount about the chemistry of the body cells. In turn, this new knowledge has given rise to knowledge of the chemicals that affect such cells, bringing physician and chemist into closer alliance. Many old drugs have been reformulated and improved. Other entirely new drugs have grown out of chemical research—such as the score or more of sulfa drugs, which had their beginning in dyestuffs research. There seems to be little doubt that the civilization into which we shall progress after this war is won will be the healthiest the world has ever known.

To credit war, as such, with this progress is to try to grace the ugliest blot our civilization knows. The only benefit asked, or that possibly can accrue directly from this struggle, is victory—for our arms and our way of life! Nevertheless, just as surely as the power and good direction of America's labors of the past stand us presently in good stead, so will America's present labors serve us in the future!

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REMINGTON MILITARY SMALL ARMS AND AMMUNITION

REMINGTON ARMS COMPANY, an affiliate of the Du Pont Company, is normally a manufacturer of sporting firearms and ammunition. In the twenty years preceding the present World War, less than two per cent of its sales represented military types.

Today, however, as in four previous wars, Remington has turned from its peacetime activities to arming the military forces of the United States. The Company's long experience with the intricate processes required in sporting arms and ammunition manufacture has proved of material assistance in the war program.

The Company has relied heavily upon its trained personnel and manufacturing knowledge, built up and maintained in time of peace. Although only three hundred were directly engaged in the manufacture of center-fire ammunition, and but sixty in center-fire rifle production, all Remington employees had a background of ammunition manufacture and a tradition of a precision craft. From this nucleus, thousands have been trained and their skill diffused throughout the expanding organization.

Remington's research and experimental developments are contributing importantly in the present crisis. Manufacturing processes, devised in peacetime, speed military production today. Remington engineers developed advanced-type equipment, the use of which is of vital importance in maintaining the exceedingly high-quality product required for aircraft gunnery. Scientific instruments and methods of analysis have facilitated the introduction of new types of ammunition required by the War Department, and insured uniformity in productive operations. Work on the design and metallurgy of both ammunition and rifle tools, first applied to sporting products, has been valuable.

Years of laboratory study are represented in the Company's present output of priming and tracer mixtures for war needs. Similar experimental projects, some conducted in cooperation with Frankford and other Government arsenals, have brought improvements that already are reported as weighting the advantage of United States troops in action.

Remington has undertaken an expansion program of almost incredible scope and magnitude, with one hundred per cent of its productive capacity allocated to the United States Government. In the last six months of 1942, the Company will deliver more small arms ammunition than the entire country produced during the four years of World War I. Military rifles will move daily by the thousands from factory to front.

Two Government-owned plants, operated by the Company, and one Remington-owned plant have just been designated as recipients of the joint Army and Navy Production Award for high achievement. In each of the Government installations, the honor came less than a year after the plant began producing—the award pennants flutter over land which twenty months ago was corn field and open range. Both these plants were operating months before Pearl Harbor.

A large share of the credit for the success of these military undertakings goes to the employees, both old and new, who have given generously of their loyalty and cooperation. In the difficult days ahead, Remington Arms Company and the men and women of its production lines, dedicate their strength, their resources, and their resolve to victory.

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DU PONT and MILITARY EXPLOSIVES

ON AUGUST 10th, the Army-Navy "E" was awarded to the Indiana Ordnance Works, built and operated by Du Pont for the Government. It was in the first group of twenty plants selected from all American industry to receive the new joint award. In constructing the plant, which covers ten square miles, a new high record of 7,000,000 man-hours without a lost-time accident was set, in addition to bringing the plant into production far ahead of schedule.

In making the award, Brigadier General Rosswell E. Hardy said to the workers: "You were told to produce a certain quantity of smokeless powder per month—a *quantity greater than any single establishment has ever produced before in a similar period.* You not only came through with this assignment with flying colors, but during the past year you have accomplished miracles in speed to the point where the anticipated capacity has been greatly increased."

The story of building and operating the Indiana Ordnance Works for the Government is representative of the Du Pont Company's response to the Army and Navy's call for explosives to win this war.This operation is being repeated by Du Pont for our Government in many places throughout the United States.

When Germany's lawless legions marched into Poland, Du Pont had but one relatively small plant producing military smokeless powder for the partial peacetime requirements of our Army and Navy. A still smaller plant was keeping alive the "know-how" of the manufacture of TNT. Military explosives represented a dwindling two per cent of the Company's diversified chemical business.

In a relatively brief space of time, huge sums were appropriated by Congress for the construction and operation, at emergency speeds, of military explosives plants to be Government-owned.

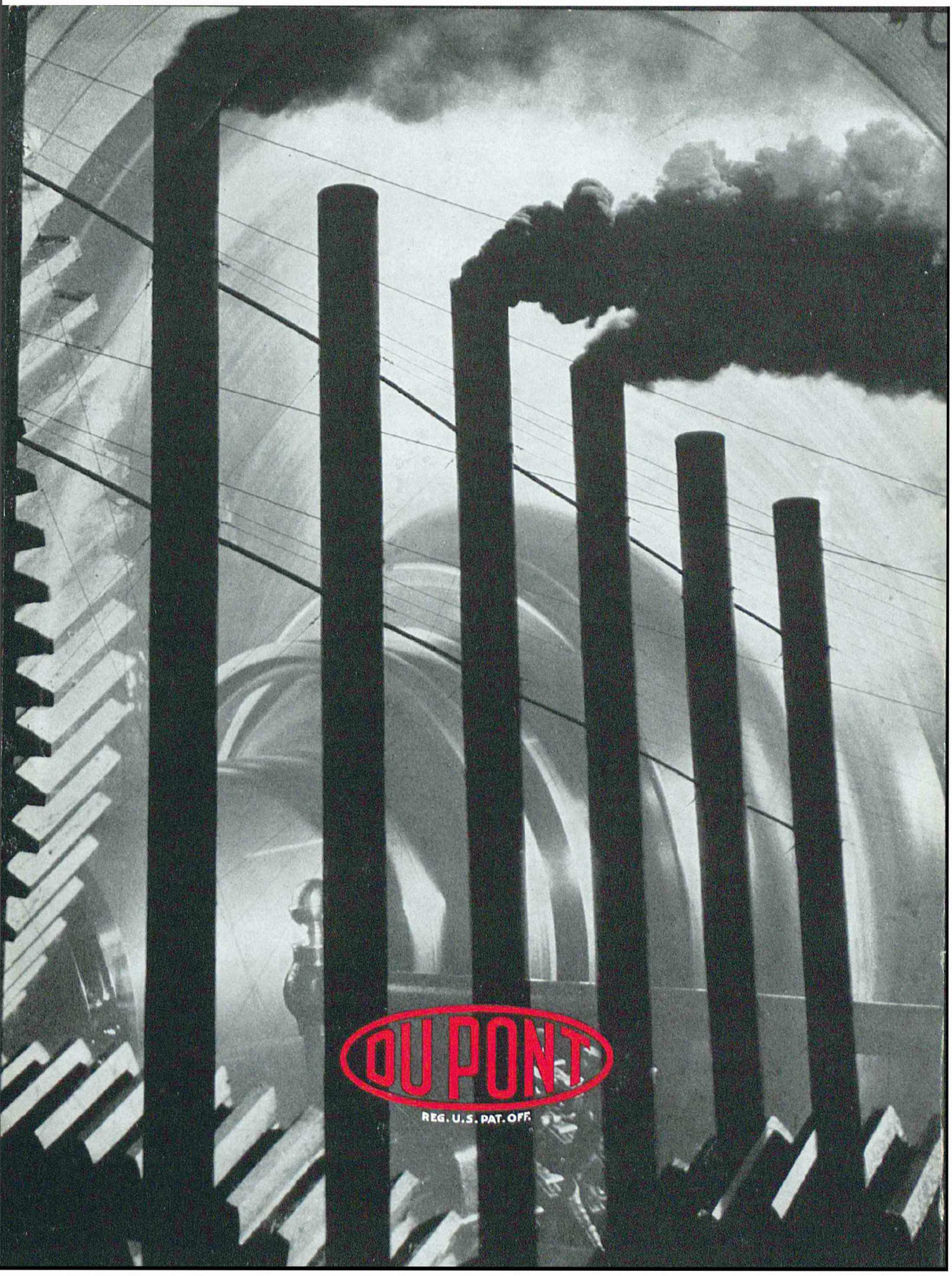
Du Pont faced the problem of erecting and equipping for manufacture military explosives plants whose annual output would exceed the combined output of military explosives in all of the country's earlier wars lumped together—and all this at a record-breaking speed to match the tempo of a war in which time might well prove the decisive factor.

Most of the capacity is now in production. And daily the volume of output grows. In every instance, Du Pont-built-and-operated plants were in production ahead of Government schedules.

To carry out its share of this program, Du Pont created for both construction and operation an organization larger than the Company's total employment in peacetime. The Company's experience, its processes and patents, have been placed at the disposal of the United States and its Allies.

As a further indication of results, improvements in making TNT have materially increased the output per production line, as compared to the highest American standards of 1918—with consequent savings in labor costs and construction materials which accrue to the Government.

This bare outline of Du Pont and military explosives is an indication of how Du Pont, with the enthusiastic cooperation of its employees, old and new employees alike, has set itself to do its share so that we shall win.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