

THE DU PONT MAGAZINE





POWDER

42 years young

IN 1889, Francis G. and Pierre S. du Pont invented "Du Pont" Smokeless Shotgun Powder. Four years later they began to produce it in quantity. A sample of the first lot made has been kept, and periodically during the 42 years since its manufacture a portion of it has been fired to test its qualities against those of the powders being made at the time of the test.

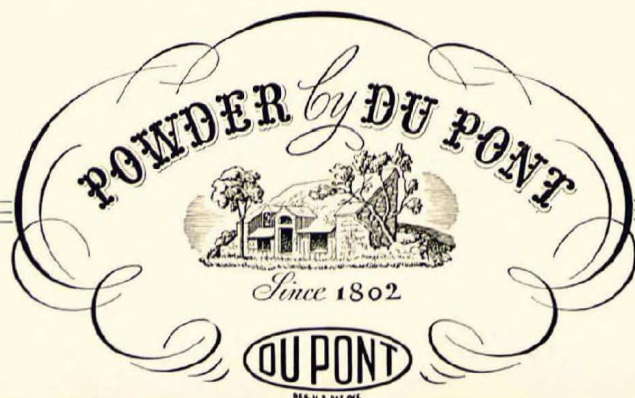
The old powder performed

well on the day it was made. It has performed just as well on every test since.

The newer powders have been better, of course. From year to year, they have been made with greater precision of manufacture . . . with greater refinement of ingredients. Du Pont chemists labor constantly to improve du Pont manufacturing methods even though these methods were good enough in

1893 to produce powder that has held its quality 42 years.

You will never want to keep shells for 42 years . . . but you will always feel safe in the knowledge that du Pont powders will do their whole duty whenever you call on them. Du Pont powders are chemically stable! E. I. du Pont de Nemours & Company, Inc., Sporting Powder Division, Wilmington, Delaware.



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A Chemical Family—III

The story of nitric acid, past and present, and how the nitration process, to which it is essential, has guided the du Pont Company's progress...

By BROOKS DARLINGTON

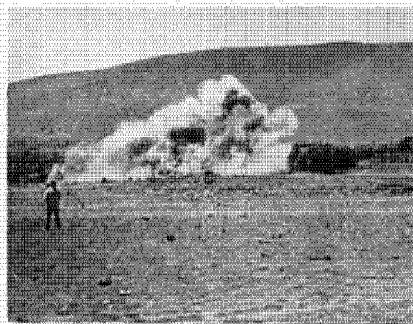
You cannot see it or taste it or smell it, yet your life depends on it. Your body is a chemical factory, and nitrogen is indispensable to its operations. This element occurs in a free state in the atmosphere, comprising nearly four-fifths, by volume, of the air you breathe. It occurs in a fixed state in protein foods. Thus you either get your nitrogen from vegetables, which take it from the air or the soil, or you obtain it from the meat of plant-eating animals.

Industry needs nitrogen, too, but must have it in some combined, concentrated form that is easy to handle and to use. So the chemist captures it in nitric acid. And thereby hangs a tale.

Inherent in the chemical make-up of this fluid lie vast potentialities. When used under the proper conditions, it has the property of converting certain cheap and abundant substances — many of which might otherwise be wasted — into a wide variety of products essential to present-day living. One of the earliest-known mineral acids, it is today one

of the most valuable and widely used. And it has been the star of a mighty industrial drama; its story forms one of the most colorful chapters of recent chemical history.

The technique of treating various raw materials and intermediate products with nitric acid is known as nitration. This is a key process. It provides the foundation on which certain basic du Pont industries have been built and forms a connecting link between them. In fact, the knowl-



The photograph reproduced here, taken some fifteen years ago when the du Pont Company relied upon "Chile Saltpeter" for its nitric acid, shows how the ore was blasted from shallow deposits on the rainless slopes of the Andes

edge of how to run nitrations actually determined the course which a large part of the Company's development has taken. By tracing this process from one interest to the next we get a striking picture of the kinship existing among many du Pont products.

The nitration process first became prominent in the du Pont operations when the Company took the logical forward step from its original black powder business to start the manufacture of industrial high explosives. Glycerine was one of the first substances so treated, the result being that well-known constituent of dynamite, nitroglycerine.

This move was highly significant, for the new business was geared to the needs of a growing country. America was extending her frontiers in those days. Her pioneers were constructing railroads, digging tunnels, clearing fields, building dams, delving for coal and iron and precious metals. They found the new explosives infinitely better for these purposes than the old, and they used them in increasing quantities. As the nation grew,



Nitration is a key process in many du Pont plants. Here, the operator is making nitroglycerine, a dynamite ingredient. Through a glass window he watches and controls with extreme care the reaction between glycerine and mixed nitric and sulphuric acids

so grew the du Pont Company. And as the demands of an advancing civilization became more complex, requiring new types of chemical products, this organization branched out to supply them.

As we have seen in a previous article, cellulose is nitrated to make nitrocellulose, the chief constituent of smokeless powder. The knowledge so acquired led the Company into other fields of manufacture, likewise based on the use of cellulose and employing the same process. The products of these industries, though differing widely in appearance and application, are closely related to each other. They form the nitrocellulose group, which includes smokeless powder, pyroxylin-coated textiles such as "Fabrikoid," the plastic marketed under the trade-mark "Pyralin," certain industrial and household cements, "Duco" lacquer, and one variety of photographic film.

While extending its interests into allied fields of chemical manufacture during the fifteen years following the turn of the century, the du Pont Company also was making rapid progress in the high explosives business. Its now-familiar standards of research and control were early applied to the development of new and improved types, better suited to the specialized needs of different users.

An outstanding advance was the introduction to this country of pow-

ders especially adapted for use in gaseous or dusty coal mines. The low-flame characteristics of these blasting agents greatly reduced the likelihood of mine disasters and, when the U. S. Bureau of Mines was organized, they were given "permissible" rating. Another was "low-freezing" dynamite. This pioneer development eliminated the necessity for thawing out explosives in which the nitroglycerine had solidified — a practice not recommended as a means of attaining a ripe old age. Notable improvements were made in manufacturing processes to insure better stability and uniformity of product. Safety methods also were applied with exceptional success. Today, it is safer to work in a dynamite plant than in many factories where the operations are not ordinarily considered hazardous.

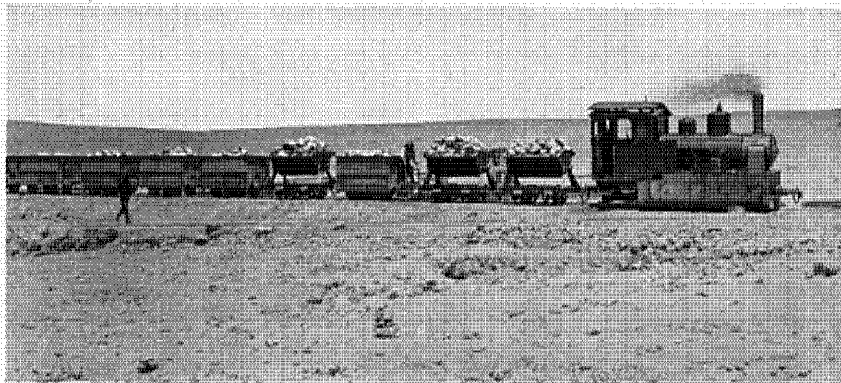
Dozens of new explosives were produced during this period, some lasting only until superseded by better ones, others continuing in use down to the present. These activities centered around the nitration of numerous substances. Starch, toluene, solvent naphtha, glycerine derivatives, even sugar, were nitrated for use in low-freezing mixtures, and nitro-cotton was produced for making gelatin dynamite. A great deal was learned about how to handle the nitration process under various conditions and about the behavior of many different

materials when subjected to nitration.

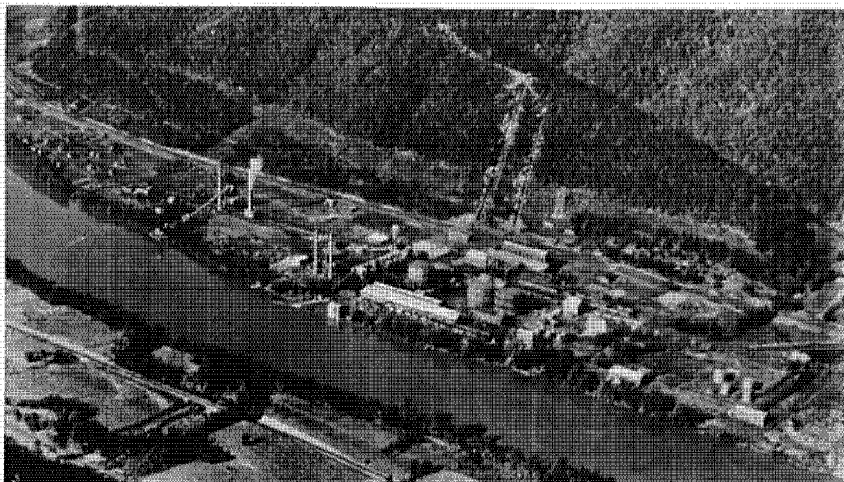
It is to the knowledge and experience gained in this way that we must turn to gain a clear understanding of how the Company was able to meet the unprecedented demand for new and highly specialized types of explosives arising from the emergency of 1914-1918. Many people have the idea that commercial and military explosives are one and the same thing, or at least very similar. Before carrying the present discussion further it might be well to bring out the sharp distinction that exists between them.

A big shell, for example, is composed principally of powder, known as the propellant, which fires the projectile out of the muzzle, and the bursting charge or disruptant, composed of a powerful but comparatively insensitive explosive which is set off by a primer when the missile strikes. Dynamite, of course, cannot successfully be used in a shell for either purpose. Neither does a plant designed for the manufacture of dynamite or most of the other commercial blasting agents have any real practical value for making high explosives suited to military requirements.

These two classes do have one important characteristic in common—they are both explosive. And in both cases this property of being explosive results largely from nitration. Hence this process provides the one vital link between the two. Mastery of nitration technique was the essential factor which enabled an organization set up on a peacetime basis to design new equipment, build emergency plants and carry on the large-scale



Transporting nitrate of soda ore to plants near the seacoast, where it was purified and shipped to the United States for making explosives. Contrast this method with the modern process for taking nitrogen from the air, illustrated on following pages



This du Pont plant, at Belle, West Virginia, takes nitrogen from the air, hydrogen from the river water and, with the aid of coal from nearby mines, turns out a wide range of chemical products. The process used guarantees this country a constant source of the nitrates essential to fertilizers and explosives

production of the particular types of high explosives required for national defense.

During this period the Company was called upon to produce, under rigid specifications, many new explosive compounds utilizing materials with which it had not previously been familiar. Important among these was the group of carbon compounds known as coal-tar derivatives. Needless to say, these newly-established operations demanded large and increasing quantities of nitric acid. Let us therefore shift the scenes for a moment to investigate the then-available source of this vital commodity and the methods by which it was made. We go first to a dry and desolate section of South America, where Nature during bygone ages had buried a most unlikely-looking treasure.

Eighteen or twenty years ago nitrate of soda was the principal raw material for the manufacture of nitric acid. This is a white, crystalline substance somewhat like common table salt in appearance, though more coarse-grained. It was obtained exclusively from natural deposits and because Northern Chile possesses almost the only nitrate beds workable on the necessary commercial scale, it gained the nickname "Chile saltpeter."

Several interesting paradoxes surround this compound. It contains the nitrogen essential to plant growth, yet the region in which it is found most abundantly is almost devoid of

all life, animal or vegetable. And it contains a constituent essential to most explosives, these in turn being utilized to blast it from its natural resting place.

After blasting the ore, known as "caliche," from beneath overlaying strata of sand and rock-like material, it was taken to "oficinas" where the nitrate was leached out, packed in bags and shipped to the United States. Nitric acid was made by treating the nitrate of soda with sulphuric acid, heating the mixture in a closed vessel, distilling, and condensing the vapors.

A situation that forced the United States and her Allies to depend upon "Chile saltpeter" for the vital constituent of high explosives was not the best arrangement conceivable. Germany, cut off from Chile by the British blockade, had devised a way to make her nitrates, using a process which insured an unlimited supply. But the Great Powers had to put their trust in old Mother Nature and the fortunes of war. Suppose the "oficinas" or their central power plants should be blown up? What if the nitrate boats were sunk? Men who realized the full implications of this state of affairs held their breaths. But

there was little they could do about it during those hectic days.

Something *was* done about this situation in due time. For even though the conflict ended without the supply having been cut off, a most unsatisfactory condition remained. There still existed the questions of shipping costs, of possible monopoly, of dependence on sources outside this country.

Yet there also remained the reality of technical advance, which had pointed the way towards a vastly better source of our versatile fluid. It had become possible to capture the elusive nitrogen from the unlimited supply existing in the air and, by forcing it to combine with other elements, to imprison it in nitric acid.

Like many another great development, the process for the fixation of atmospheric nitrogen eventually adopted and perfected by the du Pont Company could not become a working reality until other key discoveries had been made. In this case, success depended in large part upon improvement in materials of construction. Not so long ago a pressure of 150 pounds per square inch was thought high. But the steady progress made in the fabrication of metal alloys in recent years has brought possible operating pressures up and up. It finally became practicable to carry the compression of gases as high as 15,000 pounds per square inch. That is the crux of our present narrative.

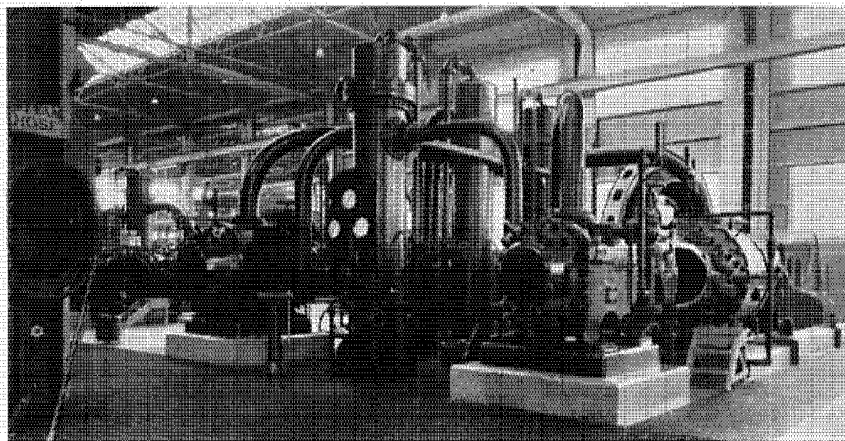
In 1926, after several years of investigation and research, the du Pont

Nitrogen as it exists in the air is an unsociable gas; brute force must be used to make it combine with other elements. The compressor shown here builds up the pressures—as high as 15,000 pounds per square inch—needed in making ammonia for nitric acid manufacture



Company completed a plant on the Kanawha River near Belle, West Virginia, to guarantee its own and other operations dependent upon nitric acid a stable domestic source and to insure a constant supply at costs subject to manufacturing control. When a somewhat bewildered populace heard that the new works was to make ammonia, many wondered what that had to do with nitric acid. And when visitors were told that water was going to be pumped up the hill so that when it ran back down it would run a turbine and make electric power, they marvelled at what appeared to be the first real perpetual motion machine in all history.

Now the first of these anecdotes represents a brilliant scientific accomplishment while the second, of course, is just a bit of local whimsy. The Belle plant does produce ammonia; nitric acid is made from this substance by still another process. Water is forced up the hill in order to remove carbon dioxide, the "Big Bad Wolf" of the process, and impurities which might contaminate the river if discharged into it. So the water is purified in aeration towers on top of the mountain, then brought back down to the plant and used over again. The pressure it generates on the way down also is utilized. Some of the works' officials concocted their little joke to satisfy the curious, because at first they weren't certain themselves how this novel scheme was going to work



One of the low-pressure compressors used in the fixation of atmospheric nitrogen. This machine, employed during intermediate stages of the process, carries the compression of gases to about 450 pounds per square inch.

out in practice. But now it can be told, for the method is a success.

The Belle plant makes ammonia from two of the cheapest and most abundant of all raw materials—air and water. But it requires huge amounts of coal to wrest from them just the elements needed for making ammonia. And if you could follow the numerous operations through the maze of complicated equipment and see the large staff of technicians and workers required, you would readily grant that this process is not nearly so simple as it sounds.

That grimy, unpromising-looking stuff, coal, is one of the most remarkable substances the human race has ever found. The service it renders in generating heat and light and power has been known and utilized for a long time. But during the last twenty or thirty years, chemists and engineers have begun to reveal the wondrous riches that it holds. To it, directly or indirectly, we owe many of the gorgeous colors with which our textiles are dyed, drugs that keep us well or cure our ills, flavors for our foods, glamorous perfumes, and many other requisites of modern living. We will have more to say about these varied products when we discuss the part played by coal-tar derivatives

and carbon compounds in the du Pont Company's dyestuffs development—really a continuation of our present nitration theme. Right now we want to watch it at work in the high-pressure industry.

At the Belle plant, the coal comes down the Kanawha river in barges, the water is pumped up from the same and the air is sucked in through blowers in the gas house. When the heat is applied and the reactions get under way it's something of a "now-you-see-it—now-you-don't" proposition, for the aim, first of all, is to get certain invisible gases. Hydrogen comes from the water and nitrogen from the air, but it is something else to make them combine. That is why such terrific pressures are needed.

The object of all this is to get a gas mixture of seventy-five per cent hydrogen and twenty-five per cent nitrogen. At various stages between the many compressings, scrubblings, conversions, and reactions required, catalysts are used to help make the desired elements unite, to purify the mixture, and finally, to convert the compressed and purified mixed gas into ammonia.

Catalysts are curious things. Processes such as the one we have sketched so briefly here would not work without them, yet they do not themselves enter into the reaction. No one quite knows how or why they accomplish what they do. Indeed, some cynics say that a catalyst is the name a

(Continued on page 23)



One important use for ammonia is in nitric acid manufacture, but it has many applications of its own. Compressed in the cylinders pictured here, it is shipped all over the world, to be used for refrigeration and other purposes.

Introducing "Nitramon"

- This new blasting agent is designed for quarrying and stripping operations and requires a cartridge of dynamite to explode it

By S. A. MAXON

Ever since Nobel invented dynamite chemists have been trying to make it fool-proof. They have gone far in that direction, but haven't yet succeeded in altering the properties of that product so as to eliminate all hazards from its use.

Meanwhile, here's news of a fact accomplished. The du Pont Company has developed and patented a blasting agent that looks like caked table salt and is no more hazardous to handle than that household commodity. Yet, when detonated by a high-explosive primer, it rates twenty per cent stronger than T.N.T. It is being sold under the trademarked name "Nitramon."

Before discussing its safety features and the conditions surrounding its use, let's sketch in a little background by referring briefly to some other earlier achievements of du Pont explosives chemists. "Nitramon" is just the latest fruit of thirty-three years of research at the Eastern Laboratory in New Jersey. There, in 1907, the first successful low-freezing dynamite was made to eliminate the hazardous business of warming frozen dynamite. Now thawing kettles are museum relics. There, the first American-made "safety" explosive was formulated for use in gaseous and dusty coal mines. More than 38,700,000 pounds of these so-called permissibles were supplied to domestic coal producers by the American explosives industry last year. Still another development of note was the first

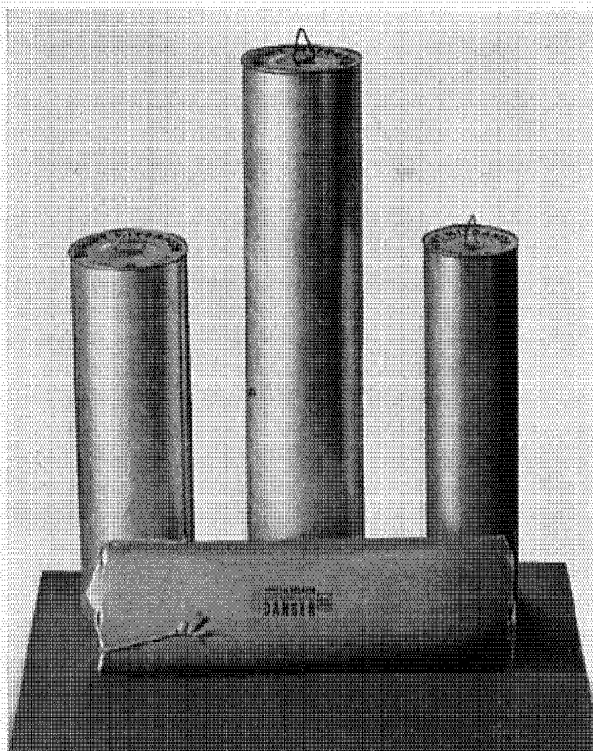
low-density, ammonium nitrate permissible powder. Increased safety and economy followed the introduction and use of all these products. Others might be cited, but none is more dramatically interesting than the latest material to emanate from this research laboratory.

Although "Nitramon" consists essentially of ammonium nitrate, it is entirely different from any blasting agent previously manufactured. It is outstandingly safe; in fact, it has been called "the ultimate in safety."

The reason for developing this material grew out of the use of well drills in quarries and strip mines. For years the standard size of drill-bits was five and five-eighths inches in

diameter. Then operators discovered the advantage of using larger units. Incidentally, drill bits of six, seven, and even of nine-inch diameter are now employed. This turn of events called for big dynamite cartridges, and they were made up to eight inches by twenty-four. Now a stick of gelatin dynamite, seven-inch diameter, weighs about fifty pounds and is the largest-size cartridge the railways will accept for shipment. And for well-drill blasting in hard rock, quarrymen have favored gelatin dynamites of sixty to seventy-five per cent strength despite a certain degree of hazard in their use.

Since 1931, Eastern Laboratory research chemists have been busy developing a safe blasting agent to replace these gelatins in well-drill holes. The result is "Nitramon," a product unique in several respects. It contains no nitroglycerin. It cannot of itself be detonated by the strongest blasting caps, Cordeau fuse, flame or the impact of a rifle bullet. The only way to develop its full blasting strength is to employ a cartridge of forty per cent dynamite as a primer — a great big one packed with plenty of power. A blasting cap or Cordeau — detonating fuse — is used to explode the dynamite, and that sets off the "Nitramon." This illustrates the insensi-



"Nitramon" is packed in air-tight cans of various sizes. Note the triangular-shaped rings at the top for convenience in loading. Lying on the table is a large cartridge of dynamite the blaster uses as a primer

NUMBER OF STANDARD-SIZE CANS PER 100 POUNDS

Size of Cans	4" x 16"	4 3/8" x 16"	5" x 16"	5 1/4" x 24"	7 1/4" x 24"
Nitramon A	—	—	—	—	2
Nitramon B	11	9	7	4	—
Nitramon C	12	10	8	—	—
Nitramon D	13	11	9	—	—
Nitramon E	14	12	10	—	3

tiveness of the material to ordinary shocks. Fire, too, is futile. You can start "canned heat" functioning with a match, but not this form of "canned energy," the first to be put on the open commodity market.

"Nitramon" is being introduced to the trade in five densities, A to E inclusive, with A representing the highest bulk strength and E the lowest. The standard-size cans range in diameter as shown in the accompanying table. These variations in densities and sizes include a broad enough range to meet the expected requirements of quarrymen and stripminers who ordinarily use high explosives ranging in strength from that of forty per cent ammonia dynamite to seventy-five per cent gelatin.

The cans are made entirely air-tight and, barring such rough usage as might cause them to break or be deformed, they offer practically unlimited water resistance when handled and loaded properly. Each one is provided with a triangular-shaped ring at the top so that it can be let down into the borehole by means of a hook and lowering line.

Unlike an explosive used for well-drill blasting, "Nitramon" cannot be chopped up or loaded loose, which of course imposes the requirement for smooth boreholes.

To take full advantage of the safety features of this product, certain loading practices must be followed. The charges should be loaded in a solid column; that is, without having any part of the load broken or separated with tampering material. To insure propagation from top to bottom, the cans must be loaded end-to-end with no foreign material or air

spaces between them, and the charge must be confined in a borehole.

To secure all the advantages claimed for deck-loading, an unbroken column of "Nitramon" can be used by loading the lower-density grades or smaller-sized cans of dense grades as a top load.

"Nitramon" C, D and E cannot easily be used in water-filled holes, for the cans will float, thus defeating the requirement that there shall be actual contact between each separate can in a borehole so that the detonation, once started, will propagate through the entire charge.

As stated before, "Nitramon" requires as a primer a dynamite cartridge at least four inches in diameter and not less than eight inches in length. If the borehole is dry, a "stick" of Red Cross Extra forty per cent is recommended; in wet work, Special Gelatin of forty per cent or higher strength should be used. In either case, for greatest safety the primer



ACME
The effect of shooting bullets into a can of "Nitramon" with an Army rifle. There was no explosion. D. M. Carr, of the du Pont Company was the marksman.

should not be inserted until all holes have been loaded.

If an electric blasting cap is used to initiate detonation of the dynamite primer, the cap should be deeply imbedded in the cartridge. If Cordeau is used, it should be laced through the primer. Again, for safety, the primer should be placed on top of the charge—not at the bottom or the middle—so that if a misfire should occur, due to broken wires or broken Cordeau, the primer can be removed, leaving the "Nitramon" in an entirely



Even the flames from a blow-torch cannot explode this new blasting agent "Nitramon," as was demonstrated at Millville, N. J., to representatives of the press.

INTERNATIONAL NEWS PHOTO



ACME

Demonstrating that "Nitramon" will not explode even when pounded repeatedly with a sledge hammer. Left to right, Charles Bennett, Dr. W. E. Kirst, assistant director, Eastern Laboratory, and Paul Sweeney

safe condition, to be handled by any means available. For only when the primed dynamite cartridge is actually in position to detonate the "Nitramon" charge is there any risk of an explosion.

The foregoing paragraphs have outlined the principal conditions as a guide for blasters who will use "Nitramon." The fact that it is the least sensitive of all blasting agents thus far produced strongly recommends it for safety. But once in action, its power is not to be discounted. That may be inferred from the fact that this blasting agent, in cans of four-and-one-half-inch diameter, shows velocities of detonation as high as 18,000 feet per second. This velocity is comparable to those recorded for the highest-strength dynamites commonly employed in well-drill holes.

All new du Pont products are tested thoroughly, first in the laboratory and then under actual field conditions. "Nitramon" has been proved by a number of actual quarry shots in Pennsylvania and New York State in competition with forty and sixty per cent grades of ammonia dynamite, and seventy-five per cent ammonia

gelatin. These tests were entirely successful; in fact, they exceeded all expectations in point of execution.

Following is a brief summary of the advantages of using "Nitramon":

It is absolutely safe to handle as long as it is kept apart from a primed dynamite cartridge.

It is non-flammable.

It does not freeze.

Properly handled, it has unlimited water resistance.

Its use does not cause headaches, for "Nitramon" contains no nitroglycerin; moreover, the material is

packed and sealed in tin containers.

By itself, it is as safe to transport by truck or train as so much salt or sugar would be.

It offers the customer a substantial saving in the cost of explosives.

It can hardly be doubted that "Nitramon" will be found practical for use in quarry and strip-mining operations where well drills are employed. But we are requested to make clear to readers that it cannot be used in such work as ditch-blasting, stumping, underground mining, blasting salamanders, mud-capping, block-holing or for any other blasting operations where cartridges of less than four inches in diameter are used.

Further research will be carried on with a view to making the product adaptable for as wide a range of industrial applications as may be possible. There are, of course, limitations inherent in all materials. Nevertheless, chemists and physicists are at work unceasingly to discover new combinations that will better serve mankind's needs. Many revolutionary developments have come from the laboratories of the du Pont Company, but "Nitramon," the practically fool-proof explosive, must be rated as the most outstanding to date in its particular field of usefulness.



Press representatives wanted to see what would happen if a cartridge of dynamite were set up as a target for the rifleman. The result is visualized here

From Heel to Toe

Let's take a woman's shoe apart and see some details of its construction

By R. T. ELLIS

THE legendary old woman who lived in a shoe had, if you remember, many unruly children, and was undoubtedly a busy individual, but one suspects that she knew a good deal about her home and the construction materials used in it.

Modern women—and men, too—spend a considerable part of their lives in shoes without knowing much more about their structure than is casually apparent to the eye. "Shoes are made of leather," they will tell you, which is like saying that watches are made of metal. But such generalizations skip blithely over some important, but little-known details that are quite commonplace in the shoe industry. Only by close inspection of the components can one understand how wonderfully they are made in modern factories.

The limits of this article preclude anything like an exhaustive discussion of shoe materials, but it may be diverting to point out wherein the pyroxylin plastic you know best by

the trade-mark "Pyralin" is employed to advantage.

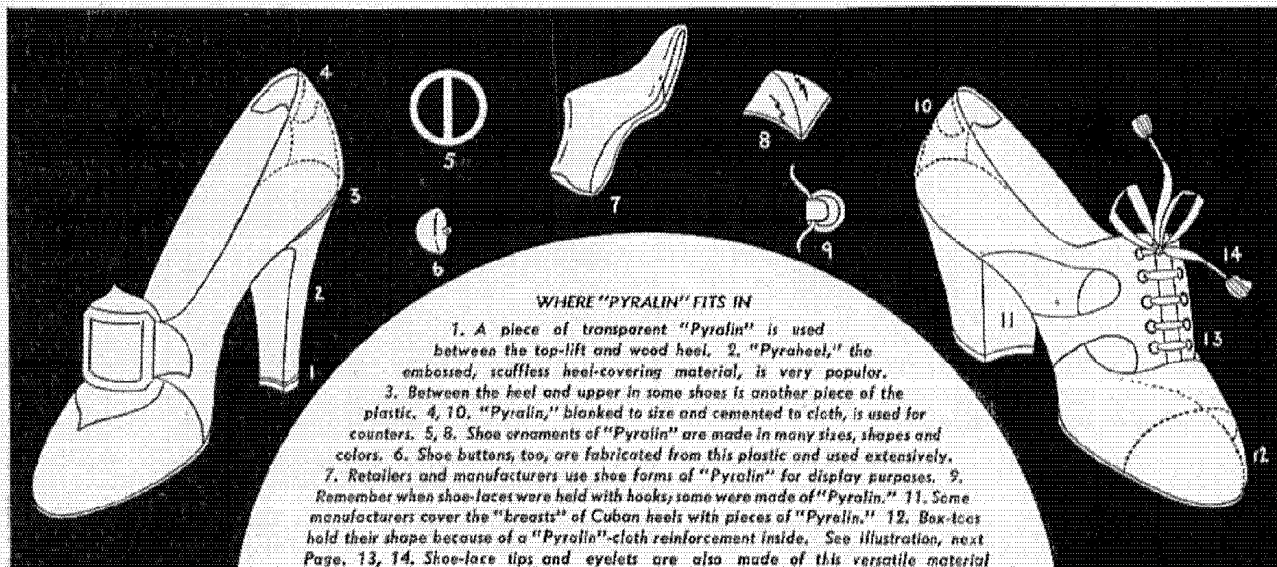
Consider then, first, the heels. Relatively few of them are made of leather. Those attached to many high-grade women's shoes are made of wood and covered with "Pyralin." In fact, only the top lift—the part that pounds the pavement—is made of leather or rubber. The heel-covering that seems to be patent leather, calf-skin, pigskin or snake-skin and that duplicates in appearance the material used in the body of the shoe, in most cases is not a leather, but a du Pont product named "Pyracel," a hard, tough substance making women's shoe heels scuffless.

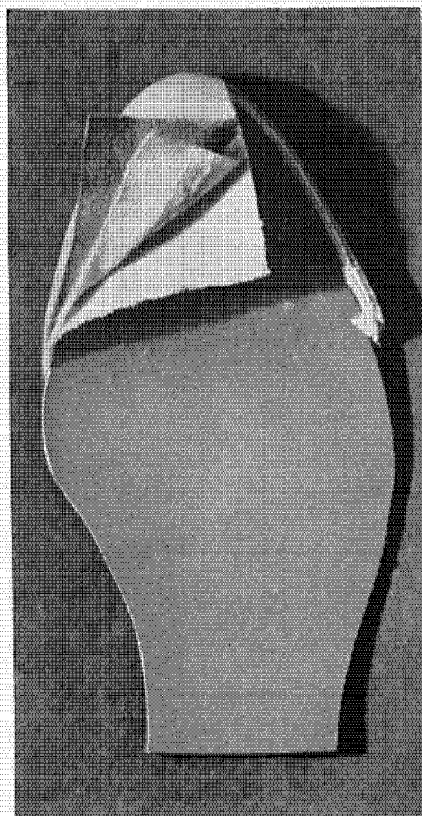
Now, let's see how they are produced and covered. First, the wood forms are turned to shape and made ready for covering. Then dye-press operators blank out from a sheet of "Pyralin," twenty by fifty inches in size, the covers which are to be cemented to the wood. Before that

can be done, however, each piece of the plastic must be immersed in a softening solution until it is in a condition to be embossed.

The embossing plates are photo-engravings of shoe materials, faithful reproductions down to the last detail of leather grains, textile designs or whatever else the manufacturer may be using. There are fine, medium and coarse-grain kid designs, lizard, alligator and a variety of other effects etched in these so-called master plates.

The embossing is done in this manner: The covers and plates are placed between rubber pads and inserted in a hand-operated machine that forces the softened "Pyralin" against the plates so that the design is impressed therein. The covers remain under pressure usually from two to five minutes, depending upon the depth of impression desired. With a little practice an operator can secure any desired depth or grain effect within the limitations of each plate. The





There are more materials in the box-toe of a woman's shoe than you might suppose. This picture reveals its laminated structure. Note the leather, cloth lining and "Celastic" material

shaped it over the last before applying the leather, so that the finished box-toe is rigid enough to hold its shape permanently. This reinforcing material is marketed under the trade-name "Celastic." Not only does it prevent the toe of a shoe from becoming misshapen, but it also has waterproofing properties so that it helps to keep out the dampness on stormy days.

Again, the back part of each shoe would soon lose its shape and break down, if the manufacturer did not build into it a greater degree of structural strength than leather itself possesses. That is why a counter is sandwiched between the leather and the inside lining. In many cases the material for this purpose is a piece of heavy cotton cloth laminated to a piece of the "Pyralin" sheeting. An ingenious machine turns out this part which is softened by heat and shaped before it is fitted into the shoe. Since counters of this type are not affected by heat or moisture from the foot, shoes so manufactured will hold their shape permanently.

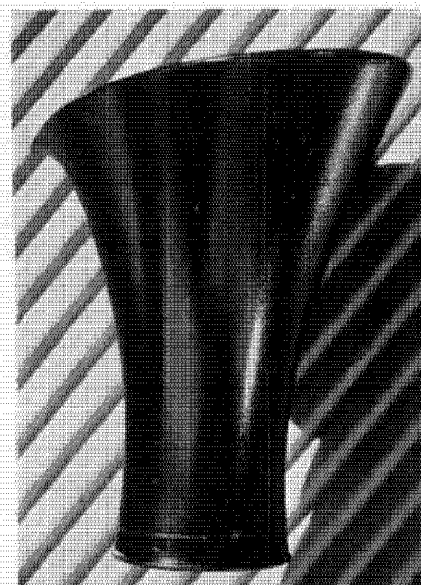
Other structural uses of "Pyralin" in making shoes are not concealed, but probably not one person out of ten knows about them. For example, it may surprise you to know that shoe-hooks, eyelets and even shoe-lace tips are not always made of metal. The fact is, large quantities of these parts are made of "Pyralin."

So far we have been discussing structural uses of the plastic, but no woman will need to be told that it has a place in the decoration of her fancy slippers and pumps. Buckles and ornaments are in many instances

made of "Pyralin" by the die-press method. Little discs of the material are pressed into the desired form and attached to the shoe by means of metal shanks or clips. Because of the wide variety of colors and imitative effects in which "Pyralin" is available, buttons, buckles and shoe ornaments can be made to match practically any shade of leather or fabric, and they can also be dipped in color solutions, if need be, to secure other color effects.

Strictly speaking, shoe display forms made of "Pyralin" are outside the province of this story, but they are closely enough related in use to justify brief comment. Manufactured in various sizes and colors, they are used extensively by retail dealers in their counter and window displays. These forms help to show to the best advantage the shapes of shoes, and where contrasting colors in "Pyralin" are employed, the effect is especially attractive.

As stated before, the covering of wood heels is by far the largest single use of "Pyralin" in the shoe industry. If the foregoing paragraphs have brought to your notice some of the other interesting uses, they have served their purpose. Manufacturers of shoes are always alert to improve their products, and so perhaps still other practical applications will be found for this plastic which fits so well into their business.

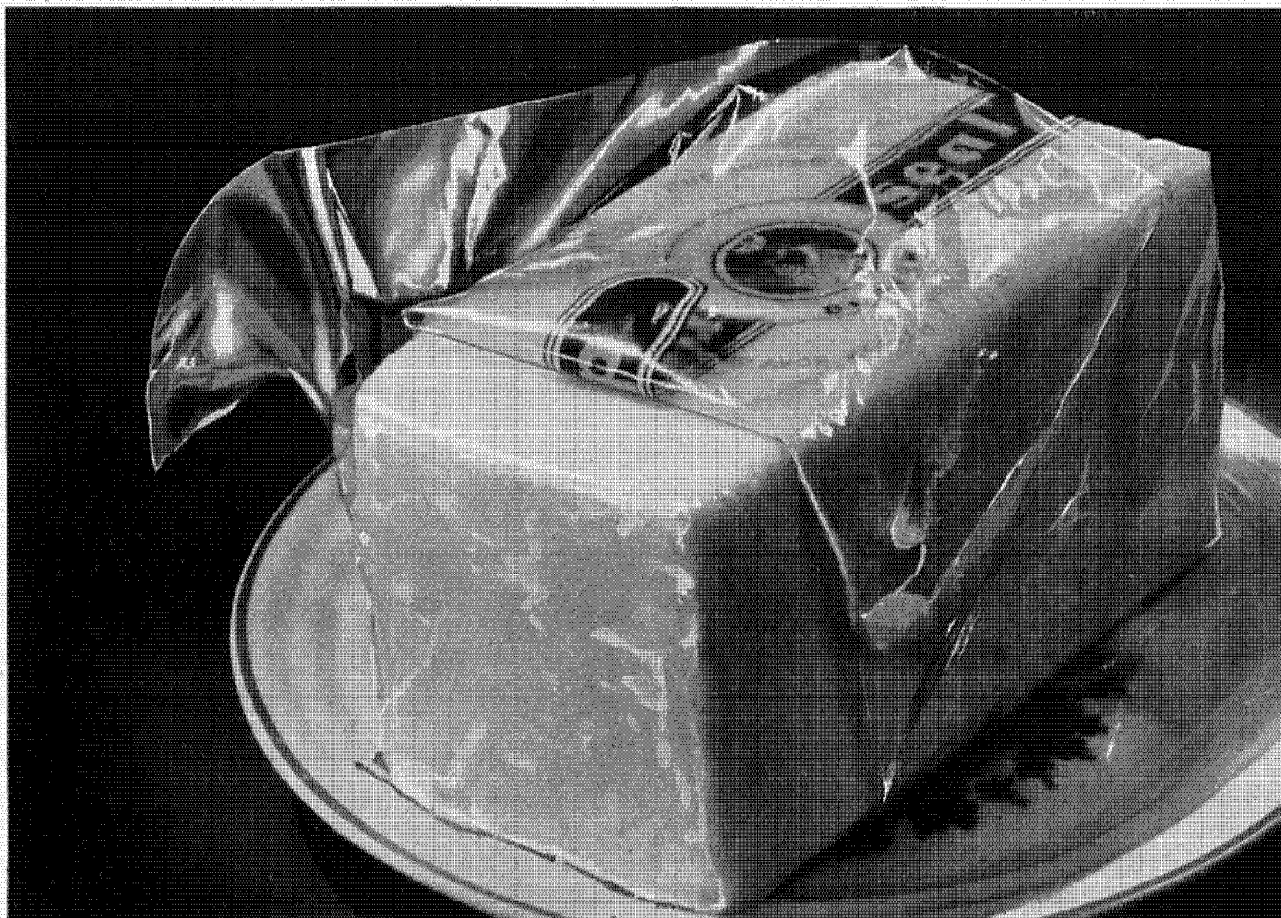


One of the currently popular kid-grain effects in "Pyraheel," the heel-covering material that is lightweight, durable, scuffless and easy to keep clean. A great variety of leather effects is obtained by means of embossing presses

embossed covers are, of course, carefully removed to avoid stretching.

Covering wood heels in this manner constitutes one of the outstanding uses for plastic material by the shoe industry. Approximately two-thirds of the shoe manufacturers in this country are now using "Pyraheels" wholly or in part on the shoes they sell. And while we are discussing heels, it may be noted that some manufacturers also make a practice of inserting between the bottom of the wood block and the top-lift previously mentioned, a piece of "Pyralin" called the plate. This protects the wood from wear in the event a woman neglects to replace a badly-worn top-lift before the heel itself is damaged beyond repair.

Next, consider the toe of a shoe. You have noticed, of course, that it is both shapely and upstanding, and you may have wondered why. The answer is that beneath the leather, and hidden from view, is a reinforcing membrane of cotton cloth and "Pyralin." An operator in the factory has made the material pliable, and while in that condition he has



Wrapping the Spread for Our Daily Bread

A specially-formulated grade of "Cellophane," a cellulose film, is now used to protect butter in its packaged form

By ROLAND HINTERMEISTER

BUTTER is probably one of the oldest foods produced by the hand of man. Archeologists have shown that it was being made in Babylonia as far back as 2000 B. C., and there are also evidences of its use in the many picture decorations left by the ancient Egyptians. On one of these may be seen the first example of a butter churn and of butter itself, which appears in roll form similar to that produced on farms today.

In some parts of the world, notably in Arabia, butter is still made by a method so primitive that it

seems almost fantastic. The milk is poured into a goat-skin bag, which is hung from the branch of a tree to facilitate the shaking operation. Perhaps it is best not to dilate upon the taste and sanitary condition of the finished product. We are told that the Moorish method of making butter is the same, except that the goat-skin bag is exposed to the sun during the process. Packaging in any form is, of course, unheard of.

In America butter was first made by the dash-churn method and also by means of revolving-box or barrel

churns. For almost seventy years following the Revolutionary War, devising new churns seems to have been the chief form of expression for our nation's inventive genius; for, according to the records of the U. S. Patent Office, a new type of churn was introduced about every two weeks during this entire period.

Until the second half of the nineteenth century butter in this country was made chiefly on the farm. Then as machine methods began to be introduced and as population became more concentrated in urban centers,

farm butter making was gradually replaced by factory production, although about one third of our domestic supply is still made on farms.

It was not until 1892, however, when the first butter printing machine made its appearance, that any real change in packaging methods took place. Previously, all butter was marketed in pails or in wooden tubs and sold loose. But with the advent of "print" or block butter, which meant greater convenience and ease of handling, the combination parchment and carton wrap was developed as the best possible form of protection.

During the past few years there has been an increasing amount of attention given to creamery methods by the Government in an effort to improve butter quality. Various colleges and universities have also conducted exhaustive tests on the subject, and producers themselves have been cooperating to the same end. As a result, the butter now being offered the public generally meets high-quality standards, and producers have shown a renewed interest in packaging to bring it to consumers in the best possible condition.

The latest advance in this direction is a new special formula for making a film that has recently been developed by du Pont chemists for wrapping butter.

As a result of two years' research, the new film has, in recent tests, proved to be admirably adapted to overcoming the usual risks encountered in bringing this highly-perishable product from churn to table in its most palatable state. For example, it was found that butter wrapped in "Cellophane" has far better keeping qualities than when packaged in other materials. The original flavor and freshness was preserved for a much longer time.

Another advantage revealed by these tests is that loss of weight through shrinkage—and it is commonly as high as one-sixteenth to one-eighth of an ounce per pound—is approximately eighty-seven per cent less in "Cellophane" than in the usual combination parchment and carton wrap. For this reason the necessity for over-weighting on the part of producers to compensate for

these losses is now practically eliminated, and there is absolute assurance that the butter will reach the consumer, full weight.

It was also observed that the original color of the butter is retained for



COURTESY, NEW YORK PUBLIC LIBRARY

Reminiscent of the days when butter was made laboriously in churns like this

a much longer time, an important advantage in communities where a preference prevails for a very yellow butter or for its opposite in the lighter shades. In addition to this, the complete transparency of a "Cellophane" film permits the housewife to see precisely what shade of butter she is getting at the time of purchase. Most butter wrappers of "Cellophane" show the producer's brand identification printed in attractive designs of several colors, contrasting with the golden yellow of the butter, making a truly beautiful package.

Although this method of packaging butter has only just begun, it has already won favor with housewives in several Eastern communities, where producers are offering their output to the public in this manner. The idea is spreading rapidly, and the time may not be far off when we may see the nation's butter, as well as its specialty bread, wrapped in "Cellophane."

Zinc Found Essential to Plant Growth

FOR years it was thought that the nutrient elements essential to the growth of crop plants were limited to the rather well-known elements calcium, carbon, hydrogen, iron, magnesium, nitrogen, oxygen, phosphorus, potassium and sulphur. Yet from time to time crops have failed to produce well on apparently suitable soils and under conditions otherwise favorable. Obviously something was missing.

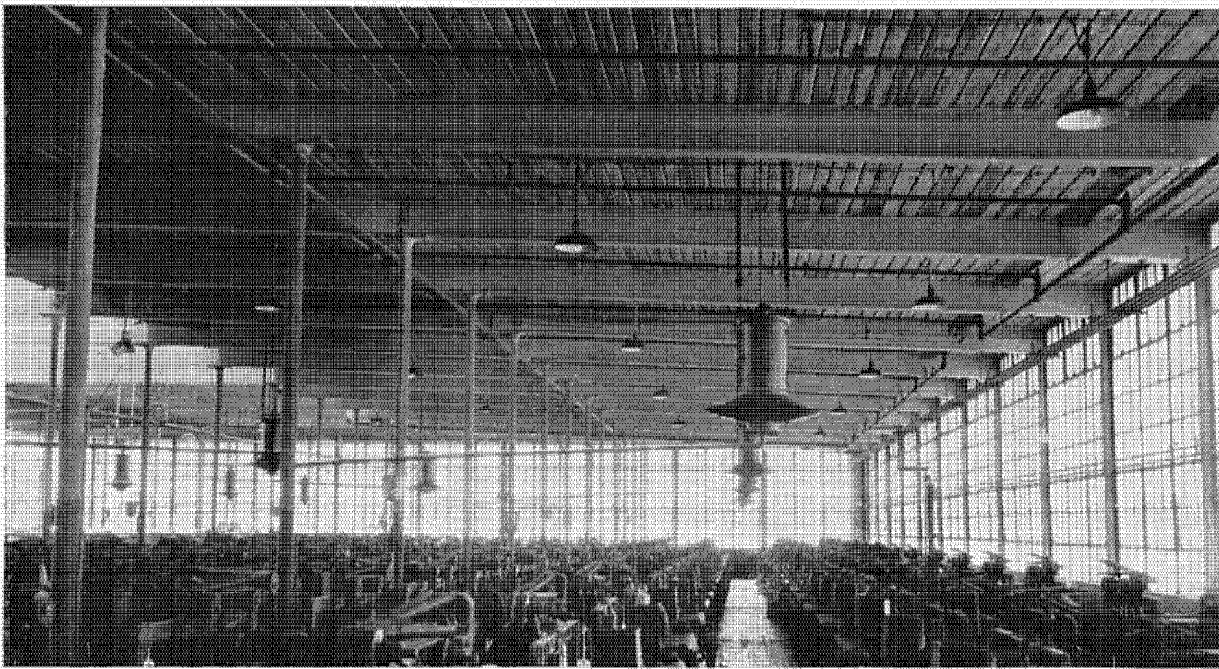
These occurrences spurred the scientists of the state agricultural experiment stations and the U. S. Department of Agriculture to extensive research. In certain cases the cause was found to be a growing deficiency in the soil of some element not hitherto regarded as necessary to crop nutrition. As a result, several elements have been added to the list.

One of the more recent additions to the roster of those found essential to certain crops, particularly fruits, is zinc, in the form of zinc sulphate. An article prepared by the Office of Experiment Stations, of which James T. Jardine is chief, describes the work leading up to this discovery. All the information presented here has been taken from that paper. The results disclosed are typical of the accomplishments of these agencies in applying science to agriculture.

Zinc sulphate, as the report brings out, has long been used as an industrial chemical and as a constituent of medical preparations. That it has been found effective in preventing or reducing the severity of physiological disorders in fruits and other crop plants, and in promoting normal growth, is of enormous practical importance to farmers seeking to produce quality crops at lower cost.

The foundation for this discovery was laid twenty years ago, when it was established that zinc was necessary to the normal development of corn under certain conditions. But the researches of experiment stations in California, Kentucky and Oregon really brought out its full significance in agricultural production.

(Continued on page 24)



The weave room of the Samoset Cotton Mills, Talladega, Alabama, before the painters went to work. See illustration on next page

Plant Protection by Painting*

- Paint is an investment, not an expense. Expertly-planned programs of painting textile mills and villages, when followed, pay dividends

By S. W. QUISENBERRY

MANY textile manufacturers have felt that painting plants and mill villages, both inside and outside, was an expense, and too often they have put off the work until the necessity for making extensive and expensive repairs has forcefully brought to their attention the inevitable penalty for neglect of upkeep requirements.

The investment made by the textile industry in operating and maintaining plants and villages aggregates many millions of dollars. And the only way this physical property can be protected from the ravages of rust and decay is with paint. Too much emphasis cannot be placed on the importance of protection in the tex-

tile field, for every dollar's worth of paint products intelligently applied, makes possible saving many dollars in repair bills. In other words, paint should be considered as a capital investment, not an operating expense, for its use adds value to property and can and does in many cases increase its income-producing power.

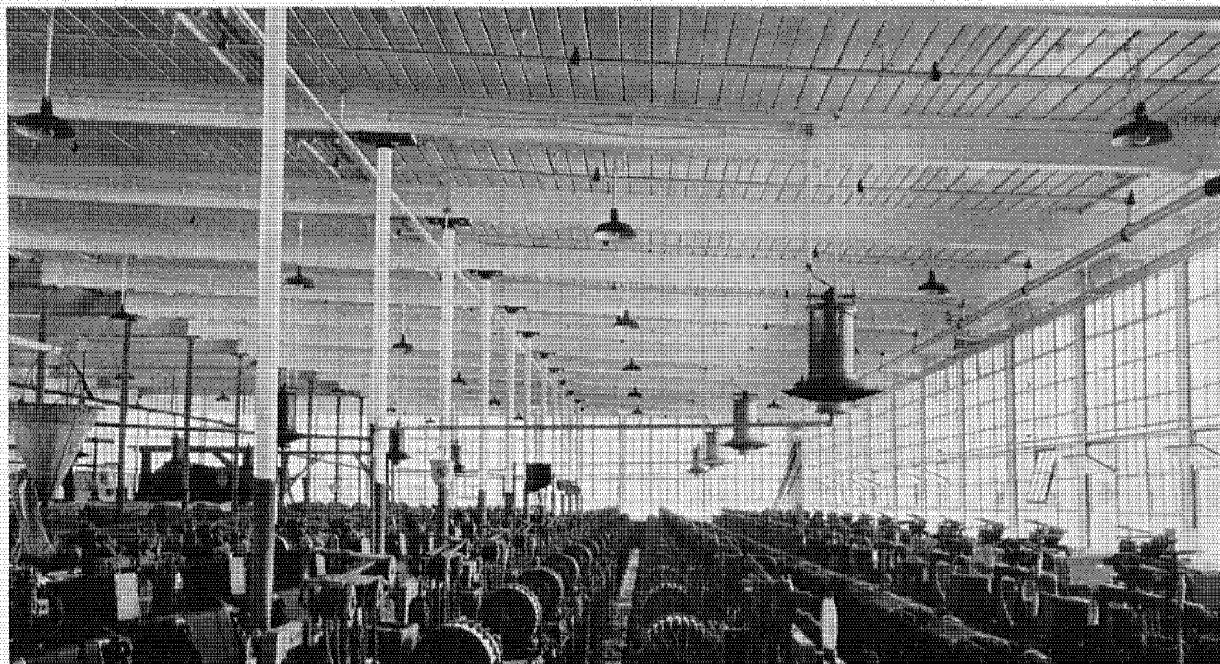
Some people mistakenly believe painting jobs can be deferred without much apparent loss to the plant. Nothing could be more untrue, for the actual rust and decay proceeds unceasingly—during slack periods as well as in periods of peak production. No plant manager would think of cancelling his fire insurance just to cut costs; he *might* suffer loss by a fire. And paint is even more necessary, for there is the absolute *certainty* that

rust and decay will cause serious property loss, if he neglects to keep things adequately protected. How great a premium management pays for delaying necessary painting schedules can be illustrated by a few pertinent examples.

WAITED TOO LONG

At one mill with which I am familiar, the woven-wire fence around the plant needed painting. But due to business conditions, it was decided to defer the work until the following year. The result was that rust had time to do its work, and eventually it was necessary to sand blast the entire fence to remove the rust accumulation and to apply a priming coat as well as a top coat. Neglect increased the cost of the job more than three hundred per cent.

*Adapted from the author's article in the February, 1935, number of *Cotton* and published by permission.



The same weave room after painting. Note the transformation in appearance and visibility following the use of "Dulux" Mill White

At another mill the metal sash was badly in need of paint. Here, too, a delay was permitted "until business improved." The result was that some costly replacements had to be made, aside from the heavy expense of cleaning and preparing the usable sash before it could be repainted. This not only greatly increased operating costs, but also involved expensive repairs. Both could have been eliminated by painting at the proper time.

Delaying necessary painting programs is false economy, for almost always it means increased costs in preparing a rotted or rusty surface, expensive repair work, additional coats of paint and, in many cases, interrupted plant operations.

ANNUAL PAINTING PROGRAMS

I believe that if the heads of every textile mill would budget and use a sum annually for interior and exterior paint maintenance, they would find it a lucrative investment, both from the standpoint of decreased painting costs and repair expense.

The mill owner will do well to plan an annual painting program so that he will not be confronted all at once with a large and expensive painting project. Let him lay out a con-

tinuous maintenance schedule for each operation, so as to eliminate the bulge in expense at one particular period, a schedule that will keep the properties in good condition at a minimum repair cost.

INSPECTIONS

This plan can be made effective by a systematic, periodic inspection of mill properties and villages. To assist in making these surveys, many paint manufacturers employ experienced paint engineers who will be glad to inspect the properties regularly. Their reports will usually confirm the advice of the mill owner's own employees. No surface will then be permitted to go beyond the time when repainting is necessary. Repairs and replacements will be reduced to a minimum.

It is, of course, difficult to set a definite period for the inspection of all surfaces, for in textile mills some areas are subjected to extremely severe exposures. Differences in construction materials, contacts with steam, water or chemicals, as in a dye-house, for example, may cause paint films to fail quicker in one place than in another. But it is necessary to find the facts in each case first, and then to provide the right kind of paint protection as, where and when it may be needed.

A JOB FOR EXPERTS

To start such a program, we suggest having a manufacturer's paint engineer survey the entire operation, including the villages. His work should cover every surface requiring the use of paint or paint materials. He will then prepare a chart showing various surfaces in need of attention and will specify the proper product and color for each one.

We can all recall in years gone by when paint was just paint. Then an ordinary oil house paint, for instance, was often applied to pipe lines, even though that particular type of material might be rust-promoting instead of rust-preventing. Today, one must have more than a layman's knowledge of paint products to avoid making unwise selections.

By following the chart referred to, you can be sure of getting the proper material for each surface, with resulting economies in purchases and in replacements. Reproduced on page fourteen is one of these charts—an example of actual specifications prepared for the managers of a well-known Southern textile mill group.

COSTS AND RESULTS

Next, consider village painting. Let us reduce costs to a dollar basis and

think in terms of protection or insurance against depreciation and repairs. The average cost of painting a village house with two coats is approximately \$30.00 to \$35.00. The average paint-film life is from three and one-half to four years, which means that adequate protection of this investment costs about \$8.00 per year. The influence of well-painted houses on employees is of course difficult to estimate, but as a means of promoting health, sanitation, better living conditions and improved morale, will anyone question that such a modest investment as we have indicated is not well worth while?

In a word, mill owners will find that following a systematic program

for the interior painting of their mills is profitable. By actual test it has been proved that a properly-painted room develops considerably more light than one that is not. There is usually a marked improvement in working efficiency, and in well-lighted plants the percentage of "seconds" or "throw-outs" in production is materially reduced. Look again at those two views of a weave room, before and after painting, on the two preceding pages. They illustrate better than I can describe the result of applying to interior surfaces of factories a light-reflecting paint.

The fact that more and more textile mill operators are planning definite systematic painting programs, is easily

explained. They have observed that it pays to do so.

In order to secure the best value for your paint dollar, ask some experienced paint engineer to assist in outlining your program. Learn about the many advances made in the paint industry during the past few years, and the advantage of using those new and improved products. He will advise you regarding the proper materials to use and give you information of value as to the best methods of surface preparation and application.

Editor's Note: Paint engineers of the du Pont Company will be glad to cooperate with plant and mill owners who desire assistance in preparing standard paint specifications for maintenance and upkeep work.

PAINTING STANDARDS FOR WEST POINT MANUFACTURING CO.

LANCET MILL
LANETT SHEAVERY & DYE WORKS
SHAWMUT MILL

LANGDALE MILL
LAUREL MILL
RIVERDALE MILL
DIXIE MILL

ANCHOR DUCK MILL
WEBBIDGE YARN MILL
SAMONET COTTON MILL

Prepared by E. I. Du PONT de NEMOURS & CO. Volunteer Life Building, Atlanta, Ga.

MILL INTERIOR

NO.	SURFACE	REMARKS	PAINT	CHIPS
1	WALLS-Ceilings	Interior Walls	White Enamel	
2	WALLS-Ceilings	Interior Walls	White Enamel	
3	FLOOR	Floor and Walls, Paint Room	White Enamel	
4	FLOOR	Floor and Walls, Paint Room	White Enamel	
5	FLOOR	Floor and Walls, Paint Room	White Enamel	
6	SPRINKLER LINES-Fittings Only	Interior Walls	White Enamel	
7	CONDENSER LINES-Fittings Only	Interior Walls	White Enamel	
8	HEATING LINES	Interior Walls	White Enamel	
9	ABSORBER LINES-Fittings Only	Interior Walls	White Enamel	
10	HUMIDIFIER DECKS	Interior Walls	White Enamel	
11	HUMIDIFIER LINES-Fittings Only	Interior Walls	White Enamel	
12	DYEING WATER LINES-Fittings Only	Interior Walls	White Enamel	
13	SERVICE WATER LINES-Fittings Only	Interior Walls	White Enamel	
14	ELABORATE	Interior Walls	White Enamel	
15	DOORS	Interior Walls	White Enamel	
16	MACHINERY	Interior Walls	White Enamel	
17	MACHINERY	Interior Walls	White Enamel	
18	MACHINERY	Interior Walls	White Enamel	
19	MACHINERY	Interior Walls	White Enamel	
20	MACHINERY-Card Room	Interior Walls	White Enamel	
21	MACHINERY-Spinning Room	Interior Walls	White Enamel	
22	SHUTTERS	Interior Walls	White Enamel	

MILL EXTERIOR

1	WOOD SASH	Exterior Walls	White Enamel	
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MILL EXTERIOR-Continued

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MILL VILLAGE INTERIOR

1	WOOD SASH	Exterior Walls	White Enamel	
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A typical chart prepared for a group of Southern mills by the du Pont Company. Note the list of surfaces on which paint or paint materials should be used, and the specified products for each purpose. Beside their names are chips showing the standard colors.

What's New

Brief notes about developments, products, booklets, and the like

The latest addition to X-Ray film products of the Du Pont Film Manufacturing Corporation, New York City, is a line of packaged developing and fixing powders. These compounds have two outstanding characteristics; the Developer is extremely active in its action without the danger of undesirable fogging, and the Fixer has an especially long life.

* * *

"Pontamine" Diazo Orange GR is the name of a new, patented du Pont dye for silk, rayon or cotton dress fabrics. As a self-color it produces bright, clear, orange shades with a decided reddish tone. When used as a shading color, it enables dyers to obtain those rich, warm shades of brown so much in demand. It is very level dyeing, discharges well, possesses very good fastness towards acid, hot pressing and crocking, and has good fastness to light and alkalis.

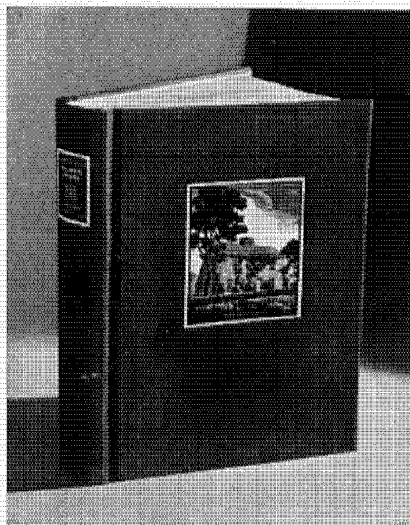
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"Monobel" B and "Duobel" B are the names chosen by the du Pont Company for two new explosives which have passed the permissibility tests of the U. S. Bureau of Mines for use in coal-mining operations. Field representatives of the Explosives Department are in position to point out the advantages to be gained by the use of these special forms of dynamite.

* * *

"RH-35" is the trade name of a new hydrocarbon resin recently announced by The "R. & H." Chemicals Department of the du Pont Company. The fact that it is a practically water-white, odorless, tasteless, thermoplastic substance indicates that it may have a number of industrial applications. Its properties are more fully described in an "R & H" Technical Bulletin, copies of which may be obtained on request.

The F. W. Dodge Corporation, 119 West 40th Street, New York City, announces a service catalogue for people contemplating building new homes over \$7,000 in value. It lists all products that enter into home fabrication and furnishing, and includes many new materials and apparatus. Anyone interested is invited to write for this new book, giving the name of architect and builder. The catalogue, illustrated below, is bound in Du Pont PX Buckram.



Much information of value is contained in the trade literature issued by various divisions of the du Pont Company. Among recent publications of this kind are the following bulletins and booklets prepared by the Fine Chemicals Division:

Bulletin No. 1.—Organic Chemical Specialties, which describes the properties and uses of seventeen products of particular interest to manufacturers of textiles, leather, paper and various other lines.

Bulletin No. 2.—Brilliant "Avirol," "Lanaclarin" and "Duponol." These registered trade-marks identify sulfated fatty alcohol products. The

text deals with their applications in processing cotton, linen, wool, silk, rayon, leather, paper and miscellaneous materials.

Bulletin No. 3.—Organic Solvents and Plasticizers. Following a description of nine products, three chapters are devoted to a discussion of du Pont solvents (1) in the textile industry; (2) for soaps and detergents; (3) in the paint, varnish and lacquer industries. Tables for reference are included.

Bulletin No. 4.—"Tetralin" for the Gas Industry." A revision of a booklet describing the uses of this solvent. It is published and distributed for the information of gas engineers.

* * *

"Gardinol"—This booklet issued by the Gardinol Corporation presents a review of the uses of alcohol sulfates in the textile industry, describes the three types of "Gardinol" and outlines how each should be used for best results.

* * *

Quarterly Price List—The "R. & H." Chemicals Department is distributing the April, 1935, number of this publication. Copies may be obtained from the Department upon application to the Wilmington Office.

* * *

Outstanding in the line of new fabrics offered by more than a score of leading French fabric houses, as shown in their displays recently held in Paris, is an imposing array of materials made of rayon and acetate yarns and mixtures containing slit cellulose film. The collections were reviewed by a representative of the du Pont Style Service, who includes in the list of French spring and summer fabrics nearly 200 specifically named materials.

THE DU PONT MAGAZINE

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Vol. XXIX April, 1935 No. 4

The Penalty of Leadership

(This text appeared as an advertisement in *The Saturday Evening Post*, January 2nd, in the year 1915. Copyright, Cadillac Motor Car Company.)

IN every field of human endeavor, he that is first must perpetually live in the white light of publicity.

"Whether the leadership be vested in a man or in a manufactured product, emulation and envy are ever at work.

"In art, in literature, in music, in industry, the reward and the punishment are always the same.

"The reward is widespread recognition; the punishment, fierce denial and detraction.

"When a man's work becomes a standard for the whole world, it also becomes a target for the shafts of the envious few.

"If his work be merely mediocre, he will be left severely alone—if he achieve a masterpiece, it will set a million tongues a-wagging.

"Jealousy does not protrude its forked tongue at the artist who produces a commonplace painting.

"Whatever you write, or paint, or play, or sing, or build, no one will strive to surpass or to slander you, unless your work be stamped with the seal of genius.

"Long, long after a great work or a good work has been done, those who are disappointed or envious continue to cry out that it cannot be done.

"Spiteful little voices in the domain of art were raised against our own Whistler as a mountebank, long after the big world had acclaimed him its greatest artistic genius.

"Multitudes flocked to Bayreuth to worship at the musical shrine of Wagner, while the little group of those whom he had dethroned and displaced argued angrily that he was no musician at all.

"The little world continued to protest that Fulton could never build a steamboat, while the big world flocked to the river banks to see his boat steam by.

"The leader is assailed because he is a leader, and the effort to equal him is merely added proof of that leadership.

"Failing to equal or to excel, the follower seeks to depreciate and to destroy—but only confirms once more the superiority of that which he strives to supplant.

"There is nothing new in this.

"It is as old as the world and as old as the human passions—envy, fear, greed, ambition, and the desire to surpass.

"And it all avails nothing. If the leader truly leads, he remains—the leader.

"Master-poet, master-painter, master-workman, each in his turn is assailed, and each holds his laurels through the ages.

"That which is good or great makes itself known, no matter how loud the clamor of denial.

"That which deserves to live—lives."

South American Rayon

The du Pont Company has announced its intention to expand further industrial activities in Argentina. With its associates there and a French group, represented by the Comptoir des Textiles Artificielles, a new company will be formed, to be known as "Ducilo" S. A. Productora de Rayon, which will engage in the manufacture and sale of viscose rayon. Construction work will shortly be started on a thoroughly modern plant to be located near Buenos Aires. There is at present no rayon manufactured in Argentina, the entire requirements being imported, chiefly from Europe. Approximately one thousand employees will be required when the plant gets into full operation.

An Educational Exhibit

SOME years ago the librarian of the Engineering College, University of Michigan, in a historical discourse on materials, said that the "Age of Steel" was improperly named; that it should have been called the "Age of Explosives," for without the use of blasting agents, none of the great achievements for which steel is given the credit would have been possible.

Whether you subscribe to that viewpoint or not, explosives are important tools in carrying on an enormous volume of work initiated by Federal, state and county agencies.

In this connection a du Pont exhibit reproduced on the facing page draws attention to certain phases of these works. Brief explanatory legends hardly more than suggest the kinds of service explosives render.

In efforts to control mosquitoes that carry malaria germs to plague thousands of our citizens, explosives are used effectively. Land drainage is one good way to eradicate these pests.

Hundreds of dams are built in rivers and streams to insure control of water in times of floods and to conserve it during periods of drought. These structures impound water and serve to meet the needs of navigation, irrigation and power development.

Federal efforts to control soil erosion have been referred to before in this publication. In this work the function of explosives is to supplement the activities of thousands of young men who are fighting to keep fertile soils in place on American farms by checking water flow in gullies and by reforestation.

It is of course not possible to include in one small exhibit the entire range of public works in which explosives are helpfully employed, but those shown are at least representative. And it should be understood, too, that blasting is resorted to only where work cannot be done efficiently by other means. Even so, federal projects under way last year accounted for the use of approximately thirty million pounds of explosives.

The exhibit will be placed on view within a few weeks in the Du Pont Exhibit at Atlantic City.



EXPLOSIVES IN FEDERAL WORK

1. Ditches are blasted with dynamite to drain the swamps where mosquitoes breed and become a menace to public health.
2. Dynamite is used to blast channels in bed-rock to anchor flood control dams in many parts of the country.
3. Rock blasted from quarries is used for building dams and highways, and there are scores of such projects under way.
4. Gully erosion is stopped by building temporary dams, blasting soil into gully bottoms and then planting trees in the blasted soil.
5. Broad terraces check farm-land erosion. Stumps and boulders must be blasted from terrace lines.
6. A crooked stream causes flooding and erosion. Dynamite is used to straighten the channel as shown here.
7. Rock cuts are blasted along scenic highways to insure easy grades and a safer alignment for traffic.
8. Explosives assist in clearing, building and maintaining fire lanes which are so essential to forest preservation.

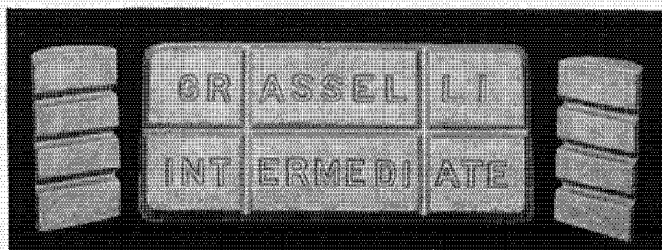
Sodium-Zinc Alloy

A new metallurgical tool, the use of which prevents certain flaws in casting brass

By B. A. WEIMER

For years one of the most persistent and troublesome problems in the non-ferrous metallurgical field has been that of oxide and gas occlusions in brasses, with their concomitant troubles, such as blow-holes, spills and similar casting faults. The deoxidizer commonly used in the past has been phosphor-copper, which, while quite effective in reducing metallic oxides, is somewhat limited in its scope and must be added in carefully-controlled amounts, for over-dosage markedly alters the physical and electrical characteristics of the treated metal.

Forward-looking metallurgists in the brass industry have long desired a method of eliminating casting-flaw difficulties by some simple means, a method that would not alter the actual physical properties of the particular brass being made—one in which slight errors in dosage would not result in harmful effects, and a



Two ingots of sodium-zinc alloy and a slab of zinc

treating method that would not be too expensive to employ.

To this end the Grasselli Chemical Company and the "R & H" Chemical Division of the du Pont Company have jointly developed a new research and working tool in Grasselli sodium-zinc alloy. This alloy may be used in all non-ferrous alloys where a content of two per cent or more of metallic zinc may be tolerated or is called for.

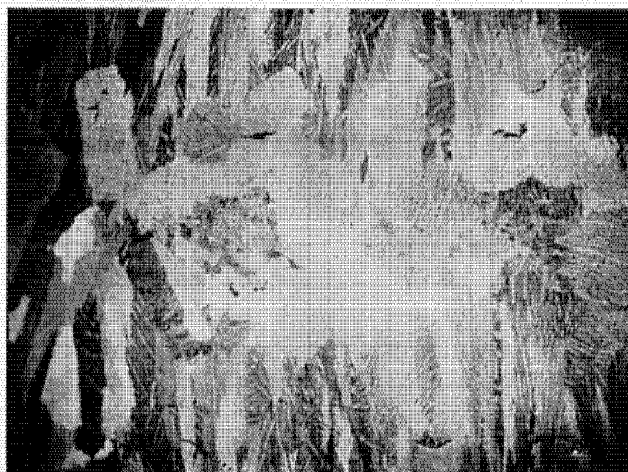
The constituents of the alloy are ninety-eight per cent intermediate grade zinc and two per cent metallic sodium. It is cast in ingots which are semi-cylindrical and fitted with breaking notches for the sake of

ready divisibility. The appearance of the ingot, and its size as compared with a standard slab of zinc, may readily be seen by a glance at the illustration. Its melting point—and curiously enough, too, since the melting point of sodium is roughly the temperature of boiling

water—is about 140° C. higher than that of pure zinc. The ingots may be stored without any particular precautions other than those which would be observed in the storing of slab zinc; for this alloy, despite its sodium content, is not in the least unstable. It is much more brittle than straight metallic zinc and is thus readily fractured for use, being reduced to size on a shear or by breaking on a bucking board.

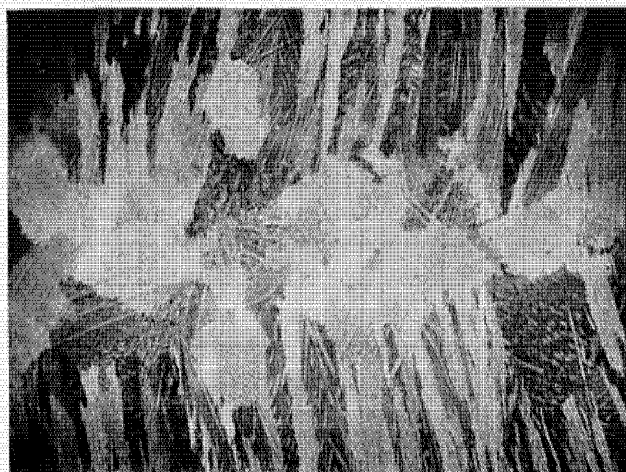
The use of this alloy is simplicity itself. After the brass batch is almost ready to pour—and it is made up with less than the final desired amount of zinc in order to

Yellow brass
No sodium-zinc used



A B

Yellow brass—
3 per cent sodium-zinc used



compensate for the additional zinc charged in the alloy—the requisite amount of sodium-zinc alloy is added in solid form. These fragments sink to the bottom of the bath and then, at the high temperature encountered—for commercial brasses it ranges from 900° to nearly 1100° C.—the alloy breaks down into its components. The sodium, with a tremendous affinity for oxygen, energetically reduces any metallic oxides that are present in the bath, regardless of their state; the sole products of the reaction being sodium oxide and pure reduced copper, tin, zinc, or whatever the metal may be whose oxide was present in the bath before the addition of the deoxidizer. The sodium oxide, which has a normal boiling point of 880° C., boils out of the bath with great vigor, resulting in a bubbling and stirring action. This is highly beneficial to the metal, reducing segregation and imparting a "liveness" which is quite noticeable even when the metal is poured into the mold.

Indicative of what can be accomplished by the simple substitution of this alloy for a portion of the total zinc requirements of a brass, the photomicrographs A and B should be consulted. These pictures were taken in the metallurgical laboratories of the Scovill Manufacturing Company, Waterbury, Connecticut, and were taken from alloys prepared by William B. Price, chief chemist and metallurgist. Photomicrograph

A is a typical section of a sixty-six per cent copper, thirty-four per cent zinc alloy, which is usually known as a yellow brass. The tiny black spots which are scattered throughout the section, both enclosed by and running through the crystal boundaries, are due to oxide or gas occlusions. This should be compared with photomicrograph B, which is of a brass of the same composition, with the exception that three per cent of sodium-zinc alloy was substituted for a similar amount of metallic zinc. It should be noted that there is no significant difference in the metallic structure, yet the tiny faults and blow-holes are almost completely eliminated.

The physical properties of the brass are not harmed in any way by the use of sodium-zinc alloy. In general, slight increases in elastic limits, tensile strength, and elongation under fracturing load are to be expected; this effect of increased strength is due, however, to the elimination of faults rather than to a significant change in the actual metallic structure.

The use of this alloy is not limited to straight brasses. By consulting photomicrographs C and D, which are also reproduced by the courtesy of the Scovill Manufacturing Company Laboratories, one may readily see the significant difference in flaw occurrence in a copper-silicon alloy. Incidentally, this alloy is a very difficult one to cast satisfactorily, due to the excessively frequent occurrence of

shrinkage holes. The effect of the sodium-zinc alloy is to decrease the viscosity of the metal, when poured, as well as to eliminate refractory oxides, thus resulting in a much-lowered occurrence of these shrinkage troubles.

While in some cases oxide and gas occlusion difficulties have been surmounted by such physical or mechanical expedients as the increase of mold size, for example, such expedients do not have the same virtues as the use of sodium-zinc. In the first place, the use of larger molds is of no advantage where the metal is to be used in the "as-cast" form. To cite one example, for pump casings, where the appearance of a blister on the surface will cause rejection of the casting, the use of larger mold sizes would, of course, be valueless. The second disadvantage is the increase in power cost, when the material is cast in billet form, due to the necessity of effecting a greater overall reduction in physical dimensions. Where the expedient of using a larger billet-mold size has already been adopted, however, it is reasonable to believe that the use of sodium-zinc will effect still further reduction in segregation, occlusions and similar troubles.

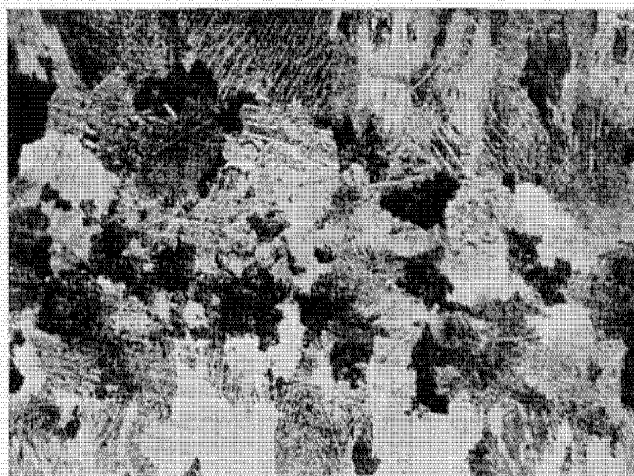
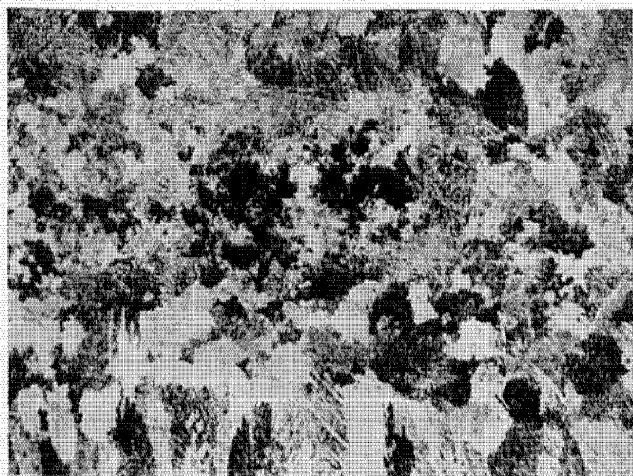
The cost of this alloy is very low as compared with the results secured by its use. After all, ninety-eight per cent by weight of the alloy is left in the metal as alloyed zinc. It

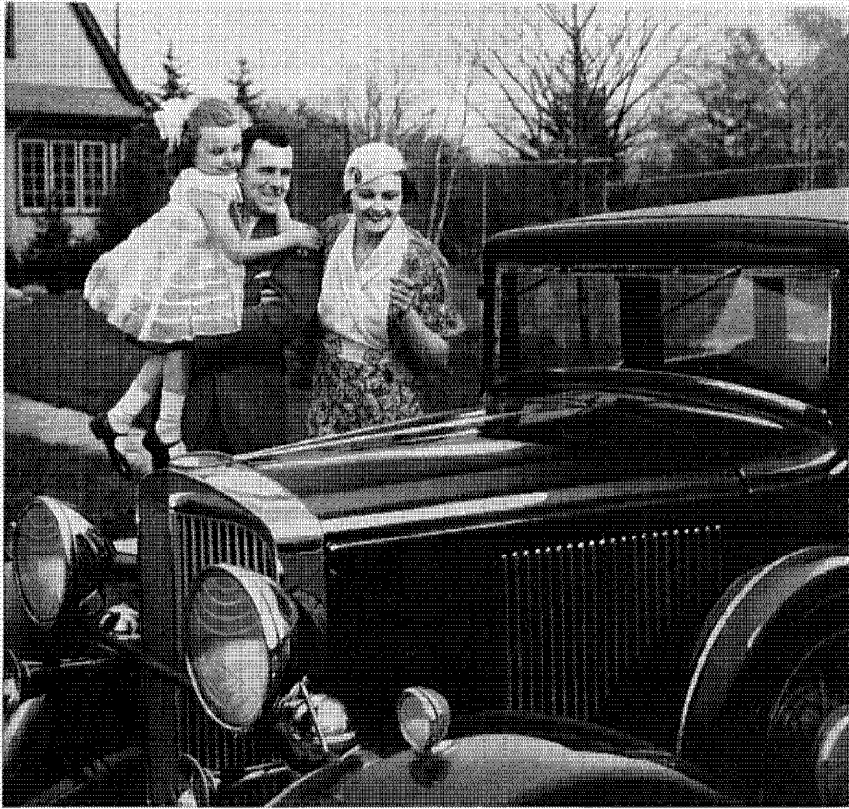
(Continued on page 24)

Copper-silicon bronze—
No sodium-zinc used

C D

Copper-silicon bronze—
2.9 per cent sodium-zinc used





The Smiths could not afford a new car this year, so they did the next best thing—had the old one refinished in "Ducco," in one of the bright, new color schemes appearing on the 1935 models

Car Colors Are Brighter

The new 1935 automobile colors are as varied and brilliant as the rainbow—and they are available for refinishing the old model

By J. W. LOGAN

THE growing appreciation of color in our modern world seems to be more strongly reflected in automobiles this season than ever before.

In general, the 1935 trend is toward lighter and more cheerful hues. There is nothing depressing about the autos on the road this year, and those who are buying new cars or refinishing old ones will do well to choose their finishes from the score of lively and attractive colors now available.

The cars displayed in the shows this year include roadsters in yellow, light green, brilliant blue, light cream, bright brown, with the ever-

popular grays holding their own. A gray with a bluish tinge is one of the most interesting. Another timely color offering that will doubtless be much used for refinishing is a blue with a somewhat greenish tinge, called Nakhota. This is a dark blue-purple-blue of great brilliancy and can be successfully accented with an extremely wide range of stripe possibilities.

Other choices include a gunmetal flanked with red gold bronze, or an extremely light and bright variation of body colors, with hair lines of yellowish orange, or even plain

white. Green, relatively little used for several years, gives a new note for those who do not like maroon, blue or black. Two new greens are Dartmouth, a brilliant, colorful finish which should prove popular, and Bosphorus, a somewhat lighter green-blue-green, which is most pleasing to the eye.

A decidedly new and different combination is red accented by a silver striping that should find favor among those who seek novelty in automotive finishes. And there is a brown of a reddish shade, rather low in brilliancy, called Longchamps Brown. Its natural red undertone can be vividly enhanced by using a plain copper striping.

There's nothing blatant and bold about these new refinishing colors. Instead, they are deep and rich in tone whether in the light or dark register. They run the gamut of grays, beiges, blues, maroons, greens or browns. They contribute to an elegant simplicity, the keynote of the smart mode. The trend generally is for a single all-over color with embellishments as simple as possible. When color is used for accent, it is generally a thin-line treatment—always very discreet.

Public opinion as registered by a questionnaire sent out by the leading automobile manufacturers indicates that maroon is much favored, particularly a variety known as "Ducco," Regent Maroon, of medium value and intensity. Several beautiful maroons were seen at the automobile shows this year. Light, bright maroon will be effective as a color replacement for old black or dark blue finishes. A combination stripe of copper and silver provides effective ornament. Maroon's complement, blue-green, with hair-line stripes of brilliant vermillion, is another ornament possibility that will add an up-to-date feeling to the old car.

Just as pleasure cars have enjoyed the fashionable touch of new color

(Continued on page 24)

The New Mode "Acele" in Various Moods

Below—PRUNELLA—This suede cord crepe is one of the most celebrated of fabrics made of synthetic yarn. Ensembles from Jay Thorpe, New York



Above—CREPE MORNY—A Carlin-designed fabric with a smooth surface. Here is shown a finely-tailored ensemble from Peck & Peck, New York

Below—LA TELITA STRIPE—These smart knitted costumes are made for holiday leisure and active play. Designed by William Bloom for leading shops



Above—SQUARE SPOT—A petal-soft knit. Cool and practically uncrushable. The frock from Bonwit-Teller, Tailored Woman, New York

Below—TARA—The exquisite new sheer. These flattering and feminine frocks are from Saks Fifth Avenue, Lord & Taylor, and Tailored Woman, New York



Away Down South in Arkansas

The Camden Furniture Company refused to let a business depression interfere with its business-building plans . . .

TEN years ago H. C. Rothert and his son were active in the business of the Huntingberg (Indiana) Furniture Company. Perhaps the industrial outlook there was not too rosy. At any rate, they thought the time had come to seek a new factory location where timber would be more readily available. The Southwest seemed to be the most promising region, and so they finally decided to establish themselves at Camden, in southern Arkansas, and manufacture solid wood furniture.

A suitable site was acquired and on it M. H. Rothert, then twenty-one, built a new factory which he designed himself. In October, 1926, the first car of furniture was shipped. For a time the Camden Furniture Company was operated as an associate of the Indiana concern, but hard, purposeful work during the next three years put the enterprise on its feet. It could and did stand alone. Then came the depression that ruined many long-established businesses.

The Rotherts continued to manufacture inexpensive, smartly-de-

signed furniture, and to change styles with each market. And they advertised and merchandised the line so effectively that a strong demand arose for Camden-made products. They were good values. When a du Pont finish was adopted as standard about two years ago, that, too, helped sales tremendously. As a

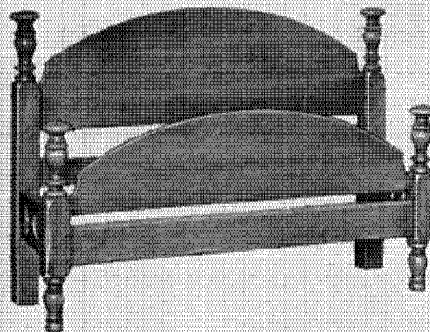
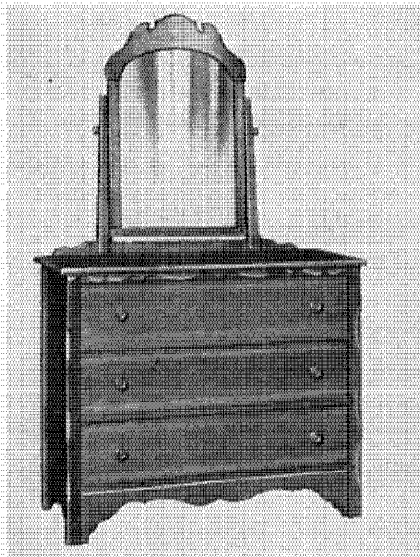
result, the sales curve has shown only a slight tendency to drop during the depression years.

The present status is shown by a few facts obtained in a recent interview. The company now manufactures 600 cars of furniture a year, employs twenty salesmen; ships its products to every state in the Union as well as to Canada, Mexico and Cuba, and the sales forecast for this year is \$500,000.

Although the elder Rothert is no longer active, the business is being capably directed by M. H. Rothert, manager, and his sister Louise. The vigor of youth characterizes the personnel of the organization. In the factory the average age of the foremen is thirty years. Altogether they have built a strong foundation for future growth, and even as this is written, the factory output is being stepped up by the addition of new kilns, machinery and production lines. Manager Rothert is well pleased with the present location of the business and with the general outlook for the furniture industry.



Illustrating four pieces of a bedroom suite that has found a ready sale because of its simple design, good workmanship and durable du Pont finish



A Chemical Family—III

(Continued from page 4)

chemist gives to anything he cannot explain in order not to disclose his limited knowledge. It might be kinder, and a little more helpful, to liken a catalyst to the foreman of a laboring crew. While he is on the job, even though he appears not to do any work himself, the others buckle right down to the task in hand. When he is absent, they may loaf or quit working entirely. In any case, results count, and it is enough that the chemist has learned how to make and use certain catalysts to help him get the results he wants.

Another astonishing thing about this process is that, by changing the gas mixture, other products, highly useful and important in themselves, can be obtained in addition to ammonia.

Prominent among these are certain synthetic alcohols, which are made by varying the high-pressure procedure. Nearly every motorist is familiar with "Zerone" anti-freeze, the chief ingredient of which is methanol. "Dynol," a power lubricant for two-cycle engines such as those in outboard motorboats, and "Dynax," a racing fuel for the same type of motor, are also derived from this source. A number of the higher alcohols are widely employed as solvents in various industries.

The carbon monoxide gas produced at one stage, when treated under heat

These towers represent one of the last steps in the manufacture of nitric acid. Here the gases formed by burning a mixture of ammonia and air in the presence of a catalyst are absorbed in water to yield weak acid

and pressure with caustic soda, yields sodium formate, which in turn is converted into formic acid, used in textile finishing and leather manufacture. The carbon dioxide, when combined with ammonia and water, produces ammonium carbonate and bicarbonate, used by bakers to give the desired "puff" to their dough. Also derived from ammonia and carbon dioxide are urea and urea ammonia liquor, which find extensive application in the fertilizer industry.

Other products include foam inhibitors for the beet sugar and paper industries, frothing oils for use in ore flotation, dimethyl sulphate, used by manufacturers of pharmaceuticals and other fine chemicals, and a wide group of hydrogenated substances.

Ammonia itself has many valuable uses. Large quantities are used in refrigeration equipment. The various salts of ammonia include ammonium chloride, ammonium phosphate and ammonium nitrate. The latter is an explosive ingredient in an important variety of dynamite and is produced by combining nitric acid with the very ammonia from which it is made. However, by far the most important derivative is nitric acid itself. The oxidation of ammonia to produce this acid is therefore the last chapter in our account of its past and present origin.

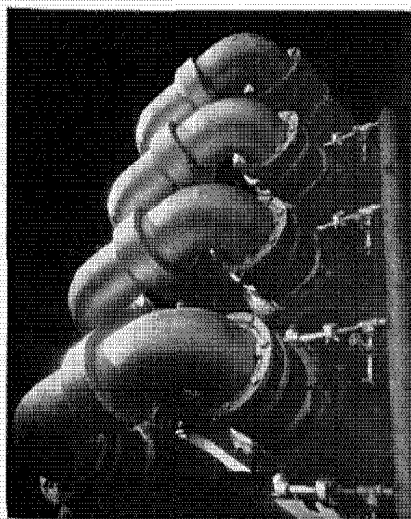
One of the plants maintained for this purpose is located in the acid area of the du Pont dynamite plant at Repauno, New Jersey. Here ammonia and air are forced at high velocity into a chamber where the gas is burnt in the presence of a catalyst. There is a little window in this bulbous chamber through which one can see the red hot mixture glowing at about 900 degrees Centigrade. But what happens after that has to be assumed from the results obtained;

Here the photographer has focused his camera upon a small detail in order to give some idea of the complex equipment needed in converting ammonia to nitric acid



one soon loses track of the itinerary in a maze of weirdly twisting pipes, tall towers and other odd-looking items of equipment. We know, however, that the ammonia has been converted into gaseous oxides of nitrogen, which are carried to coolers, and from there to absorption towers, where they are dissolved in water to form nitric acid of sixty per cent strength. Strong acid for nitration is obtained by concentration, a separate operation in which the water is removed by means of sulphuric acid.

We have now looked into the past and present source of the nitric acid required in certain du Pont operations. We have also touched upon some of the materials that were nitrated in connection with explosives and other lines of manufacture, prominent among these being cellulose, glycerine and the coal-tar derivatives. Now it is an interesting parallel that in the process for the fixation of atmospheric nitrogen, considerable quantities of these coal-tar derivatives are obtained as a result of "coking" coal. If we follow this material we again meet our old friend, the nitration process. And how a knowledge of nitration technique led the du Pont Company, during the years following 1917-18, into the fascinating field of coal-tar colors, is a story in itself. But that story must be left for a later chapter.



Zinc Found Essential to Plant Growth

(Continued from page 12)

In certain Pacific Coast states, particularly California, large acreage of walnuts, citrus fruits, grapes, apples and peaches were being rendered unprofitable by disorders known locally as little leaf, rosette and chlorosis. The experiment station in that state has recently adopted zinc as a means of preventing these losses. Effective control of the little-leaf disorder of fruit trees, for instance, was secured by placing zinc sulphate crystals in holes bored into the trunks. Benefits were secured on grapes and citrus fruits by spraying with a zinc sulphate solution.

The work done on the West Coast has paved the way for the solution of puzzling nutritional problems among various important crop plants in other parts of the country. The U. S. Department of Agriculture, working with the Indiana Experiment Station, showed that zinc sulphate lessened the damage caused over a wide area by bacterial spot of peaches. One peach grower recently used twenty-four tons in his orchard, which gives some indication of the practical effect this research may have on the chemical industry.

The Florida Experiment Station found zinc sulphate effective for the treatment of tung oil trees affected with a disorder known as bronzing, which causes dwarfing and premature defoliation and results in lower vigor and productiveness. Benefits were obtained both by applying the compound to the soil and by spraying the trees. The treatment was also found distinctly beneficial to orange trees affected with mottle leaf and pecan trees affected with rosette.

Sodium-Zinc Alloy

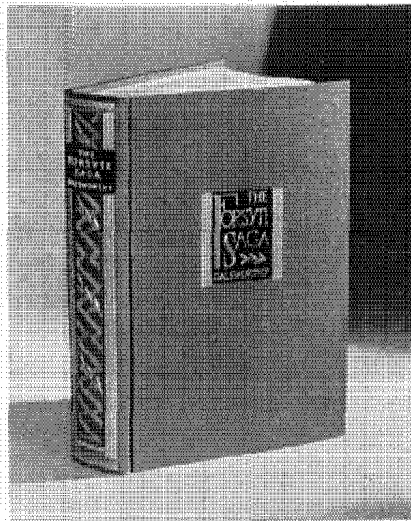
(Continued from page 19)

will, when used under proper conditions, much more than repay its use by the reduction in rejects. In addition, it eliminates the necessity for mechanical puddling or stirring to prevent segregation.

Anyone interested in this alloy can secure technical information, samples, or any other data desired by writing to the New Products Division, The Grasselli Chemical Company, Inc., Cleveland, Ohio.

Another Masterpiece Goes PX

THE new edition of the *Forsyte Saga*, published by Scribner's of New York, is beautifully bound in DuPont PX Cloth. Some French book collectors buy editions unbound and then bind them in colors of their own choosing. Americans prefer to have their books bound for permanency at the outset—one reason why DuPont "Fabrikoid" PX Cloth has a front place in the publishing field.



Car Colors Are Brighter

(Continued from page 20)

hues, so to have delivery cars. This year finds a real advance made toward brightening up commercial cars. The trend is to make the color scheme express, as far as possible, the vehicle's use. As in the past, it is likely that florists' delivery vehicles, for example, will be finished in white, pink, brilliant gray, or with some of the lighter shades of blue. Trucks

will be finished in red, yellow or rich blue, using the colors in their most brilliant chroma, set off by fancy stripes and other ornamentations.

Delivery cars seem to follow a lighter color range than in past years. There never was any good reason why groceries had to be delivered in a black or deep-blue-finished truck when so many other lighter, cleaner and more attractive colors were available. Also, more care will be taken this year to make the lettering conform in color and design to the general finish of the vehicle. There always has been an opportunity for improvement in the use of color on commercial vehicles. In line with the current trend toward lighter, more cheerful colors, many fleets will be originally finished, as well as refinished, in livelier hues.

Because of their speed and the fact that they should be visible at some distance away, busses have always taken advantage of bright colors. Indications are that they will adopt still brighter hues. Pure, rich colors of the deepest brilliancy, and in lighter tones than ever, seem to be the order.

Indeed, the growing appreciation of color in the automotive world is more strongly reflected today than ever before. And whether it be pleasure car, commercial vehicle or bus, the new mode in color has definitely centered around a new interest in car refinishing. With the simplified processes of refinishing, and the wealth of "Duco" colors in their rich, deep brilliance, it is no trick at all to keep abreast of the fashions and convert last year's model into one that looks as though it had just come off the production line.

Color, to many people, dates an article, but the person who cannot afford a new car this spring has a friend in the color expert. He can reproduce all the popular colors in refinishing the old bus into a thing of beauty which will delight the eye of its owner. There are DuPont Refinishers in almost every town; they have all the latest colors in stock ready to give an old, shabby, weather-beaten car the chic and glossy appearance of the 1935 models at less cost than you might think.



Wear-a-Beau "DRESSMAKER" Prints

THIRSTY FOR NEW CLOTHES with "dressmaker" softness. Wear-a-Beau Prints are born for it. This mellow, fine texture is developed entirely from Du Pont Superfilament Rayon. Clear-eyed prints. Supple "hand." Even the simplest dressmaking looks like a million dollars. And what economy! The Wear-a-Beaus are as bright as new after much washing and ironing. To top it all, they're easy to sew. No wriggling, raveling, no pulling at seams. See the galaxy of patterns—the Easter parade of colors in the finer stores from coast to coast.



James McCreery, New York . . . Marshall Field & Co., Chicago . . . Woodward & Lothrop, Washington . . . J. W. Robinson, Los Angeles . . . Halle Bros., Cleveland . . . Famous & Barr, St. Louis . . . The Dayton Co., Minneapolis . . . Stewart's, Baltimore . . . Sanger Bros., Dallas . . . Frederick & Nelson, Seattle . . . Selfridge & Co. Ltd., London . . . Wear-a-Beau Prints are a Beau Monde Fabric by Marshall Field & Co., Manufacturers, Chicago . . . New York.

WOVEN OF DU PONT RAYON

Even SOFT WHITE HANDS

DEFACE *and* **DESTROY!**



TWO HANDS—soft and beautiful. Surely their touch can only be velvety—soothing.

But watch these same hands in the kitchen! Though they touch ever so lightly and capably, they are hands *heavy* with damage. Oft repeated, their touch mars and discolors.

That refrigerator, for instance. It started out a clean and glowing white. Then, hands tipped with household greases touched it, touched it over and over again—left their unseen marks. These grease spots turned rancid and formed acids which ate into the finish, softened and discolored it. Gradually, the refrigerator lost its shining beauty and was no longer white.

How could it be *kept* white? How could it be given a finish that would not only withstand the effects of acids, but dirt and bumps and knocks as well? Here was a problem that du Pont chemists solved only after months of unremitting study and research.

But when they *did* solve it, they had developed an outstanding finish for refrigerators. Its name is **DULUX**. Since its introduction, **DULUX** has been used on more than 900,000 household mechanical refrigerators—outstanding proof that this finish completely answered the finishing problem.

This achievement, a distinct service to both industry and home, is only one of many in du Pont history. In their efforts to obtain finishing materials of greater service value, du Pont chemists have been responsible for many of the major developments in finishes in the past ten years.

You know about Duco, of course. Then there's Automotive Dulux. And Dulux Mill White for mill interiors. Dulux Marine Finishes for boats. Brush Duco and Du Pont Paints and Varnishes to beautify and protect the home. Home owners everywhere—and leaders in industry—rely on du Pont for more lasting, more economical, more beautiful finishes. E. I. du Pont de Nemours & Co., Inc., Finishes Division, Wilmington, Del.



FINISHES

for industry and home

DU CO . . . PAINTS . . . VARNISHES . . . DULUX

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