THE DU PONT MAGAZINE



MAY 1937



PROTECTS CIGARS—AND LETS YOU SEE THEIR QUALITY

EVERY cigar has its loyal fans. Add them all together and you have an enthusiastic bunch of rooters for Cellophane wrapping.

Ten years ago, Du Pont chemists discovered how to make a *moistureproof* transparent wrapping. Wise cigar makers quickly appreciated the value of this new Cellophane protection, which keeps cigars *fresher*, and prevents pocket breakage—yet still lets smokers *see* the color and quality of the leaf.

Today most cigars come in Cellophane transparent wrapping—so you may be sure of *extra freshness* and *extra pleasure* in the smoking. "Cellophane" Division, E. I. du Pont de Nemours & Co., Inc., Empire State Building, New York City.

Cellophane TRADE MARK DUPONT REG. U.S. PAT. OFF.

"Cellophane" is the trade-mark of E. I. du Pont de Nemours & Co., Inc.

THE DU PONT MAGAZINE

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CHEMISTRY AND YOU PART II

BY DR. C. M. A. STINE, *Vice-President*
E. I. DU PONT DE NEMOURS & CO., INC.

Excerpts from an address delivered before a group of business and professional men at the University of Cincinnati

EDITOR'S NOTE: *In the first installment Dr. Stine reviewed some developments that have focused attention on Chemistry in its service role. In this one he discusses the chemist's work in relation to the textile, rubber, petroleum, metal and refrigeration industries. Important contributions have been made in these fields.*

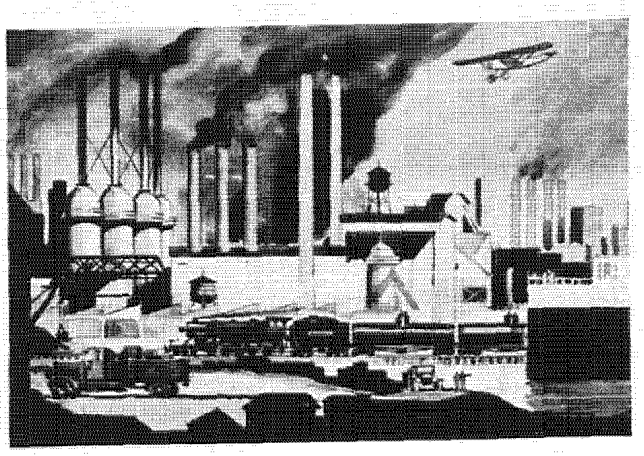
INDUSTRIAL DEVELOPMENTS

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

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

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

"However, chemistry's contribution to the textile industry is going far beyond rayon. The sheerest of dresses may now be rendered water-repellent and spot-proof, and so may hosiery, hats, suits, sports clothing, and in fact most fabrics of silk, wool, rayon, linen or cotton wherever used, as in awnings, tents, the outer covering of mattresses, in window drapes and so on. The waterproofing



chemical is applied to the fabric in a single operation, whereupon it becomes an invisible and odorless part of the fabric itself, shutting out water but not air. Rain-drops run off without wetting the fabric, and a spilled cocktail does likewise.

"Wrinkleproof fabrics for shirts and dresses, fabrics that stay 'starched' without restarching in the laundry, others that will 'hold a crease' in daily wear, and still others for use in home furnishings that are fire-retardant are already on the market or soon to be introduced. New dyes, wetting agents, detergents and kindred textile assistants have been evolved, the general purpose of which is improvement of quality, and new comfort, beauty and new utility, all at less cost both to producer and consumer.

Economic Gains

"It is well to emphasize here the all-prevalent creed of the new chemistry, which is to give more for less. You see it at work in the shoe industry, in textiles, in motor cars, wherever the science is applied. The practical result of it is a steadily growing distribution of wealth in terms of usable things; not alone the production of two blades of grass where one grew before, or perhaps where none grew at all, but production of two at the cost of one, a feat in economics that chemistry is fast making a commonplace. Business depressions lower prices temporarily, usually at the cost of employment and profits and often of quality as well. Chemical science aims to lower prices permanently, and to keep on lowering them, even as it creates more opportunities for work and insures a fair return to the labor and capital concerned. In every store in the land today you will find manufactured goods that are superior to those of five or seven years ago, or that did not exist five or seven years ago, and if you will compare their prices you will find that in most cases those of today are substantially less than you once paid for inferior articles of the same kind, if you could buy them at all. Fluctuations in the costs of raw materials affect retail prices, of course, but the present phenomenon in retail prices is not a mere passing phase of our economy brought about by low raw material costs; nor is it the result of sweating labor—sweated labor does not create and improve. It is a fundamental change, fostered by man's own ingenuity in creation, that points a way to an ever better and more abundant life. And it is change that has come to stay, for it is rooted in a scientific creed that does not admit the word retreat.



Chemistry gave the textile industry rayon, a truly fine product, as exemplified in this stylish frock of "Acele" acetate yarn.



Chemically-made neoprene serves the industry that developed it. The chemist's gloves and apron are made of neoprene compounds.

Improvements in Rubber

"I have mentioned changes in rubber. No less than shoes and textiles, the rubber industry has been revolutionized by chemistry. Indeed in no other industry is the influence of chemistry more marked. Recent tests of automobile tires made by a governmental agency and published by the Consumers' Union show the useful life of the best-made tires to be well in excess of 25,000 miles. One brand of tires gave 29,279 miles of road service, although the cost was identical with that of the poorest set of tires tested. When these mileages are compared with the three-to-five-thousand miles of haphazard travel furnished by the tires of twenty years ago, which cost from two to three times more and were only about half the size of modern tires, we can appreciate the extent to which tires have been improved. And rubber in all of its more than 30,000 uses has been similarly improved, with the chemist leading its amazing advance. . . .

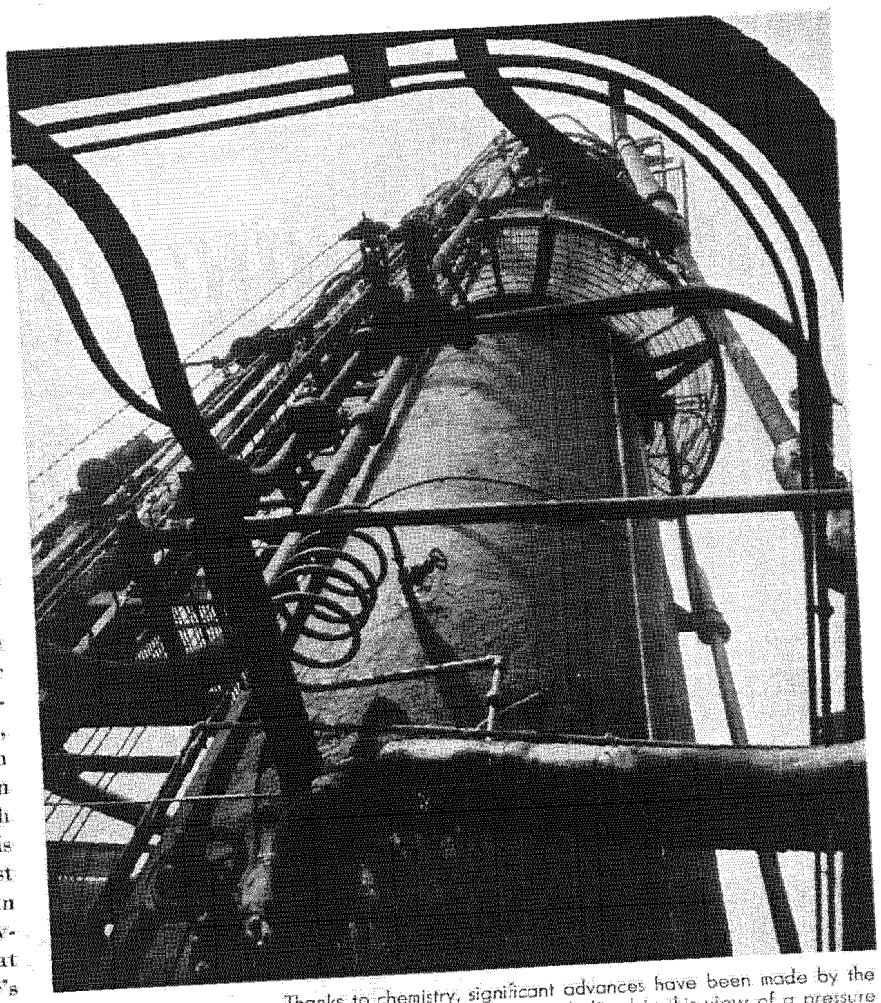
"Goodyear's process of vulcanizing rubber improved its strength and elasticity, and enabled it to resist wear within limits—how narrow these limits were I have already indicated. Also Goodyear's process consumed from three to four hours. The chemist set out to reduce this time by the use of chemical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

"Antioxidants were introduced that

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

"The rubber in common use today is a much superior rubber to that of five years ago, and incomparably superior to the rubber of twenty years ago, but it still has certain deficiencies. It disintegrates when in contact with oil, grease and gasoline. It still falls victim in time to oxidation. . . .

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



Thanks to chemistry, significant advances have been made by the petroleum industry which is symbolized in this view of a pressure still at one of the Philadelphia refineries.

Chloroprene Rubber

"Finally, in 1931, the world-sought material was successfully synthesized by du Pont chemists. Fortunately, however, the product was not true rubber—chemically it was not rubber at all! If it had been, it would have had all of natural rubber's weaknesses. This new material—built up by intricate processes from coal, limestone and salt—looks like rubber and acts like rubber; but it is many times more resistant to mineral oil, grease and gasoline, and to alkalis and most acids; it offers far superior resistance to sunlight, oxygen, heat and age, and it is less permeable to gases. This new material has been named neoprene. It is produced in quantity and is being used in a wide variety of products. . .

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

"In the meantime the price of neoprene stands as a limit beyond which the price of plantation rubber cannot go, which is a significant fact when it is recalled that only in 1925 rubber under the Stephenson Act sold for $1.24 a pound. Neoprene has an enormous immediate value in industry, but compared to its potential value its present status is relatively trivial.

"Other new rubber-like materials also have been developed here and abroad. Each has one or more special properties that make it valuable, and a broad new field in the use of such materials, as well as in the wider use of rubber itself, is opening. Rubber-tired railway and subway trains are now a subject of experiment. In view of the rising opposition to the continuous din of noise that makes our large cities like so many bedlams, it is highly probable that all vehicles such as milk wagons and street cars will be equipped at no distant date with rubber tires. . . . (*Continued on page 22*)

SCORING TWO "FIRSTS"

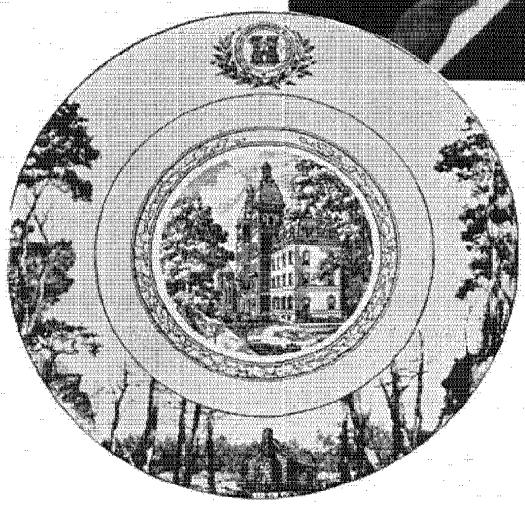
The Scammell China Company wins new distinction for products of high artistic merit



Lamberton Porcelains are truly fine examples of American ceramic art. This seated figure, with classic drapery, broken bay branches and ribbon motif, suggests the Regency style.



D. William Scammell, after thirty-seven years of manufacturing ceramic ware, still comes out with new developments.



Main Hall, one of the twelve service plates commemorating the 150th year in the life of Washington and Jefferson College.

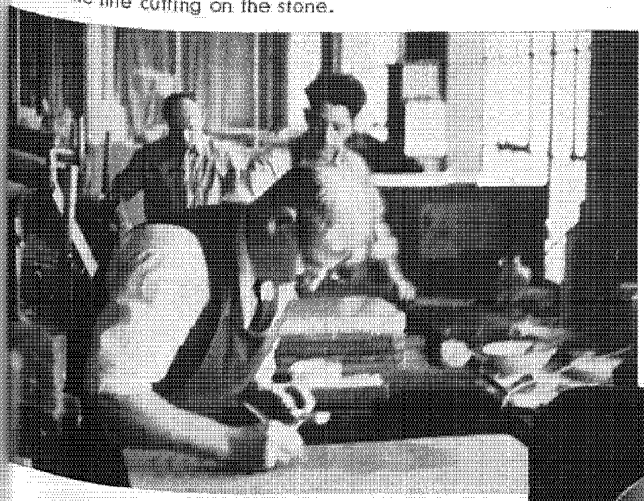
WHEN a manufacturer makes two outstanding contributions to American ceramic art—and these outside his regular line—it is a rare achievement. The Scammell China Company, of Trenton, New Jersey, has done this with the Washington and Jefferson College commemorative service plates and with the beautiful Lamberton art pottery that is now appearing in many smart homes.

Most china and pottery makers usually limit themselves to one line, which with Scammell would be hotel, railroad, restaurant and club Lamberton China services. You have probably seen these wares in the Savoy-Plaza, Waldorf-Astoria and New Yorker hotels in New York City; in the Marshall Field Tea Room and Stevens Hotel in Chicago; in the Barclay and William Penn hotels in Philadelphia and Pittsburgh respectively; and in the dining cars of the B. & O. and Pennsylvania railroads.

Behind Scammell China's venture into these other diversified lines is D. William Scammell, president of the company. Associated with him are his five brothers and Mr. Sutterlin. For thirty-seven years he has been an outstanding leader in the industry and has done much for American ceramic art. His latest enterprises are of interest to du Pont because The R. & H. Chemicals Department has been supplying his company with colors, decorations and body materials for forty-five years.

The porcelain sculptures illustrated here are the first of an extensive collection of American art pottery designed for the modern home. These pieces are already familiar to interior decorators, architects and artists. The body is hard-fired porcelain, reminiscent of fine Meissen. The sweeping lines, delicate curves and fine details have the surety of contemporary sculpture, and are given subtlety and elegance by the rich glaze. All come in lustrous white, some in bisque finish or in a mellow-toned *cafe au lait*.

A ceramic pattern takes form as an expert lithographer does some fine cutting on the stone.

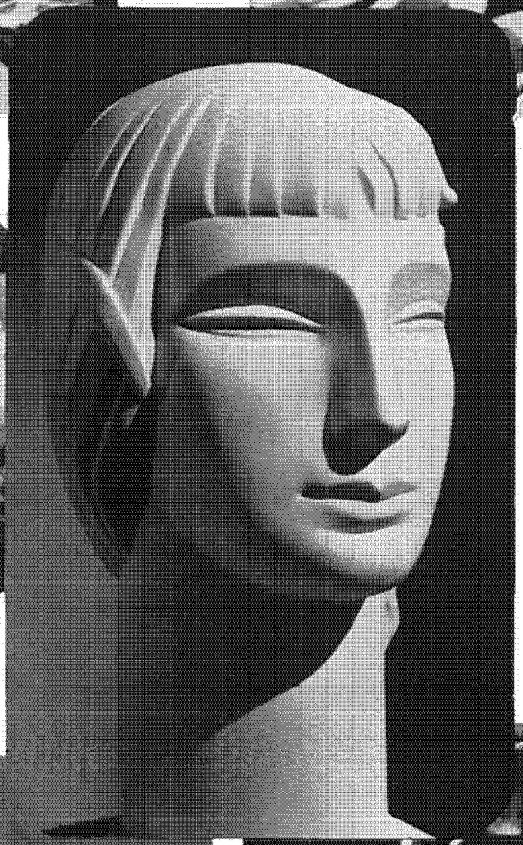




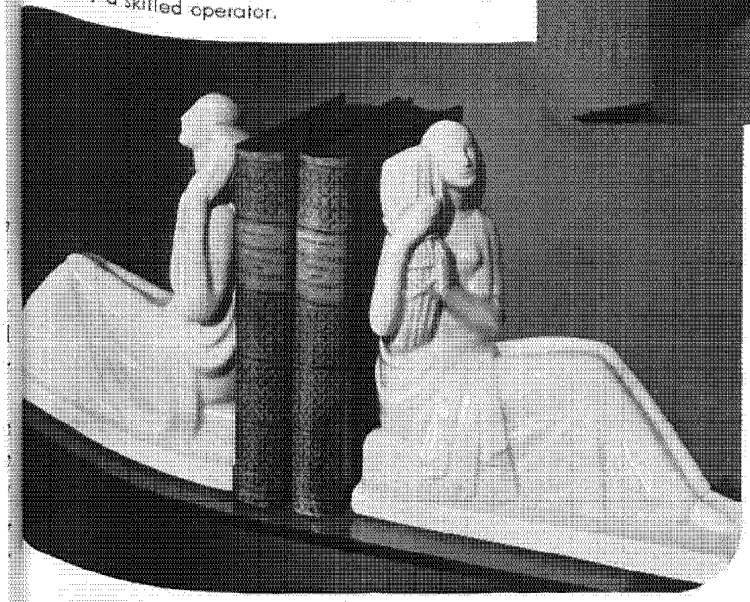
Pouring "slip" in hollow-ware molds at the Scammell China Company's plant, Trenton, New Jersey. Gravy boats are being made, plenty of them.



Banding, which is to say applying ceramic color around the edge of a plate. This requires careful work by a skilled operator.



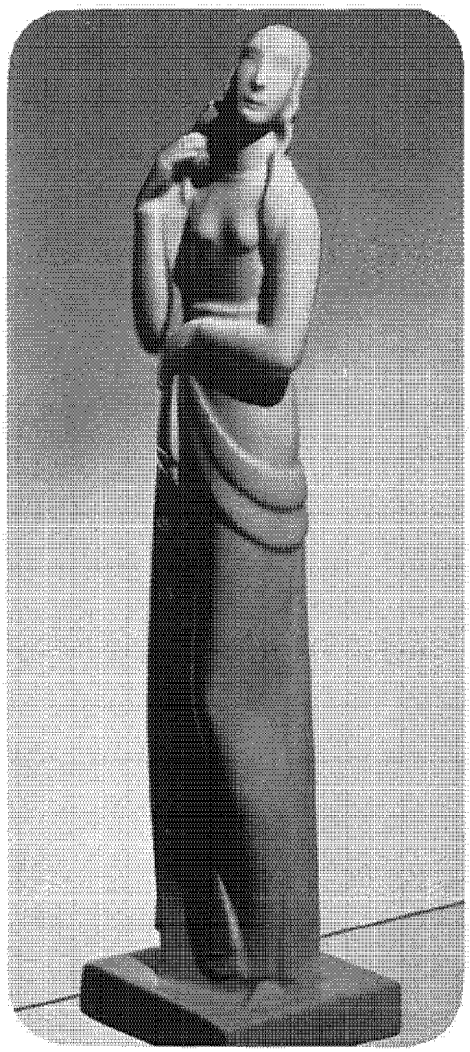
A blend of Greek perfection with contemporary style in modeling. For a pedestal or the mantel.





A typical scene in this busy plant. At this point in the production line, printed decorations are applied by expert workers.

Book-ends of this type are both useful and, in this case, amply decorative. Note the luster.



Figurines are high-style decorations. This upstanding one is more than sixteen inches high.

The sculptured models by Geza de Vegh are styled and sold exclusively by Mary Ryan, of New York City.

Any of the various foreign porcelains comparable to this line are much higher in price, in some instances as much as three times; this, despite the fact that the wage scale of European craftsmen is only one-third that of American workers. In other lines, mass-production methods offset this foreign advantage, but not with the Lamberton porcelains. Great skill and craftsmanship are required to produce each piece. Some of the molds have as many as thirty-seven parts which must be withdrawn most carefully to avoid breakage. Seams are then removed and the surfaces prepared for finishing.

These decorative porcelains probably will never form a profitable line, but Mr. Scammell continues to manufacture them; he enjoys making beautiful things.

The Washington and Jefferson College commemorative plates rate a "first" because the decoration is of a type never before employed for a small issue. There have been all sorts of souvenir plates, but they have been decorated by costly hand painting, except in the case of long runs and simple designs. By means of decalcomanias, a type of transfer, twelve colors are applied to each of these plates! This is in itself a noteworthy achievement because the production methods employed have made possible offering these plates for sale at a nominal price.

The plates are ivory-tinted china with the decorations applied over the glaze. The decalcomanias, all of which are made by the company, present the chief problem. Minutely accurate art work is required in preparing the lithograph stones and the zinc and copper plates. From these, the designs are printed in varnish on tissue paper. Then the ceramic colors are dusted on the tacky surfaces. Extreme precision is required throughout. To insure proper register of the designs, the room where the decalcomanias are made is air-conditioned to prevent the paper from shrinking or expanding. Twelve days are required.

There are twelve plates in the series, and at the center of each one is a pictorial design related to the history and development of Washington and Jefferson College. The border, in yellow, brown, green and red, shows the original log building flanked by native trees. The college coat of arms is in brown, black, green and red. Dr. Ralph Cooper Hutchinson, president of the College, autographed the first 200 dozen plates. Decorations are by the late Emil Schnepf.

Some day these plates may have a collector's value comparable to that of the famous B. & O. blue china, which, incidentally, was produced by Scammell.

And that brings us back to the company's regular line and to an interesting side-light. A couple of decades ago china breakage in the average hotel amounted to fifty per cent each year. Today, with much lighter ware, it is only twenty-five per cent. Finer body materials, which include United Feldspar Corporation's "Chemi-Trold" products of definite specification, and improved manufacturing methods have made possible china of greatly increased strength. Lighter and more attractive ware is found nearly everywhere today, even in dairy lunches.

At the same time, new and better ceramic colors and decorations have matched this improvement in bodies. Formerly, a glaze had to be applied over the colors to make them permanent. Now, The R. & H. Chemicals Department is supplying colors that are relatively unaffected by washing, wear and acids. These colors, applied over the glaze as in the Washington and Jefferson plates, retain their brilliance and uniform intensity.

Ceramic color manufacturers have contributed to the development of distinctive American china and pottery of good quality by supplying materials adapted to modern production methods. Today, colorful wares of this kind, with definite domestic character, are available at popular prices, which in itself is an achievement and justly recognized in the stamp on the back, "Made in America."

E. A. SAMPSON

FINE PACKAGES FOR FINE THINGS



Lingerie retains its pleasing freshness when wrapped in "Cellophane."





The size and style of garments can be seen clearly through these "Cellophane" wrappers.

HAVE you ever noticed a table of women's lingerie in a department store after a sale has been in progress for even a short while? If one deliberately sought to mess things up, he could hardly do a better job.

Naturally, the slip, the pantie or nightgown is not particularly inviting after it has been handled by the shopping throng. The effect of daintiness and freshness which the manufacturer has taken pains to create has been thoroughly dispelled.

There is a different story to tell about the lingerie found in many stores today. Because progressive retailers try to give women what they want, they have welcomed the packaging of this intimate apparel in delicately attractive wrappings of transparent "Cellophane" cellulose film.

These packages not only look clean, but they are clean. There is not a spot or a finger-print on the garments when they are unwrapped and the purchaser knows that she is the first to handle them. Of course jumbled-up heaps of goods on the counter are being replaced with neat stacks of these sanitary and inviting packages. They are garments to please the eye and to gratify the wish of the most discriminating shopper.

In addition to the cleanliness of this type of package there is another advantage — on the outside is printed information that is of importance to the shopper. Take, for instance, the package illustrated on this page. It tells "which to wear and when," tells how to launder, gives the price and describes the salient features of the garments.

Clean, convenient packages can be found in more and more stores today, where they help to make lingerie buying easier and more satisfactory.

F. M. BURGESS

SAFETY

BY H. L. MINER, *Manager*
SAFETY AND FIRE
PROTECTION DIVISION

IN recent years industrial safety has become a problem to which enlightened business executives have devoted much time and money. Many companies now have well-developed programs, and some of them have achieved remarkable "no-accident" records in the face of hazardous operations. Safety projects, at least on the present scale, are comparatively recent developments. Let us review the progress that has been made.

It is impossible to fix a definite date for the birth of a safety movement either in American industry or in the du Pont Company. We know that when E. I. du Pont de Nemours built his first powder mill in 1802 near Wilmington, Delaware, the building was constructed of heavy stone masonry on three sides, with the fourth side open and facing Brandywine Creek, so that the force of any explosion would be directed where it would do the least harm. We also find evidence that even at this early date other safety measures were considered in both construction and operation.

Even though the founder designed his mills to make them as safe as possible, and doubtless instructed his employes to be careful, not many years passed before there was an explosion in a drying house. Fortunately, with wind and weather conditions favoring, the fire which ensued did not spread to other buildings. That was in 1807. No other serious mishap is recorded until 1818 when five powder mills exploded, almost demolishing the entire plant and with it tons of powder. Thus, early in E. I. du Pont's experience as a manufacturer, the necessity of safety was borne home.

Another historic incident that had its bearing on the subject came to light in 1835, when a shipment from Wilmington to New York was made for use on the *U. S. Constitution*. The powder was moved part way by rail in box cars over which damp cloths were placed to minimize the hazard from flying sparks. The locomotive was coupled to the train at the rear as a further safeguard.

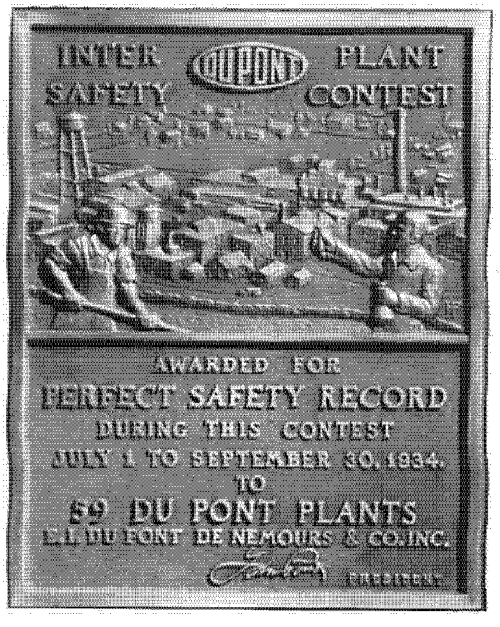
Safety traditions in the du Pont organization grew up with the business from the early days. For one thing, no employe, however experienced, was permitted to start making powder in a new or rebuilt mill until one of the executives had personally operated it. And for generations when an accident, fire, or explosion occurred, the owners took charge of each emergency. The older employes delight in recounting dramatic incidents, as for example, when a du Pont president rushed into the Brandywine and, using his high silk hat as a fire bucket, scooped up water to cool an overheated bearing in one of the nearby mills he had been inspecting.

The hazards of powder making were of a kind to encourage a zealous regard for safety. But later, when the Company's business had become expanded and new plants were built in other states, it was no longer possible for the owners to give close, personal supervision to all plant workers, and careless practices occasionally resulted in serious consequences.

The period 1895–1900 might be termed the renaissance of accident-prevention in industry with chief emphasis on guarding or protecting the obviously hazardous places. This work was accomplished usually by following out the ideas of the individual operators involved. We find toward the end of this period the development of spiked feet for ladders; cage guards for belts, pulleys and moving machinery; handrails, and guards for machine tools such as circular saws, jointers and grinding wheels.

Also, during this period an effort was made to provide protective clothing such as rubber gloves, aprons, leggings and special shoes for protection against chemicals, molten metals and other materials. But little or no thought was given to the individual employe's attitude toward accident prevention. He was supposed to rely on his own judgment and to look out for his own welfare. Such safety developments as did take place during this period were confined chiefly to a few of the larger companies.

The second stage in the development of accident-prevention work started about 1900 when industry, realizing more fully its responsibility for accidents, began to take more defi-



Bronze plaques were awarded to group winners and plants with perfect scores at the end of the contest.

IN INDUSTRY

Intelligent, organized effort yields results in accident prevention. The du Pont record is reviewed briefly

nite steps toward their prevention. The amount and quality of mechanical guarding increased and efforts were made to follow a standard procedure. About this time, too, it became apparent that mechanical guarding alone would prevent only certain personal injuries and that, to eliminate most of the accidents, something must be done to improve the safety attitude of the workers and to combat ignorance, haste and carelessness.

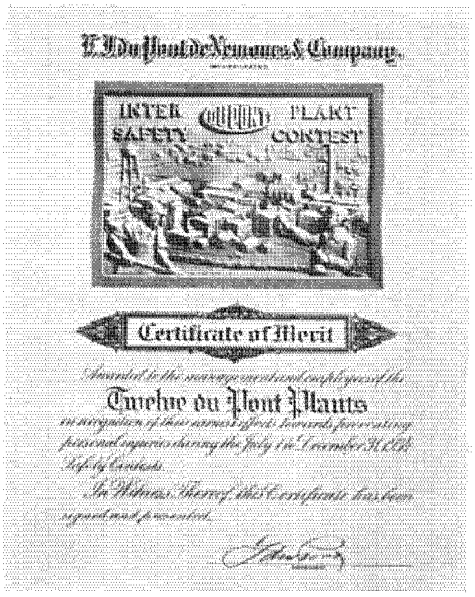
As early as 1904 carrying matches in du Pont plants was prohibited; special shoes and clothing was provided for powder workers, and emergency water tubs were installed for use, if an employe had the misfortune to be burned with some acid. Yet, the Company's safety efforts were not actually organized until 1911. At this time safety commissions composed of operating and main-office executives were appointed to study and promote personal-injury-prevention measures. These commissions promulgated formal rules governing certain operating methods and practices; prepared standard drawings for construction design and mechanical safeguards; introduced injury report forms and methods of tabulating injuries; made plant and equipment inspections and supervised other miscellaneous safety features. All of this information was then assembled in a code book which was distributed to all plant and operating department heads and to other interested persons.

The third stage of accident-prevention development in the du Pont Company—and for that matter in the United States as a whole—started late in 1914. At that time the rapid expansion and speeding up of industry, with the subsequent employment of many thousands of inexperienced workers, necessitated better organization and more comprehensive safety programs, if personal injuries were to be kept at a minimum.

In the du Pont Company the early safety commissions were replaced with a special staff in the Engineering Department known as the Safety Division, which functioned as a central clearing house for all safety items and also served in an advisory capacity for all plants. Following its establishment, safety departments with safety engineers in charge were installed at most of the larger plants. Gradually it became apparent that accident prevention was not a job for one man or any group of specialists, and that to obtain best results, the operating organization would have to be brought into this field. Accordingly, safety committees were established in the plants to supplement the work of the trained safety inspectors. Workmen were now given an actual part in the program.

During the period 1915–1919, which really marked the beginning of our present-day safety activities, new safety programs were formulated and a definite system was established whereby all major injuries and data on minor injuries were reported to the Wilmington Office. There, injuries were tabulated and analyzed to determine the most prevalent causes. Operating safety rules for all plants and for each department were formulated locally and in conjunction with the main offices. These rules were printed and posted in the plants. Safety standards were developed and issued in three booklets, and in a fourth, the Company's plan for safety organization and education was outlined.

Following the emergency period and during the years from 1919 to 1926, which might be called the fourth stage, we find the safety movement in the du Pont Company halting for breath, so to speak, and taking stock of itself. Also, about this time the Wilmington Safety Division became a section of the Service Department which combined under one head many general activities such as medical care, safety, fire protection, personnel, compensation, industrial relations and salvage and reclamation.



This certificate of merit was awarded to twelve plants which made a splendid effort but came short of having perfect records.

In 1926 the safety and fire-protection work was combined in one unit now known as the Safety & Fire Protection Division. That year may be considered as the beginning of the fifth and most recent stage of the Company's work to prevent personal injuries. It might also be termed the effectuating and refinement stage that developed a really effective program and resulted in our present remarkably low-accident rates.

The organization of plant personnel to carry out the safety activities was perfected, standardized and made effective. The scope of the educational program was broadened to include every worker. A detailed, periodic inspection service to the plants was begun. As personal injuries became less frequent, each employe took pride in that accomplishment and sought to make his own record and that of his department outstanding for safety. The prevention of personal injuries thus finally and definitely became an important part of the operating routine and safety work was placed on a sound foundation.

One means of teaching safety to the individual employe that stimulated and sustained his interest in preventing personal injuries was the Safety Poster Contest entitled "What is Wrong in This Picture?" The idea was the result of a poster submitted in 1927 by a draftsman at the Wilmington Machine Shops. In typical cartoon style he portrayed a number of unsafe practices and conditions he had observed, and this suggested a contest to teach employes, through pictures, to recognize industrial hazards.

In preparing the contest posters, the records of the Company were analyzed to determine the chief causes of major injuries, and plant inspection reports were also reviewed to determine what conditions were found to be most troublesome. As a result it was decided to call attention to 104 practices or conditions that were likely to result in personal injuries and fires, or that were incompatible with good housekeeping rules. All of them were portrayed in posters showing six typical plant scenes.

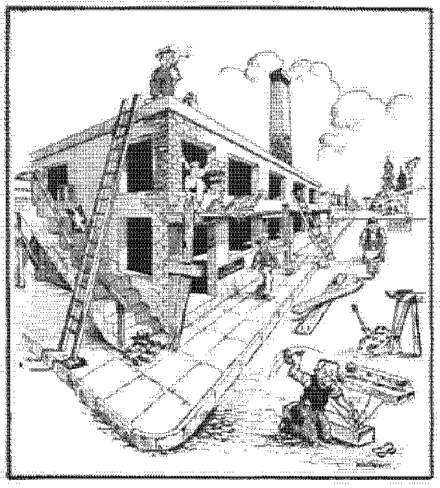
With few exceptions, all plant payroll employes of the du Pont Company and its subsidiaries were eligible to enter the competition, and the rules were made very simple. A poster was given to each employe with instructions to "draw a circle around each of the things you think is wrong in this picture and explain why you think so on the back."

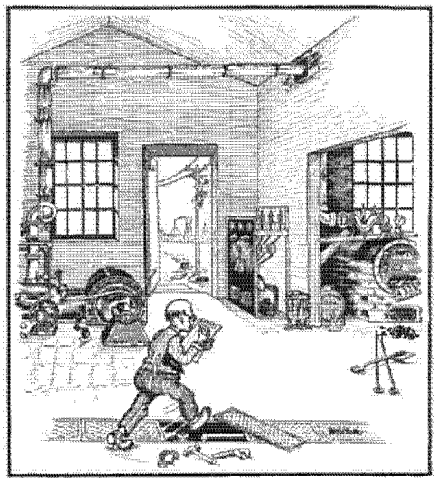
Of the approximate 15,000 eligible employes, 11,000 actually took part. Cash prizes ranging from $5.00 to $50.00 were offered by the plant managements, and the Company also offered twenty-five additional prizes aggregating $250.00. By means of this contest the workmen learned to recognize unsafe practices and conditions and how to correct them, and the beneficial results were immediately seen in substantial reductions in the injury frequency and severity rates.

Much has been accomplished through the Company's no-accident award plans, no-accident monthly campaigns and inter-plant competitions to eliminate unsafe practices and conditions. All these important links in safety education have been strengthened, with the result that du Pont's present safety record is an excellent

(Continued on page 24)

WHAT'S WRONG WITH THESE PICTURES?





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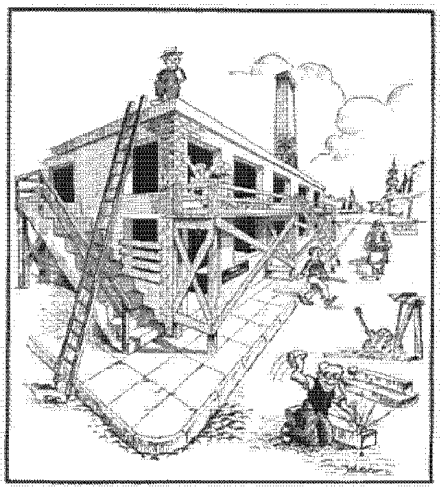
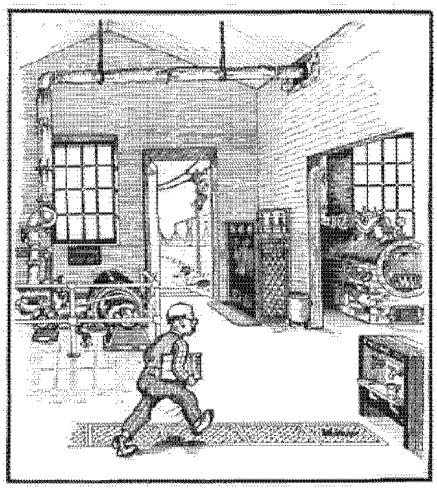
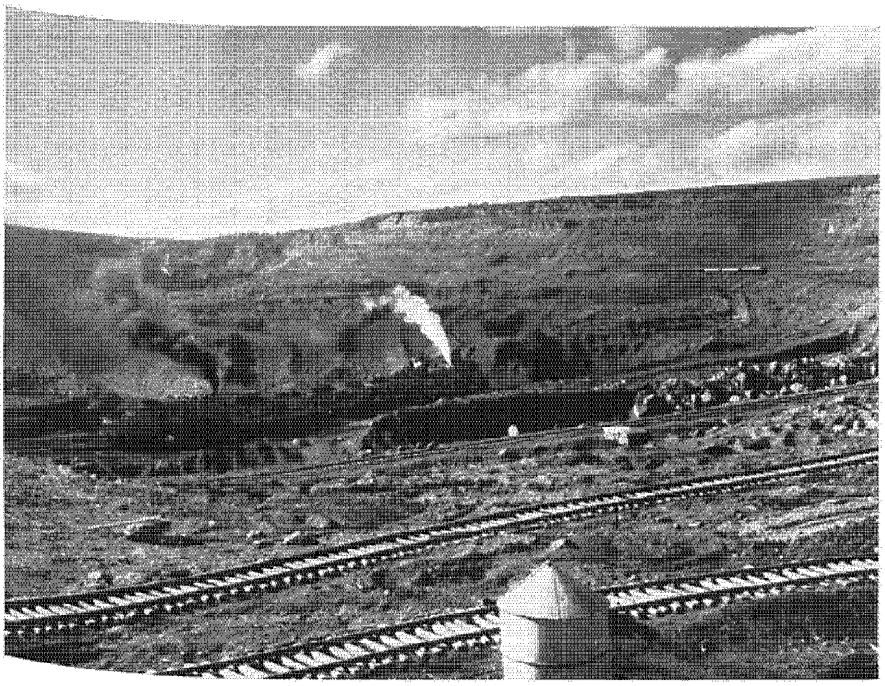




Contest posters like these started thousands of employes looking for hazards and applying the lessons portrayed in these pictures.

THE LARGEST OPEN-PIT IRON-ORE MINE



BY ROBERT YARNALL RICHIE FOR THE U. S. STEEL CORP.

It is known as the Hull Rust-Mahoning Group and is located on the Mesaba Range at Hibbing, Minnesota

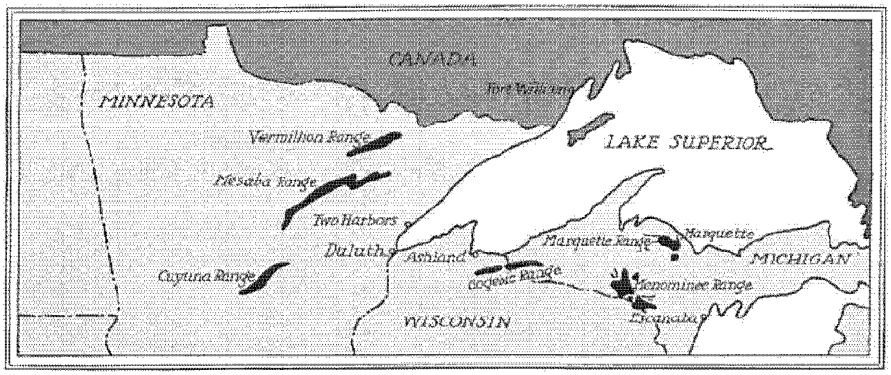
A partial view of the great hole in the ground near Hibbing, Minnesota. From this pit, with its seventy miles of track, millions of tons of iron ore have been removed. A loaded train, center, is about to start on its way to the top.

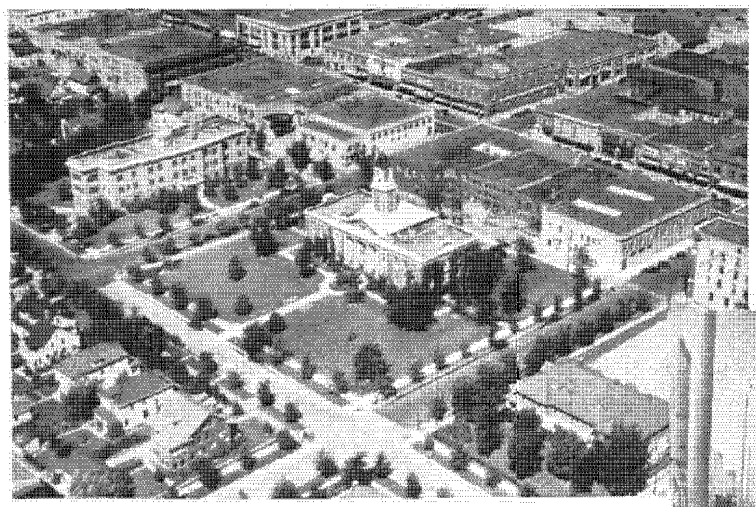
ONE of America's awe-inspiring spectacles is the Grand Canyon of the Colorado River where visitors stand speechless as they look across a great hole in the ground—Nature's handiwork, the result of thousands, perhaps millions of years of erosion.

Less beautiful in coloring, but hardly less impressive is another scene in northern Minnesota, a great irregularly-shaped gash where man has blasted and carried away enormous quantities of earth and iron ore to serve our nation's industrial needs. If you can imagine a pit with an area equivalent to eleven 100-acre farms, a hole that stretches out two and one-half miles long, and from a half to one mile wide, its depth at one place 350 feet, you will have some conception of this hole and the amount of material that has been removed from it since 1895. Builders of the Panama Canal excavated altogether about 232 million cubic yards. At Hibbing the count in 1936 had reached a total of nearly 225 million cubic yards of earth, rock and iron ore.

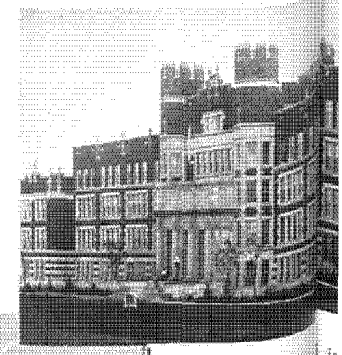
It is claimed that iron ore was first discovered on the eastern part of the Mesaba Range in 1872, but it was not until twenty years later that ore was found in the locality where now is operated the largest open-pit iron-ore mine in the world.

The story goes that some lumberjacks, while digging a water well at a lumber camp, encountered the heavy, dark-red dirt without realizing that they had broken into one of the most





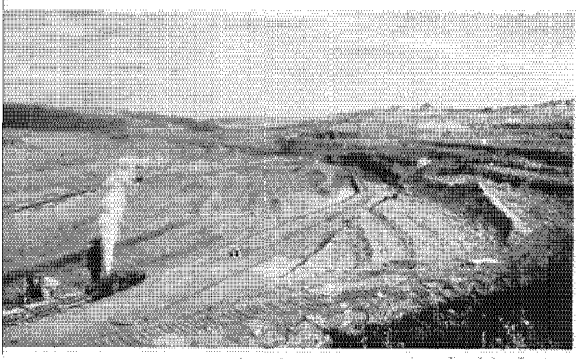
LEFT: Hibbing as it appears today. Note the Village Hall, center, and the hospital, left. Howard Street, the main thoroughfare, can be seen in the background.



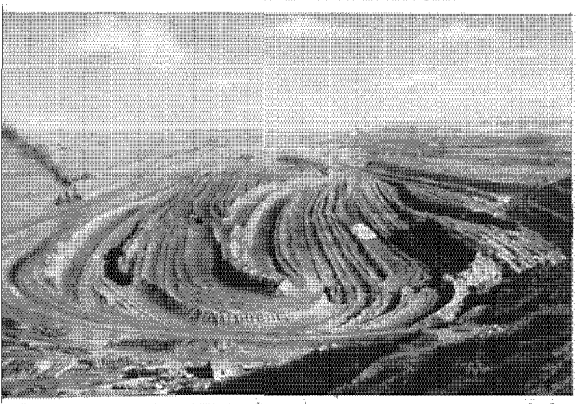


Hibbing's Hi... over $4,000,... several years...

LEFT: Main Stre... was moved. A... a part of the ...



ABOVE: Another picture taken by Mr. Richie is included here to show you one of the big locomotives now used in the pit.



ABOVE is shown an extensive view of the open pit. BELOW: A glimpse down into the "Grand Canyon" of the Mesabo Iron Range. Both pictures were taken several years ago.

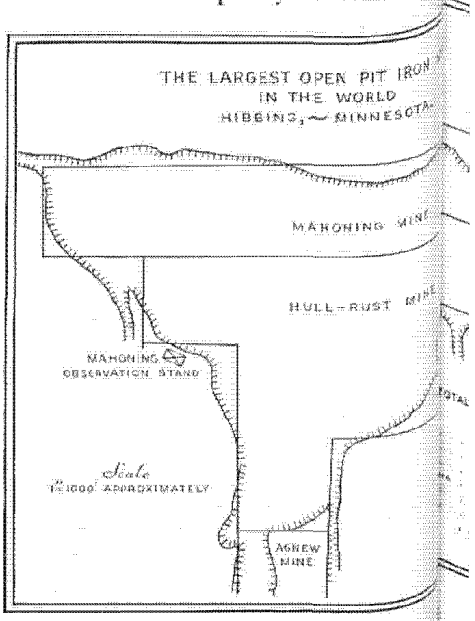


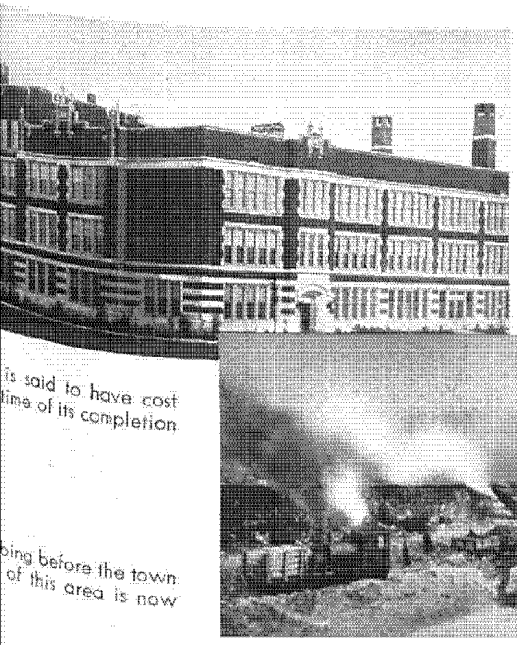
extensive bodies of iron ore ever found. The first year saw exploration work spread east and west with evidence of ore for miles along the range. The first estimates of mineral wealth in the region were ridiculously low compared with the facts as they became known. In 1895 contracts were let to remove the overburden by stripping so that the ore could be mined economically, and a railroad was being built from Duluth to Hibbing so that the ore could be transported to the docks; thence, by boats down the Great Lakes to steel mills in the East.

The first pay dirt was removed by men who used hand shovels to load the material into wagons; however, this method proved so laborious and ineffective that contractors brought in small dump cars capable of holding a cubic yard or a yard and a half of material. Horses and mules furnished the motive power for hauling. Later, cars of four- and five-yards capacity were introduced; they were pulled by twelve-ton "dinkey" locomotives operating on a narrow-gauge track.

Steam-shovels, too, had come into the picture as loading units, and nondescript machines they were, resembling a cross between a bunkhouse and a locomotive. When one dug into a bank of ore or dirt, the tail end reared, the stack shivered and belched out fire, cinders, smoke and steam. And the result of all this effort was to transfer as much as three-fourths of a yard of material into the car. In short, the equipment of these early days affords a striking contrast with the present-day electric shovel, weighing 350 tons, that hoists sixteen tons per swing into thirty-yard dump cars so smoothly and quietly that one would hardly know it was operating if he did not see it move.

With the multiplicity of uses for





is said to have cost
time of its completion

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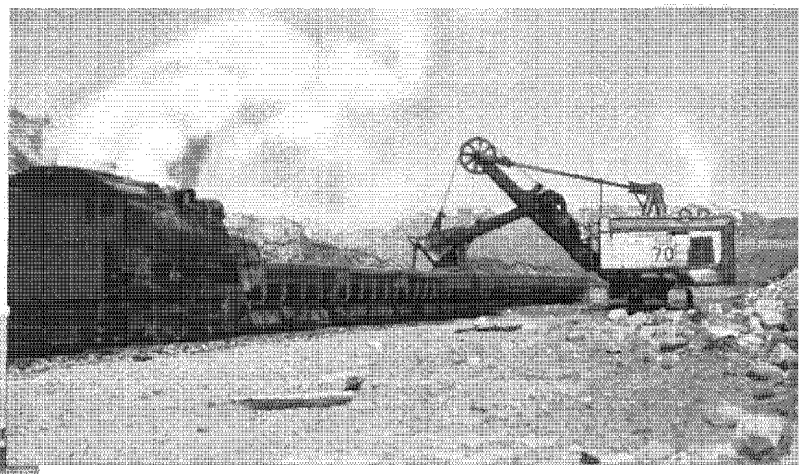
of this area is now



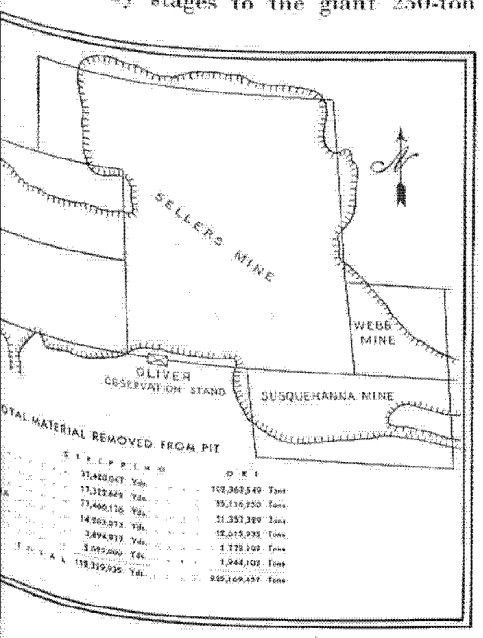
A study in contrasts. ABOVE: A caterpillar-mounted electric shovel loading a train of 30-yard dump cars. LEFT: Early types of equipment used in the pit for stripping operations. Note the small dump cars.

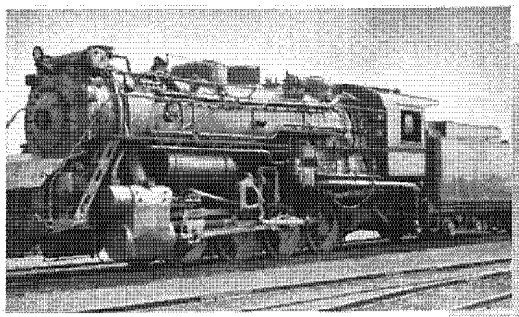
steel and the rapid increase in the demand for iron ore, production problems pressed for solution and presaged a steady flow of improvements in mining, material-handling and transport equipment. Looking back, it is hard to realize that not many decades ago twelve-ton "dinkeys" were the prototypes of 200-ton locomotives that now haul from the pit trains of fourteen to sixteen cars, each loaded with from fifty to seventy-five tons of ore. Shovels, too, have increased in size by stages to the giant 250-ton steam and 350-ton electric units. And the dipper capacity, starting with a small shovel capable of scooping up a half yard of material, has likewise been increased up to six, seven, eight and ten cubic yards.

The mining companies that have operated in the big pit have played a major part in the development and improvement of many kinds of equipment. They were the pioneers of open-pit mining and their heavy production schedules for many years have imposed on the operating equipment extraordinarily severe service tests.

Ever since man began to extract mineral wealth from the earth, he has realized that human strength has its limitations, and has therefore sought to find easier and better ways of doing useful work. Machinery and tools have lightened his labors, but big-scale iron-ore mining would not have been possible or practicable if it were not for the service rendered by explosives. They have been one of his most efficient aids.

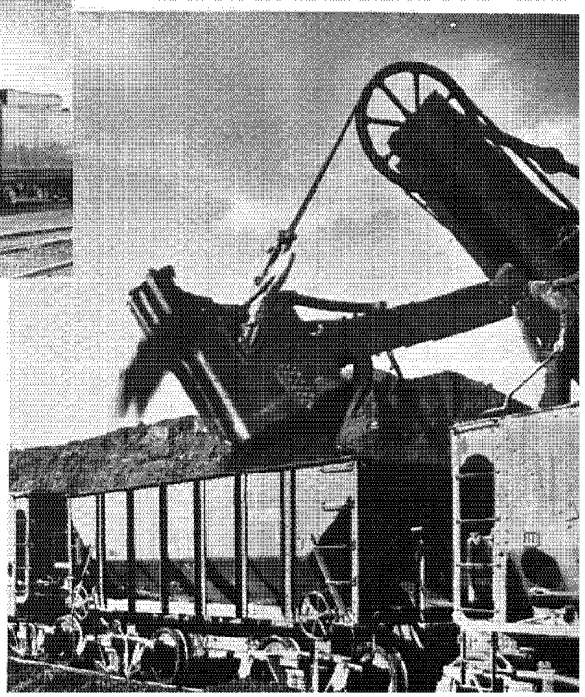
And mining methods on the Iron



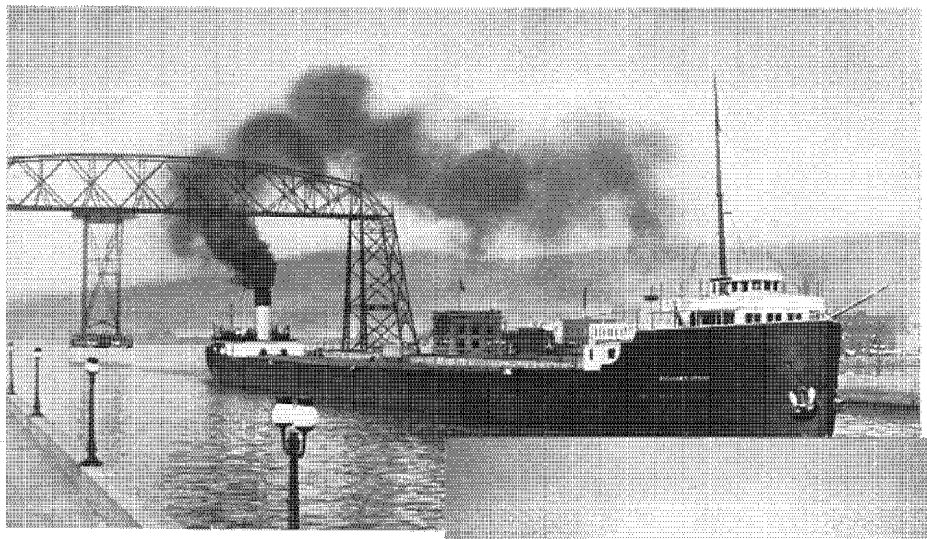


The present type of locomotive is known as the "700" class. Note the "booster" on the tender to supply additional power in hauling ore and stripping from the pit.

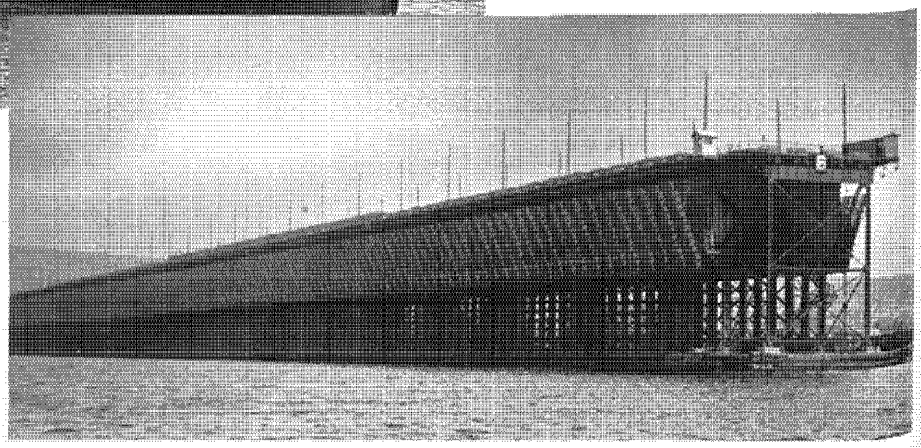
BY ROBERT YARNALL RICHIE FOR THE U. S. STEEL CORP



Up goes the dipper, down comes the load. A "close-up" of one of the big electric shovels in action near Hibbing, Minnesota.



Hundreds of freight boats of this type shuttle back and forth from Lake Superior ports to others in Lake Erie. Iron ore moves south and coal, north. This view shows one of the boats at Duluth.



Dock No. 6, at Duluth, Minnesota, is said to be the largest iron-ore dock in the world. It is owned by the Duluth, Mesaba & Northern Railway Company. Trains discharge the ore into pockets from which the cargo boats are loaded in a surprisingly short time.

Range have kept pace with mechanical progress. It is axiomatic that if one expects to obtain the full benefit of the force stored up in a quantity of explosives, the load must be placed in the proper position with respect to the work to be done. For example, in a bank of ore or frozen dirt this place is below and behind the burden. In the early days before power drills were invented, preparing holes for a blast was slow and tedious work. Long drills were bodily lifted and dropped by man power until the bits were forced down to the required level. And the result in each case was a hole so small in diameter that one found it difficult to load a sufficient quantity of explosives to get good breakage.

Later, "gopher holes" or tunnels were driven in from the face of the banks, and at the far end charges of black powder were loaded, whereupon the hole was filled with tamping material and the shot was fired. This blasting technique was effective, but the digging was expensive and likewise dangerous. Cave-ins occurred, material frequently fell from the crest of the bank, and blown-out shots were not uncommon.

The solution of this problem was at first a portable well-drill rig driven by a gasoline engine. Drills of this type have now been replaced by caterpillar-mounted electric well drills that can be moved quickly anywhere in the pit and used to put down holes six inches in diameter to any depth required. Bore-holes of this size permit of loading dynamite properly and in amounts sufficient to obtain effective results from the use of modern explosives.

Hibbing, Minnesota, is not only famous as the location of the world's largest open-pit iron-ore mine, but it came under the spotlight in the early 20's when proposed mining activities introduced a new civic problem. At that time the pit had extended around three sides of the town, and there were indications that the main ore body was supporting a portion of the village. With industry clamoring for more ore, something had to be done, and the problem was solved by moving from this area many buildings a mile and a half south to what was then a residential suburb. It was not uncommon to see two, three or four structures being moved on wheels through the town and toward new foundations made ready to receive them.

Along with this moving program was the construction of a new village hall, fire departments, hotels, a hospital, bank buildings, apartments, department stores and business structures of all kinds. Hibbing today is a beautiful up-to-date village of 15,000 people as will be noted from a study of one of the accompanying illustrations.

Iron ore shipments from Hibbing were largest during the seasons of 1916 and 1929 when traffic over the seventy miles of rail lines in the pit

(*Continued on page 21*)

LITTLE LADIES OF FASHION

Tiny figurines model garments of "Acele," du Pont's acetate rayon yarn

FOUR years ago Lester Gaba fashioned a doll from a piece of soap, not an ordinary doll, but a mannequin in miniature—long-limbed and exquisitely proportioned. Officials of the du Pont Company liked it as a model for displaying garments made of fabrics of their "Acele" yarn and asked for nine copies to be made, in plaster. The next year new models and more plaster copies were added to the group; and the little ladies, impeccably dressed in hand-tailored garments, began to visit the show-rooms of selected manufacturers and retail establishments selling fabrics and dresses made of "Acele."

Today the mannequins are made of rubber and hundreds of them are kept "on the road." Each one is dressed individually, in the height of fashion, and the garments are tailored so meticulously that there are often many fitting operations in making one dress.

The "Acele" figures are used frequently in fashion shows, usually with the portable theaters that accompany them. These miniature theaters are themselves works of art, of enameled wood with lacquer finish, and chromium bars and pillars. Recently they have been equipped with sound—a short interval of music before the performance; a commentator's introductory remarks, then the dolls' own description of their costumes. One of these theaters is now in operation at the New York Museum of Science and Industry, Rockefeller Center, New York City, in conjunction with the du Pont chemical exhibit, Better Things for Better Living Through Chemistry.

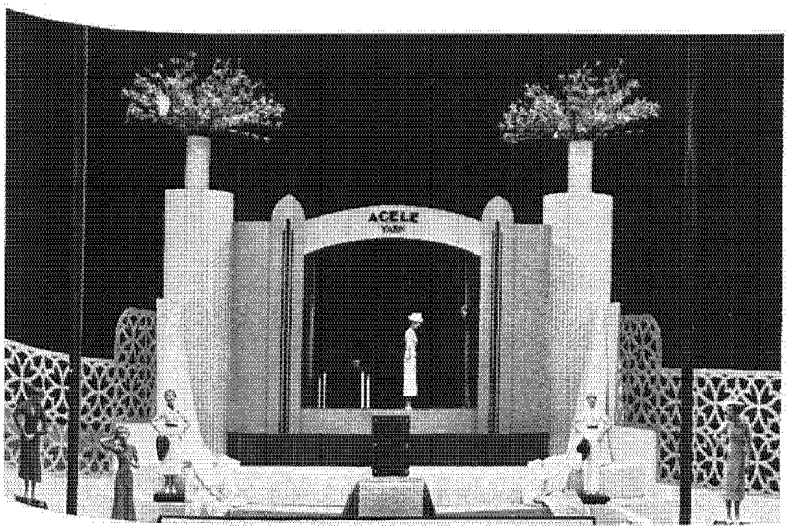
Sometimes the mannequins are arranged in cleverly constructed settings or against colored resort backgrounds,



Here is a typical mannequin, in a smart frock of "Acele" acetate rayon yarn.

and displayed in important retail store windows and manufacturers' show-rooms. They are routed from one place to another, and a record, on a large chart, is kept at the home office, showing the whereabouts of each one.

These popular little ladies, with their pert features and the charm that goes with all beautifully-made objects in miniature, are becoming almost as well known as the name "Acele," which is the registered trade-mark name for du Pont's acetate rayon yarn.



One of the portable miniature theaters, showing a mannequin crossing the stage.

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VOL·XXXI · May 1937 · NO·5

YOU CAN COÖPERATE

FEWER children were injured last year by playing with blasting caps than in 1935, according to information collected by the Institute of Makers of Explosives. The reduction in the number of such accidents—nearly ten per cent—was accomplished despite a more than twenty-seven per cent increase in the use of explosives. Nevertheless, 213 children under sixteen years of age were injured from this cause.

Eleven years ago the Institute started an educational campaign to help reduce such hazards, and with the Bureau of Mines, Department of Agriculture, Boy Scouts, Girl Scouts, school organizations and civic bodies actively cooperating, definite progress has been made—but not enough.

Blasting caps are small, copper cylinders, a quarter of an inch in diameter and about an inch and a half long. They resemble an elongated .22-calibre rifle cartridge, minus the bullet, although the type designed to be exploded by electricity has wires attached. The caps, used for detonating dynamite, are filled with a very sensitive, powerful explosive, such as fulminate of mercury or lead azide.

Workmen, in spite of the most earnest warnings, leave caps heedlessly about mines, quarries, construction work, on farms, or even in their own homes, and too often children find these caps and are maimed by them. If the little capsules are picked at, lightly pounded or brought near a flame, a powerful explosion is certain to result, with blinding bits of copper flying in every direction. One cap alone will rip a hole through a plate of steel a sixteenth of an inch thick.

Blasting-cap accidents among children occur in every month of the year. However, it is during this season especially, when young folks start to play more out-of-doors, that the accident curve begins to rise until it reaches a peak at midsummer when quarrying, construction, and land-clearing projects are in full swing.

Now is the time, therefore, to warn boys and girls of the dangers of playing with these little copper-cased tubes. Or to repeat such warnings, if they have already been given. You can help by telling your children that playing with blasting caps is as dangerous as stirring up a coiled rattlesnake.

ANOTHER RECORD YEAR

THE recently-published annual report of W. S. Topping, chief inspector for the Bureau of Explosives, Association of American Railroads, throws another interesting sidelight on industrial safety, a subject referred to elsewhere in this number. For the past thirty years the activities of this Bureau have centered on efforts to insure the safe transportation of explosives and other dangerous articles, and highly creditable results have been obtained.

Last year, according to a review of this report in *Railroad Data*, the railroads of the United States and Canada transported approximately 400,000,000 pounds of commercial explosives—dynamite, black powder, blasting caps and fulminate of mercury—without a single explosion taking place and without any person being killed or injured. That is an excellent safety record, but it is merely the continuation of a similar record set up each year during the past decade.

IN SHARPER FOCUS

THE term "streamlined" is applied to many things—trains, airplanes, underwear, beverage bottles, cosmetic containers and even gravestones. And "air-conditioned" in common, if not correct parlance, is so broadly descriptive that the National Better Business Bureau, Inc., some time ago came to the rescue. With the aid of dealers and engineers, it has sharpened the focus in one case by pointing out that:

1. Summer air-conditioning should, as a minimum, cool, dehumidify and circulate the air;
2. Winter air-conditioning should, as a minimum, heat, humidify and circulate the air;
3. Year-'round air-conditioning should, as a minimum, cool and dehumidify the air in summer, heat and humidify it in winter, and filter and circulate it.

That is information briefly stated and well worth remembering.

PICKING FLOWERS

THE cover picture this month we hope will strike home to everyone, with the memories it brings and the thoughts it inspires. Can you remember the thrill of finding the first field daisies or dandelions of the spring, and how eagerly you gathered a fistful of them to take home to mother, just as this youngster will probably do? She was as pleased as if they had been gardenias or orchids.

The old saying, "It's not the gift but the giver that counts," is as true today as it ever was. Even a bouquet of field daisies or a sincerely-spoken word of appreciation is more precious than an expensive gift that carries a "duty" tag on Mother's Day.

This picture is from the collection of H. Armstrong Roberts of Philadelphia.

What's NEW

NEW beauty in "Pyralin" plastic boudoir sets is exemplified in the "Patrician" pattern, of Celestial material in alabaster effect. The colors, too, are new—Tea Rose, Bonnie Blue, Fern Green and Hyacinth. The outstanding feature of this pattern is that the clear, crystal-like handles are made of the new du Pont plastic named "Lucite."

A BRIEF review of electroplating, discussing the present need for scientific analytical control, is contained in a new service bulletin on "Solution Control for Electroplating" just issued by the Grasselli Chemicals Department.

ONE problem that has puzzled merchants whose stores are air conditioned has recently been solved by the use of the du Pont product trade-marked "Cel-O-Glass." Lightweight doors for summertime use are made with panels of this transparent plastic coated-wire mesh, which admits light freely but excludes hot air from the street. Doors of this construction are attractive and also meet the requirements for protection perfectly.

THE R. & H. Chemicals Department has instituted a new style service for the American ceramics industry with the publication of the first of a series of bulletins illustrating and briefly describing a selection of new and novel designs in tableware, pottery and glass. The initial number, entitled Foreign Fashions in Ceramics and Glass, features Parisian trends as noted by the trained observers of the du Pont Style News Service overseas. This booklet is intended solely for the designers and manufacturers of American ceramics and glass, and its distribution is restricted to these groups.

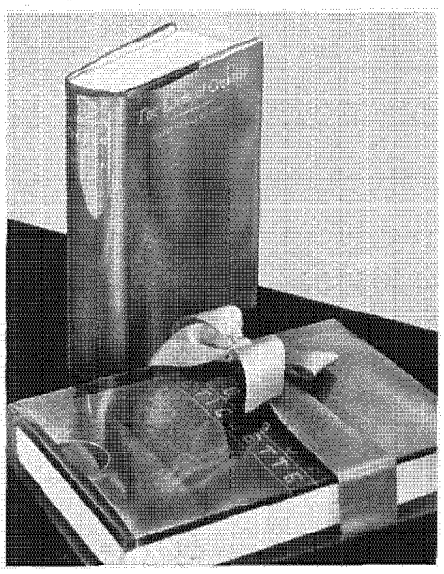
ONE reason why you see fewer motor cars stalled along the highways is that ignition cable has been improved. Copper wire insulated with rubber has been further protected by an extra jacket of neoprene to prevent deterioration from heat, oil and oxidation. The news is that The Rajah Company, of Bloomfield, New Jersey, which manufactures spark plugs and terminals, is now supplying neoprene nipples that resemble straight-stem tobacco pipes. The ignition cable is inserted through the "stem," and the "bowl," inverted, fits over the top of the spark plug to keep out water, oil and grease.

RECENTLY installed in one of the rooms of the Rubber Chemicals Division on the eighth floor of the du Pont Building is an interesting exhibit of commercial products made wholly or in part of neoprene compounds. Through the cooperation of many rubber companies who manufacture finished products from this chemically-made material, it has been possible to bring together for display a great many samples, representing a wide range of practical applications. These displays are open for inspection to anyone who may be interested in rubber products for any purpose.

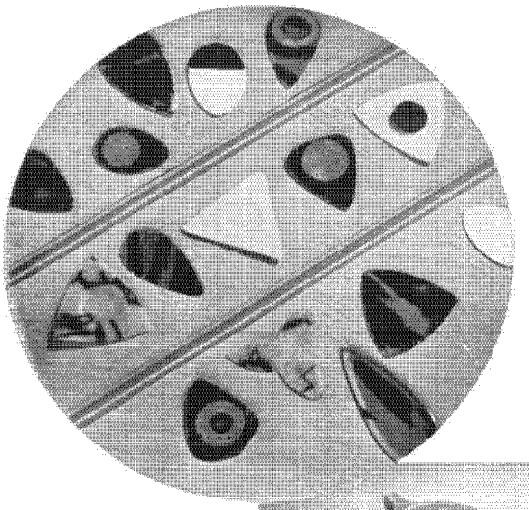
A NEW acetate fiber dyestuff, trademarked "Celanthrene" Pure Blue BRR (Patented), has just been announced by the Dyestuffs Division of the du Pont Company in order to meet the demand for a reddish shade of blue for all types of acetate fiber materials such as satins, taffetas, knitgoods and combination fiber crepes. It will be used chiefly as a base for direct dyeing navies.

ON the du Pont Experimental Station grounds near Wilmington, Delaware, a well-equipped laboratory building and a new greenhouse are now in use by the Pest Control Research Section of the Grasselli Chemicals Department. Complete facilities are provided for the staff of chemists, entomologists and plant pathologists to evaluate pest-control products of all kinds. We shall plan to tell you in greater detail about this development in a subsequent number.

THE "bookworm" will welcome this transparent book cover of "Plastacele" cellulose acetate plastic. Providing a neat cover for the book, the transparent plastic makes it possible for the reader to see the title at a glance, and to enjoy the colorful binding of the book without soiling it. The cover is dustproof, moistureproof and nonflammable and can be kept clean by wiping with a damp cloth. In the back of the cover are several slits and a tab, making it possible to adjust the jacket to books of various sizes. In the foreground is a transparent "Plastacele" gift box for books, made with a sliding cover and tied with a ribbon matching the color of the book.



LET'S TAKE A LOOK AT PLASTICS



BELOW: "Phenolin" is du Pont's name for its cast phenolic resin, a material admirably suited for making cutlery handles like those shown here.

ABOVE:
When you see a man playing a banjo, it is a safe bet that he is using a "pick" made of "Pyralin." There are styles aplenty.



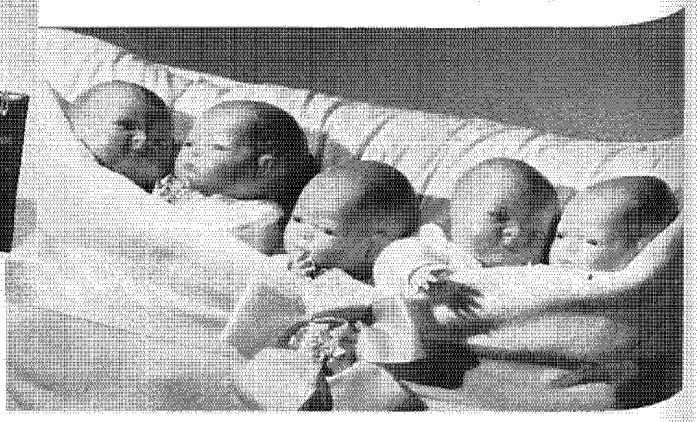
EVERY day one sees fresh proof of the versatility of du Pont plastics for both structural and decorative uses. Literally hundreds of articles once fashioned of wood, metal, glass, rubber, bone, pearl and the like are now being made of plastics because these man-made products are better adapted for industrial and consumer needs than those found in nature.

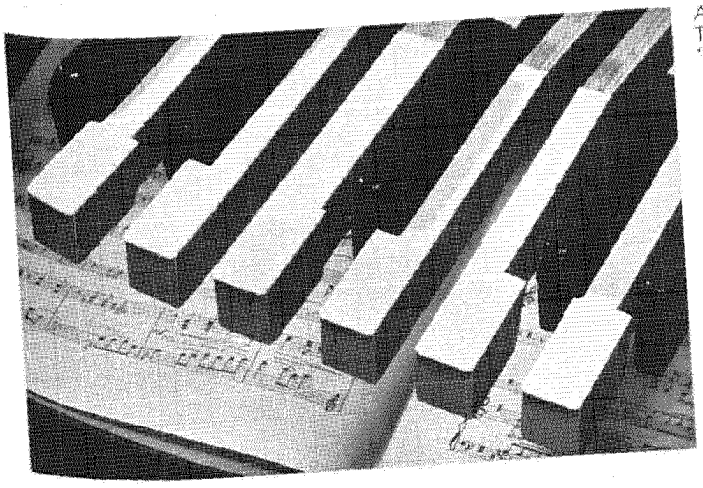
The du Pont Company has had the benefit of more than fifty years' experience in manufacturing plastics, and this year rounds out twenty years of actual service in the industry. During this time its chemists and research workers have improved old plastics, formulated new ones and produced them to meet the needs of thousands



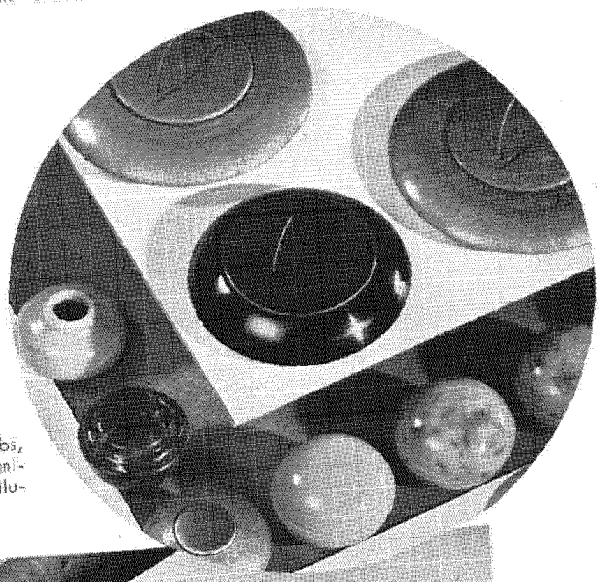
To obtain a better "weld" to various surfaces, thin transparent "Pyralin" sheeting is composited to metal initials on ladies' hand bags.

Tucked in for the night, but only two are sleepy. The special point of interest is that the eyes of these dolls are made of "Pyralin" plastic.





An arrangement for the piano, in case you are musically minded. The tops of these wooden keys are covered with ivory-like "Pyralin" Sheeting.

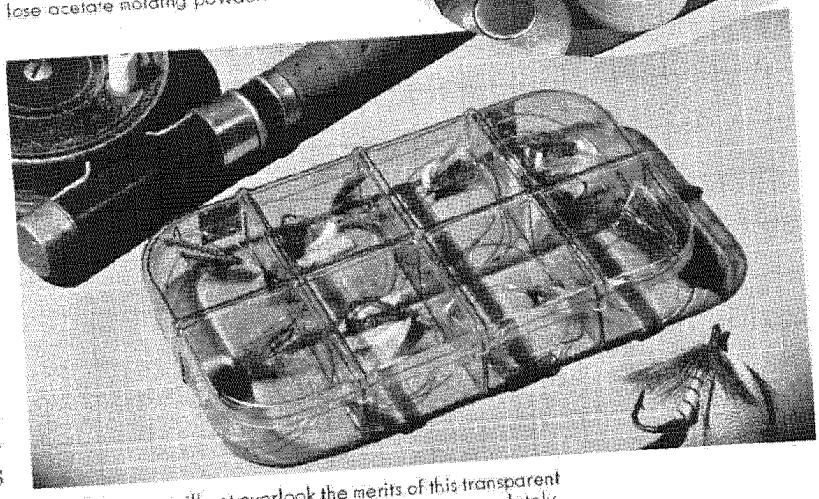


Horn buttons and gear-shift knobs, and they can be produced economically, too, with "Plastacele" cellulose acetate molding powder.

of fabricators, Du Pont is now supplying six different plastics, each with special characteristics and points of superiority.

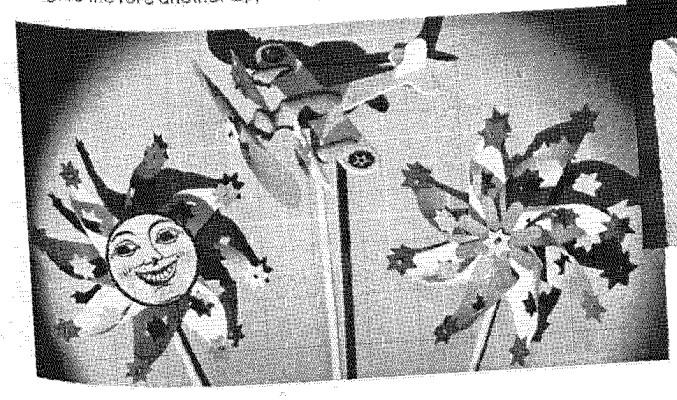
The pictures reproduced here call attention to a few among the many industrial uses of these materials. They are described and illustrated more fully in a new brochure entitled Du Pont Plastics for Products of Today and Tomorrow, copies of which may be obtained by writing to the Arlington, New Jersey, office of the Plastics Department. And du Pont technicians stationed there will be glad to coöperate with any manufacturer who has a specific problem to solve—one involving the use of plastics for any purpose.

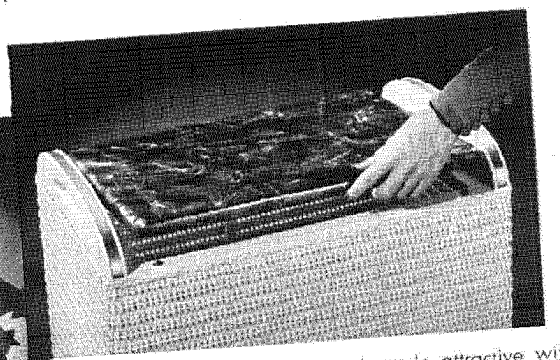
R. T. ELLIS



Trout fishermen will not overlook the merits of this transparent "Pyralin" box, for the picture tells the story quite completely.

Pinwheels are perennially popular with all the youngsters when the circus comes to town, which brings to the fore another application of "Pyralin."

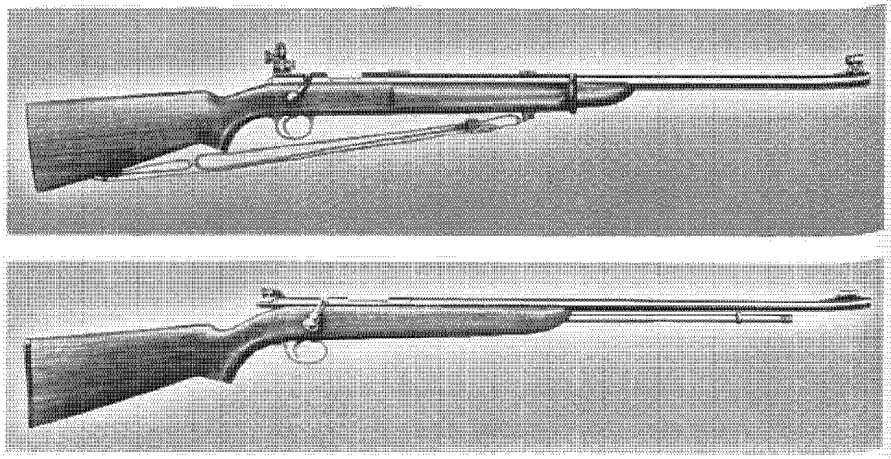




A clothes hamper is made attractive with a Pearl "Pyralin" top, and one might also mention towel bars, toothbrush handles, shaving brushes and toilet seats among other uses for this plastic.

THE MARK OF A MASTER

Wherein is briefly described the weapons used by the modern nimrod



AT THE TOP, "Rangemaster," the rifle that set a new world's record last year at Camp Perry, Ohio. Experts consider it the finest target gun yet made. BELOW it is shown the "Sportmaster," which is just right for small game.

DIANA, lovely goddess of the chase, is still paid grateful tribute each year by millions of hunters, whether they are sitting in a damp and chilly duck blind on the lonely, salty shores of Great South Bay or trailing the ponderous Kodiak over Alaska's frigid wastes.

Hunting, it seems, is one phase of man's activities that remains constantly popular, and the modern category of nimrods includes extra special classifications — bargain hunters, fortune hunters, microbe hunters, as well as those who like to think they are twentieth century Annie Oakleys and Daniel Boones.

Many people today, are really much better equipped for "drawing the bead" than these famous shooters ever were, and there is a good reason for that. Although Boone and other old-time riflemen managed to keep the wolf from their doors and throats, the guns of their day were anything but accurate compared to modern weapons equipped with proper sighting and other scientific innovations.

A leader in the sporting field today —and a favorite among crack shots and followers of Diana everywhere— is the new Remington-du Pont "Master" line of firearms.

Whether Uncle Joe is troubled with squirrels in his corn crib or Cousin Charley has a hankering to bring home a deer, makes no difference to these guns. There is a rifle for all kinds of game existing on the North American continent.

Take the "Speedmaster" for example. That's a .22 caliber autoloader that does a real job on a target and is ideal for "plinking" and for all-year-round hunting of small game in season. Willie Woodchuck and Sollie Squirrel are included among those who have been informally introduced to this weapon, and who consider it deadly.

This "Speedmaster," by the way, is one of the rifles chosen by the Museum of Comparative Zoology, Harvard Expedition, now en route to Africa and the East Indies. So you see the rifle is not limited by any means to North American game.

To digress from the hunting field for a moment, the latest master of the line deserves a word of praise and a little explanation. It is the "Rangemaster." Hardly had the rifle come from the inspection department than it was guest of honor at the 1936 National Rifle Matches, Camp Perry, Ohio, where it set a new world's record.

No ordinary rifle, this. It was more than five years in production, while gunsmiths and designers carried on a constant program of checking, refining, readjusting and testing, but their work resulted in the finest rifle in its class, a welcome addition to an already famous family.

We must not forget to tell you something about the "Targetmaster," which is the kind of gun Johnny should get and loan to the "old man," and often does. Once a bead is drawn on small game with this gun, a direct hit is usually the result. As the boys say, "It's curtains for small game and pests once they come into the sight and line of this rifle." Farmer, vacationist, "plinker," marksman—all are included among the users of this bolt-action, single-shot .22 of outstanding quality at a low cost.

(Continued on page 24)

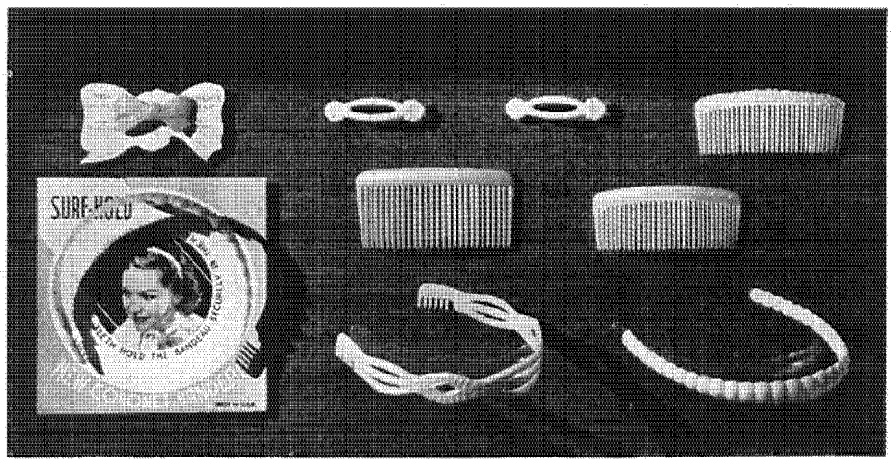
THE KEY TO ORDERLY LOCKS

With "Pyralin" hair accessories, tomorrow's debutantes keep their curls in order

CHILDREN naturally emulate older people—wanting to do the things their dads and mothers do, and to dress as much like them as they can. They learn early to watch fashion trends and little girls, in particular, like to be "in vogue." Aside from clothing styles, one of their earliest interests is the arrangement of their hair.

Sometimes we become exasperated over the amount of time that women spend at the dressing table, but we should give them credit for their patience and for the excellent results they obtain. Almost any mother will use even greater care in arranging her daughter's hair than in doing her own. She works hard to get those few extra curls, and then looks about for some device to hold them in place. A bandeau or a pair of barrettes of "Pyralin" plastic turns the trick and holds the little girl's hair in order, whether she's playing or attending a party.





She likes to wear these accessories, too, because they are as pretty as they are useful.

Not so long ago bandeaux were worn solely as evening ornaments, but now they are popular daytime accessories for sportswomen, and during the spring and summer months children wear them almost constantly. Heretofore these bands were kept in place with elastic cords, but that inconvenience has been eliminated by an improved type of snug-fitting and comfortable bandeau with several teeth at both ends.

Coronet bandeaux are made in so many colors that mother as well as daughter can have the exact match for any costume for daytime or evening. A wide selection of patterns is also available to please individual tastes. Other popular "Pyralin" hair ornaments include side combs, back combs with and without jewels, and barrettes in a variety of patterns and colors.

When mother plays golf or when her daughters dress up for a party — bandeaux and barrettes of "Pyralin" will keep their hair in order.

Coronet bandeaux and other "Pyralin" accessories are on display at the Du Pont Exhibit at Atlantic City, New Jersey, and at the du Pont showroom in the Empire State Building, New York. These articles are sold by leading department and chain stores throughout the country.

MAX ROSEDALE



CHEMISTRY AND YOU

(Continued from page 3)

Serving the Petroleum Industry

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

"Cracking became commercially practicable in 1912. Improvements in the process have resulted in sensational increases in the yields of gasoline from crude oils, and have probably extended the life of our oil deposits by many years. Late in 1932 two plants for cracking by hydrogenation began operating in this country. This process makes possible yields of as high as 101 barrels of fuel from 100 barrels of low crudes that under old methods yielded as little as five barrels, a feat that sounds like black magic. The rapid deterioration of cracked gasoline in storage has now been largely eliminated by the use of antioxidants which retards gum formation, and high-test fuels may be stored for six months or longer as against the one-time limit of two or three weeks. Lubricating oil has been chemically treated and improved through the addition of extreme pressure lubricant bases. This has fitted it for gear loads double and quadruple what the untreated oil of a few years ago could carry, and made possible the use of improved gears in the transmission of power.

"Uncounted millions have been saved to you and me, the daily consumers of oil, by the chemical development of a host of petroleum by-products once wasted. The number of such by-products was estimated in 1923 to be about one thousand. Today, it is double or treble that figure and includes detergents and lubricants for the textile industry, solvents that are of great importance in the lacquer industry, raw materials for synthetic resins, and chemicals for influencing the ripening of fruits and destroying insects on farm crops, to say nothing of various oils for medicinal use.

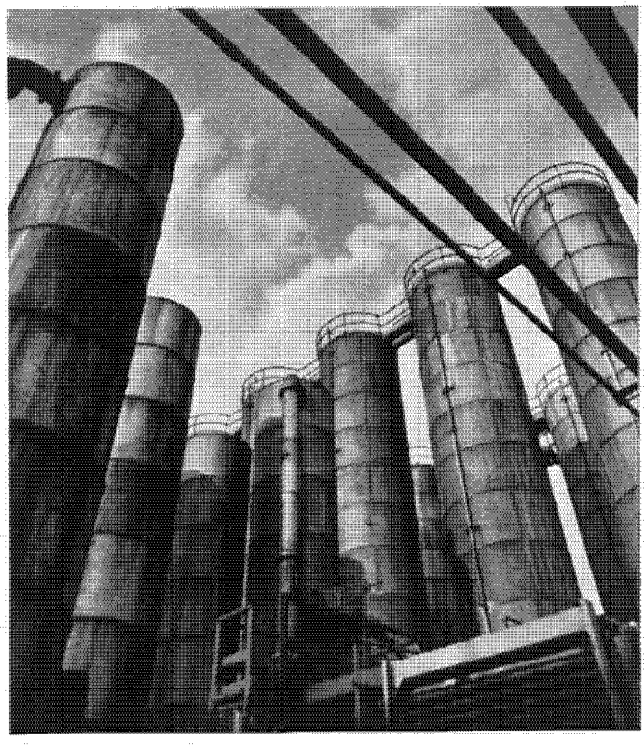
"Liquid Coal"

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

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

In the Field of Metallurgy

"Closely associated with petroleum in daily use are the various metals, and so closely associated are the sciences of metallurgy and chemistry that it is difficult to draw a sharp line between them. In our generation so many changes have been brought about in metals that today most of the metals in use seem new. Yet such 'new' metals as tantalum, molybde-

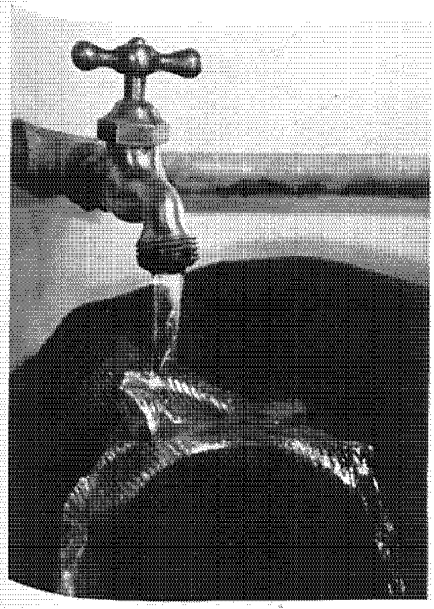


Ammonia oxidation towers at the du Pont plant at Repauno, New Jersey. The special point of interest is that these towers are constructed of non-corrosive metal.

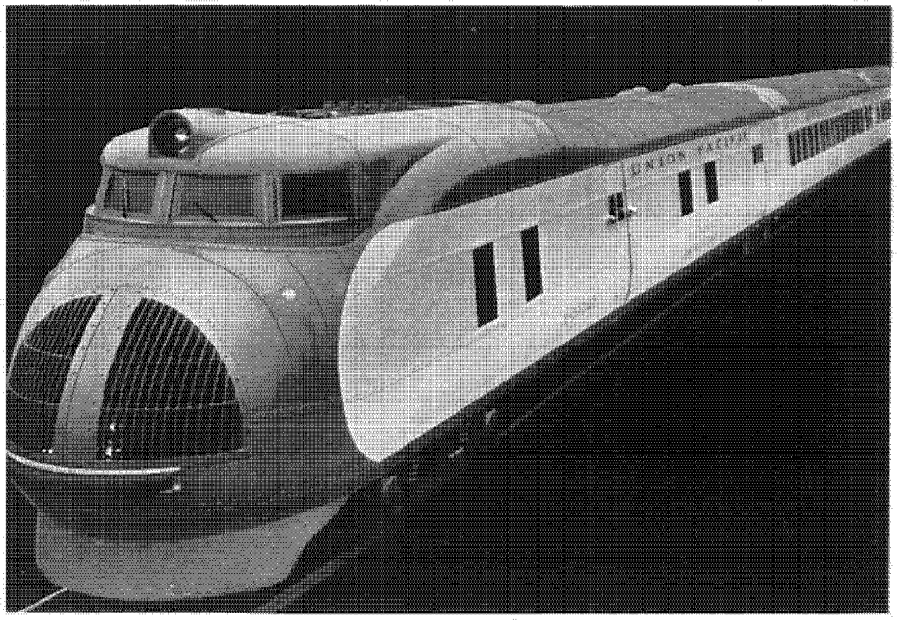
num, tungsten, platinum, cadmium and others have been known for a hundred years and more, usually in some form, however, that made them as unavailable as the moon and as costly or even costlier than gold. Modern science has not only made such rare metals available for innumerable uses but it also has created hundreds of alloys that are new, and in effect are wholly new metals.

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

"So obvious are these changes in metals—one finds them in profusion as close by as in one's own kitchen—



Just a piece of corduroy treated with "Aridex" water repellent and held under the tap, but it demonstrates still another way chemistry is serving the textile industry with better products and processes.



Metallurgical developments have come to notice prominently in recent years through the use of light-weight metal alloys in the construction of streamlined trains of the type shown here.

that it seems almost unnecessary to mention them until one recalls that as recently as 1929 stainless steel, for instance, was little more than an industrial curiosity, and that the first streamlined railroad train in regular operation dates only from 1934. Entirely apart from the utility added by these new metals and the new operations they are making possible, they have a tremendous significance to our economy in supplying a direct means of reducing losses from rust that have been estimated at three billions of dollars annually.

"The elements cæsium and rubidium were known to our scientific grandfathers, but only within recent years have they come into their own in a field so startling in its potentialities that the opening of it alone would stand as a gigantic achievement of our generation. An alkali metal such as cæsium or rubidium is used as the essential element in the photo-electric cell or electric eye. This element might be called the retina of the electric eye. Such metals possess a sensitivity to light rays and colors that, in certain cases, is similar to and in some respects even superior to that of the human eye. The photo-electric cell has an almost infinite range of actual and possible uses—in counting, sorting and in inspecting units, colors and materials; in automatic alarm, signal and safety systems and in fact throughout mechanics; in photography, in communications, and notably in that fast-developing new wonder of the radio waves, television. They are being used in astrophysical and astronomical investigations to uncover the mysteries of stellar radiation. And some experimenters see in photo-electric cells the means by which man will in time convert to his use the vast and inexhaustible energy given off by the sun.

"The vacuum tube is a triumph in the creation of new materials and the practical utilization of old materials such as tungsten and tantalum. Tubes are limited as yet in the amount of power they can handle, but work in progress with another rare metal, columbium, now indicates these limits may be extended to where tubes will

be able to handle thousands instead of tens of kilowatts of power. Columbium is being put to other uses too, notably in alloying with stainless steel to give the property of corrosion resistance to welded joints without subsequent expensive heat-treating.

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

New Refrigerants

"Artificial ice-making has been practiced almost fifty years, and as early as 1914 the Santa Fe Railroad was trying to achieve air-conditioning in passenger cars that would make travel more comfortable. Not long after 1918, we were becoming definitely aware of the huge market opening for mechanical refrigerators in the home. However, a serious lack worried the industry and jeopardized its whole future. It was without a refrigerant that was safe under all conditions, regardless of leakage, fire or other accident, that is, a gas that was at once non-toxic, non-explosive, non-flammable and non-corrosive.

"To compound a refrigerant possessing any two of these properties was a feat in itself; to compound one possessing all four, which at the same time would be equal in effectiveness to the refrigerants in use, seemed a feat in the realm of the miraculous. Nevertheless, in 1932 the prescribed new material emerged from the laboratory under the trade-mark of 'Freon.' . . .

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

(*To be continued*)

SAFETY IN INDUSTRY

(*Continued from page 10*)

one and is so recognized throughout the American industry.

In commenting upon safety activities, President Lammot du Pont recently stated:

"From a humanitarian standpoint, the work of preventing personal injuries in the plants and operations of the du Pont Company and its subsidiaries is considered most worthwhile. Its object is to safeguard the employes, thus reducing the probability of fatalities and unnecessary injuries and eliminating the anguish and suffering which follow such events. This preventive work teaches the employe to think, makes him more efficient, contented and happier. It safeguards the trained worker, results in more loyal workmen, and it is economically a paying proposition.

"The du Pont Company's activities toward preventing personal injuries to employes has produced outstanding results. Based upon the average annual frequency and severity rates over a six-year period (1920 to 1925 inclusive), it is estimated that the improvement in safety during the ten years following 1925 has prevented 197 fatalities, 387 permanent partial disabilities, and 4,654 temporary disability major injuries . . .

"This reduction in suffering, maiming of employes and loss of life, warrants all the time, effort and expense involved in carrying on the Company's work to prevent personal injuries."

NOTE: A limited number of brochures describing the Safety Poster Contest in detail is available for those who are interested. Write to the Safety and Fire Protection Division, Wilmington, Delaware.

THE LARGEST OPEN-PIT IRON-ORE MINE

(*Continued from page 14*)

reached high peaks. And even though there were a few lean years during the depression, mining is proceeding at a rapid rate and millions of tons of ore are being shipped. If the furnace demand continues to improve, it may be that the production records of peak years will be equaled or exceeded. Meanwhile visitors to the "Grand Canyon" of the Mesaba Iron Range may look forward to broader vistas opening up than ever before.

C. J. PERRY, JR.

THE MARK OF A MASTER

(*Continued from page 20*)

Our own Uncle Bert has the right idea when he goes to the Adirondacks. He never carries a revolver with him; nevertheless, he is prepared for a face-to-face encounter with a bear. Carefully stowed in the rear seat of his auto is a "Gamemaster." Uncle is always ready for any emergency. He even wears a twin-peaked Sherlock Holmes cap, with ear-muffs attached. And early each morning when he shoulders the big brother of the Remington-du Pont "Master" family, and goes into the woods, it's more than unfortunate for any bear or deer that may come within shooting range.

Finally, I'd like you to know that the "Woodmaster," a .35 caliber rifle of the autoloading type, is fast-shooting and powerful enough for any big game found in North America.

If rifle shooting is your hobby on the range or in the field remember that there's a Remington "Master" gun for every purpose. And—when it's a Remington—it's right!

DUNBAR S. REYNOLDS

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now better



AGAINST DECAY AND INSECTS

● Here's a welcome economy message to executives, builders and home owners interested in reducing maintenance costs.

The problem of protecting lumber against decay and rot is now materially aided by Grasselli Chromated Zinc Chloride. It has definite preservative value being decay resistant, fire retardant and termite repellent. It can be worked readily and is clean, odorless and paintable.

This treatment cannot be applied superficially, but is a thorough impregnation with Chromated Zinc Chloride under pressure. The lumber is treated when you receive it.

No stronger argument can be expressed for treatment of wood with Chromated Zinc Chloride than its outstanding economy. Wood treated with this preservative averages 3 to 10 times longer life than untreated wood, thus eliminating many costly replacements.

When you specify lumber treated with Grasselli Chromated Zinc Chloride, you are making a small investment which will protect your large investment. *For further information write to:*

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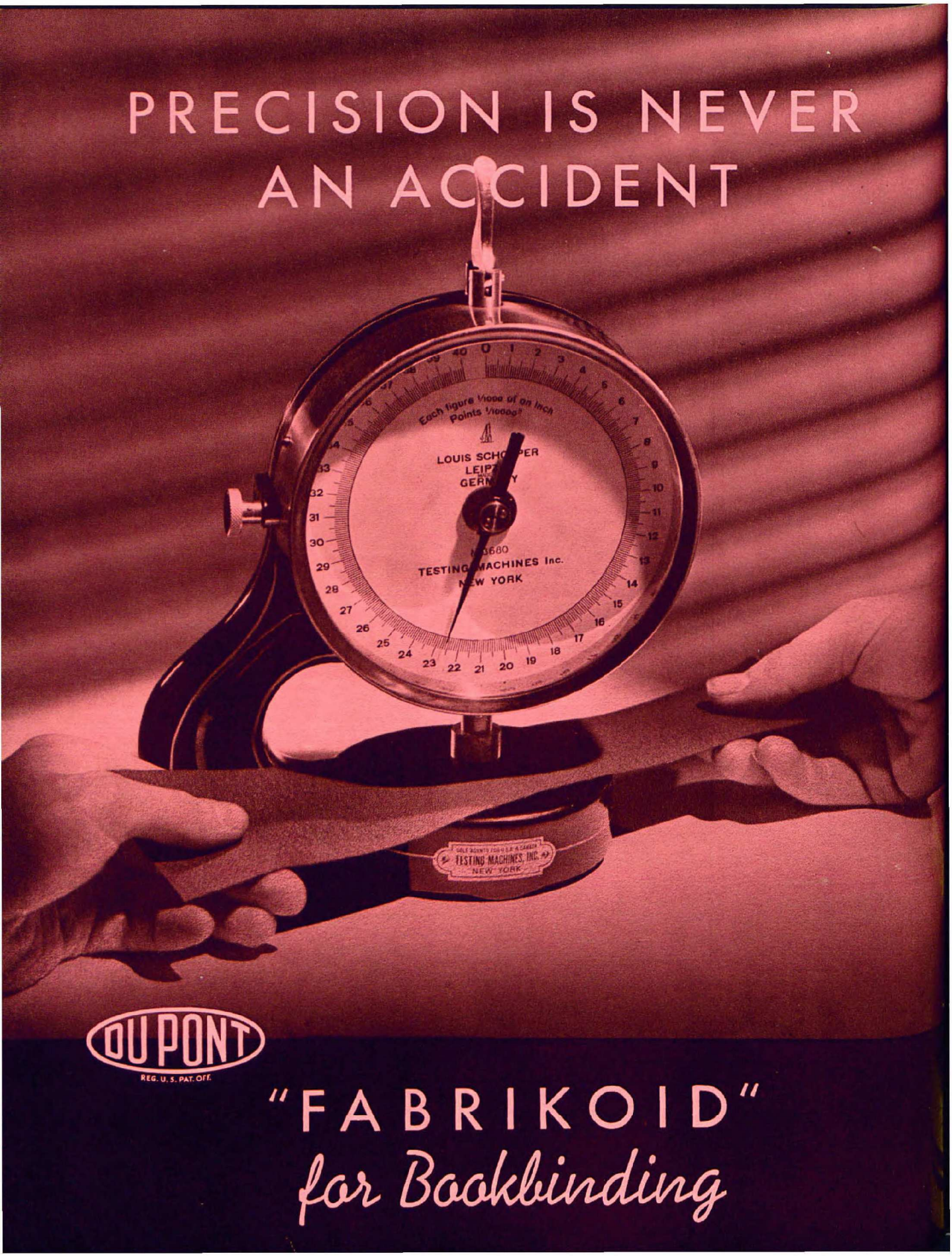
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