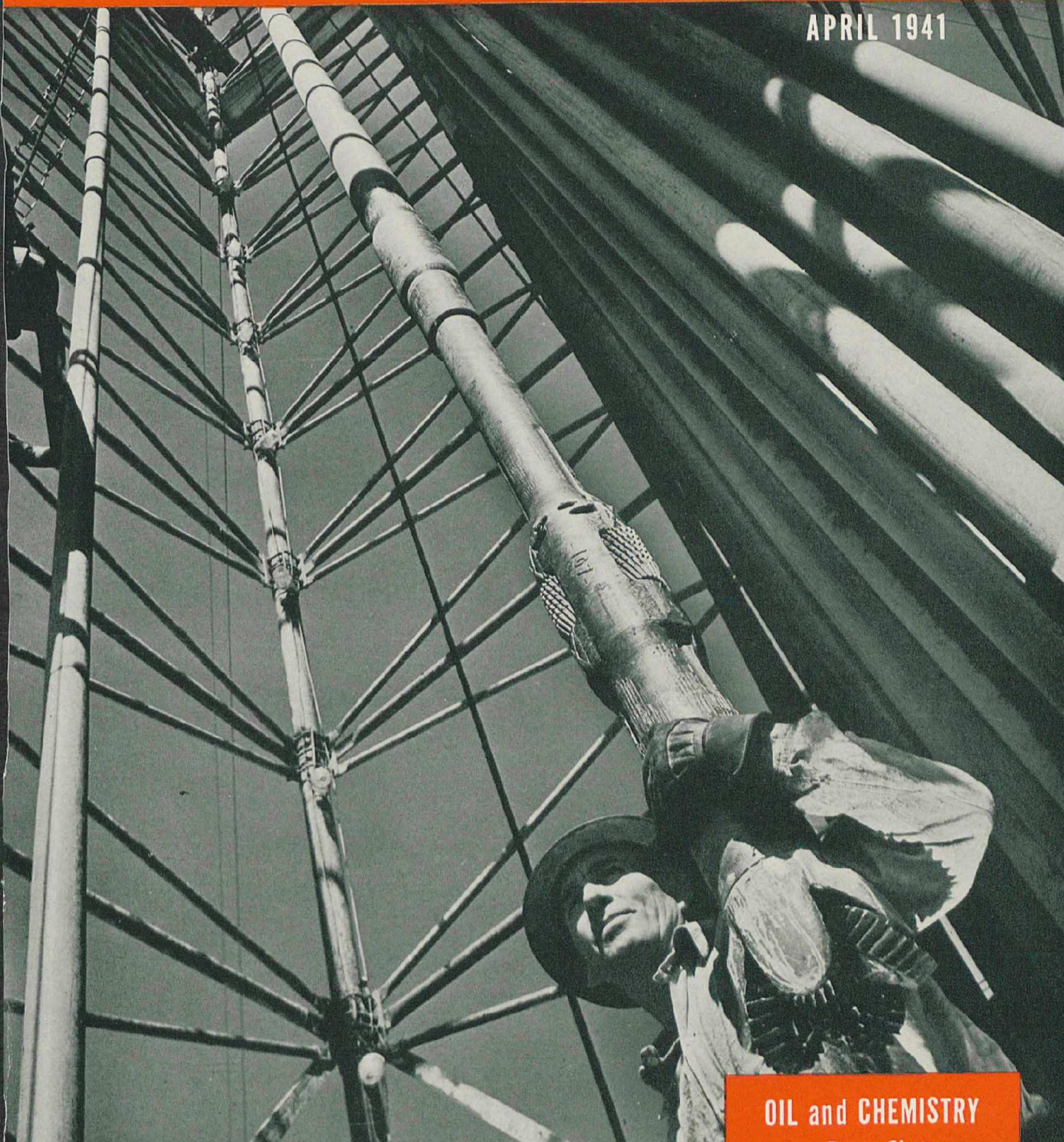


THE DU PONT MAGAZINE

BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

APRIL 1941



OIL and CHEMISTRY



NOT A MONKEY, but the seed pod of a flower. To help bring flowers from this ugly beginning to their full beauty, greenhouse flower growers use "Loro" Contact Insecticide.

from Flowers to Coal mines...

A STORY OF DU PONT VERSATILITY



"LIGNASAN" Larry is a good friend of lumbermen everywhere. He represents Du Pont "Lignasan" an anti-stain chemical that prevents sap stain in freshly sawn lumber during the air seasoning period and keeps it bright.



IF RED ANTS were still the source of formic acid (as they once were), there wouldn't be enough to go around. But Du Pont now supplies industry with formic acid and many other essential chemicals.



GOLFER'S GRUDGE is a course ravaged by worms and grubs. But "Grasselli" Lead Arsenate spells doom to insects, just as other Du Pont Chemicals help growers produce bigger and better crops.



TREES OF LEAD are fun to make in school with a test tube of water glass. But in industry, Du Pont Sodium Silicate fills many practical needs — as an adhesive, as a size and coating, a binder, a deflocculant or a detergent.



FIRE'S NEMESIS is any fabric treated with one of Du Pont's Sulfamic Acid Compounds. This acid and its salts also promises important uses in processing leather, manufacturing dyes and killing weeds.

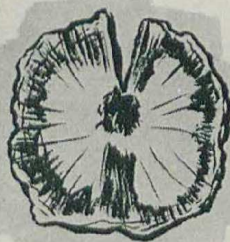


GRAVITY UNDISCOVERED, Newton unknown—that might have been our lot if Du Pont "Parmone" had been in existence then. This amazing new chemical helps make apples *stay* on the trees until harvest time!



JAWBREAKER NAMES like Tetra Sodium Pyrophosphate don't frighten chemists—when they identify such useful compounds as Du Pont TSPP. This chemical is used in more and more industries because of its unusual qualities and properties.

16 YEARS HARD WORK is the record of this mine tie still in good condition. And thanks are due to a wood preservative known as Du Pont Zinc Chloride. Another newer preservative, Chromated Zinc Chloride, is now busy making history wherever wood takes a beating!



THESE newer products are finding increasing uses in industry. And not only that—there are other new compounds which may be money-savers in *your* plant. So when you have any processing problem which involves the use of chemicals — ask du Pont.



CHEMICALS

Acids • Heavy Chemicals
Agricultural Chemicals
Metal and Ore • Specialties

E. I. DU PONT DE NEMOURS & CO. (INC.)
GRASSELLI CHEMICALS DEPARTMENT

Wilmington

Delaware



E. I. du Pont de Nemours discussing location of first Du Pont powder mill with his friend and customer Thomas Jefferson, President of the United States.

Who? .. What? .. When? .. Where? .. Why?

By WILLIAM S. DUTTON

THOUSANDS of new employees have joined the Du Pont organization in recent months. Thousands more are coming in the months ahead. They are the men and women from city, town and farm being recruited to man the Du Pont and Remington sectors in the nation's front line of industrial defense.

And at Birmingham and Memphis and Charlestown, Indiana, at Kankakee, Morgantown, Denver and other widely scattered points where the smokestacks of new plants are rising, questions are being asked.

Who are the Du Ponts?

What is the Company's role in industry—and war?

When did it begin?

Where is it headed?

Why does Du Pont make so many things?

These questions merit answers and here they are, to the extent that almost a century-and-a-half's tale can be told in tabloid. . . .

The Du Pont family came to America in 1800 as refugees from a Europe not unlike that of today. They had endured the Reign of Terror. Their business had been wrecked. The father and younger son, E. I. du Pont de Nemours, had been imprisoned. Their closest friend, the great chemist Lavoisier, had been beheaded.

Dictatorship loomed above the bayonets of Napoleon's soldiers in 1800 and no nation was safe from war.

In America, the Du Ponts found the country confronted, as now, by a serious problem of defense. The

best gunpowder was imported from England. Home powder mills were small, poor, out-of-date. Thomas Jefferson urged E. I. du Pont, who had been trained by Lavoisier in powder manufacture, to establish mills here equal to those of Europe. The outcome was the founding, in 1802, of E. I. du Pont de Nemours & Company.

Since then, Du Pont gunpowder has been employed by the United States in five major wars, while Du Pont resources and technical skill in the manufacture of military explosives have been at the government's command both in peace and war. The Company takes pride in the fact that its part in the present defense program is its traditional one in times of national emergency.

However, that is but the beginning of the story. Excluding Indian conflicts, all the country's wars together since 1802 have lasted about ten years. Only in two foreign wars, the Crimean and the World War, have heavy demands been made upon the Company.

That is to say, almost a century and a quarter of Du Pont activity has been devoted overwhelmingly to peacetime industry and progress—all told, less than fourteen years have involved wartime activities. The "peace" years outnumber the "war" years nine to one. In terms of products sold, just prior to the current world emergency, the ratio in favor of industrial as opposed to military goods was almost fifty to one.

It follows that the Company, in keeping with the normal character of the nation in which it lives and does business, is and must continue to be mainly a commercial enterprise. Otherwise, it could not exist. Du Pont's role in the present emergency is similar to that of the individual who is giving his services to the country, but who depends on a "regular job" for his livelihood and future.

Both the citizen and the Company prefer their regular jobs to the uncertainties and disruptions of conflict.

Even during the early years of the past century, when the United States was chiefly a farming community and the Company an explosives manufacturer only, the peacetime uses of Du Pont explosives exceeded those of war years. Hunting, land clearance, mining, quarrying and construction work were on an ever-expanding scale in step with the development of the country.

With the advent of steam railroads, discovery of new mines, introduction of steel in building and the growing use of machinery in shops and on farms, the demand for explosives to blast new right of ways and get out coal and metal began to tax the capacity of all manufacturers to supply them. Five-sevenths of the Du Pont production during the 1870's was black blasting powder.

Invention of dynamite and other highly specialized blasting agents, only of incidental value in war, further broadened this rich commercial market and drew explosives makers still closer to the industries and mines buying the great bulk of their goods. For example, a single engineering project, the Chicago Drainage Canal, consumed more explosives measured in pounds than the entire Civil War. By 1904, the consumption of industrial explosives in the nation as a whole was on a scale fully fifty times that of the Civil War.

Meanwhile, a succession of epochal inventions pointed the way to broad, new commercial fields. The fibrous substance that is the solid part of cotton, wood and all plants is known as cellulose. Its supply is limitless. Starting in 1845, one discovery after another was made by chemists in various parts of the world of the

From Dixieland comes cotton, and with the cellulose obtained from cotton linters Du Pont manufactures a great variety of useful products.



astonishing uses to which cellulose may be put by industry. It became the basic material in manufacturing pyroxylin plastics, lacquer finishes for hardware, rayon, tough fabrics resembling leather, and also guncotton, smokeless powder, and other high explosives such as blasting gelatin for under-water work.

By 1890, the Du Pont Company was very much interested in cellulose, first, of course, because of its importance in the explosives art, but that interest soon was to widen and embrace the whole range of cellulose products.

And while chemical pioneers were raising cellulose to a rank with iron and copper in terms of their usefulness to man, a paralleling sequence of inventions lifted coal-tar from obscurity to prominence. It was found that from this black sticky mess, obtained by distilling coal, whole families of valuable substances could be derived and compounded into literally scores of things—among them dyes of countless hues, and powerful new high explosives such as TNT.

Thus, again *via* explosives, a second churning stream of discovery lapped over the Du Pont doorstep, and the Company became interested in coal-tar as well as in cellulose. When one isolates these two major chemical trends from their confusing technical background, it is easy to understand why, today, Du Pont makes so many products other than explosives, and why explosives were destined to become normally a secondary interest.

In 1904, the Company's Experimental Station was organized to explore (1) new sources of raw materials and (2) new uses of cellulose. The same year lacquer finishes were added to the Du Pont line; and in 1910, the "Fabrikoid" coated textiles were added. Plastics, rubber-coated textiles, heavy chemicals and paints followed in rapid succession.

The large-scale manufacture of dyes from coal-tar was begun in 1917, of viscose rayon in 1920, of "Cellophane" cellulose film in 1923, and synthetic ammonia in 1924. Draw up a chemical chart, mark the lines of relationship between these seemingly unrelated activities, and they will all be seen to be closely akin.

The World War of 1914-18 temporarily placed the Company's major emphasis on military explosives, because they constituted the major need of the period. In four years Du Pont factories, built at unprecedented speed for the emergency, furnished 750,000 tons of explosives of all kinds to the Allied forces. The total included forty per cent of all the propellant powder the Allied armies and navies consumed. One-half of the huge output was sold at prices no higher than in 1913, despite sharp rises in the cost of every other type of commodity.

The Company emerged from the war with an enlarged program of scientific research aimed at accelerating the expansion beyond explosives then well under way. The primary objective of this research was the creation of new industries, the products of which would contribute to better living in America. First among the results was the invention and development of "Duco" pyroxylin lacquers, which revolutionized the paint and varnish industry and broke a bottleneck retarding the production of low-cost automobiles. The change was the first of real consequence that had taken place in the finishes industry in more than a century.

"Cellophane" cellulose film was a French invention, but high in price and impractical for wide use. Du Pont chemists improved and moistureproofed it, prices were driven downward to a fraction of what they had been, and the sparkling new wrapping film introduced a new era in the packaging and display of countless kinds of retail goods. Simultaneously, the Company's laboratories shared in effecting a Cinderella-like transformation of rayon that took it from basement bargain counters to a position and prestige second only to King Cotton. Rayon became the textile queen.

In 1931, neoprene was announced. Made from salt, coal and limestone, and superior to natural rubber in some of its qualities, here was something world science had been seeking for 50 years. It was one of the first to break the hold of rubber, of which the United States was the biggest user. The Du Pont chemical "rubber" was the trail-blazer of an independent industry at home that is now taking larger form daily.

For two centuries, scientists had been baffled by the spinings of the silkworm. No other textile fiber was in existence that could compete with silk in certain of its fields, notably hosiery. Then, late in 1938, Du Pont announced nylon, a new raw material derived from coal, water and air. The fact that nylon can be spun into filaments comparable every way in excellence with those of any textile fiber is only one of its merits. Nylon is a whole family of new substances housed under the same chemical roof. The ultimate extent of its usefulness even the chemists who invented it are unable to guess.

Nylon supplies bristles for brushes, leaders for fishing lines, strings for rackets, sutures for surgical use, and lace for evening gowns with equal facility. It is giving new beauty and serviceability to fine hosiery. Chemists are experimenting with it in a dozen other potential fields. Not even "Cellophane" received so immediate a popular indorsement; no other discovery of Du Pont research has so quickly attained the "new industry" status. Nylon plants built and building today represent an investment of many millions of dollars.

These outstanding results of research outline only the skeleton of the expansion program which broadened and diversified the Company's activities during the decades of the '20's and '30's. By 1937, twelve lines of new products not in production ten years earlier were contributing 40 per cent of all sales. Employment was 34 per cent greater than in the "boom" year of 1929; wages and salaries paid out were 47 per cent greater.

Changes in the Company's general interests during these two decades can be most quickly appraised by glancing at the industries buying the most Du Pont goods. Normally, the textile industry is now Du Pont's best customer. It accounts for 22 per cent of sales.

The next best customer is the paper, container and wrapping industry. A large consumer of "Cellophane," dyestuffs, pigments and heavy chemicals, it accounts for 12 per cent of the Company's sales income.

The automobile industry ranks third with 11 per cent of all sales, which are principally pyroxylin lacquers, synthetic resin enamels, plastics, anti-freeze, brake fluid, pyroxylin- and rubber-coated fabrics, neoprene, and electro-chemicals for chromium and other plating.

The chemical industry and its some 7,000 enterprises is Du Pont's fourth best customer through its purchases of miscellaneous "chemists' chemicals." Not until the fifth largest customer is reached in the construction and maintenance industry do explosives loom into prominence, and then they stand side by side with paints, varnishes and other finishes to make up five per cent of goods sold.

Mining, once the first customer, now is merely tied for fifth place, but in addition to explosives it buys flexible tubing for use in underground ventilation, and chemicals for the flotation process of ore extraction.

Export sales normally contribute only about four per cent of the Company's business, which is also the volume accounted for by the iron and steel industry. That is to say, by far the bulk of the Du Pont business is American business.

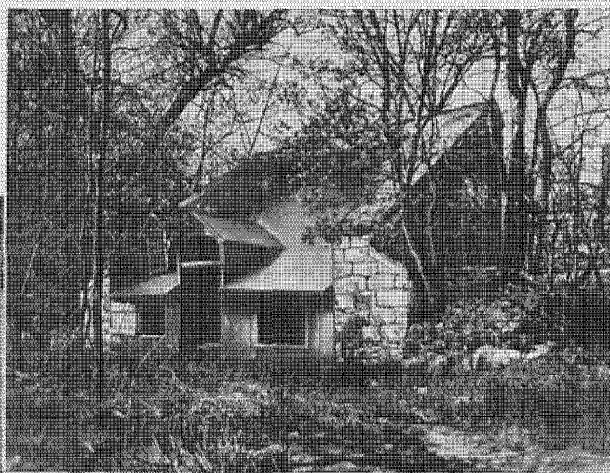
In other respects, too, it is worth noting that the business is dominantly American. Almost all of its more than 77,000 stockholder-owners are Americans living in America. The Company's history and growth parallel those of the country. A fundamental aim of Du Pont research and manufacturing effort is and always has been the economic independence of the United States.

Yes, Du Pont makes munitions when munitions are demanded for the country's security, as is the case now. However, just as the United States is dedicated normally to the pursuits of peaceful industry and is dependent on peaceful industry for its livelihood, so likewise are the Company, its management, its laboratories and plants, and the 60,000 men and women who fill Du Pont's "regular jobs."

Such is the "Who, What, When, Where and Why" of E. I. du Pont de Nemours & Company.

A view of the first Du Pont powder mill. It was located in what was termed the Upper Yard of the Brandywine Plant near Wilmington, Delaware. Not even a trace of it remains today.

BELOW: Veteran powder workers once called this area the Lower Yard, but the century-old plant structures have been razed. Now covering the hillside are the many laboratory buildings identified as the Experimental Station.



Good News for Tennis Players



New equipment for this popular game includes rackets with strings of nylon

Presumably the rackets then used were not too strong; the game was still a pastime. Not until the 19th century did tennis attain the standing of a major sport, with the first championship tournament held in 1877 at Wimbledon, England.

The medieval tennis ancestors probably would be as startled as a modern gallery was not so long ago when a well-known player arrived on a close-cropped court, sauntered over to the umpire's stand and without further ado dunked his expensive racket into a bucket of water! Nor did he quickly withdraw it. Calmly, as if it were a routine practice, he left it there a full half hour while he talked with friends. Then, to cap the unusual with the unbelievable, he took the racket out of the water bath, strode out on the court and played set after set of flashing tennis.

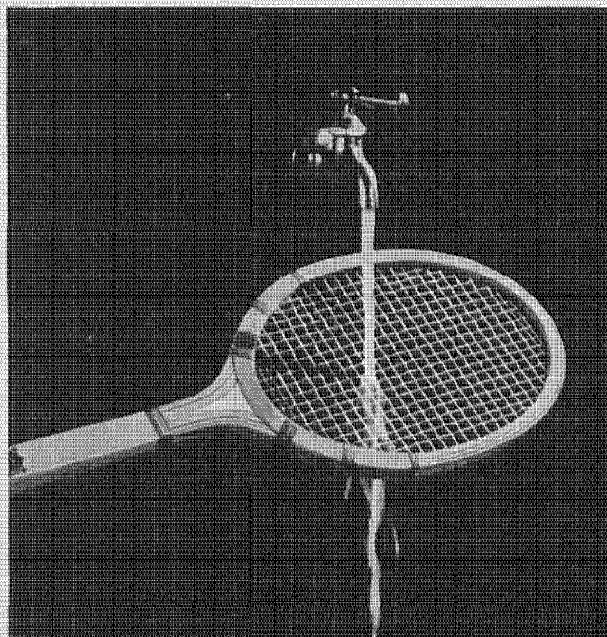
Now water is not recommended for racket frames and still less for ordinary racket strings. This player was not "touched by the heat," nor were the people in the gallery. They had witnessed a somewhat dramatized demonstration of a new material that will solve, to a great degree, one problem of keeping racket strings intact, regardless of weather conditions.

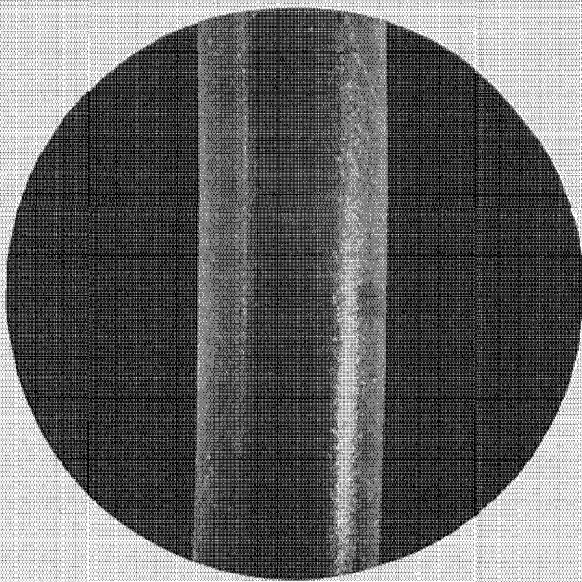
The racket referred to was strung with nylon; yes,

By E. J. PECHIN

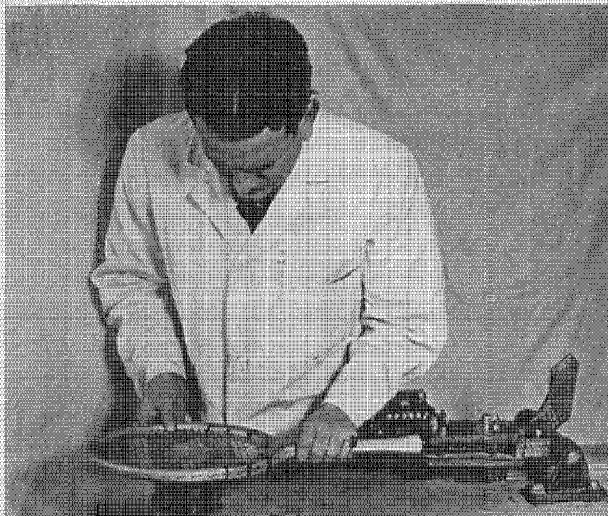
ORIGINATORS of the game of tennis, so historians tell us, have been occupying their last resting places several hundred years. Astonished they would be if they could return to life and see the game as played today and inspect the carefully-constructed equipment with which "aces" and placement points are scored. For the early devotees played with bare hands or with rackets strung with parchment. Historians tell us that the playing courts were enclosed by walls, somewhat like the squash courts of our day.

Back in the Middle Ages courts were not constructed primarily for tennis, but were either excavated or walled-in areas surrounding medieval castles. They were filled with water for protection in time of war, but when an era of peace came the moats were drained and the dry beds of these ditches were used for tennis courts. Charles V of France, who lived in the late 1300's, was an enthusiastic tennis player. He is said to have attempted restricting the right to play to the ladies and gentlemen of his royal court. Once tennis was the Game of Kings.

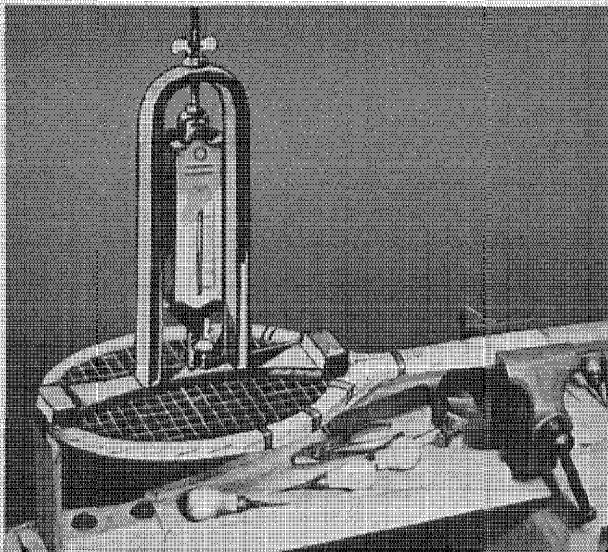




A greatly magnified section of a nylon string. Note that it is solid all the way through and cannot possibly fray.



How durable are tennis strings? Armour & Company's technicians subject stringed rackets to prolonged pounding with this machine which performs the "hammer test."



What is the tension of racket strings after play? The gauge on this testing device answers the question accurately and quickly, Armour & Company photograph.

the same nylon that in the short space of a year has become so important in the field of women's hosiery; the same nylon used for hairbrush and toothbrush bristles, fishing leaders and even surgical sutures. Chemically, the material used for racket strings is essentially the same, although a special manufacturing process had to be developed for its production. Then followed two years of pre-testing and rigorous field testing in several "tennis laboratories."

The term quoted is factually descriptive, for sporting goods manufacturers maintain facilities to test the performance of equipment for recreational and sport needs, just as manufacturers of industrial materials do. In brief, when Du Pont made nylon strings, samples were submitted to A. G. Spalding and Brothers at Chicopee, Massachusetts, and to Armour & Company, Johnson Suture Corporation, Victor Surgical Gut Corporation, and Wilson Sporting Goods Company, all of Chicago, for further testing by these organizations.

Under the eyes of experts who know the demands of the game, the strings were put through all the tests which are applied to these products. "Whacking" machines tested the abrasion resistance and impact strength of the chemical newcomer. Cameramen made their multi-flash photographs to reveal the resiliency of nylon strings at the moment of impact with a ball. Tensile strength testing machines stretched the strings to the breaking point. Even robot machines set up on the manufacturers' private courts drove balls from all angles so that experienced players on the opposite side of the net could try predetermined strokes and get the "feel" of nylon-strung rackets in making return shots.

Thus, the facts about performance were developed under conditions simulating actual play, from the soft, "push" shots of the beginners to the long, lightning-like drives delivered with power and precision by the top-notchers of the game. Of course, it was the hard-hit drives that gave nylon its severest test. After trying the entire repertoire of strokes—drop shots, chops, lobs and the like—the consensus of opinion among the upper-bracket amateurs and professional players might be summed up in a single sentence: "Nylon-strung rackets will bring a new boon to the tennis-playing public." In a word, nylon has come through with flying colors, and American tennis players this spring will have an opportunity to use this new equipment.

In addition to the desired characteristics of other types of racket strings, nylon has several outstanding advantages. The dunking demonstration, first mentioned, emphasized the fact that this material is unusually moisture resistant. Gone is the one-time dread of playing tennis on wet grass courts or in the rain, as tournament contestants occasionally have to do. Water does not affect nylon injuriously. Damp-weather play with a nylon-strung racket need not entail any worry about string breakage from that cause in any section of the country. The West Coast, for example, is considered a year-round tennis player's paradise, but even in that favored clime, moisture in the air provides plenty of trouble for ordinary tennis strings.

Players will also be glad to learn that nylon strings will not dry out. It is not necessary to apply, from time

to time, conditioning agents such as shellac and "dope" to prolong the service life of the strings, for nylon is inherently stable, resilient and strong and requires no protective or preservative treatments, an advantage that will be appreciated by all devotees of the game.

Again, there are no special problems in storing nylon as is the case with the older types of material. Tennis racket dealers and restringers need not be concerned about the condition of the strings even after prolonged storage, for this material is not susceptible to deterioration from ordinary exposures.

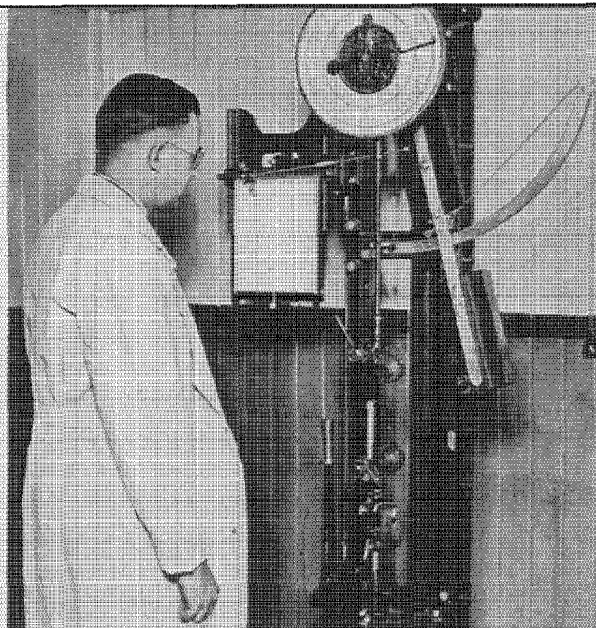
Another point of advantage is that nylon strings cannot possibly fray. Those made of animal substances are of composite construction, that is, made up of many small strands twisted tightly together forming a continuous piece. When a racket is strung and used for play, abrasion usually occurs at the intersections where the lengthwise and crosswise strings overlap. And when one of the small strands rubs through and breaks, it is the beginning of the end. One strand after another gives way until the entire string snaps. Not so nylon strings. They are not made of twisted or braided strands; each string is a single filament, solid all the way through.

Nylon racket strings are identified by their lustrous translucency and further by decalcomanias and metallic tags which will probably be used by manufacturers and dealers of tennis equipment. Nylon for use in tennis rackets is produced at the Du Pont Company's plant, Arlington, New Jersey, and is now available in the standard 15 and 16 gauges. The required length of material for stringing a racket is coiled and mounted on a card of maroon color and the package wrapped in "Cellophane" cellulose film.

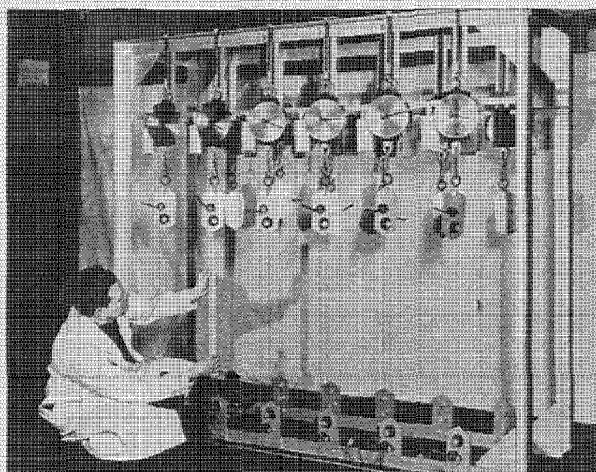
Earlier in this article mention was made of several companies who collaborated in the development of nylon for this use. They are all authorized distributors of the new racket strings and will sell them to restringers through the regular retail outlets. Practically all manufacturers of tennis equipment will sell nylon-strung rackets this spring. Tennis enthusiasts who may contemplate buying a new racket or having an old one restrung will do well to get in touch with the leading sporting goods stores in their communities.

Nylon is not a cure-all for tennis ills. By no stretch of the imagination can the new strings be called indestructible. But the performance reasonably to be expected from them and the fact that they will be sold at a moderate price will be good news both to court veterans and to the tyros of the game. Tennis is gaining in popularity with the younger generation. It is estimated there will be 8,500 high school tennis tournaments held this year. How many young and adult followers of the game will hear the reassuring "ping" of nylon strings when the season gets under way is an interesting speculation, but at this writing nylon is being manufactured for new and old rackets, and that, in the words of a well-known radio commentator, "is the news at this moment."

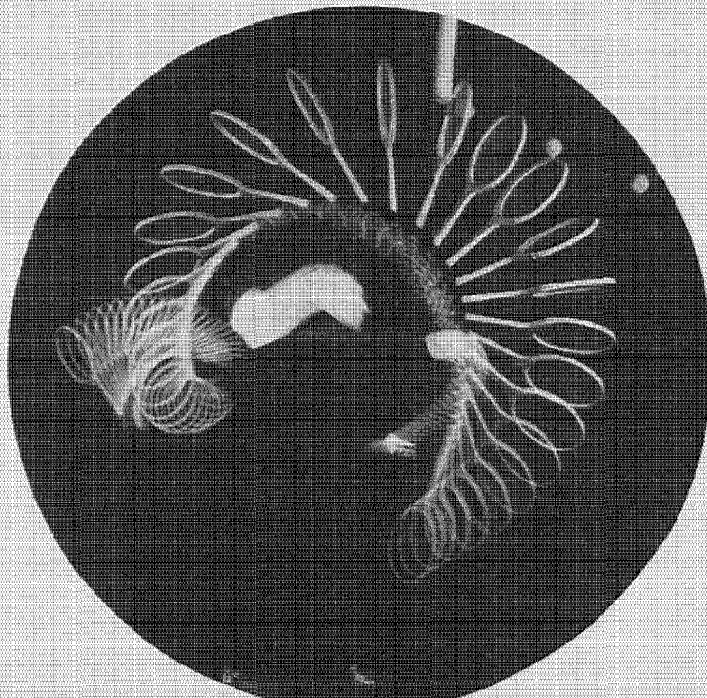
A multi-flash camera record of a tennis player serving the ball. From the start to the "follow-through" of the stroke, you see the entire action. Photography helps in studying racket performance.



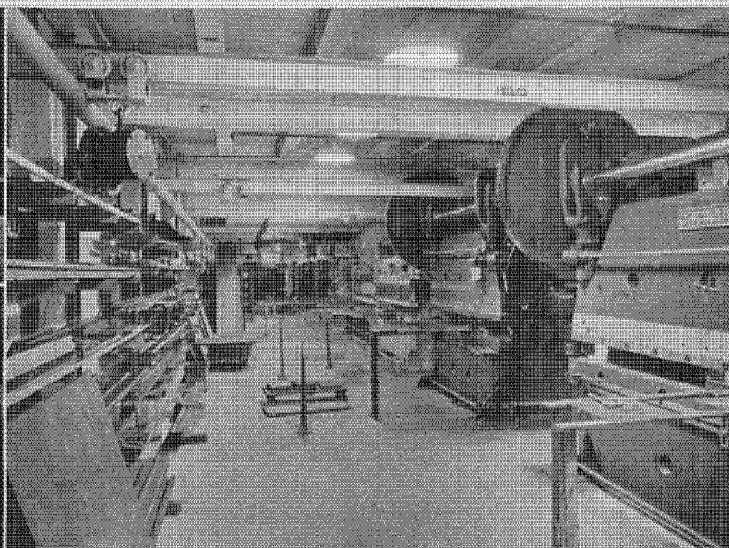
How strong is this tennis string? "I'll tell you in a moment," says the man watching the dial indicator. He is conducting a "break test" for Armour & Company.



What about the liveliness of tennis string? Armour & Company's technicians make measurements on the so-called "rack test" to determine the facts.

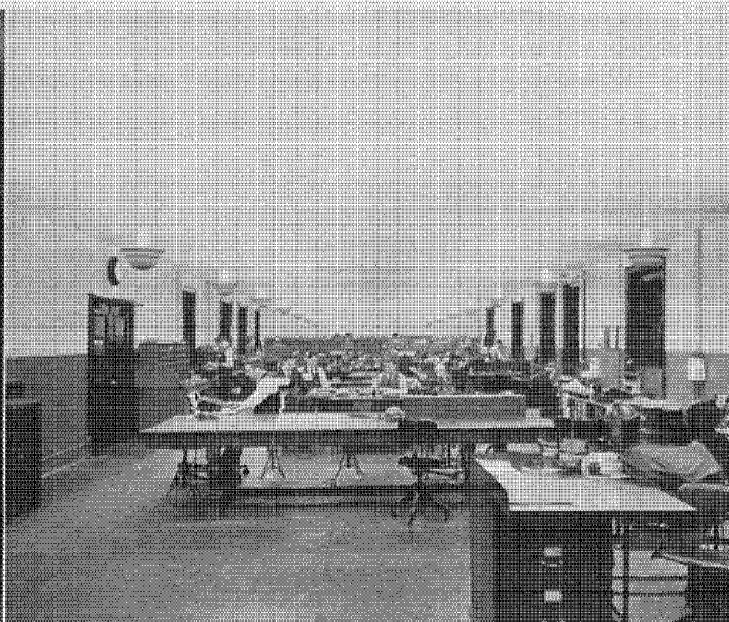


Two views of the same plant before and after carrying through a carefully-planned program of improvement by lighting engineers.



Industry needs Better Light

Mill and factory workers must be able to see what they are doing. Du Pont paint finishes, expertly selected and applied, are efficiency aids.



New lighting equipment in this office resulted in better working conditions. Notice the diffusion of light from walls and ceiling.

INDUSTRIAL America has plenty of work laid out to insure our national defense, and every one is agreed that in carrying through this job, the Shakespearean line, "If it were done, . . . then 'twere well it were done quickly," is much to the point. But that involves more than merely accelerating the r.p.m.'s of the machines in our plants and factories. Rapid production depends as well upon human factors, upon the ability of men and women employees to do their work safely and

skillfully, and for that, better factory lighting is needed.

While human eyes can adapt themselves to widely differing conditions, the strain of working at a job that calls for good vision in a poorly-illuminated room is too great to be endured long without fatigue that lowers the operator's efficiency and productiveness. Employees cannot work well if they cannot see objects clearly—and that applies particularly to tasks involving great precision.

George G. Taylor, lighting expert of the General

Electric Company, in an article recently published in *Textile Age*, outlines the following deterrents to what may be termed "good seeing."

1. High brightness sources causing glare, either direct or reflected.

2. Poorly shielded or completely unshielded sources.

3. Uneven illumination resulting in poor contrasts and dark, harsh shadows at the working point.

4. Low levels of illumination.

"Where any of these conditions exist," he adds, "production suffers." Further along he refers to the work of a committee of the Illuminating Engineering Society, which has conducted research studies based on a three-point approach, namely "(1) what must be seen, (2) how it is seen, and (3) what quantity and quality of lighting will provide the easiest seeing, all to the end of determining the quantity, direction, brightness of the source, and spectral quality required for the best lighting results."

Illumination engineering has made steady progress during recent years as scientific knowledge and new materials have been brought into use. Lighting equipment has been improved, notably through the use of fluorescent lamps. And better control of this light has been achieved through the use of Louverglas, which was described in the February number of this magazine. It is one of chemistry's contributions in this field. Improved paint finishes for factory walls and ceilings also make possible better illumination whether the light source be the sun or an electric current.

Broadly speaking, there are five distinct types of lighting systems in use today—direct, indirect, semi-indirect, semi-direct and general diffusing. The accompanying pictures, as shown in order, left to right, illustrate the lighting effects obtained by these systems. Factory-lighting needs, of course, vary widely, but some one or more of these systems can usually be relied upon to insure the proper intensity and distribution of light in any interior. Maximum efficiency, however, cannot be expected in any case unless the surrounding wall and ceiling surfaces are properly painted. To fail in this respect is to make one's investment either in new or old lighting equipment less productive than it should be, while continuing to pay electric light bills for a service without getting all its benefits.

One requirement of all of these systems is that there should not be excessive contrasts of illumination within the worker's field of vision. Glaring lamps that cast sharp shadows are to be avoided. It is important not only to provide enough light, but also to secure the right degree

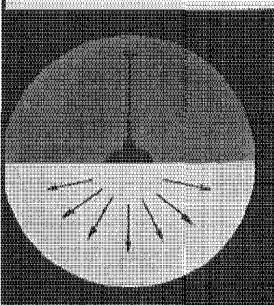
of light diffusion for maximum efficiency. Any competent illuminating engineer, after studying the particular requirements of a room, will know how best to achieve the result desired.

The system most commonly installed in industrial plants is direct lighting, although in most cases the intensity of direct light is modified by shielding devices and by applying to the wall and ceiling surfaces suitable light-reflecting or light-diffusing paints. As a general rule, ceilings should reflect at least 75 per cent of the light that strikes them, and even higher values are desirable. Painted walls directly in line with a worker's vision should have a light-reflection factor of 50 to 60 per cent. Paint helps in conserving light for use, and also diffuses it, thus eliminating the sharp contrasts which are so objectionable.

The other four systems mentioned are also dependent upon secondary reflecting surfaces to a greater or lesser extent. Indirect or semi-indirect lighting systems are particularly dependent upon paint for their maximum effectiveness. Freshly-painted white ceilings and walls reflect a maximum of light, but sometimes, even at a sacrifice of lighting efficiency, it may be preferable to use light colors other than white to produce a desired decorative effect. Conditions are encountered where a high gloss finish, reflecting light at sharp angles, would be objectionable because of the tendency to produce glare. In such cases, it is better to apply paint in a flat or eggshell finish for greater light diffusion.

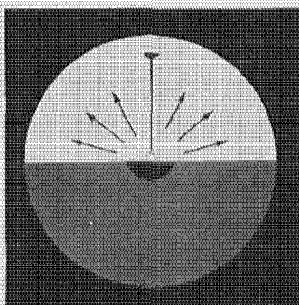
One exception is in factories with high ceilings, where little direct light, either natural or artificial, strikes the ceiling or upper wall surfaces. A flat finish in such rooms is of no practical advantage, and a gloss white can be recommended. In practice, local plant conditions always determine whether a gloss or flat finish should be specified. The lower wall areas, below the eye level of a seated person, do not reflect useful light to the working plane and may therefore be—and usually are—painted in a darker color.

Scientific lighting in factories, mills and plants is more complicated than one might suppose it to be. It is a job for professionally-trained and experienced engineers who know or can ascertain what quantity and quality of light will serve best in each individual case. The technology is too involved for discussion here. Laymen are not interested in visibility readings, foot-candle measurements, nor in light-reflection and transmission factors, but engineers need this information in their professional work, and they are getting more and more of



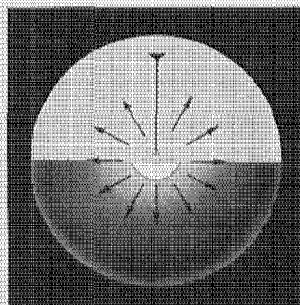
DIRECT

Reflector directs almost all of the light to a particular area without reflection or reflection.



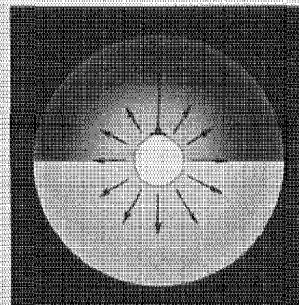
INDIRECT

Here 90 to 100% of the light rays strike the ceiling and are reflected down into the room.



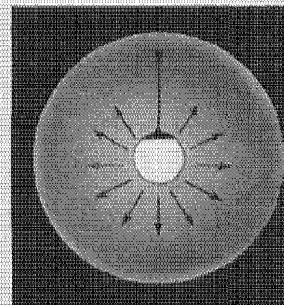
SEMI-INDIRECT

Reflector directs 60 to 90% of light to ceiling and side walls; the rest is directed downward.



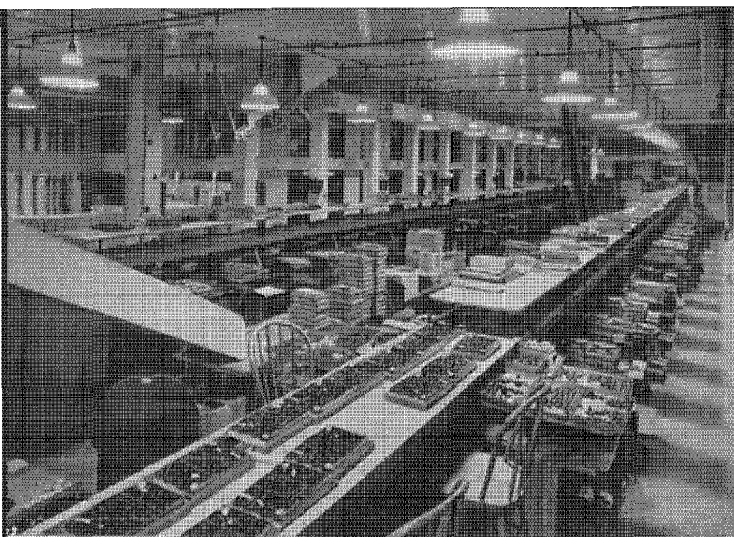
SEMI-DIRECT

Reflector directs 10 to 40% of the light upward and 60 to 90% is directed down into the room.



GENERAL DIFFUSING

Light is controlled by a reflector so that all of it is evenly directed, as shown in this sketch.



Obviously the factory-lighting problem in this candy factory was expertly handled to achieve the result illustrated here.

it from our nation's physical and chemical laboratories and from their own cooperative research studies.

As an instance in point, the Lamp Division of Westinghouse Electric & Manufacturing Company, Inc., has compiled data showing the reflection factors, in percentage figures, of Du Pont white and light-colored paints and finishes. The reflection factor, it may be explained, is determined by comparison with magnesium carbonate, which has a rating of 98 per cent, and is the accepted standard. In the following list of products, the percentage ratings in light-reflective properties afford a basis for making selections:

REFLECTION FACTORS OF DU PONT PAINTS (Partial List Only)

<i>Product</i>	<i>Percentage</i>
"Du-Lite" Mill White Eggshell	92
"Du-Lite" Mill White Gloss	85
"Dulux" Mill White Gloss	85
"Dulux" Mill White Eggshell	83
Interior Gloss White	86
Interior Gloss Light Ivory	76
Interior Gloss Light Buff	62
Interior Semi-Gloss White	82
Interior Semi-Gloss Ivory	78
Interior Semi-Gloss Buff	71
Interior Semi-Gloss French Gray	61
Flat Wall White	90
Flat Wall Ivory	75
Flat Wall Cream	71
Flat Wall Yellow	68
Flat Wall Light Buff	63

It will be noted that the improved "Du-Lite" Mill White Eggshell finish and the Flat Wall White finish have a higher rating than any of the others.

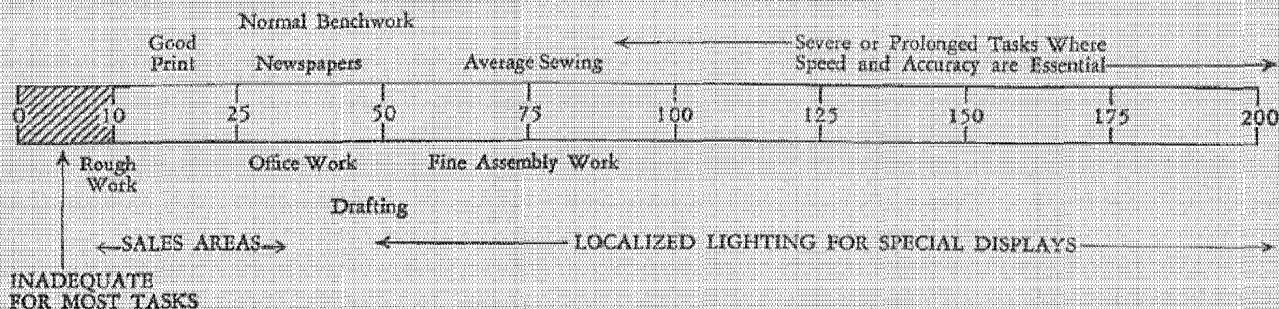
Another chart, reproduced here through the courtesy of the Philadelphia Electric Association, indicates in terms of foot-candles the range of illumination or lighting intensity which is recommended for easy seeing. This chart condenses a great mass of data which have been compiled by illuminating engineers, and they use it as a standard guide in their work. While the light values recommended for specific tasks depend upon local conditions, such as the size of objects seen, brightness of the background and surrounding areas, the duration of an eye task, age of the workers, the condition of their eyes, and so on, this chart presents in general the requirements under what are assumed to be average conditions.

Lighting efficiency and the use of paints as a contributing factor must be considered also from the viewpoint of permanence. Assuming a satisfactory paint film has been applied initially, the question arises how long will it remain effective under service conditions? Paint engineers with long experience in handling maintenance problems are best qualified to give the correct answer. Technical service is a plus value offered by the Du Pont



Here is another example of effective lighting in a hosiery mill, where machine operators work to advantage under fluorescent lamps.

Company to the paint-consuming trade, and particularly is it valuable to industrial concerns now contemplating paint modernization work. Better seeing is the key to better and faster production and to the increased efficiency of the army of men and women now engaged in turning out materials to implement our national defense. Paint intelligently selected and applied can help materially.



Consolidation Coal Company

By C. L. POTTS

THE Consolidation Coal Company is one of the leaders in the bituminous coal industry. From headquarters in Fairmont, West Virginia, it operates mines in the Fairmont region of that State; in the Millers Creek and Elk Horn sections of Kentucky; in Somerset County, Pennsylvania, and in the Frostburg field of Maryland.

At many of the mines, company towns are maintained. Their houses, built on lots large enough for vegetable and flower gardens, are kept well painted and repaired. Modern retail stores conducted by the company are clean and sanitary, their large, fresh stocks supplying the needs of the communities at prices comparable with those of similar merchandise elsewhere.

STORAGE AND HANDLING OF EXPLOSIVES

At each mine, two storage magazines, one for permissible explosives and another for electric blasting caps, are situated at proper distances from occupied dwellings, public highways and railroads. Two separate distributing magazines for explosives and accessories are conveniently located near the mine entrances.

SAFETY DEPARTMENT

The safety and first-aid work is supervised from Fairmont by a general safety director. Under his direction, a crew of safety inspectors tour the mines from the working faces to the tipples. The division managers hold monthly meetings, attended by mine superintendents, safety men and other officials, at which all accidents are thoroughly discussed and their exact cause determined for prevention of future mishaps.

For the protection of the men, extensive safety rules have been set up, and care is taken to assure their being observed. Each employee working in the mines or tipples is required to wear safety shoes, hat and goggles. In addition, the miners are one hundred per cent first-aid trained each year, and all of the mines are thoroughly rock dusted.

The grocery section of a modern department store operated by the Consolidation Coal Company's Merchandising Division.

PREPARATION OF COAL

Rigid supervision of coal preparation is constantly maintained by the Preparation Department from headquarters. A force of field men watch over the preparation of the coal from the working face to the railroad car. The high quality of coal shipped by the company results from close cooperation between the Preparation and Operating Departments.

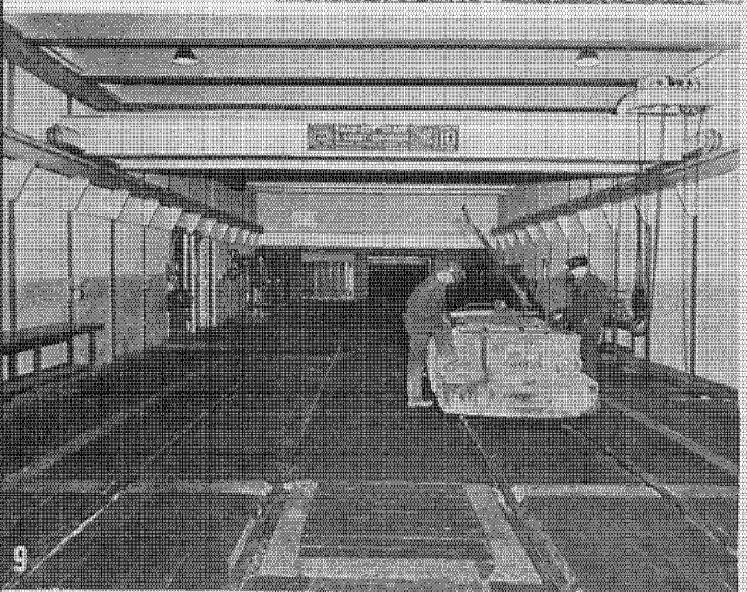
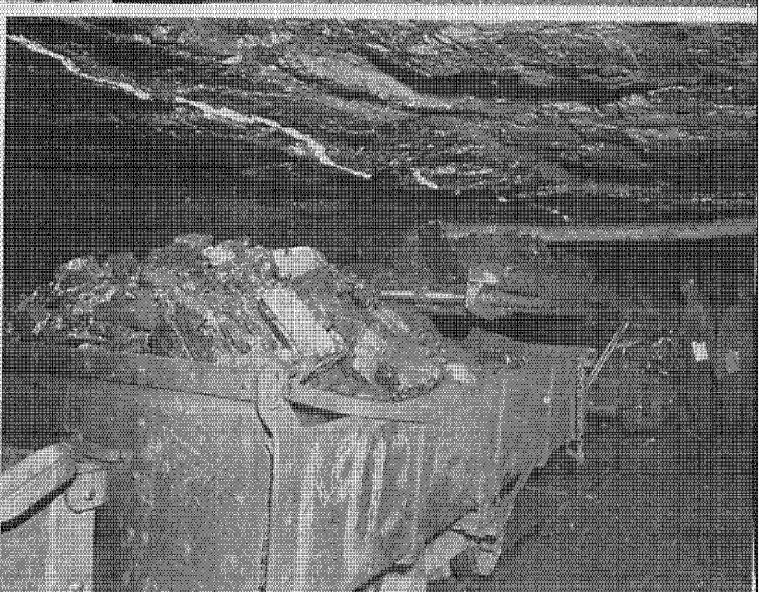
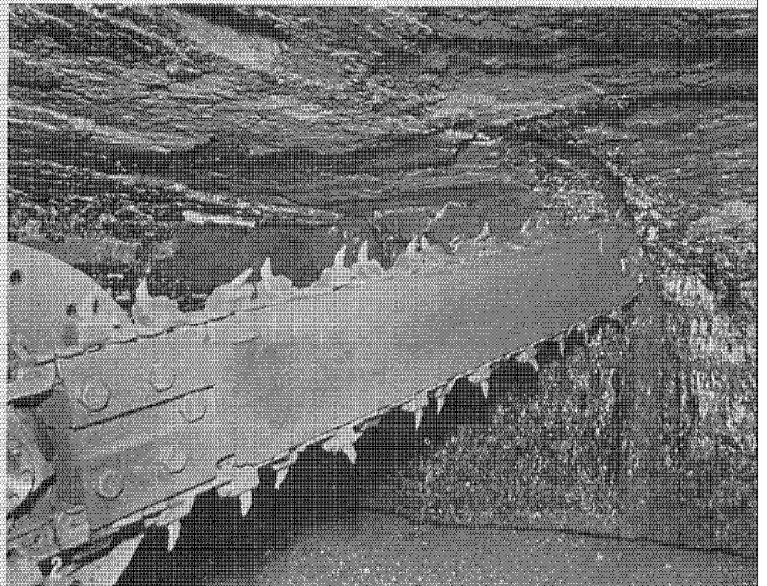
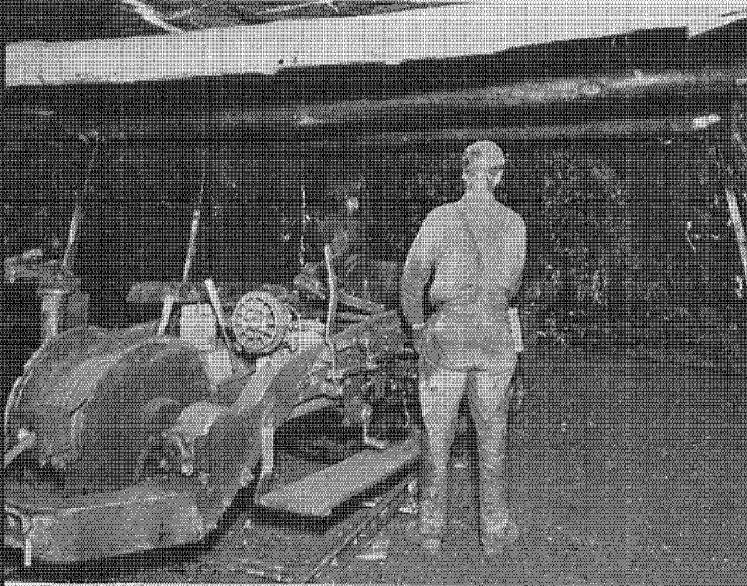
MINING OPERATIONS

When Du Pont introduced "Lump Coal" C permissible explosive, Consolidation Coal Company was among the first organizations to use it, as it is its policy to try new improved explosives in the interest of securing the best-prepared coal possible. "Lump Coal" C proved particularly suited for use in most of the mines in the West Virginia Division and was adopted for use in these mines as well as in some mines in other divisions.

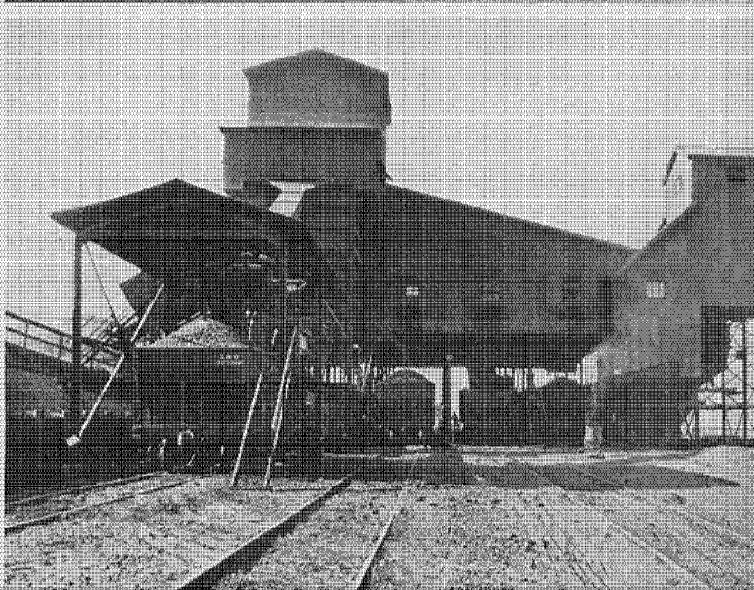
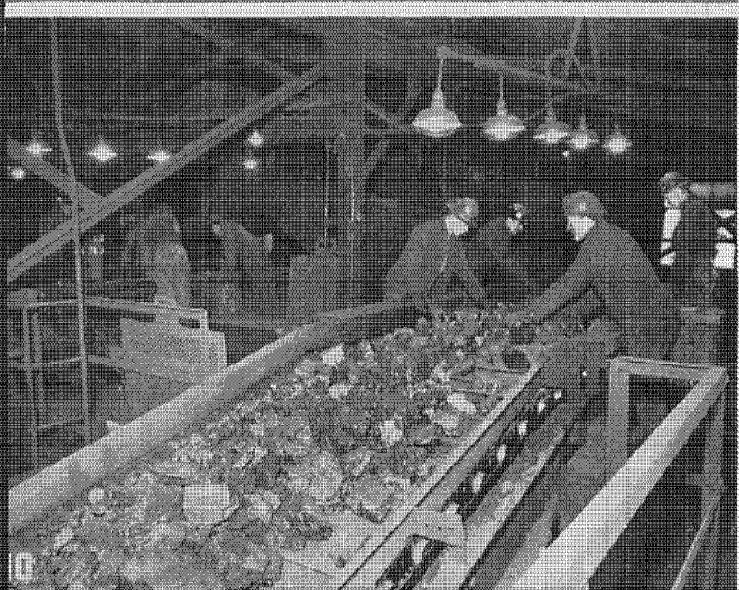
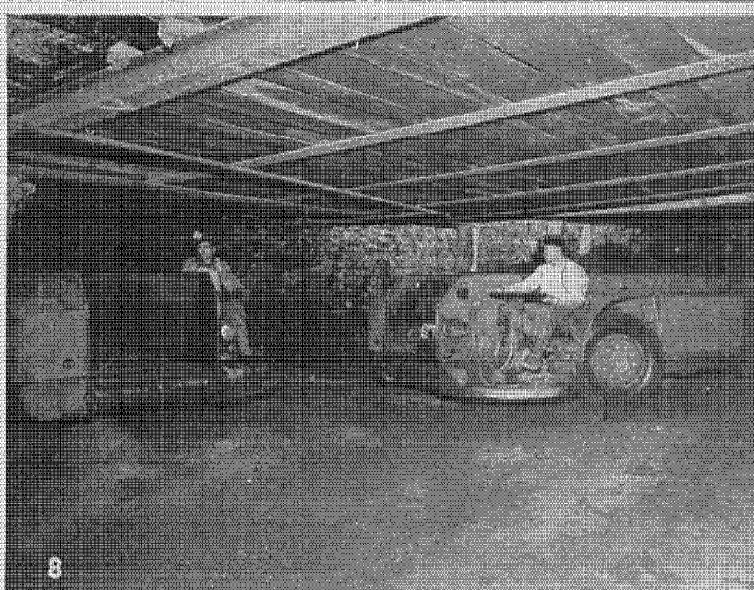
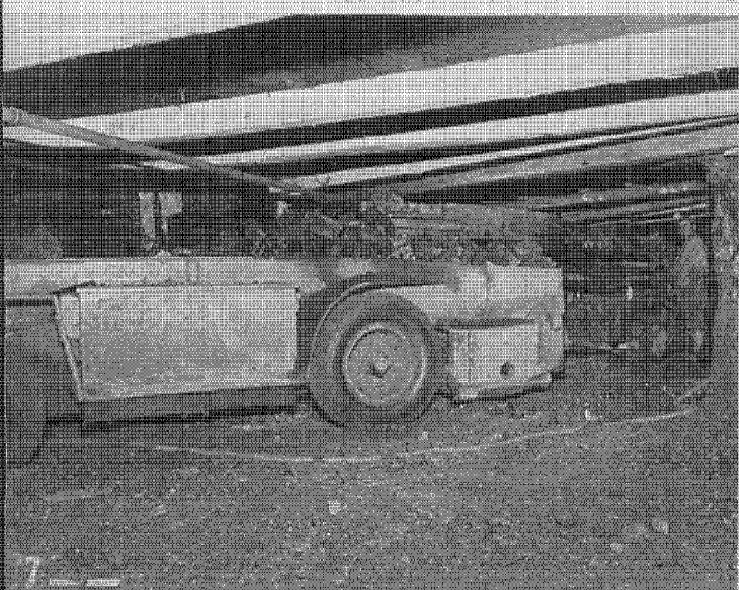
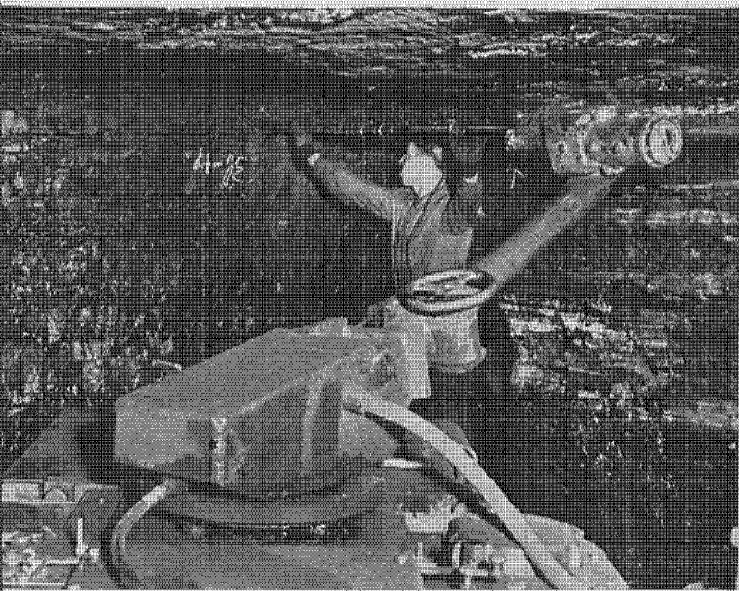
Due to limited space restrictions, the remainder of this article will be confined to a discussion of mining operations in the West Virginia Division alone. The accompanying illustrations (see pages 12-13) will present pictorially at least part of the story of coal production and coal preparation. Four of the seven mines in this division are mechanized.

In No. 93 Mine at Jordan, near Fairmont, track-mounted equipment is used for coal preparation. Caterpillar-type loading machines tram on the tracks and operate off the tracks at the face on caterpillar tread.





1. An Arzowall machine at work. The undercut has been made and shearing started five feet from the right rib. See No. 2.
2. A "close-up" of the cutter-bar of the machine, photographed while making the vertical cut in the face of the coal seam.
3. An electric drill, mounted on the machine, makes the bore holes in which the formidable explosives will be loaded.
4. The first hole, right, is loaded and tamped. Miner is shown loading the second hole. The third, to be loaded, is on the left side. Note on floor clay-filled "dummys" for tamping.
5. The same room after the shot which brought down the coal in large size lumps for easy handling by the loading machine.
6. Looking toward the boom end of the machine. The lumpy coal is being transferred to a mine car which holds three tons.
7. Here you see a caterpillar-mounted machine at work loading coal into a shuttle car which is equipped with rubber tires.
8. A loaded shuttle car starts the journey to the elevating conveyor. The empty one, left, prepares to enter the room.
9. Travel three miles underground from the pit mouth and you come to this machine room, modern and thoroughly equipped.
10. Inside the tippie, where groups of men are stationed at the picking tables to remove any impurities found in the coal.
11. The tippie. Clean coal, after careful preparation in the various sizes, is loaded into railroad cars for shipment.



Here the coal averages seven feet in thickness, and from four to six inches of bottom coal is left. Places are driven fourteen feet wide.

The cycle of work may be outlined as follows:

1. Track is laid in the place, and timbermen set up timbers in accordance with State Mining Department requirements and company rules.

2. The cutting operation: Arcwall machines bottom cut and shear, with the shear off center, about five feet from one rib. Cuts and shears are nine feet deep by six inches in width.

3. Drilling: Drills are mounted on cutting machines and operated by the cutting machine men. Three holes are drilled in each place, two on the wide side of the shear and one on the narrow.

4. Shooting: Shot-firers first test for gas, then check the cut, shear and drill holes. Bug dust is removed from the undercut next and thoroughly sprinkled. Finally the bore holes are loaded, tamped full with dummies consisting of clay, and shot one at a time. The shot-firer thoroughly sprinkles the coal again after shooting.

5. Loading: The machine now loads out the cut into mine cars of three-ton capacity. A gathering motor feeds empty cars to the loading machine and takes the loaded ones away. A swing motor handles "loads" and "empties" between the gathering motor and the main line, where a tandem electric locomotive hauls the loads three miles to the pit mouth and returns with a string of empty cars.

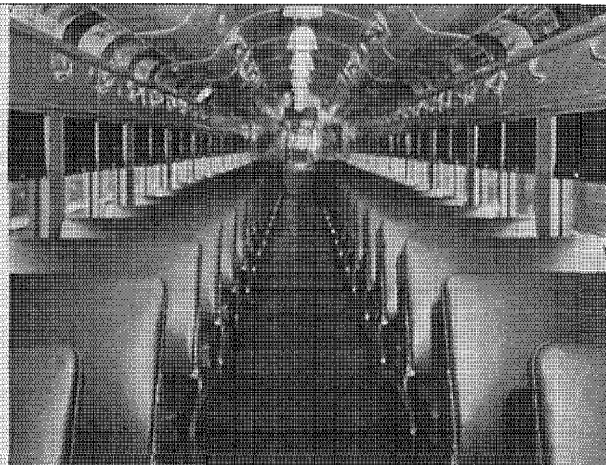
6. The coal is screened into the various sizes and cleaned by hand on picking tables in the tippie.

The underground construction of a large, completely-equipped repair shop is an interesting recent improvement at the Jordan Mine. Repairs to all the underground equipment are made here, three miles from the pit mouth, thus saving the time and expense of taking the equipment above ground.

A radical departure from established mining methods is employed at No. 25 Mine at Clarksburg by eliminating all but the main-entry tracks and substituting trackless equipment. The drilling is done by electric, post-mounted drills; cutting, shearing, and loading machines are caterpillar-mounted; and rubber-tired shuttle cars are used to haul the coal the short distance from the loading machines to an elevating conveyor, where it is loaded into regular mine cars and hauled to the surface by electric locomotives. The coal is top-cut and sheared; this top-cut is twelve inches from the top of the seam, eight feet thick here, thus leaving twelve inches of top coal for roof protection. Places are driven fourteen feet wide on ninety-foot centers, and the retreat work closely follows the advance. By this system practically all of the coal is secured. "Lump Coal" C, $1\frac{1}{2} \times 8$, is used in this mine.

NOTE:

"Lump Coal" C permissible explosive, referred to in this article, is the latest one of four products of this type manufactured by the Du Pont Company. The others, well-known in the coal-mining industry by the trade-marks "Monobel," "Duobel," and "Gelobel," are listed here in the order of their development. Each one has its individual characteristics and its special adaptability for use in mining operations. "Lump Coal" C enjoys high repute because it more nearly approaches the slow, heaving action of black powder than any other permissible explosive yet developed.



Erie's Commuters travel on "Cavalon"

By W. B. BURNS

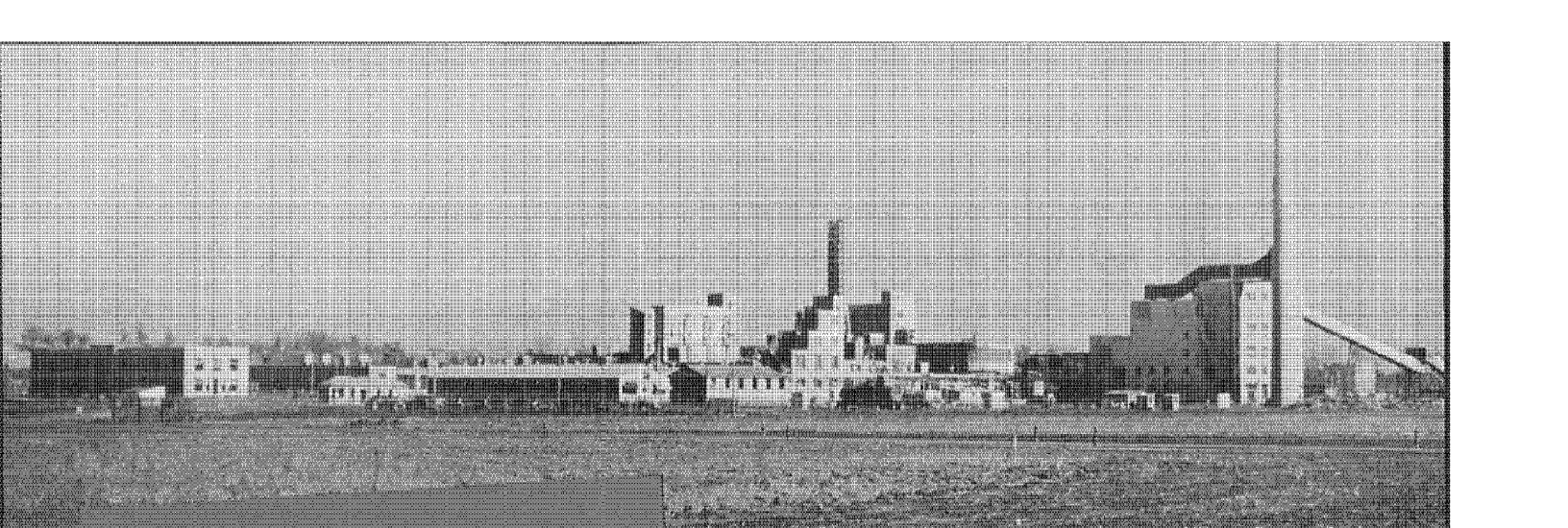
WITH northern New Jersey rapidly growing in popularity as a residential area for people who work in metropolitan New York, many of the transportation companies who carry their passengers to and from their homes daily have been directing their consideration not only to the safety and sanitary condition of the railway equipment, but also to the comfort of their passengers.

Each week day, some 65,000 passengers arrive and depart at the Erie Railroad Company's terminal, at the foot of Pavonia Avenue in Jersey City, on 980 cars made up into 215 suburban commuter trains. While the mid-day traveling is curtailed to a major degree, the heavy commuter traffic comes between the hours of 7:30 and 9:30 A. M. and again during the evening hours.

Early in 1940, the Erie Railroad Company set out on a program to rehabilitate its suburban passenger equipment at the rate of fifteen to eighteen cars monthly.

In the course of rehabilitation, the interior color scheme of the cars was completely changed from drab, dingy brown to light buff, and Du Pont "Cavalon" rubberized upholstery fabric in an attractive two-toned shade of brown was selected for covering the seats. The transformation in appearance of the remodeled cars has brought many favorable comments from the Erie passengers.

Because of the "case-hardened" finish of "Cavalon," it can be readily cleaned with soap and water. Because of its resistance to edge-cracking, scuffing and peeling, this coated fabric is ideally suited for railway upholstery installations. Rugged construction and the ability to withstand hard wear and abuse have similarly led to its adoption as an upholstery by many of the largest American manufacturers of commercial motor trucks, theater seats and furniture.



New "Cellophane" Plant Begins Production

By JAMES SHELLENBERGER

ON MARCH 3, 1941, the fourth "Cellophane" cellulose film plant built in America, since the Du Pont Company introduced the film here from France in 1924, was opened at Clinton, Iowa.

The new Clinton plant, which will employ more than 400 mid-westerners when full production is reached, is a commercial operation exclusively and, like the other three plants at Buffalo, New York, Richmond, Virginia, and Old Hickory, Tennessee, is incapable of being converted to "any purpose other than that for which it was originally designed; namely, the manufacture of 'Cellophane.'" Work on the project was begun in 1939. At the peak of construction more than 1,000 men were employed.

The new factory site covers twenty acres. There are four main buildings designed to function as a single continuous manufacturing operation. Into the top floor of the chemical building goes wood-pulp from the forests of the Pacific Northwest, and caustic soda. Working downward, the mixture finally emerges as a syrupy liquid known as viscose. Up to this point the process is similar to that employed in the manufacture of viscose rayon. Incidentally, it may be noted that this plant, the first situated west of the Mississippi, will be completely dissociated from any manufacture of its companion cellulose product, viscose rayon.

There was no difficulty in recruiting an operating force of the highest caliber in the Clinton district, though the type of industry was entirely new to this community. Outside the office staff, all but ten or twelve of the plant's employees are men.

Photo by Everett A. Stoltz, Courtesy Clinton, Iowa, Herald.

Out in the Midwest "where the tall corn grows" this new group of buildings commands attention. Here "Cellophane" cellulose film is being manufactured near Clinton, Iowa. Left to right, administration building, the operating area and the power-house.

At intervals, groups of new employees will enter the plant for intensive instruction and practice under the eye of experienced groups, until the full force of 400 is working. The method of training has been so efficiently worked out that quality of output will be up to the standards of the other plants from the beginning of production.

In addition to the plant proper, there are an administration building, power-house, and facilities for storing raw and finished materials. Most of the machinery was fabricated according to exclusive designs in the Company's own shops in Wilmington, Delaware.

"Cellophane" officials have stated that the food industries of the Middle West will receive the first shipments of the new film and thereafter consume the largest share of Clinton's output. It is interesting to note that back in 1927 when "Cellophane," after three price reductions, was selling at \$1.45 a pound, the food industry was skeptical of this new wrapping material, since the film made then lacked the moistureproof qualities of other protective wrappings.

In that year, however, Du Pont chemists succeeded in developing a moistureproof film which keeps food fresh. From that time on, the use of "Cellophane" in the food industry grew by leaps and bounds.

The plant at Clinton, serving the many food industries of the Middle West, will devote a large part of its production to the manufacture of moistureproof "Cellophane," but plain transparent film will be available for wrapping such merchandise as textiles, paper specialties and the like, products of staple character in which "drying out" is not a problem.

As a scientific curiosity, an expensive novelty wrapping exclusively for luxury merchandise back in 1923, "Cellophane" sold for \$2.65 a pound. Today, with the price down to \$.33 for the plain transparent film and \$.41 for the moistureproof variety, the result of twenty voluntary price reductions, established uses of "Cellophane" number more than 5,000 items literally running from almonds to toy zebras. Including the new plant at Clinton, Iowa, there are now four plants in four sections of the country, and they are providing jobs, directly and indirectly, for approximately 10,000 workers.

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Vol. XXXV APRIL, 1941 No. 4

"Cavalcade of America" Changed to Mondays

"CAVALCADE OF AMERICA" is now heard over a nationwide NBC network on Monday evenings instead of Wednesdays. This change of time, which went into effect with the program of March 31st, enables it to be heard at an advantageous hour in every part of the country, both now and after the resumption of Daylight Saving Time in many communities on April 27th. At present the hour is 7:30 P.M. in the Eastern area, rebroadcast so that the Central States receive it at 9:30; Mountain States at 8:30 and the Pacific Coast at 7:30, all local time. Beginning with the program of April 28th, the hours will be (according to the time systems most universally employed in the given areas) 7:30 Eastern Daylight Saving Time; 8:30 Central Standard Time; 7:30 Mountain Standard Time, and 6:30 Pacific Standard Time.

The new schedule further more takes in nine important stations which were previously not on the network: stations in the cities of Dallas, Houston, Kansas City, St. Louis, Louisville, Milwaukee, Indianapolis, Raleigh and Shreveport. Rochester and Des Moines, which on the former schedule carried the program by transcription, now join the live network broadcast on Monday evenings.

The net result, it is felt, will afford more people an opportunity to enjoy the ever-growing stature of the "Cavalcade of America"—recently mentioned by a New York news-

paper as "a staple of American radio entertainment" and by a Cleveland editor as "a show that makes Americans proud of their heritage."

Oil and Chemistry

OIL! Next to gold, there's no more magic word to kindle the imagination of the adventurous, to shift the sands of population, to influence the destiny of nations. Oil today has lost none of its romance through the technological improvements which have been brought about in locating, producing, refining and using it.

The extraordinary progress of the petroleum industry can be traced directly to research. Young as industries go—less than one hundred years old altogether—the petroleum industry has not only espoused research as its most productive asset in the solution of its own problems, but has also been able to profit by the advances of science in other fields, notably in the manufacture of chemical products.

There's a close partnership between the chemical industry and the petroleum industry. Petroleum on the one hand is becoming an increasingly important source of raw materials for chemical synthesis. On the other, chemical research provides the petroleum industry with valuable tools at every step of the way from oil prospecting to oil consumption.

Seismic prospecting, which maps the earth formations far underground and locates "domes" wherein oil may lie, thus saving millions of dollars in time, money and energy, depends upon dynamite. Du Pont developed "Nitramon" S to do this particular job effectively. Explosives are also used for shooting oil wells to increase the flow. Drilling equipment makes use of neoprene chemical rubber, taking advantage of its superior resistance to oil.

The refining of petroleum demands a long list of chemicals: solvents, acids and "doctor solution" (lead plumbate) to remove objectionable constituents; tetra-ethyl lead to give the gasoline more power; inhibitors to stabilize the marvelous new gasolines made possible by modern cracking and polymerization processes; dyes so that the public can distinguish between different grades of

gasoline; addition agents for lubricants to increase their oxidation stability and film strength; and bases for extreme pressure oils and greases. The research facilities of Du Pont laboratories are constantly being applied in cooperation with petroleum technologists toward improving their processes and products.

The marketing branch of the petroleum industry makes use of neoprene for gasoline hose and other important services; of dozens of different finishes—for storage tanks, marine tankers, trucks, filling stations; even of plastics for protecting pipe lines which transport oil thousands of miles underground.

Oil and water don't mix—but obviously oil and chemistry do.

Larger "Paint Farms"

PAINT PANELS exposed on Du Pont "test farms" have been increased from approximately 30,000 to 60,000 in the past five years, with more than a million periodic inspections each year. The panels range in type from tin plate to steel one-half inch thick and from Venetian blinds to freight-car sidings. Prolonged exposure tests in various climates are conducted on every shade of paint. Expansion of the program is a result of the benefits provided by this system of pre-testing.

In Philadelphia alone, last year, 94,660 test panels passed through the Philadelphia laboratory on their way to and from the test farms. Some 5,000 different exposure studies were made.

Approximately 30,000 test panels are exposed in Delaware, 26,000 in Florida, and 4,000 in Texas, not including those exposed adjacent to Du Pont plants in Parlin, New Jersey; Flint, Michigan; Chicago, Illinois, and San Francisco, California.

Many field evaluations are also being made. These include tests on finishes for structural steel, for gas and oil tanks, automobiles, refrigerators, and marine finishes for pleasure boats and ocean liners. The field tests on house paints involve the use of more than 450 houses throughout the country. Some, along the sea-coasts, show how paint stands up in salt air. Others in Florida test resistance to humidity and strong sun-

(Continued on Page Twenty-Four)

WHAT'S NEW

NYLON THREAD for home sewing has now been put on the market for both hand sewing and machine stitching. Tests show this thread has great strength and elasticity, permitting garment seams to stretch under unusual strain without danger of breaking the stitches. Bias seams, too, stand the strain of longitudinal stretching. Nylon thread is also resistant to rot from perspiration, does not shrink when a garment is dry-cleaned or washed, is not adversely affected by normal ironing conditions, but, as with all fine fabrics, use of a very hot iron should be avoided.

This thread is manufactured by Belding-Heminway-Corticelli Company of New York City, and may be obtained at leading department stores and chain stores throughout the country.

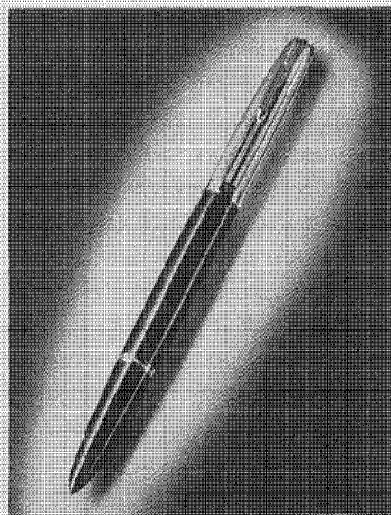
NEW paint pigments 33 per cent more effective in "hiding power" and opacity than any known today have been announced by Du Pont chemists. This development is the "first fundamental change in the pigment field in many years."

The process involves a transformation of the crystalline structure in the minute titanium dioxide particles comprising the pigment. By altering the form of the finely-ground crystals, it is possible to deflect more of the light rays striking the surface, resulting in a more opaque covering. Chemists liken the change to Nature's turning of a dull carbon mass into a diamond by revision of the crystal form. The "index of refraction," a property determining the opacity of a substance, is substantially increased in each instance, they say.

The new pigments are improvements on the titanium-dioxide type

which have come into wide use in the industry in recent years. Pigments based on titanium are the whitest and most opaque produced from any known source, and have introduced unusual properties into paints, notably a self-cleaning quality important in outside building finishes.

A NEW 16-page bulletin describes briefly the complete group of Du Pont chemicals, processes and materials used by electroplaters. Ten pages are devoted to ten different metal finishes. This bulletin also presents facts about alkali cyanides, cleaning, pickling, carbonate removal, test kits and service. Copies are obtainable from the Electroplating Division of the Du Pont Company.



THE new Parker "51" pen, in its streamlined sheath of "Lucite" methylmethacrylate resin, embodies several clever innovations. One is the gold point which is tubular in form and is enclosed within the barrel so that it remains moist and well protected. Another is the cylindrical comb inside the barrel, for trapping ink overflow. The extreme accuracy required for this patented ink trap necessitated the use of "Lucite." Its chemical resistance and durability enabled the manufacturer, The Parker Pen Company of Janesville, Wisconsin, to offer a lifetime guarantee with every pen. In keeping with the advanced styling of this model, the Plastics Department of the Du Pont Company developed its material in black and in such colors as cedar blue, red and gray.

A new Du Pont bulletin on organic chemical specialties describes a number of products used by the textile industry and in a wide range of other applications, such as leather manufacture, paper making, metal cleaning and plating, pigment dispersion, cosmetic preparation and the like.

Most of these materials have surface-active properties, and are used where wetting, cleaning and emulsification are involved. A table listing the various wetting efficiencies is given. Other factors, such as scouring and emulsifying efficiency, solubility, stability, chemical reactivity and solvent properties, are discussed. Solubilities in the presence of various metal salts are also shown.

The bulletin was prepared by the Fine Chemicals Division, Wilmington, Delaware, as a guide in selecting materials. In requesting copies, please use your company letterhead.

"CAVALON" rubberized upholstery fabric, a Du Pont product, has been chosen in ox-blood color as the upholstery for Kansas City's new Municipal Airport Restaurant. This material, originally developed for heavy-duty seating in trucks and taxicabs, has gained wide acceptance in suitable color and finish effects as a furniture covering. It meets the demand for a tough, pliable upholstery for deep-seated chairs and other furnishings likely to be abused.

"Cavalon" is made on a cotton fabric base and given a rubber coating at the Fairfield, Connecticut, plant of the Du Pont Company.

A DRAFTSMAN'S triangle made of the Du Pont "Pyralin" cellulose nitrate plastic is being manufactured in a design which makes it possible to use one instrument only, instead of two required heretofore. The shape is such that it not only serves in place of the 30°-60°-90° triangle, and the 45° triangle, but gives additional angles as well. An added feature is deep-bevel lifting cuts, convenient for raising the angle from the drafting board. According to comments of architects and engineers, this device is convenient and easy to use. It is manufactured by Elmer Coffey of La Grange, Illinois.



Replanting time in a cane field in Puerto Rico is a busy period for the field workers. Short lengths of cane are laid in furrows and covered with soil. Note the pile of cut pieces at the right.



A long-distance view of a field with the crop about ready to be cut. Under favorable soil and climatic conditions, the cane grows rapidly; sometimes mature stalks reach a height of twenty feet.



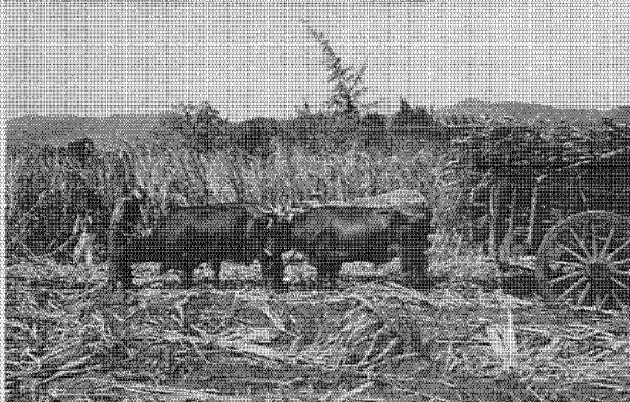
Harvest time. This "close-up" gives you a good idea of the dense growth. The instrument used for cutting cane is a large steel knife with a hook on the back to strip the leaves from the stalk.

Puerto Rico

... one of our sugar bowls

By OVE F. JENSEN

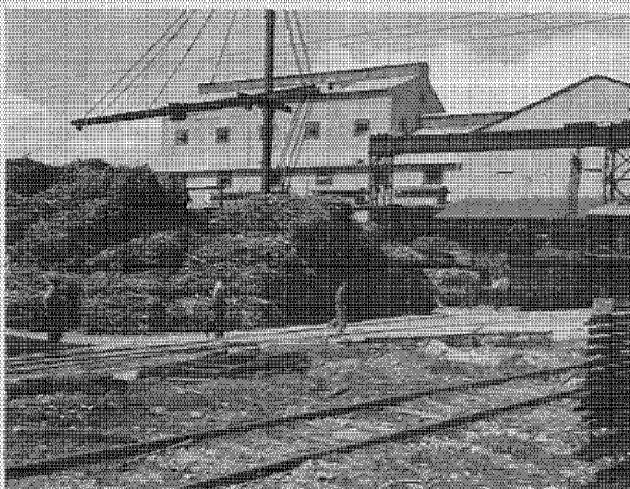
Photos Courtesy of Assoc. of Sugar Producers of Puerto Rico.



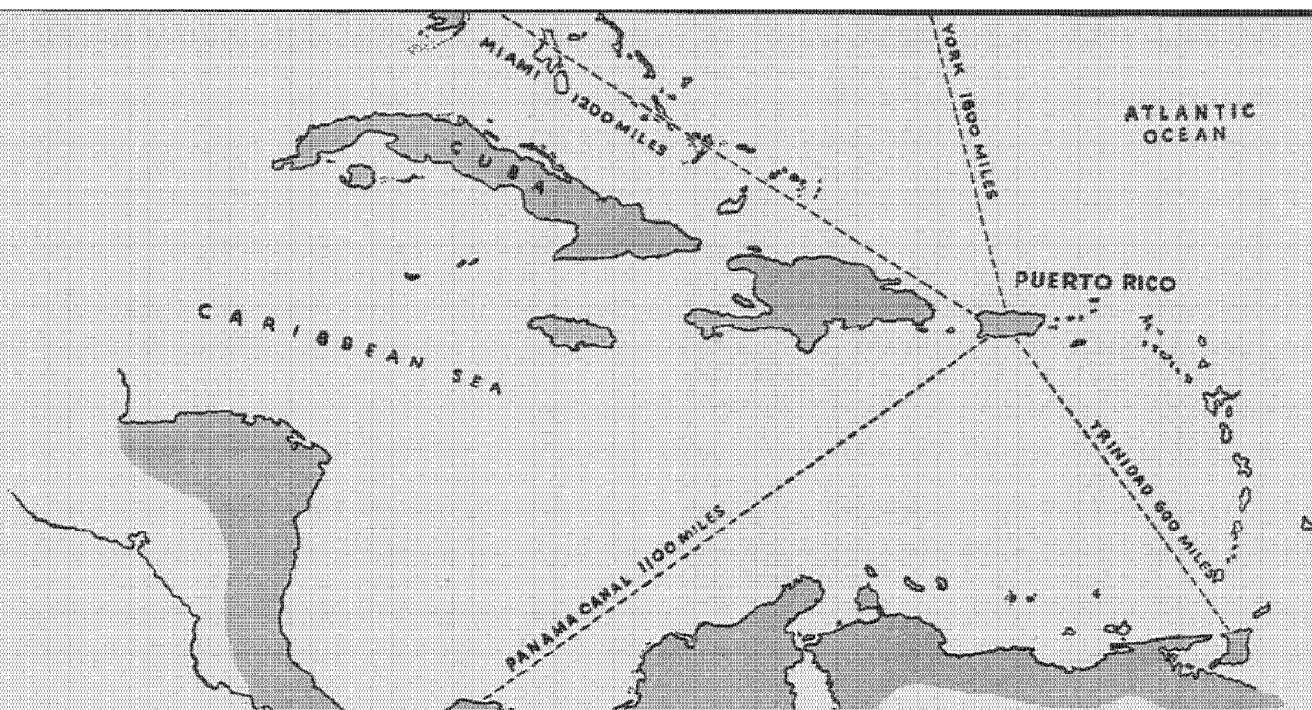
Cutting and hauling cane on a sugar plantation in Puerto Rico. Transporting heavy loads of cane to the mill is a real problem in many localities, and ox-teams and wagons are commonly used.



Despite the primitive road conditions in the outlying regions, many plantation roads are improved, as will be noted in this



The end of the journey. Here may be seen huge bundles of cane piled up at the mill awaiting the attention of the grinders.



PUERTO RICO has recently become well known as a strategic link of our national defense. For many people, further knowledge of this island is limited or vague. It deserves better acquaintance, not only for its location value, but for the part it plays in our sugar supply. In many other respects, too, Puerto Rico—its people and its problems—is interesting and compelling.

This island seems remote because it is not in any of the heavily-traveled lanes of steamer or tourist traffic. Actually, it is not far away in these days of speedy transportation. A part of the West Indies, Puerto Rico forms one of the stepping-stones of the Antilles from Miami to Trinidad, a second connection between the continents of North and South America. By plane, Puerto Rico is approximately 1,200 miles from Miami, 600 miles from Trinidad, and 1,100 miles from the Panama Canal. This little tropical island of only 3,400 square miles has a population of 1,900,000—one of the most densely populated land areas in the world. Compared with the State of Delaware, it has 75 per cent more land area, but over 700 per cent more people. However, unlike Delaware, much of the terrain is mountainous, and not tillable.

Nearly two-thirds of the land area in Puerto Rico is so mountainous that ordinary field crops cannot be grown, and only three-eighths—less than one-half acre per inhabitant—is classed as arable. Again by comparison, the State of Mississippi has over eight and one-half acres of arable land per inhabitant. The pressure of population is accentuated by the fact that the island is almost wholly agricultural, with no well-developed industries.

In its agricultural economy, and in the life of its people, sugar is dominant. Sugar and its by-products, molasses and rum, account for about sixty-three per cent of the income of the island. This past year, Puerto Rico produced over 1,000,000 tons of sugar. Under our quota system Puerto Rico supplies thirteen per cent of our continental sugar consumption. The other cash crops are tobacco, pineapples, citrus fruits, coffee and coconuts.

In any densely-populated area, the crops that yield the highest returns in food or in terms of the necessities

of life are given precedence. Sugar-cane is a remarkable crop in this respect. For while Puerto Rico is able to grow some of its food, principally bananas, sweet potatoes and a few other tropical crops, it imports rice, beans, corn, oats, wheat and potatoes in such amounts as would require 389,000 acres, if grown on the island with the same average yield as in the States. However, Puerto Rico secures these crops in exchange for the sugar produced on 47,000 acres.

The superiority of sugar-cane over other common food crops, in terms of energy values produced per acre, is enormous. For example, the average acre of cane in Puerto Rico produces sugar with an energy value equal to the potatoes produced on twenty-five average acres



Puerto Rico has much to offer the tourist in its tropical scenery, its quaint villages and its Old-World atmosphere.



Casa Blanca, residence of Ponce de Leon, a companion of Columbus on his second voyage and the first Governor of Puerto Rico.

in the States. Likewise, an acre of cane is equivalent to twelve acres of wheat, or to six acres of corn, at the average yields prevailing in the States.

Diverse elements make up sugar-cane economy and culture in Puerto Rico. At one extreme are the large sugar corporations, or Centrals, applying the latest machine methods and scientific management based on their own extensive research. At the other extreme are farmers, or *colonos*, working in the most primitive way, most of them eking out a bare existence. In the forty-odd years under the American flag, sugar-cane acreage in Puerto Rico has quadrupled, but the total yield has increased ten times, due to improvement in varieties, in methods of culture, and in fertilization.

Growing the cane requires much labor, from planting time until harvest. Two kinds of cane are harvested—plant cane, meaning the first crop from planted canes, comprises about one-third of the total crop each year; and ratoon cane, the second or third crops from the stubble of previously harvested plant cane, makes up about two-thirds of the total crop. On occasion, as many as six or seven successive ratoon crops may be obtained.

Plant cane is of two kinds: Gran Cultura, planted in the fall, is harvested beginning the second January or February after planting; and Prima Vera, planted in the spring, is harvested in the late spring of the following year. This work is spread over as long a period as possible, to make for efficient and economic mill operation. Huge mills, operating twenty-four hours a day, handle enormous tonnages, grinding the cane between massive rolls to express the juice, and evaporating and purifying the juice to make raw sugar. To keep the mills going properly requires large supplies of cane, drawn from outlying areas by narrow-gauge field railroads, or by trucks and ox-carts over heavily-traveled, winding and picturesque roads. The program of deliveries must be carefully timed, for cane is perishable and cannot be kept long after cutting, without deterioration. But standing cane can, if necessary, be left in a field until the following season, with little or no loss in total sugar content.

In terms of actual plant material produced per acre, or compared with other crops, cane yields are quite

remarkable. The harvested cane generally averages thirty-three tons per acre for the whole island, and often averages fifty tons for the better-managed Centrals. Yields of 100 tons per acre have been known. Such yields are naturally exhaustive of soil fertility and necessitate a fairly heavy fertilizer program. Puerto Rico uses about 120,000 tons of fertilizers annually, much of which is mixed fertilizer. The average formula contains 29.46 units of plant food per ton, as compared with an average of 18.62 units for the United States. The higher concentration is due to several factors—in part, to the progressive leadership of the large sugar companies.

Fertilizer is generally used in two or more applications per year—400 to 800 pounds per acre at planting time, and a like amount two months or so later. The grades selected may be 10-6-16 or 14-4-10, the most popular grades, or fertilizers supplying nitrogen only. "Uramon" nitrogen fertilizer compound, recently introduced by the Du Pont Company, is now being successfully used for the fertilization of sugar-cane.

About ninety per cent of the cane lands are located in the fertile, coastal plain areas fringing the island. The remaining ten per cent is in interior valleys. Soils vary from moderately acid in the northern and northeastern regions to strongly alkaline on the south coast.

Rainfall averages seventy inches annually, but varies widely from more than 140 inches per year in the mountains to less than thirty inches on the south coast, where irrigation is necessary. Heavy rains on the steep slopes of much of the arable land make soil erosion a serious problem. Soil conservationists estimate that only twelve per cent of the land area has not been affected; nineteen per cent has lost up to one-quarter of its surface soil; twenty-seven per cent has lost up to one-half, and forty-two per cent of the land area has lost more than three-quarters of the surface soil.

Puerto Rico has much to offer the tourist in its tropical scenery, its quaint villages, its Old-World atmosphere. One is impressed with the problem of population pressure—as yet largely unsolved—rather than with the supposedly easy and romantic life of the inhabitants. Sugar-cane, yielding relatively high returns, and requiring much labor, is admirably adapted to Puerto Rico's needs, for sugar is life to this island and to its people.



Tobacco is another one of Puerto Rico's cash crops. This view shows a typical field scene with a backdrop of native trees.



Sleuthing for Toothaches

By H. H. GILBERT

IN THE role of dental detective, X-rays play a part of increasing importance. The current emphasis placed upon the early treatment of unhealthy teeth necessitates the location of trouble while still in an incipient stage. Many dentists today make a routine X-ray examination of every patient's teeth. Films regularly show sources of future difficulty that would pass unnoticed in an examination by any other method.

X-raying the teeth is not the arduous undertaking that it once was. Modern shock-proof machines are amazingly fool-proof and simple to operate. Du Pont's new dental films and processing solutions further simplify the technique of X-ray examination. They allow considerable leeway in choosing the exposure that will produce a good picture, and they reduce the time consumed in making an examination.

The two Du Pont dental films are similar in several respects. Both are extremely sensitive. Their "speed" permits the use of a shorter exposure which, in turn, reduces the risk of a patient's spoiling a picture by moving. Both films are made with a blue-tinted cellulose acetate (safety) base. The clarity and color of this support add to the brilliance of the final picture.

The two films differ principally in just one respect. Du Pont "D" films have two emulsions—one on each side of the base. These films, by forming two super-imposed images, produce an extremely contrasty X-ray picture of the type preferred by some dentists. For those who like a softer result, Du Pont "S" films, through the

use of one emulsion, offer more tonal steps in the range between black and white. The emulsions in each case are overcoated with a layer of clear, tough gelatin to protect the film from abrasion.

X-ray films differ from most other films in that they are not exposed in a camera. This, plus the penetrating nature of the X-ray itself, allows the film to be incased in a light-tight envelope to facilitate handling. In dentistry, these film packets are of paramount importance. Since they are placed in the patient's mouth, they must be spotlessly clean. They also must be comfortable to hold in the mouth, and sufficiently flexible to conform to the contour of the jaw. The Du Pont "Pull-A-Tab" packet meets these basic requirements and possesses the additional feature of being extremely easy to open. Considering that this operation is done in the dark, and that it is repeated for each of the fourteen films in a complete examination of the mouth, the ability to do it quickly materially shortens the interval elapsing between the exposure of a film and the viewing of it as an X-ray picture. "Pull-A-Tab" packets are used for both "D" and "S" films. They are available containing either one or two films each.

While Du Pont films may be treated in any standard X-ray developer and fixer, for rapid processing Du Pont's new Concentrated Liquid X-ray Chemicals are recommended. These formulas have been worked out to produce optimum results in the shortest possible time of immersion. They process a film so that it can be viewed (wet) in less than four minutes from the time it was placed in the developer.

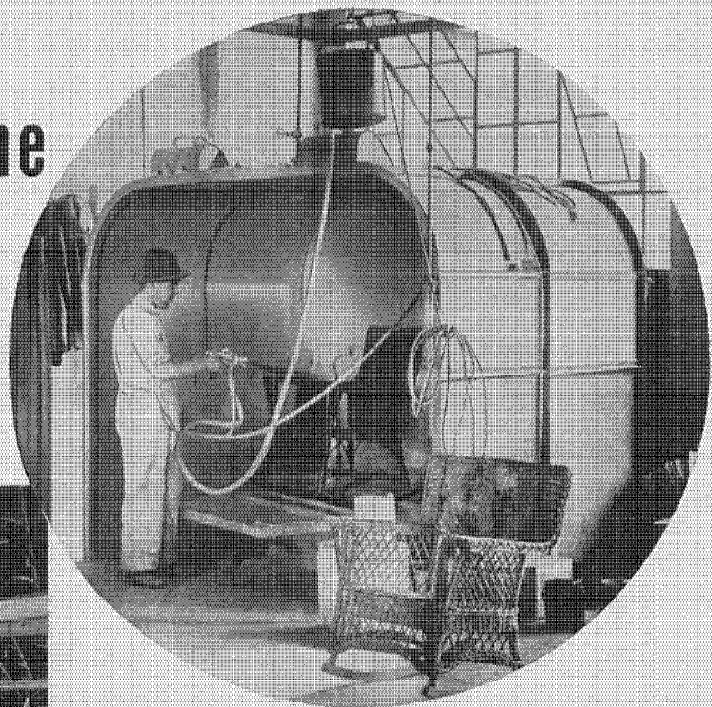
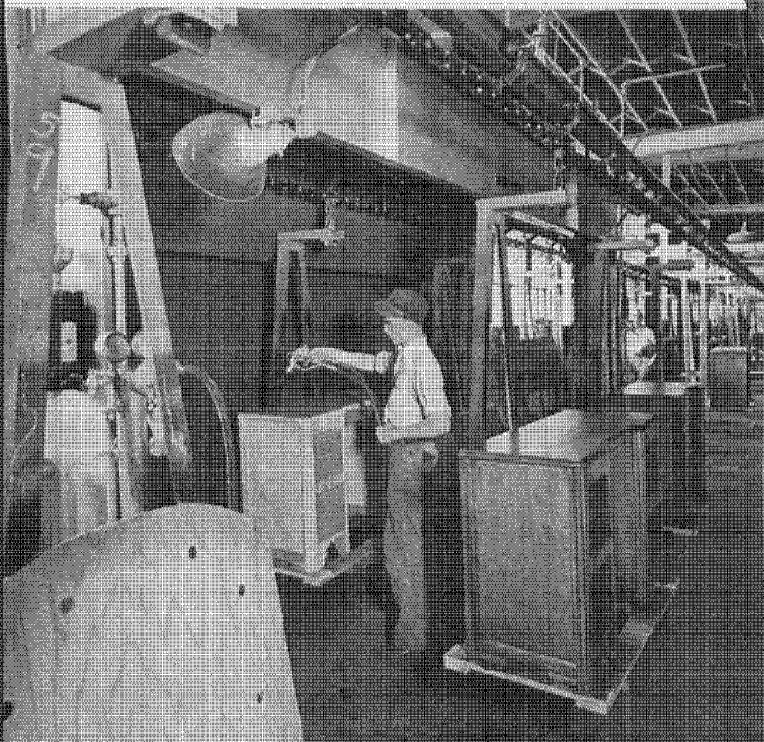
NOTE: Du Pont Dental X-ray Films and Chemicals are products of the Du Pont Film Manufacturing Corporation; they are made in Parlin, New Jersey.



This dentist is inserting a smooth, round-cornered packet of Du Pont Dental Film, yet his patient experiences no discomfort.

"About-face" in the Furniture Industry

Highlights of trends and developments



ABOVE: Once furniture was finished in spray booths like this, with overhead tanks supplying finishing materials to the gun.

LEFT: Now "Dulux" Furniture Finish is applied as the articles on the conveyor move by at the rate of six feet per minute.

pieces which, in most cases, performed no more of a function than similar articles on display in a retail store.

But times changed! Living conditions and habits were altered with each passing year; furniture took on a new meaning and grew in demand. Where once homes saw few changes in decorative schemes, and people were content to get along with the same parlor or bedroom suite for years on end, home owners became more style-conscious and replaced outmoded articles with newer, more smartly-designed pieces. Out went the stilted, uncomfortable chairs; in came more comfortable, more attractive furniture which not only served a utilitarian purpose, but also introduced a new note in interior decoration.

Other factors contributed to a greater demand. With increases in industrial business, payrolls soared and people in all sections of the country were able to buy, along with other things, needed articles of furniture for their homes. Growth in population and building construction added further impetus. Installment selling, introduced to maintain volume and to compete with other businesses, made it possible for more home owners to buy more furniture.

As a result, it was up to the industry to gear production to meet the rising needs by increasing output without impairing quality. Closely approaching changes in manufacturing technique made by the automobile industry, furniture manufacturers revised their processes by scheduling the output of plants on a mass-production basis. Portable, interchangeable tools and modern electrically-operated equipment made it possible to eliminate many needless hand operations which had previously been slow and laborious. More efficient performance of necessary manual operations and more-carefully planned

By ROBERT P. MILLER

IN TRACING the evolution of things, it is ordinarily necessary to go back many years, and often centuries, to disclose any marked contrasts or radical developments. Yet, in studying happenings in the furniture industry, you need turn back the calendar only about fifteen to twenty years to find that this industry since then has almost completely taken an "about-face."

At that time, as many will recall, the home was not thought of in the same light as it is now considered. The gracious living-room of today was then the stiffly-formal parlor, a room usually entered through sliding doors, and then only on special occasions. The bedroom was merely a place in which to sleep. The dining-room was not meant for the daily enjoyment of the family, but was largely reserved for "company." Under such circumstances, the finer pieces of furniture were primarily of little utilitarian value; they served rather as show

movement of pieces from step to step in the manufacturing process also effected additional short-cuts in production and corresponding savings in time.

Perhaps the greatest contribution to increased speed and volume of supply has been the installation of conveyor systems to transport articles from one part of a plant to another during the process of construction and assembly. In the past three or four years, a number of manufacturers have replaced slow, cumbersome "push-trucks" with overhead conveyors which enable workmen to make furniture on a straight-line production basis in a manner similar to that now employed in the manufacture of automobiles. Component parts of chairs, tables and other articles are assembled and then placed on a holder supported by an overhead chain which moves along at the rate of about six feet per minute. As this conveyor moves slowly forward, skilled craftsmen along the line perform their assigned tasks of filling, staining, finishing, sanding and other operations, and this forward progress is not interrupted until the completed pieces are fitted with hardware, carefully inspected and finally packed for shipment.

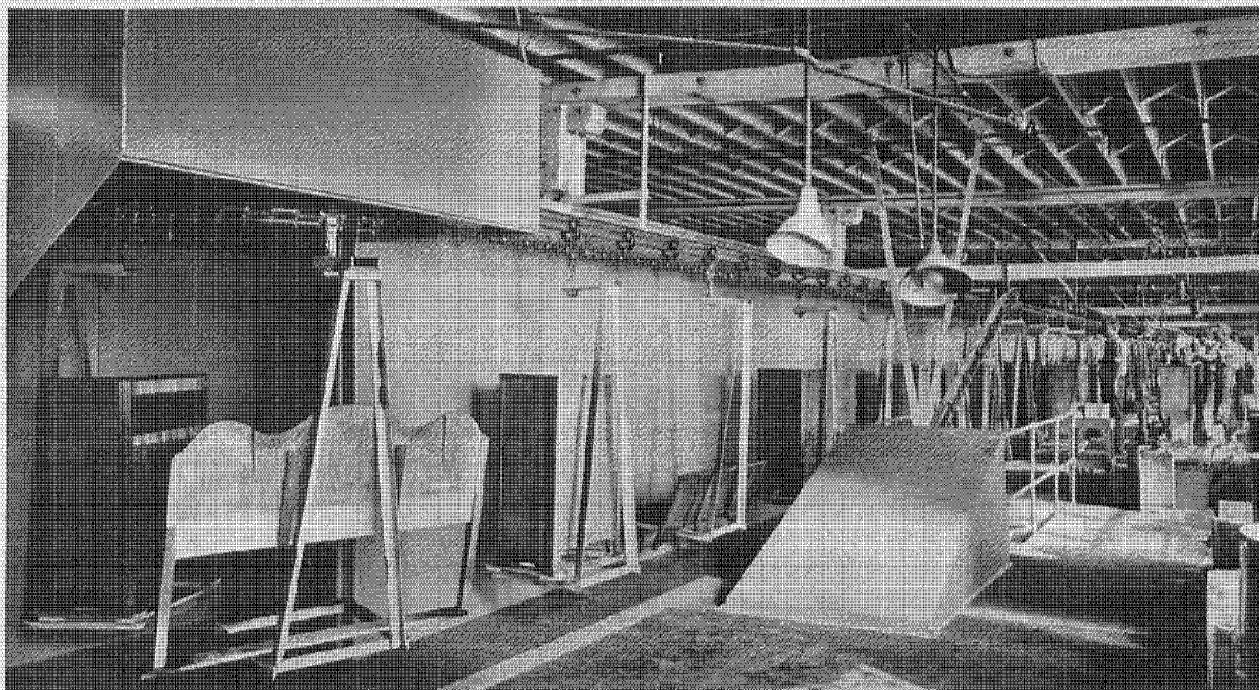
While manufacturing processes were streamlined, changes and improvements were also made in finishing systems and materials. In contrast with the old-fashioned spray booth with overhead gravity finish containers which were in use about fifteen to twenty years ago, the refined finishing equipment of today enables operators to apply a better, more uniform finish in far less time. Both the air necessary to operate a modern spray-gun and the finishing material to be applied are supplied to the gun by means of controlled air pressure. In some cases, plant operators have gone so far as to install paint-circulating systems that pipe paint through the plant and into the finishing department in much the same way as water is carried through pipe lines.

In the interest of speed, a particularly significant development is the use of baking ovens to shorten the drying time of finishes. Used in conjunction with conveyor systems, these ovens literally slash hours off production time. Immediately after the finish is applied, the chair, table or other article is transported into the oven, which is maintained at a temperature of 150° Fahrenheit or slightly higher. Through the oven it passes slowly, and emerges completely dry in little more than an hour.

Paralleling the installation of conveyor systems and baking ovens, an important contribution came to the industry about two years ago when the new Du Pont "Dulux" Furniture Finish was introduced. Before this product was developed, there were two types of materials employed as furniture finishes—varnishes and lacquers. While each had distinct advantages, there were also certain shortcomings from the manufacturer's standpoint. Although low in cost and possessing good "build" or film thickness, varnishes are relatively slow-drying. Lacquers, on the other hand, dry considerably faster but *two coats* are required to provide a film thickness equivalent to one coat of varnish.

The ideal finish, then, would be one combining the most desirable characteristics of these two products, and it was such a material that the Du Pont chemists sought. After a three years' period of research and experimentation, success crowned their effort and a new product was developed. Appropriately called "Dulux" Furniture Finish—because its basic ingredient is the same as that employed in "Dulux" enamel which has set a high mark in the world of finishes—this new material combines the speed of drying and quality characteristics of lacquer with the high build of varnish.

From the manufacturer's standpoint, its chief advantage is its economy in time. Made to dry quickly at elevated temperatures in drying ovens—as low as one and



Furniture is now moving into the oven where the finish is baked and dried under scientifically-controlled conditions of heat and humidity.

one-half hours at 140° F.—it offers a five and one-half to seven and one-half-hour finishing schedule from sealer to packing, as compared with the usual twenty-two to twenty-eight-hour schedule for lacquer and twenty-nine to forty-three hours for varnish. Further time is saved because it's so easy to rub. In addition, the unusual build of this finish means that only one coat is required over the sealer, instead of the usual two coats of lacquer.

The home owner, too, benefits from this latest finishing material to emerge from the chemist's test tube. For "Dulux" enhances the appearance of fine furniture and enables the purchaser to enjoy its natural richness of wood and beauty of design. It does not yellow nor darken appreciably with age, offers unusual resistance to scratching, crazing, water and alcohol spillage, and gives furniture greater retained beauty in the home.

Because of the streamlined developments and revolutionary changes in the furniture industry, manufacturers are now able to meet modern demands by making *more* furniture *faster*. But one should not infer that the traditional fine quality has not been maintained. Instead, the technological progress and increased manufacturing efficiency have enabled manufacturers to lower their unit costs while increasing their values. Today, higher-quality furniture may be purchased at the low-quality price levels of former years. In fact, it has been expertly estimated that, value for value, today's furniture prices range from fifty to sixty per cent *below* those of ten years ago. Furniture manufacturers deserve a vote of thanks for their foresight and progressiveness which bring these economies and higher values to home owners.

Larger "Paint Farms"

(Continued from Page Sixteen)

light. The dry heat and parching winds of Texas, the purified air in the mountains of Colorado, the sudden temperature changes in the prairie States constitute exposures under which paint films are proved year after year.

One result of this broad testing program was the introduction, three years ago, of a new "self-cleaning" white house paint. Many white paints collect and hold dirt and dust from the atmosphere, resulting in prematurely dirty, gray surfaces. Houses painted with the new Du Pont Outside White maintain a more immaculate appearance than others because certain chemical characteristics help this paint to clean itself after the paint starts to powder or chalk. This happens in a few months under ideal conditions of climate and exposure, but may be delayed for a longer period. This "self-cleaning" continues gradually, keeps the surface whiter than has heretofore been possible, and does not adversely affect the wearing qualities of the film. Years of weathering leave the surface in excellent condition for repainting.

Research goes on intensively in the laboratories, while pre-testing of finished products is carried on more extensively than ever before. Larger "paint farms" in terms of acreage have no great significance. Increased knowledge, through research and scientific tests of a type simulating actual usage, is the real objective. It is well expressed in the familiar Du Pont pledge, "Better Things for Better Living through Chemistry."

Lamp Designs—New Uses of Chemically-Made Materials

PLASTICS and other chemical products were prominent among the American materials inspiring many outstanding lamp designs exhibited at the recent lamp show held in New York City.

"Lucite" methyl methacrylate resin, a plastic of crystal clarity, appeared to advantage, with more than twenty designs in this material shown by one manufacturer. Conventionalized leaf motifs are apparently in favor, and all the designs are hand-carved.

Several wrap-around treatments were also shown—strips of "Lucite" over cylindrical frosted glass, or tubes of glass. In these, effective decorative use was made of the plastic's edge-lighting properties.

"Lucite" was also applied as a

spiral to the shaft of new metal floor lamps.

Another new use of plastics took the form of molded prisms, "tear drops," and other parts formerly made with crystal.

In lamp-shades, cellulose acetate plastics, widely shown this year in plain, pleated and cartridge shades, were also seen in stylized offerings, veering toward soft, restful colors.

LEATHER AND LACQUERED FABRICS

Leather and lacquered fabrics in leather finish were also responsible for some of the most successful presentations. One house showed an all-modern line with lamp bases covered with "Fabrikoid" lacquered fabrics. Snake and alligator grains were used for covering the shaft of floor lamps with "umbrella" parchment shades; there were also gray and red combinations in calf grain.

POTTERY, CHINA AND GLASS

In china lamps, Regency styles are on the increase, with liberal use of gold decoration, chiefly on white grounds. American hand-made lamps in unglazed or biscuit pottery were headliners. Pastels predominated in plain glazed treatments, especially turquoise, yellow and green; some in ox-blood were shown. The rich hues were achieved with American ceramic colors.

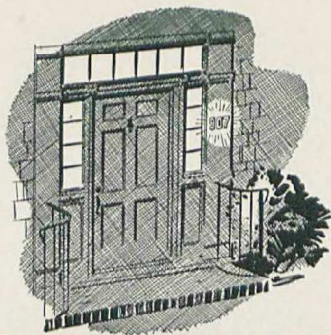
Shepherd prints and delicate florals in pale pastels, of Dresden type, were prominent among American-made lamps; also clear and colored glass, with brass, in Colonial design.

SHADES

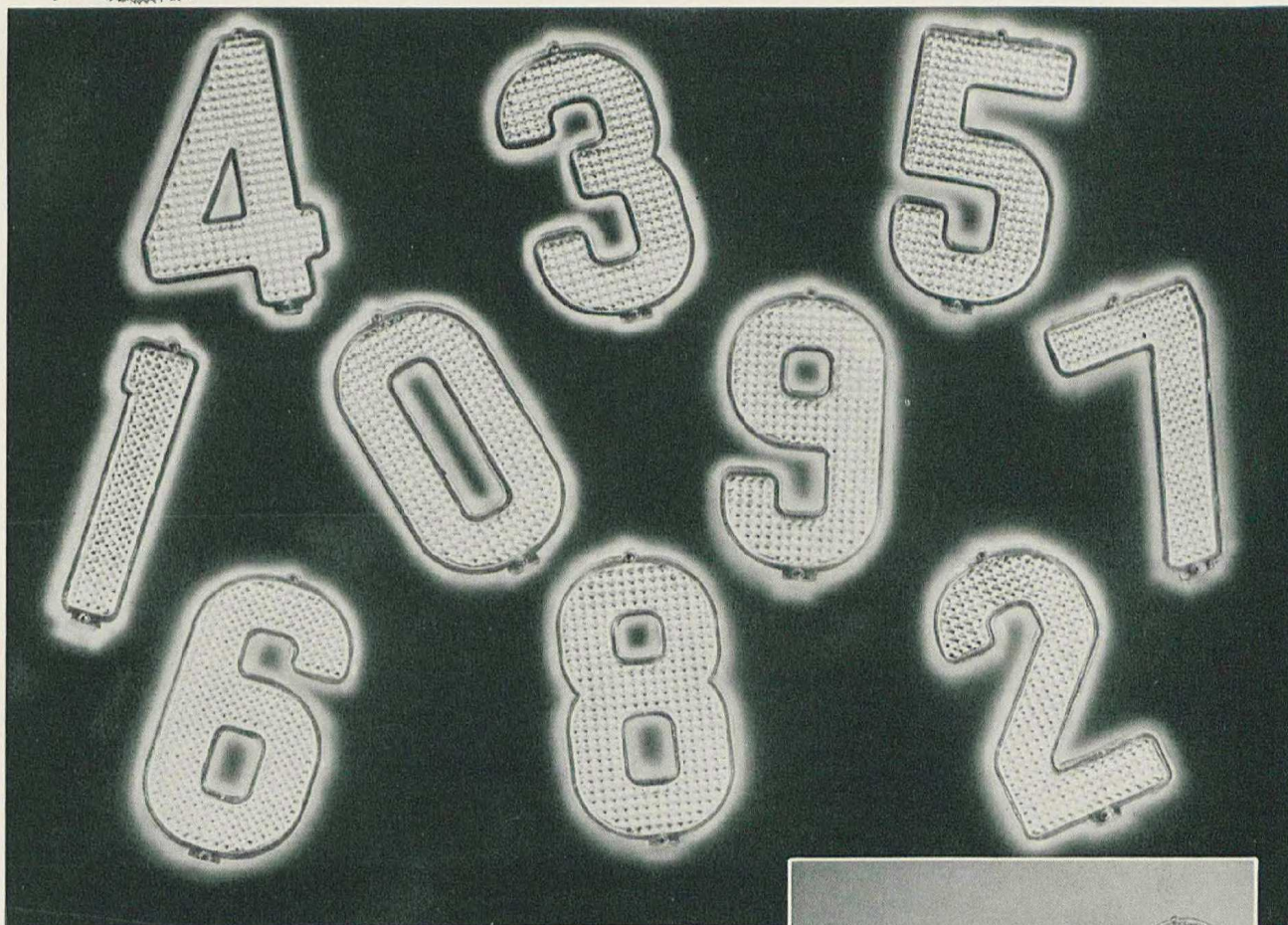
Raffia, hemp and other coarse shade materials were seen on well-styled lamps, in keeping with the trend to handicraft designs. Parchment continued in popularity for all lamp types, with cellulose acetate shades used chiefly for popular-priced offerings.

FLUORESCENT LIGHTS

Nearly all leading manufacturers show fluorescent floor lamps. Many offer a combination with incandescent bulbs. Fluorescent desk lamps are also on the increase, and an important beginning has been made in bed lamps with the introduction of a fixture using the new six-watt fluorescent tube.



THEY TOOK THE NUMBERS FROM ONE TO TEN...



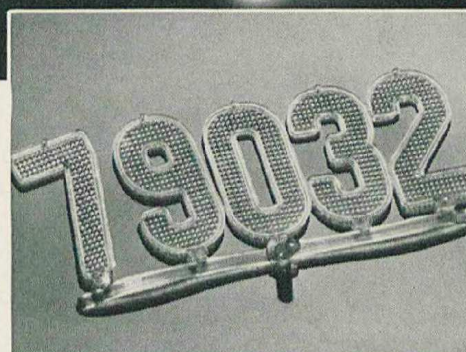
*...and "Lucite" made a sales sensation
out of them!*

YES... "Lucite" is stirring up business again... for molders and manufacturers alike! This time as brilliant reflecting address numbers. If you've ever tried to find a strange address on a pitch-black night, you'll realize why the idea is a money-maker!

But, ideas are one thing... to make them *practical* is another! That's why the Lumelite Corporation, manufacturers of the numerals, chose "Lucite" above any other material! One good reason for this choice is the crystal clarity of "Lucite" methyl methacrylate molding powder. Light is reflected brilliantly from it... loses little of its original intensity. Another is the unusual strength of this versatile plastic. And the remarkable way in which "Lucite" keeps its clear lustre, in spite of outdoor exposure, is still another reason!

Du Pont "Lucite" has a habit of making good ideas workable ideas... and *sellable* ideas. Try it for your own products, new or old. If you need help in their development, the Du Pont Technical Service is always ready to lend a hand. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J.

"Lucite" is Reg. U. S. Pat. Off.



The amazing versatility of "Lucite" enables Arpin Products, Inc., to mold a delicate honeycomb pattern into the numerals. Each cell in the honeycomb acts as a tiny mirror... not only shooting the light directly back to its source, but causing the whole area to glow as though it were lighted from behind!



PLASTICS

STOPS CRYING OVER BROKEN TOYS



JUNIOR'S howls will soon subside when you mend his toys with a little Duco Cement.

You can restore his Seabiscuit to tip-top racing condition just as easily as you fix the wife's wedding china and the chair which Uncle Herman broke apart. Duco Cement is a clear, flexible adhesive that holds permanently on practically everything ex-

cept rubber. Even warm water doesn't melt it. It's waterproof—it dries quickly and mends permanently.

Being "Made by Du Pont," it enjoys a reputation famous for high quality and extra value. That's why Duco Cement has so many friends everywhere.

Duco Cement has thousands of uses for making and mending in

home, office and shop. Get a tube of this handy cement today. On sale at leading drug, stationery, hardware and automobile accessory stores. E. I. du Pont de Nemours & Co. (Inc.), Wilmington, Delaware.



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