

DUPONT

magazine



Keeping Oil Wells Well



Better Things for Better Living... through Chemistry

DU PONT

magazine

CONTENTS

2 INDOOR OUTDOOR PLAYING FIELD

History's largest clear-span dome requires 175 tons of "Lucite" acrylic monomer for its 4,600 skylights

6 MATCHING CLOTHES TO BODY MOVEMENT

Skin, nature's comfortable body covering, is emulated by fabrics made with new corespun yarns

9 LITTLE BOOKS WITH STRONG BACKS

Wherever there's a reader, there's a paperback . . . a happy condition triggered by hot-melt adhesives

12 OIL FIELD DUTY FOR A DRY CLEANER

*How do you descale an oil well?
Easy: use Du Pont sulfamic acid*

16 BACKSTAGE AT THE FAIR

Here's what's going on in the wings at Du Pont's New York World's Fair Pavilion

19 HEADY SUCCESS OF HAIR SPRAYS

Coiffures take on new elegance when hair stylist Enrico Caruso backs up his magic with "Freon" propellents

22 EASING THE SQUEEZE IN JETS

*The aerospace engineer fights to get six pounds in a five-pound bag.
His ally: "Teflon" TFE-fluorocarbon resins*

26 THE ONE-SHOT RAMP

Four million cubic feet of iron ore was yielded by one big blast at Star Lake, N.Y.

29 "INSTANT" PAINT JOB FOR AN "INSTANT" PLANT

Du Pont was color conditioning this huge textile finishing plant before the roof was on

32 WHAT'S NEW

THE COVER. The age-old maxim that oil and water don't mix takes on a new meaning when used by petroleum producers. When a producing well, such as this pumper outlined against a dusky California sky, yields water along with oil (and most of them do), carbonate scale can clog critical passageways, restricting the flow of fluid. To keep these downhole perforations free from plugging, oilmen are turning to new dry-acid descaling products based on Du Pont sulfamic acid. For details, see page 12.

Editor William C. Halley • Associate Editors Jack D. Hunter • Robert M. Bednar • Charles E. Petty

Copyright© 1964, E. I. du Pont de Nemours and Company, Wilmington, Delaware. All rights reserved. This magazine or parts thereof may not be reproduced in any form without permission in writing from the publishers. Printed in U.S.A.

Change of Address: To insure receiving your next copy, send your new address promptly to: Editor, Du Pont Magazine, Wilmington, Del. 19898. Send old address with the new, enclosing if possible your address label. Post offices will not forward this magazine unless you provide extra postage.

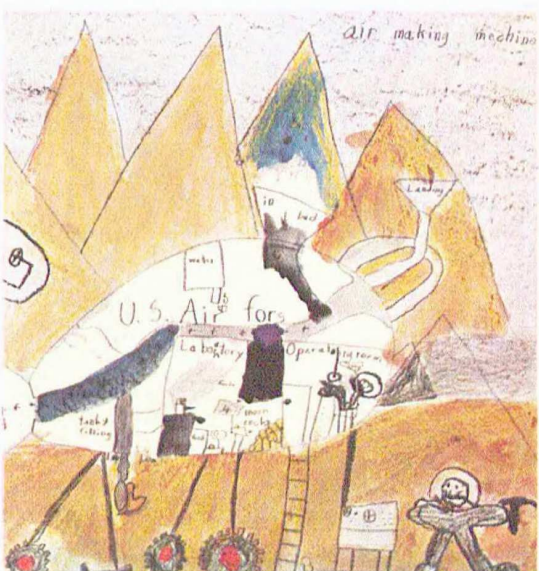
Photo Credits: Pages 2-5, Paul Peters; pages 9-10, Howard Slater; page 11, J. W. Clement Co.; page 21 (bottom left), Mark Shaw; page 21 (bottom right), Richard Avedon; pages 22-23 (top), McDonnell Aircraft Corp.; pages 22 (bottom) and 24 (top), Ling-Temco-Vought; pages 24 (bottom) and 25, The Boeing Co., Airplane Division; pages 26-28, Wayne Montague, Nils Kwick, Joe Bonner; pages 29-31, Bill Cox.



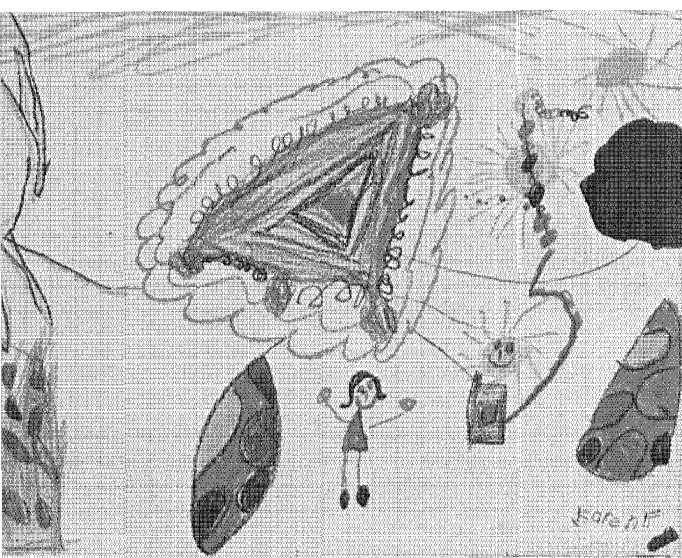
*Something to make a flower grow higher than the sky.
This magnet helps the flower pull up. It mostly works by gears which keep the designs apart.—Alan Turner*



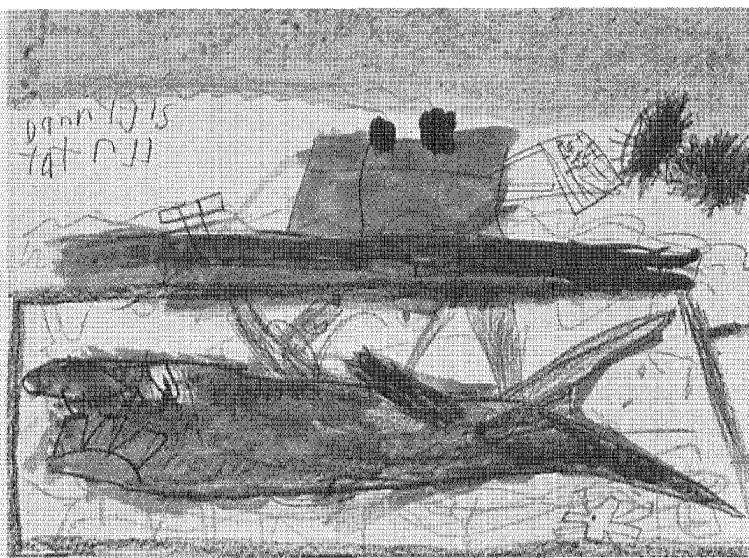
It's a tree-cutting machine that has wheels to go around the tree and a helicopter thing to make it go up and down.—Danny Gelb



This is a picture of an air-making machine. If people want to live on the moon, they can take it up with them and they don't have to worry.—Peter Kelemen



This girl pushes a button and electricity goes all the way to the sun. Then the sun falls down and gets a face. And so on.—Karen Deverell



A whale-chopping machine. It catches the whale and these brown blades chop. I haven't seen a whale machine, but people will probably eat whale in the future.—Danny Johnson

What Scientists Should Invent

Although some 1,300 Du Pont scientists and engineers were engaged in pioneering research alone last year, they didn't think of everything.

Some items they missed are reprinted in this blend of art and science by some free spirits of the first and second grades at The Tatnall School near Wilmington, Del.

What this country really could use is some instant flowers; a dependable whale-chopper; an air-making machine in case Daddy gets transferred to the moon; and a diamond-fabricating device that's a com-

fort whenever a little girl feels like getting all gussied up.

Despite these oversights, Du Pont basic and applied research men worked at filling some pretty varied human needs in 1963. Here is a sampling of those cited by President Lamont du Pont Copeland in his just-issued Annual Report to stockholders:

"Corfam" poromeric shoe upper material, a product of 13 years of research and development; on moisture-transmittable synthetic structures.

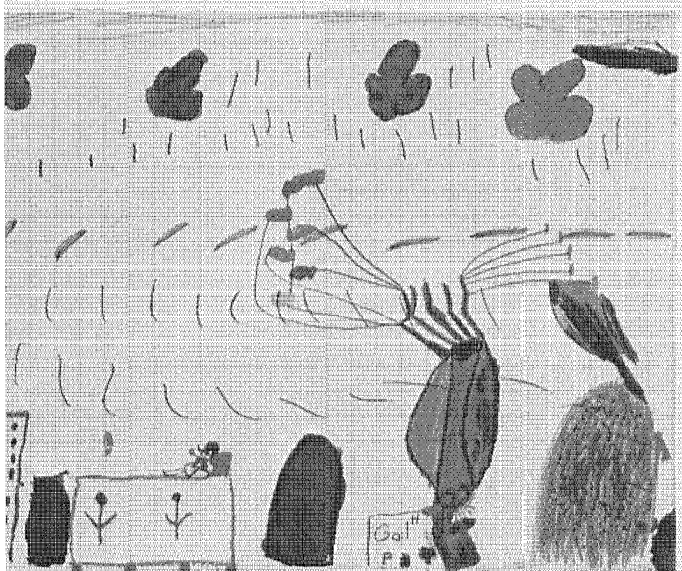
"Zepel" fabric fluoridizer, which makes

clothing and home furnishings stain-resistant and water- and oil-repellent.

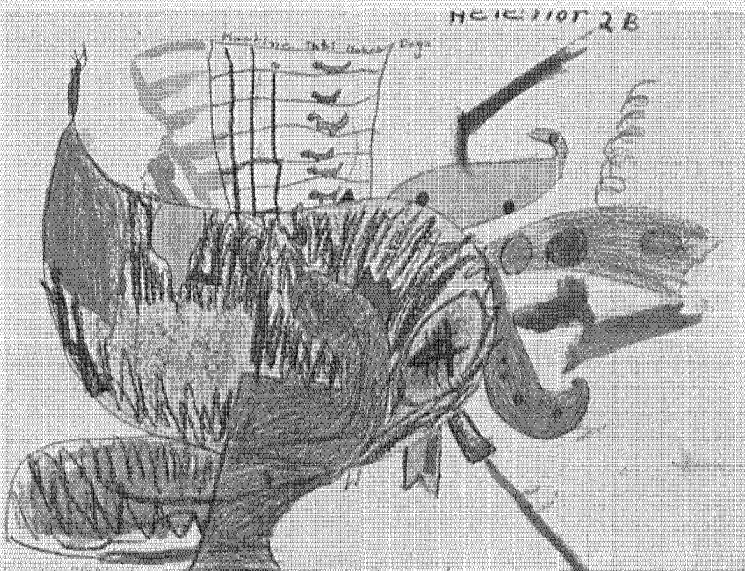
"Nordel" hydrocarbon rubber, a general-purpose elastomer with excellent chemical and mechanical properties.

A new metal alloy, TD Nickel sheet; "Hyvar" X bromacil weed killer; "Crona-press" conversion film for the preparation of printing plates; and a new class of polymers, the polyimides, for high-temperature applications.

The range, in fact, is as stimulating as the uninhibited imagination of the young. ■



This machine makes bubbles. Bubbles make rain. Rain makes snow. So a girl can push the buttons and get the weather she wants.—Gail Halley



It's a machine that makes dogs. If you look at the top of the painting, you can see a lot of them.—Helenor Ketcham

Thinking big again, Texans have specified "Lucite" for use in the world's largest clear-span dome over their

Indoor Outdoor Playing Field

By JACK D. HUNTER

Houston, Texas

When the Houston Colts of the National Baseball League assemble on the field for their first home game of the 1965 season, it'll be on a field the likes of which has never been seen.

Around and above players and spectators will be the largest clear-span steel and plastic dome in history, with a base circumference of half a mile, a diameter of 642 feet and a height of 208 feet—high enough to umbrella an 18-story building.

Now approaching completion on a 260-acre plot of flatland seven miles south of downtown Houston, the \$22.5 million Harris County Domed Stadium, scheduled to open this fall, will keep crowds of up to 66,000 in air-conditioned comfort while they watch fare ranging from football through boxing to rodeos.

The key to project success has proved to be "Evr-Kleer" (a Cast Optics Corp. trademark) cast acrylic sheet made from "Lucite" acrylic monomer, whose light weight and optical and weather-resistant properties have enabled Houstonians to create a huge outdoor playing field indoors.

Fourteen years ago, Texas sports promoters saw vast potential in a stadium for Houston, especially an arena-type structure that would protect spectators against the hot sun and humidity predominant in the

region. The project, because of its complexity, marked time until 1960, when Houston won a National League baseball franchise. With this important incentive, the idea was dusted off and updated.

Let's have, went the new thinking among the project's organizers, an arena that will accommodate not only baseball but also football, circuses, trade shows, political conventions or most any large public event. Then let's assure ideal weather conditions by putting a roof over the whole thing and installing air conditioning.

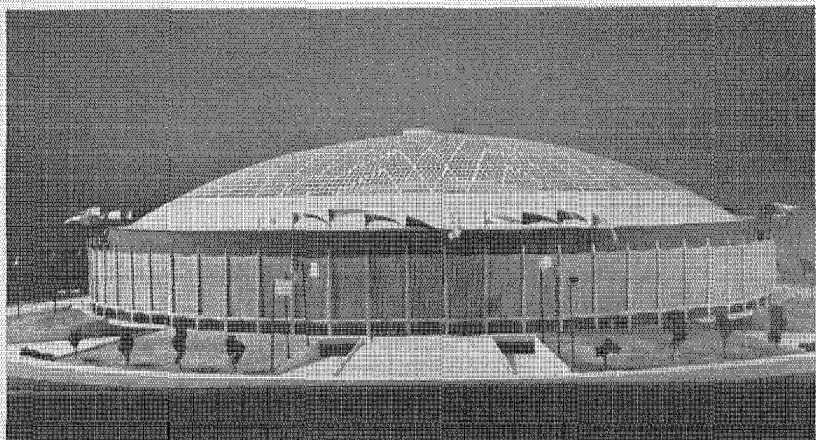
Two Houston architectural firms—Lloyd and Morgan, and Wilson, Morris, Crain & Anderson—were asked to form a task force whose aim would be to devise a structure of the type envisioned.

The architects, aided by a physicist, an acoustical engineer, an air conditioning specialist and a squad of other consultants, saw major league problems right off. For instance, you can't play major league ball on hard floors, so how do you get grass to grow under a roof? And how about pop flies—how high should a roof be to outreach them? Also, since hurricanes are not unknown in Texas, how could such a roof be made proof against high winds?

First problem tackled, of course, was the arrangement of playing area and seating. The architects conceived a playing field 25 feet below ground level. They encircled it with six levels of seats with two units of 10,000 seats each, which, when rotated 35 degrees on a motorized track, would permit the stadium to convert from baseball to football.

For the roof construction, the knottiest question of all, the group of architects considered many possibilities, i.e., geodesic designs, laminated wood, air-supported fabrics. But each had to be dropped, mainly because in answering one problem it would create another. (Example: An air-supported fabric roof might collapse when 66,000 people poured through the doors.) Moreover, an opaque roof of any design would cut off sunlight and thus make it impossible to keep grass alive and rooted. Obviously a transparent roof was a must.

continued



Umbrella 208 feet high, whose skeleton goes up at left, will protect crowds of up to 66,000 in Houston's Harris County Domed Stadium, shown in architect's model.

Indoor Outdoor Playing Field

continued

Eventually the architectural team decided in favor of a steel Lamella frame dome proposed by Roof Structures, Inc. of St. Louis, which incorporated big trussed beams, interlaced in diamond form, intermittently braced and arcing upward to meet at the center. Forming a skin for this skeleton would be a transparent material that would permit sunlight to nourish the grass playing areas. Result: a huge, skylighted dome.

But on the heels of this decision came more posers. What transparent material would admit the range of light spectrum necessary to grow grass, yet be rugged enough to withstand the elements? And how could incoming daylight be controlled so as to minimize interior visual glare? How about acoustic and air conditioning problems implicit in a dome with so much skylight area? The questions compounded, one upon the other.

Weighing these diverse needs against a list of available materials, the team finally settled on cast acrylic sheet made from "Lucite" acrylic monomer, long known to the architects for its strength, light weight, optical clarity, shatter resistance and readiness to adapt to fabrication processes. Special tests conducted for the architects showed that "Evr-Kleer" cast acrylic sheet would admit the light spectrum required to grow Tiffway Bermuda grass. Also, laboratory

and outdoor exposure data amassed by Du Pont over more than 20 years of experience with "Lucite" confirmed that cast acrylic sheet has the exceptional weather resistance the architects sought. The architects say that "the excellent performance record" of acrylic sheet, plus "the obvious flexibility of and the coordinated relationship between manufacturer and fabricators" influenced the final decision to specify cast acrylic sheet of "Lucite" monomer.

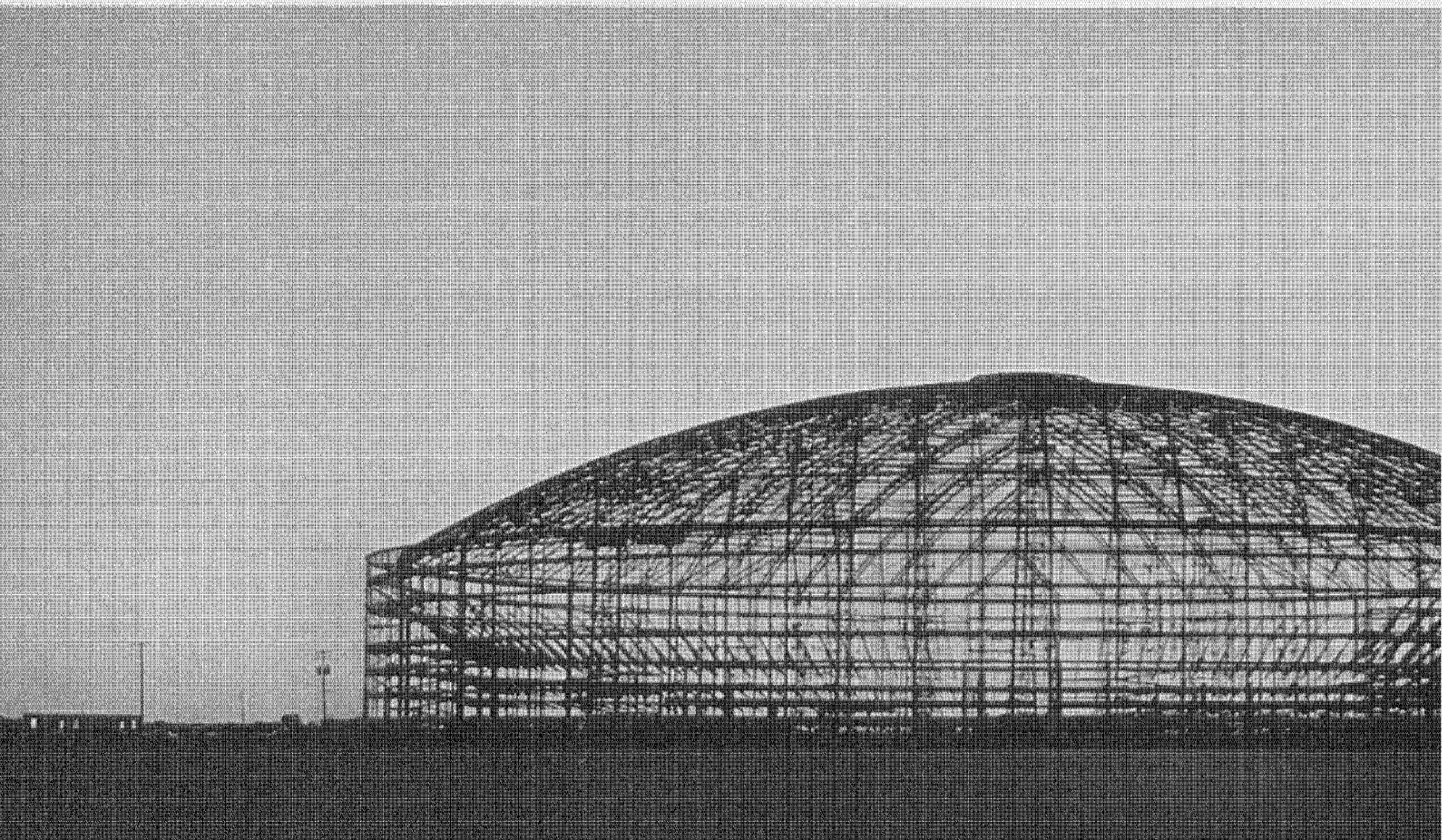
The next pressing problem was that of acoustics. A dome is superb as a structural shape, but it can become a horror of sound with 66,000 fans cheering under it. After studying the problem, the team decided that the dome's "skin" should be half cement-bound wood excelsior panels, half "Evr-Kleer" cast acrylic sheet. The lowest third of the dome would be finished completely in the sound-absorbent wood panels and the upper two-thirds would be this same material interspersed with 4,600 skylights of acrylic sheet converging toward the apex.

To keep down visual glare and facilitate air conditioning, the skylights are composed of double layers of acrylic sheet—a crystal-clear layer 0.250 inch thick facing the elements outside and a 0.187-inch-thick inner layer with a light-diffusing prismatic surface. (A total of 350,000 pounds of "Lucite" acrylic monomer is needed to

provide the required 9,200 sheets measuring 41x88 inches.) Prime contractors for the stadium are H. A. Lott, Inc. and Johnson, Drake, Piper, Inc., both of Houston. Cast Optics Corp. of Hackensack, N.J., casts "Evr-Kleer" sheets from "Lucite" acrylic monomer. The sheets are then shipped to Enjay Engineering Co., whose plant has been made available as a Houston fabrication base for Pam Co., Portland, Ore., manufacturer of the Pam Plastic Skylights specified for the stadium roof.

Meanwhile, the architects and their consultants have come up with many ingenious answers to the flood of problems that has continued to confront them. For instance, at the crown of the dome they've provided a 65-foot opening, somewhat like a cupola with louvers, to permit the escape of tobacco smoke and to house the traffic director who will oversee the 20,000-car parking lot surrounding the stadium. But this opening offered its own problem: if over-the-roof winds were to reach 60 mph or more, interior air vacuum thus created might keep exit doors from opening. The stadium's design crew answered this one by placing emergency buttons next to the doors so that cupola louvers can be closed in case doors jam. As for winds, the dome is designed to withstand hurricane velocities and gusts of up to 165 mph. One of the

Stadium framework, a half-mile in circumference, reveals steel network required to suspend history's largest clear-span dome.



consultants in this aspect of the job was an aeronautical engineer versed in aircraft airfoil performance.

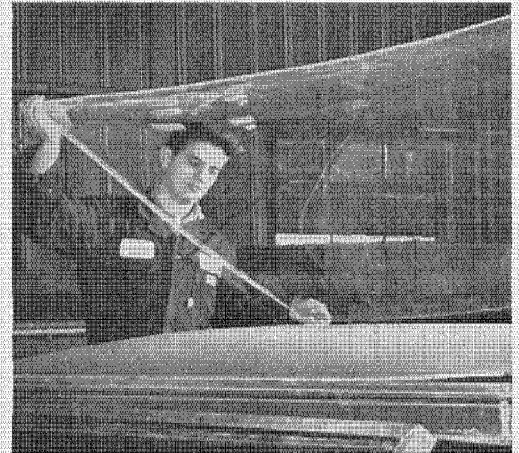
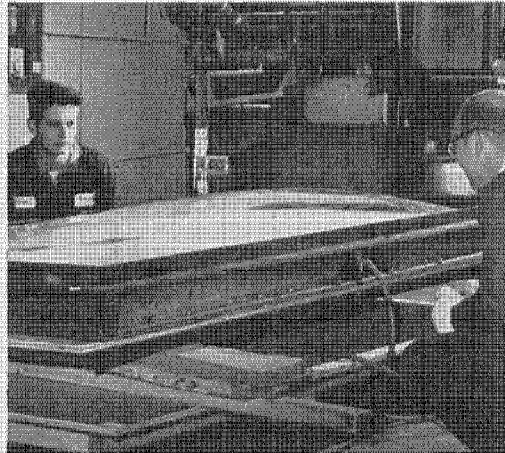
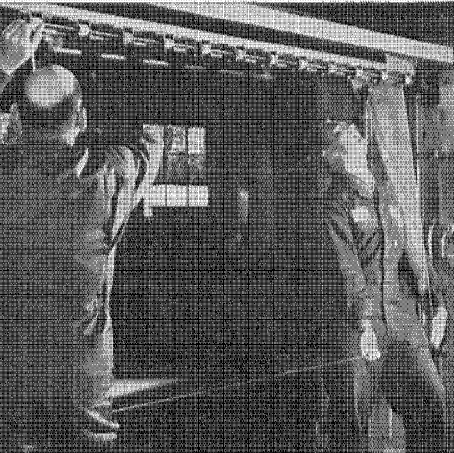
Air conditioning alone has proved to be a matter of great complexity. The body heat that can be generated by the massing of 66,000 spectators has required a \$4.5 million air conditioning system based on two 1,200-ton electric coolers to lower stadium temperature to 74°F. and two 1,800-ton steam units to maintain this level regardless of crowd size. A total of 2.5 million cubic feet of air will be circulated

each minute; 250,000 cubic feet of fresh air will be drawn into the stadium in the same interval.

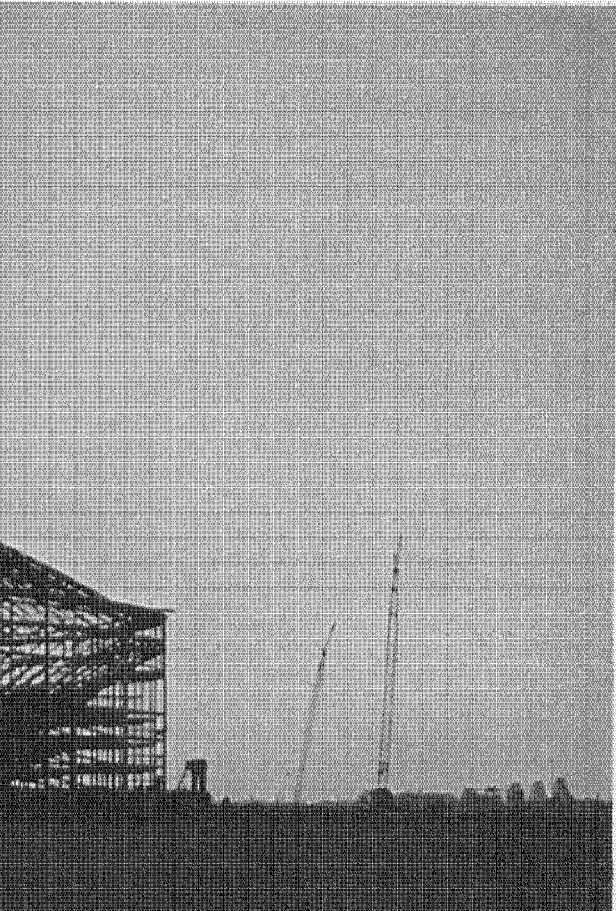
In nearly every aspect, the Harris County Stadium offers superlatives. The structure proper covers 9½ acres of land; at night it will be illuminated by 1,960 floodlights, and total electric power consumed will be more than that needed by the Texas city of Port Lavaca; one section of the parking lot will accommodate 300 buses. There will be a retractable press-TV camera platform at dome's top and, below, in the rim structure,

TV and radio control rooms, photographic darkrooms, interviewing booths. Also among facilities will be offices for the Houston Sports Association and the stadium management, snack bars, public cafeteria, gourmet restaurant, first-aid stations, dressing rooms for entertainers, locker rooms for teams.

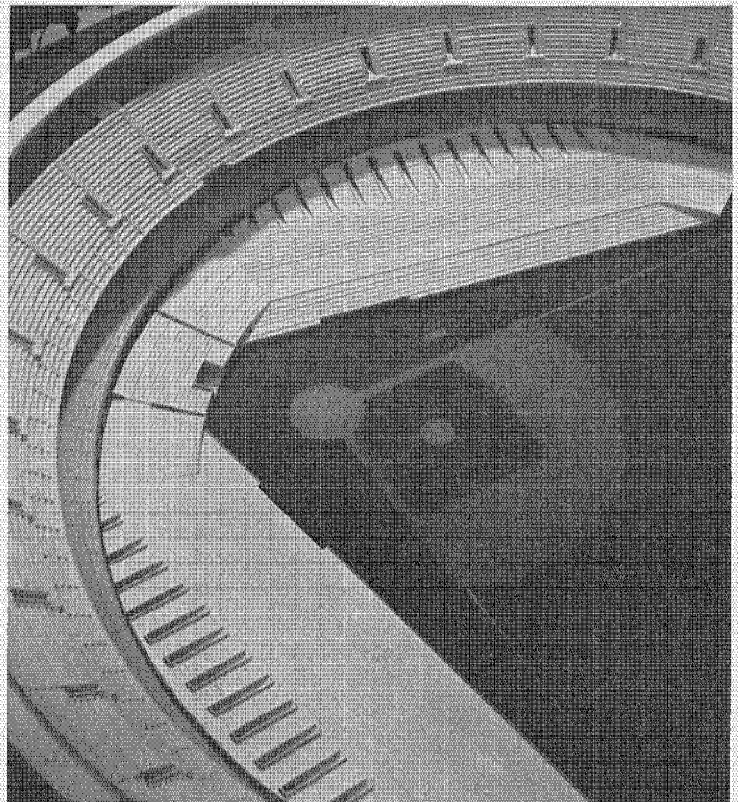
The stadium will also have one of the world's largest tobacco smoke filters. Since 66,000 fans can puff up an impressive cloud, interior air will be desmoked by electrostatic precipitators and filtered through enough charcoal to fill a railroad boxcar. ■

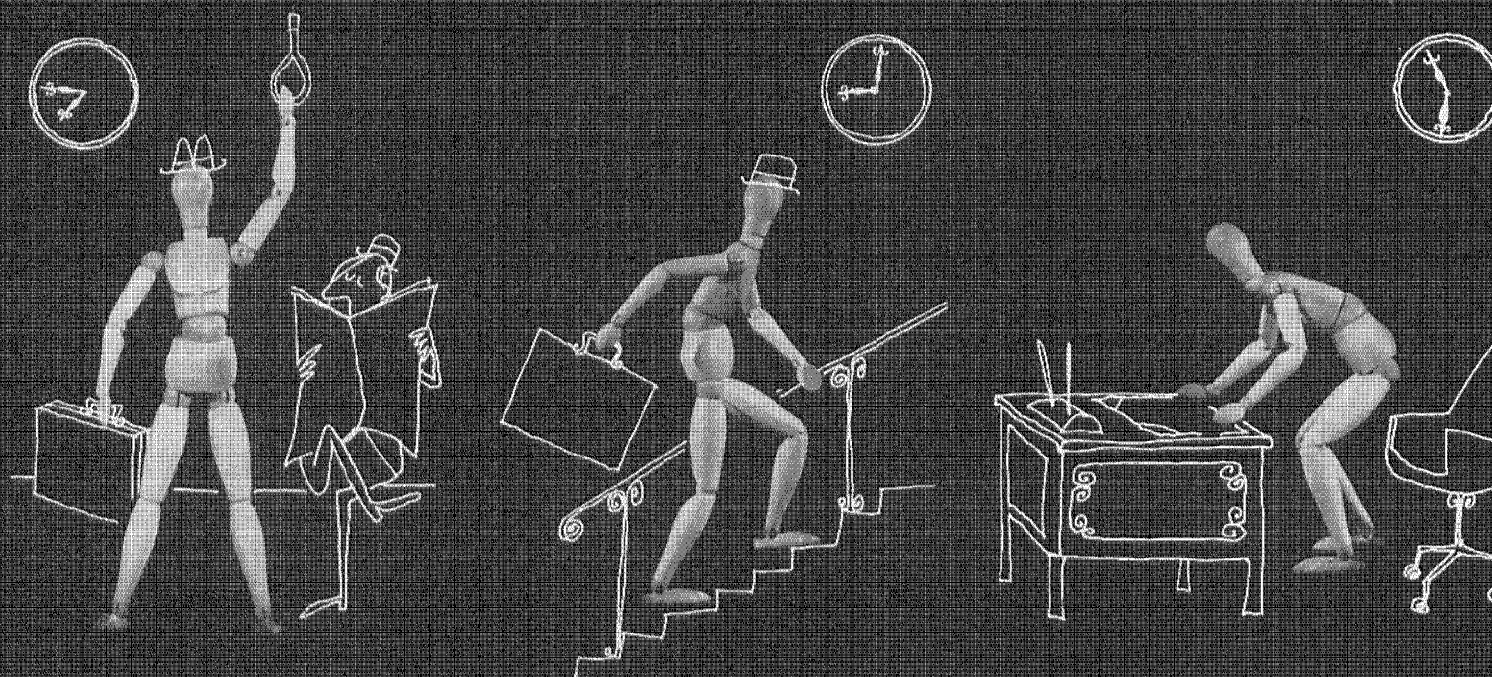


Clear "Lucite" is rolled into 350°F. softening oven, left, shaped in "pot," center, and placed atop diffusion panel of "Lucite" to complete skylight.



Seats, here arranged for baseball, rotate on track to set up for football.





Matching Clothes to Body Mov

Now Du Pont has developed fabrics that take daily stress and strain in stride

This spring you'll be able to buy clothes that are almost as comfortable to wear as your skin.

So say Du Pont Textile Fibers men who've developed a way to improve stretch in fabrics. The secret is a new kind of yarn made by spinning either man-made or natural fibers around a filament core of "Lycra" spandex fiber. Woven into fabrics, these corespun yarns yield garments with a special knack for moving when—and as—the wearer does.

Suit coats, for instance, won't bind through the shoulders when you reach across a desk. Trousers will readily stretch at the knees when you sit down, yet don't become baggy after long periods of wear.

"'Lycra' is used sparingly and usually in fine deniers in the new fabrics," says Messoud Kiachif of the Textile Fibers Dept.'s Products Division. "Unlike the powerful stretch and recovery in foundations or swimwear, it produces a gentle give-and-take that conforms to body movements. The stretch isn't dramatic to the eye; it's no more noticeable than that of your skin when you sit, bend or walk."

Fibers men continually refer to the skin because nature's comfortable covering

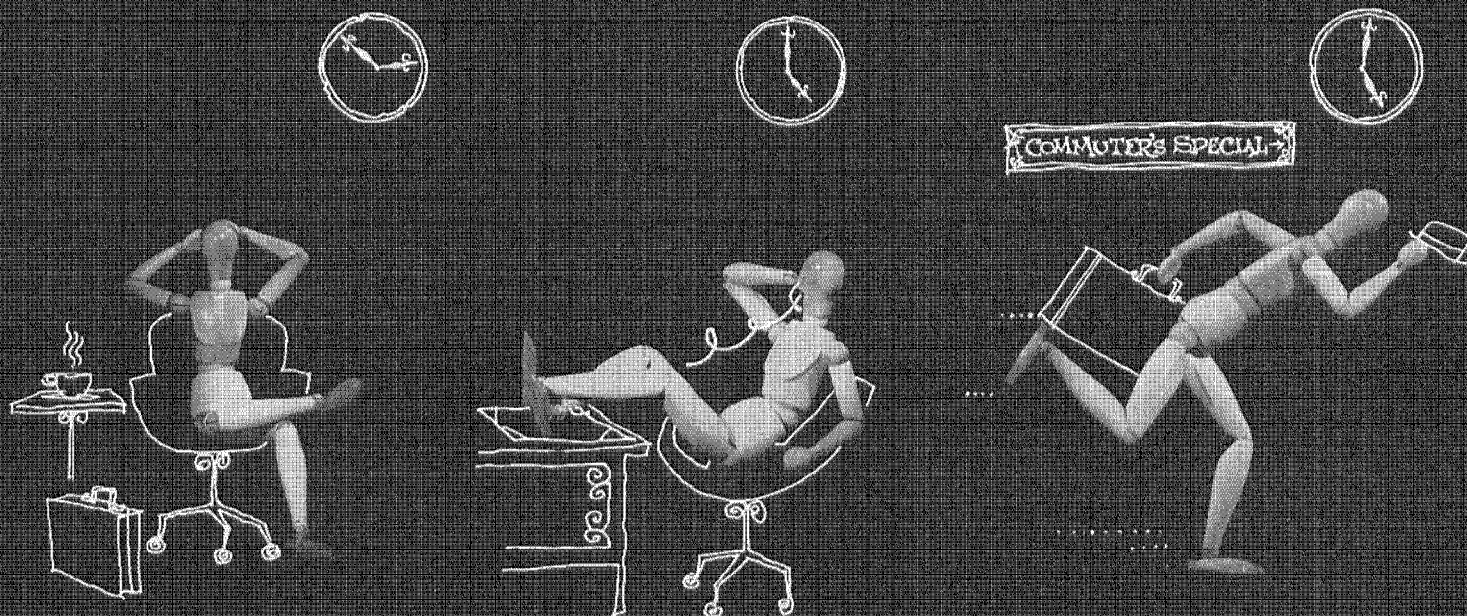
guided the development of core spinning.

"To find out how an ideal garment should fit, we measured the skin's stretching and contracting during all kinds of body movements," reports Kiachif. "For instance, we found that the skin in the human back stretches 13 to 16 per cent when the arms are moved up and out. Full bending the elbows or knees causes the skin to stretch as much as 40 per cent vertically and 20 per cent horizontally.

"It was obvious right away that the amount of stretch needed for complete freedom of movement couldn't be obtained with conventional stretch fabric techniques. For the most part, these involve putting a false twist into filaments such as nylon or 'Dacron' polyester fiber. Doing so limits the amount of stretch because the fabric can only flex as far as the unnatural crimp or curls will pull out.

"Although finished garments of such fabrics are more comfortable than those with no stretch at all, they still don't allow complete freedom.

"We turned to 'Lycra' because it's a true elastomeric textile fiber. It has about 10 times the flex life of natural rubber, meaning it can be stretched constantly without



ment

weakening. Nor does it readily lose its capacity to return to its original shape."

Different garments serve different functions and must have different amounts of stretch. For example, a pair of tensioned slacks (those with foot straps) requires more vertical than horizontal stretch for good fit. Men's and women's tailored clothing such as suits, skirts and dresses, however, requires horizontal "give" for best comfort and fit. Because "Lycra" is now available in deniers ranging from 40 to 2240, it's possible for apparel manufacturers to carefully control degrees of stretch to meet variable garment requirements.

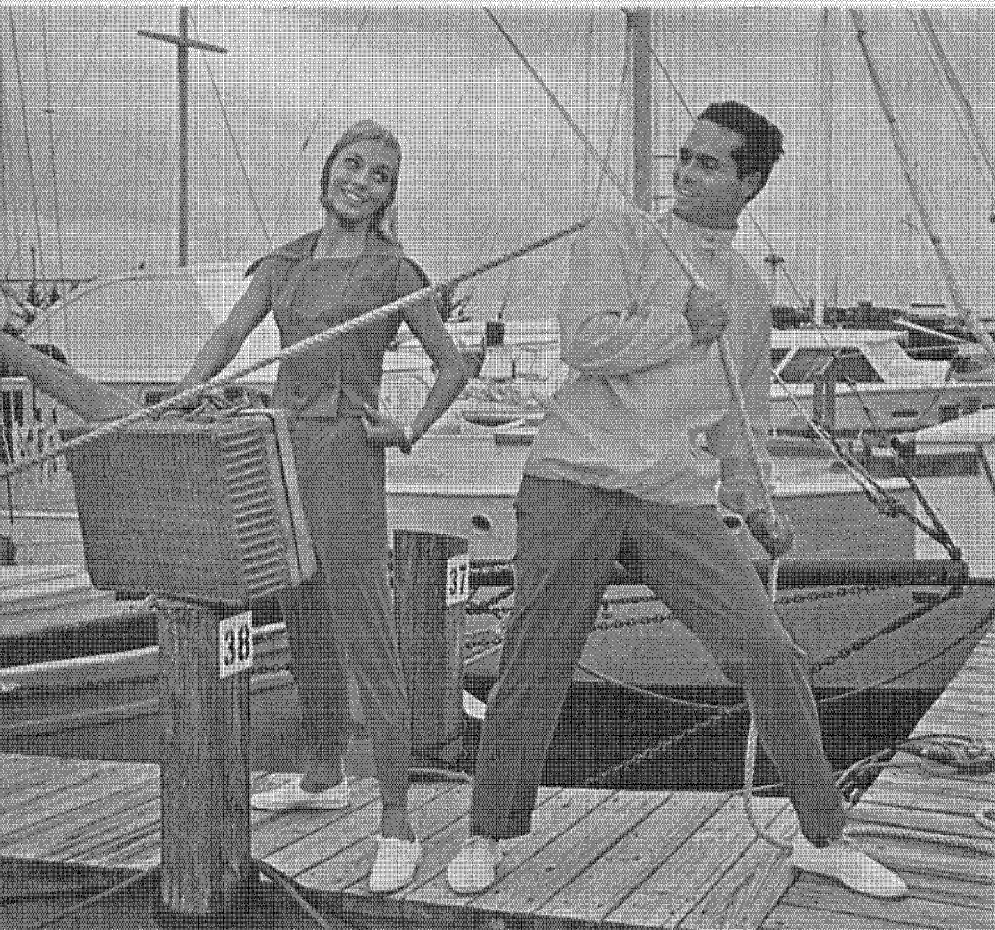
In addition to improving stretch, a core of "Lycra" enhances a garment's fit and general appearance. Fabrics woven of "Dacron" and wool spun around "Lycra", for example, look like, feel like and generally perform like conventional "Dacron" and wool blends. They don't have the "raspy" feel that is sometimes found in other stretch fabrics. Moreover, the addition of "Lycra" can improve a garment's wrinkle resistance; it doesn't affect colorfastness, stability or durability.

Textile mills should like the fact that "Lycra" accepts the same dyes used on

continued



Stretch fabric of "Dacron" and cotton woven around "Lycra" is featured in a Chestnut Hill shift, Stanley Blacker sport coat and slacks by Glen Oaks.



New fabrics with cores of "Lycra" supply extra stretch at knees of Esquire's men's slacks shown left. Maine guide jacket and a woman's two-piece outfit by Pantino also contain "Lycra". The new fabrics' wide range of uses is illustrated by men's Sternberg suit, women's outfits by Majestic shown below.

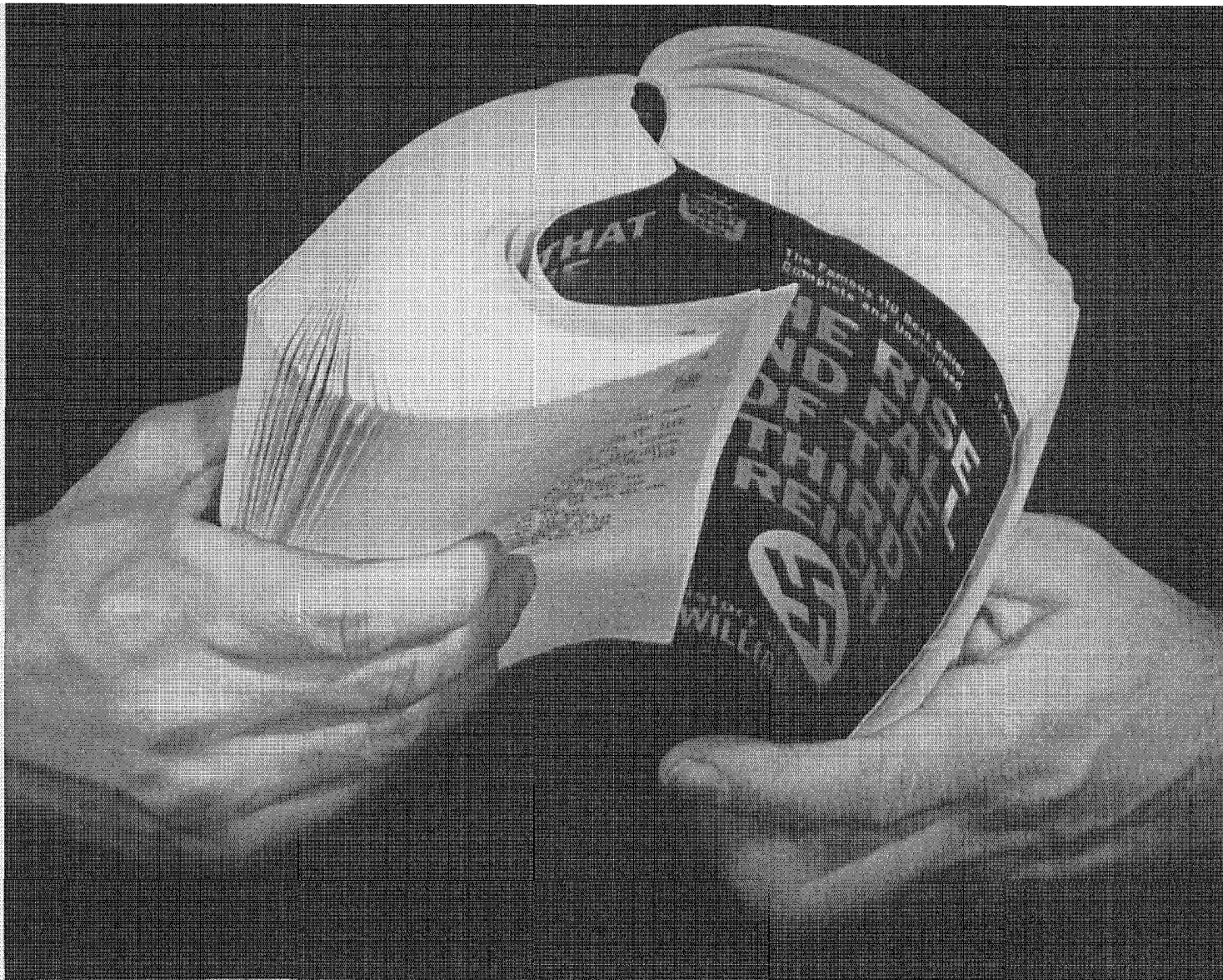
other apparel fibers; thus undyed spots don't show through colored fabrics, a problem that has plagued users of conventional elastic yarns. Another advantage is that "Lycra" can be heat-set either before or after weaving to impart excellent dimensional stability to fabrics. "Lycra" also requires no special handling. Textile mills can produce corespun yarns on existing cotton, woolen or worsted spinning systems with only minor modifications.

This is one of the few instances in which Du Pont is not making and selling a yarn it has developed. Instead, the company is licensing its customers to apply Du Pont know-how for making the new yarns.

Textile mills have been developing various new fabrics with cores of "Lycra". These include blends of "Orlon" acrylic fiber and wool, "Dacron" and cotton, and both "Orlon" and "Dacron" with worsted.

Some of these fabrics appeared in garments as early as last fall, but the big splash is coming this spring. They'll be available in men's wear ranging from suits and sport coats to underwear and sweater bands. Women will find dresses, skirts, rainwear, gloves and perhaps even lingerie that will be as comfortable as a second skin. ■





Little Books with STRONG BACKS

*With Du Pont's hot-melt adhesives to stiffen their spines,
paperbacks have won a massive and lasting place on the world's bookshelves*

At a bookstore on West Ninth Street in Wilmington, Del., the browser has his choice of 10,000 titles, ranging from ancient intellectual works which once verged on being collectors' items to fresh-as-today whodunits that can be read in a single sitting. Whatever his choice—culture or cutthroats—the customer can have it for a price between \$3.95 and 35 cents.

The books are paperbacks. The store specializes in them. Curiously, neither the books (among an estimated 289 million

paperback versions of some 23,600 titles to be printed and sold this year) nor the store (among some 110,000 U.S. retail outlets) would be likely to exist in their present vigorous form if Du Pont hadn't begun a patient and thoughtful stirring of the publishing industry's glue pot 20 years ago.

Paperbacks—age 25 this year, with sales topping \$100 million annually—are a mighty business that has changed the profile of U.S. publishing. Authors and hardback book publishers both have found a

vast new income potential in the selling of reprint rights to paperback producers. Moreover, the lure has been sufficient to induce some of the most tradition-steeped hardback houses to go into the business themselves by reprinting some of their old titles and binding them in paper covers.

Only five years ago, the biggest bookstores could accommodate all the paperbacks in print. Today, though, as Jerry Fine, manager of Wilmington's Paperbook Gallery, says: "There simply isn't room to

continued



Some 289 million paperback versions of 23,600 titles will be sold this year by 110,000 outlets.

Little Books with Strong Backs

continued

stock them all any more. There are 18 mass-market paperback publishers, and about 200 other houses are publishing higher priced paperback volumes. I buy from 130 just to meet local tastes."

Pocket Books, Inc., pioneers of paperbacks and still the largest U.S. producer of them, set things in motion in 1939. Its thesis: good books could command a mass market if they could be made as available and inexpensive as, say, cigarettes.

The typical hard-cover book is printed on a relatively good stock of paper, with sets of pages or "signatures" sewn and glued together at the cloth spine. It's usually run off in numbers ranging in the low thousands, then distributed to some 3,500 retail bookstores. How about, asked Pocket Books, reprinting these same books (after customary hard-cover marketing) in the hundreds of thousands—running them off on lower quality stock, gluing them to paper spines between coated paper covers,

and then shipping them to traditional magazine retail outlets such as newsstands, cigar counters, supermarkets and drugstores?

In its first seven months, PB sent out 1.5 million copies of 34 books embracing fare from westerns to witticisms. By 1941, about 600 magazine wholesalers had agreed to place PB production in their outlets. The results electrified the publishing world and opened a whole new theater of operations for the U.S. reading public. By last year PB had published more than one billion copies of some 3,000 titles.

Early in the game, paperback producers bumped against a vexing technical problem. It was articulated by the W. F. Hall Printing Co. of Chicago, The Colonial Press, Inc. of Clinton, Mass., and the J. W. Clement Co. of Buffalo, major printers and binders of paperbacks then and now, in discussions with Du Pont. The gist: the animal glues used to bind paperbacks were proving to be too cantankerous for mass

production and distribution. The adhesive was difficult to handle, took hours to dry (thereby causing severe storage problems between binding and trimming operations), was weakened by moisture in damp climates and became brittle in dry atmospheres—factors that caused rapid deterioration of books during and after distribution. Can you, the producers asked Du Pont, come up with an adhesive that will remain aloof to widely varying climatic conditions over long periods of time, yet will dry fast enough to permit our trimming books immediately after binding?

Ideals Listed

Du Pont's Fabrics and Finishes Dept. began to research the matter. F&F soon established a list of properties for the ideal adhesive for "perfect binding," i.e., binding which bonds each page individually, attaches the cover, holds the whole book together without stitching or side staples and withstands the severe flexing that occurs when the book is bent back on itself. Working with these ideals as their touchstone, laboratories introduced via pilot plant a tan-colored, elastic solid based on a synthetic resin. When heated to 250° to 350°F., it softened and became a viscous liquid. After applying to book spines in this temperature range, it required only a few seconds to harden and return to room temperature, permitting high machine speeds and instant trimming. The so-called "hot-melt" adhesive had been born and, in vastly improved form, it still serves today as a staple in the industry's supply cupboard.

The first major improvement was dictated by another industry problem. Paper mills value the wastepaper trim produced by bookbinders as a raw material. Such trim always contains some of the adhesive with which the book has been bound, so the adhesive should have characteristics that keep it neutral during wastepaper reclamation processes. Since ordinary glues are water-soluble, they offered no problem here; but hot-melts are made to withstand water and thus their insolubility constituted a headache for paper mill men. F&F took another look at hot-melts and devised a means to make them dilute alkali-soluble without impairing their other properties.

Says John P. Sermattei, Du Pont industrial adhesives technical adviser: "The Du Pont hot-melt adhesives being sold today will dissolve in .05 per cent aqueous sodium hydroxide in 100 minutes or less at 140°F., even after they've been heated as long as 48 hours at 300°F. This degree of alkali solubility makes the waste reusable in all paper mills that use de-inking processes and also in paperboard mills that are willing to use the small amount of alkali required. This high degree of alkali solubil-

ity is not possessed by all hot-melt adhesives and was achieved by a unique Du Pont manufacturing process."

Hot-melt adhesives provide higher quality books at lower cost even though they carry a higher price per pound than ordinary glues. Reasons: uninterrupted operations from signature gathering to shipping; more output per hour with less labor and floor space; less book repair. Consequently, hot-melts are finding continually broadening applications in such areas as magazine and catalog publishing.

Ironically, one of the most recent problems facing Du Pont adhesives scientists has its roots in one of the oldest-known perils of publishing: coated paper stock, such as that used on covers of paperbacks and magazines, is much more resistant to adhesives, be they glues or hot-melts. Up to now, Du Pont hot-melts applied over a preceding application of a special primer have had little trouble here. (For example, *Reader's Digest*, printed and bound by McCall, and *Fortune*, printed and bound by Donnelly, both contain a considerable portion of coated papers, have long been "perfect-bound" with Du Pont hot-melts.) However, Du Pont sees the need for a so-called "one-shot hot-melt" that can function at top efficiency in cover binding without primer prelude.

One-Shot Target

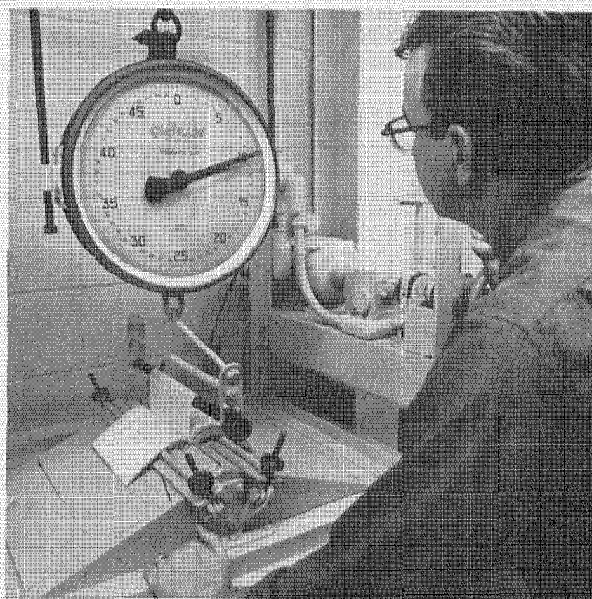
Therefore, with the assistance of firms like Hall; Clement; Colonial; Western Printing & Litho, Poughkeepsie, N.Y.; and McCall of Dayton, Ohio, Du Pont has developed and refined a one-shot hot-melt that not only serves the purpose in paperbacks but also, Sermattei says, "promises to extend to many magazines containing all coated paper that now are side-stapled." The new adhesive utilizes "Elvax" vinyl resin, a highly wax-compatible amorphous polymer manufactured by Du Pont's Electrochemicals Dept. Keeping one-shot researchers busiest these days are steps that will meet the alkali dispersibility need.

At its Marshall Laboratory in Philadelphia, F&F has installed a new experimental binder. As a research tool designed to simulate the operation of commercial machines in the field, the binder serves to solve specific problems of adhesives users.

As for the adhesives themselves, Sermattei expresses considerable enthusiasm in his prognosis. Says he: "Not only are hot-melts here to stay, but they'll expand even more in use. For instance, despite the difficulties, final solution to the coated paper problem is at hand, and this will open wide the magazine field. Basically, though, hot-melts will expand because they're in tune with the demand for faster production and lower labor costs per unit."

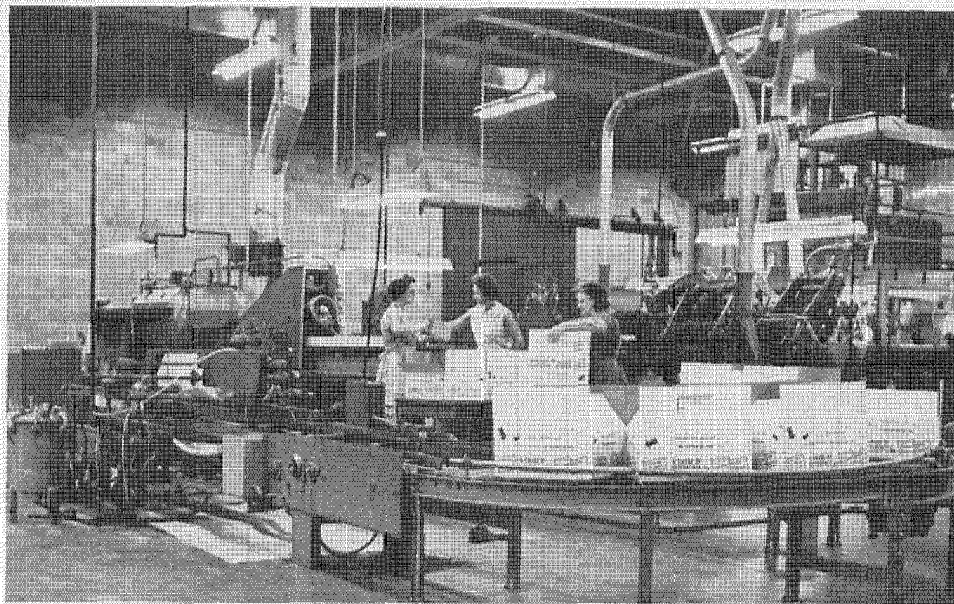


Experimental binder in F&F lab simulates operation of commercial units, is used by customers to solve problems.



Pulling forces withstood by page of paperback bound with hot-melt adhesives are measured on this laboratory device.

Hot-melt adhesives, at work here in bindery of J. W. Clement Co., Buffalo, provide uninterrupted operations, from signature gathering to shipping, also bring higher output per hour, few faulty book returns.



Oil Field Duty for a Dry

*Economical dry-acid
descalers based
on sulfamic acid
help operators
achieve safety and
convenience
in cleaning oil wells*

By ROBERT M. BEDNAR

The roustabouts waited patiently in the early morning stillness of the Texas oil patch. They scanned the horizon for a small bubble of dust: an indication that the acid truck had turned off the highway and was making its way across the tough terrain.

Two pumping wells were to be cleaned and the men were told to report for the acidizing job. Carbonate scale had clogged the perforations at the bottom of the casings, restricting the flow of oil from adjoining formations.

The acid truck never did show up. A Chevrolet sedan, however, soon appeared on the scene. The driver told the workers that it was to be a "do-it-yourself" job. Everything they needed for the descaling operation was in the back seat of his car in 100-pound drums marked Visco 900. Following instructions, the oil field roustabouts mixed the drums of dry-acid descaler into a slurry, introduced it into the annulus of each well, and left.

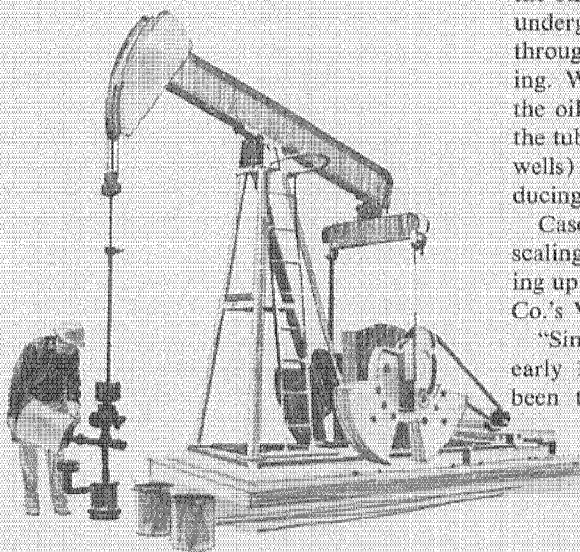
The next day a company engineer visited the site to check the gauge line measurements for each tank. Production had increased nearly 35 per cent on the first well. Results were even better on number two where productivity was up by 50 per cent.

With remarkable ease the workers had solved a problem present in most of the country's 700,000 oil wells. After a well is drilled, tubing is inserted to the level of the oil-bearing formation. The oil from this underground reservoir feeds into the tubing through perforations in the protective casing. When water is produced along with the oil (or when it's injected back through the tubing as in water-flooding and disposal wells), scale forms on the perforations, reducing or stopping production.

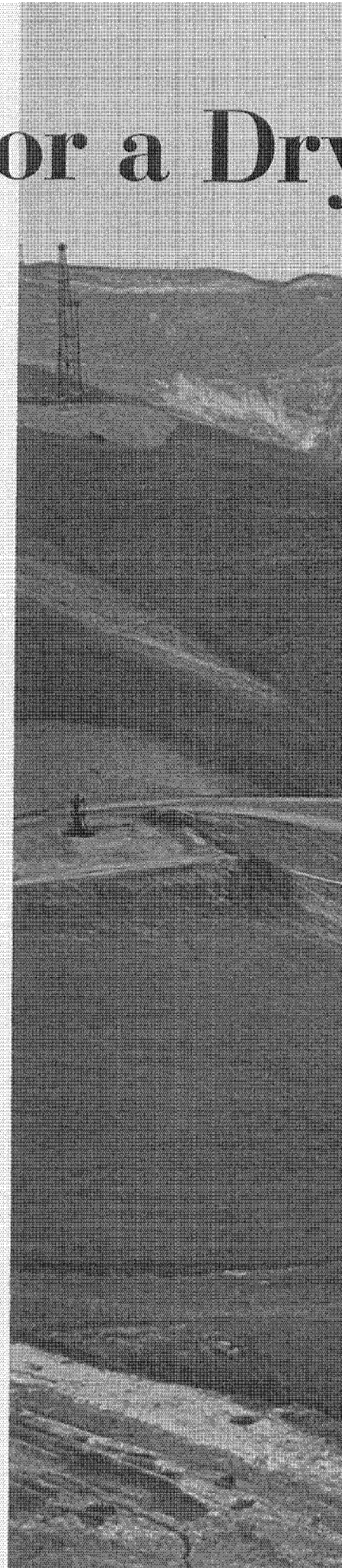
Cases of highly effective downhole descaling with dry-acid cleaners are fast piling up at the home office of Nalco Chemical Co.'s Visco Division, Sugar Land, Texas.

"Since we began marketing Visco 900 in early 1961, the response from oilmen has been terrific," says Paul Mallette, Visco

continued



On many downhole cleaning jobs, roustabout simply dumps dry-acid descaler into wellhead, eliminating need for special chemicals truck.



Oil Field Duty for a Dry Cleaner

continued

manager, Product Dept. "Like us, they had been searching for a descaler more effective than hydrochloric which arrived in tank trucks, had to be pumped in, and was hazardous to workmen. Then in 1960, Du Pont approached us with the idea of using inhibited sulfamic acid. After testing sulfamic with our own additives for nearly a year, we knew we had what we'd been looking for in a dry-acid cleaner."

In addition to stimulating production, sulfamic-based descalers such as Visco's offer other advantages: equipment and labor costs are reduced; in many cases a single man can perform the entire cleaning operation in a matter of minutes. Sometimes, sulfamic acid doesn't even have to be pumped. On many jobs the "slug" of acid, dry or in slurry form, is simply added at the wellhead and then displaced by the well's own pump down to the formation where it's left to do its work unattended.

Dry-acid descalers are convenient: stored at the well site, they are used whenever cleaning can be fitted into production schedule or on a regular preventive maintenance basis. Solutions of sulfamic acid cleaners can be handled safely anywhere without danger of fume damage to equipment or personnel. Shipped and handled dry, the products are nonirritating to unbroken skin and wash off with water.

Easy on Metals

Nor do properly inhibited sulfamic acid cleaners like Visco 900 attack metals commonly encountered in oil well descaling. Some formulated products may even be used on chrome-plated pump parts.

During its lifetime, an oil well may go through several periods of production, generally identified as flush, settle, stripper and secondary recovery.

Flush wells flow by themselves. The oil is forced to the surface by the "drive" of natural gas or water pressure. Settled wells are those in which natural pressure declines and pumping is necessary. When comparatively little oil is produced (less than 10 barrels per day) even with pumping, the well is termed a stripper. Secondary recovery or injection wells are those in which artificial methods are used to force the untapped oil to the bottom of the well where it can be pumped to the surface.

Many old fields in which oil was un-

knowingly left behind are now being reworked by secondary recovery techniques. One of the most common methods is waterflooding. In selected wells, water is pumped back to repressure the reservoir and flush the oil ahead of it to adjacent wells.

But regardless of the type of well, if water is present with the oil, operators are faced with the problem of carbonate scale and its removal.

At a Standard Oil Company of Texas field near Sivells Bend, Texas, two pumping wells were recently cleaned with Visco 900 following pretreatment with Visco 1111, a surfactant. Output had dropped to 17 and 21 barrels of oil per day (abbreviated "bopd") because scale blocked the perforations. At the end of a 17-day period, the first well showed a total increase of 155 barrels of oil—about 10 bopd more than before treatment. The second well produced an additional 214 barrels over the same period for an average gain of 15 bopd.

Precleaning tests on another pumping well near Gainesville, Texas, showed average fluid production at 62 barrels per day, only 11 of which were oil. The well was treated with Visco 900 and 1111, allowed to stand overnight, then swabbed. "The sulfamic cleaner not only removed the scale deposition but also removed some of the mud used in drilling the well," the oil company's superintendent reports. "And since treatment, the well has averaged 10 barrels more of total fluid per day."

Water injection wells and saltwater disposal wells also have their scale-plugging problems. Last spring, for example, six water injection wells in a waterflood south of Holiday, Texas, experienced a rapid decline in injectivity and would not take water at the desired rate.

In an effort to increase the injection rate, the wells were treated with 15 per cent hydrochloric acid. This resulted in little or no improvement. Shortly afterwards, the same wells were treated with Visco 900 using a pump truck. Following treatment, the project engineer reported that "Acidizing with Visco 900 increased injection rates and/or reduced wellhead pressures in five of the six wells."

Another Texas company had similar problems with an injection well. Due to downhole plugging, pressure had risen to 800 psig, reducing production and endan-

gering equipment. Fourteen hours after treatment with the dry-acid cleaner, a 140-pound pressure drop was noted. And after a month, the pressure was still decreasing.

With oilmen constantly searching out new and better methods of exploration, drilling, production and maintenance, one is hard put to imagine a time when a well producing oil was considered a failure and shut down. In the 1850's, however, wells were drilled for water and brine—not oil. Although a handful of small refineries were using crude oil skimmed from ponds and creeks to make kerosene for lamps, no one thought of punching a hole in the ground to find the source of the seepage.

Petroleum Panacea

Then in 1857, a New York lawyer named George Bissell saw the following advertisement in a drugstore: "Kier's Petroleum or Rock Oil, a Liquid of Wonderful Medical Virtues, discovered in boring for salt water near the Bank of the Allegheny River . . . about 400 feet below the earth's surface."

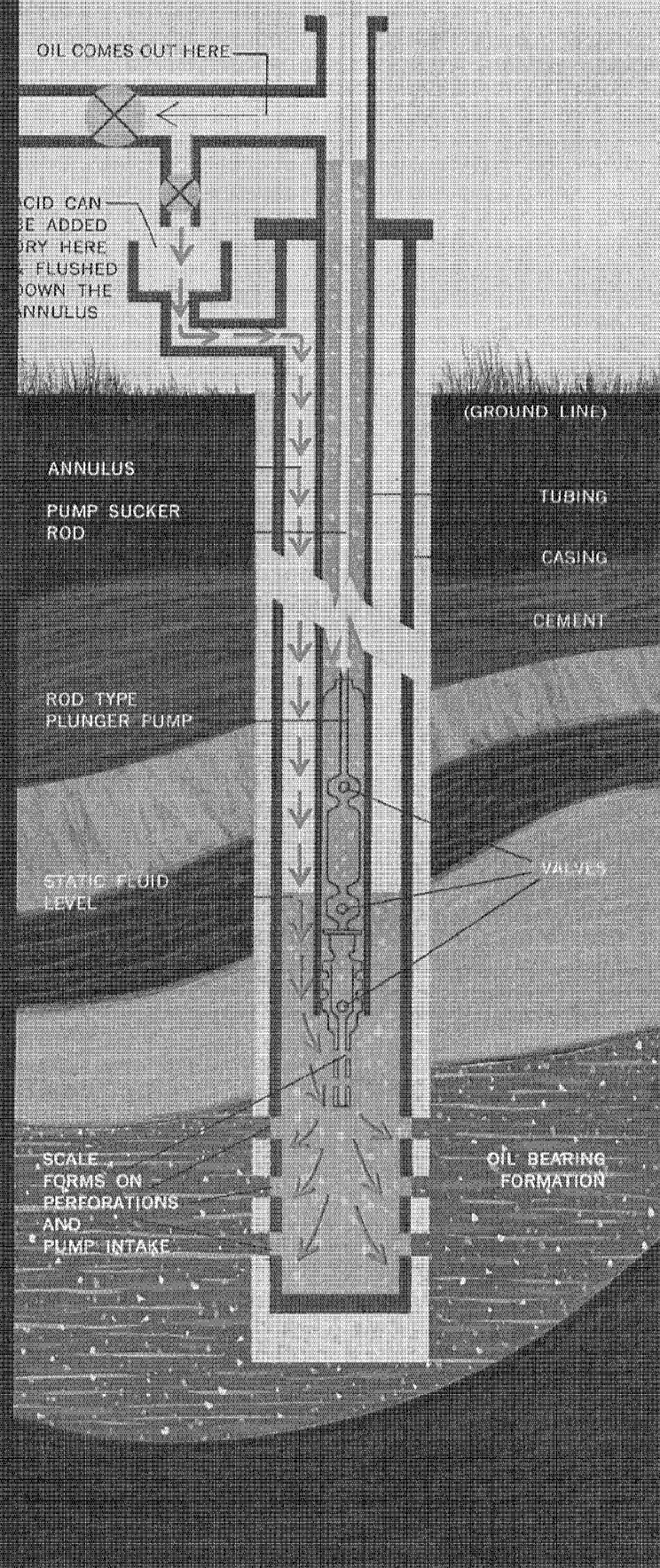
Why not drill? Bissell wondered. With financial backing from a New England banker, Bissell formed the Seneca Oil Co. and began drilling at the now-famed Oil Creek site near Titusville, Pa. His aide, Edwin Drake, struck oil at 69½ feet. The American petroleum industry had begun.

Today, billions of barrels of oil are being produced annually throughout the world for a variety of petroleum products ranging from fuels, lubricants and waxes to such secondary products as detergents, synthetic rubber and fibers, and plastics.

In the United States alone there are some 600,000 producing wells and about 75,000 secondary recovery wells. "More than 80 per cent of these wells produce at least some water along with the oil," says Bill Cooke of Du Pont's Industrial and Biochemicals Dept. "And when water comes up with the oil, it usually means scale build-up and plugging. Today, however, with the safety and handling ease of products like Visco 900, one man with a couple of drums and a piece of hose can acid-treat a well in no time flat.

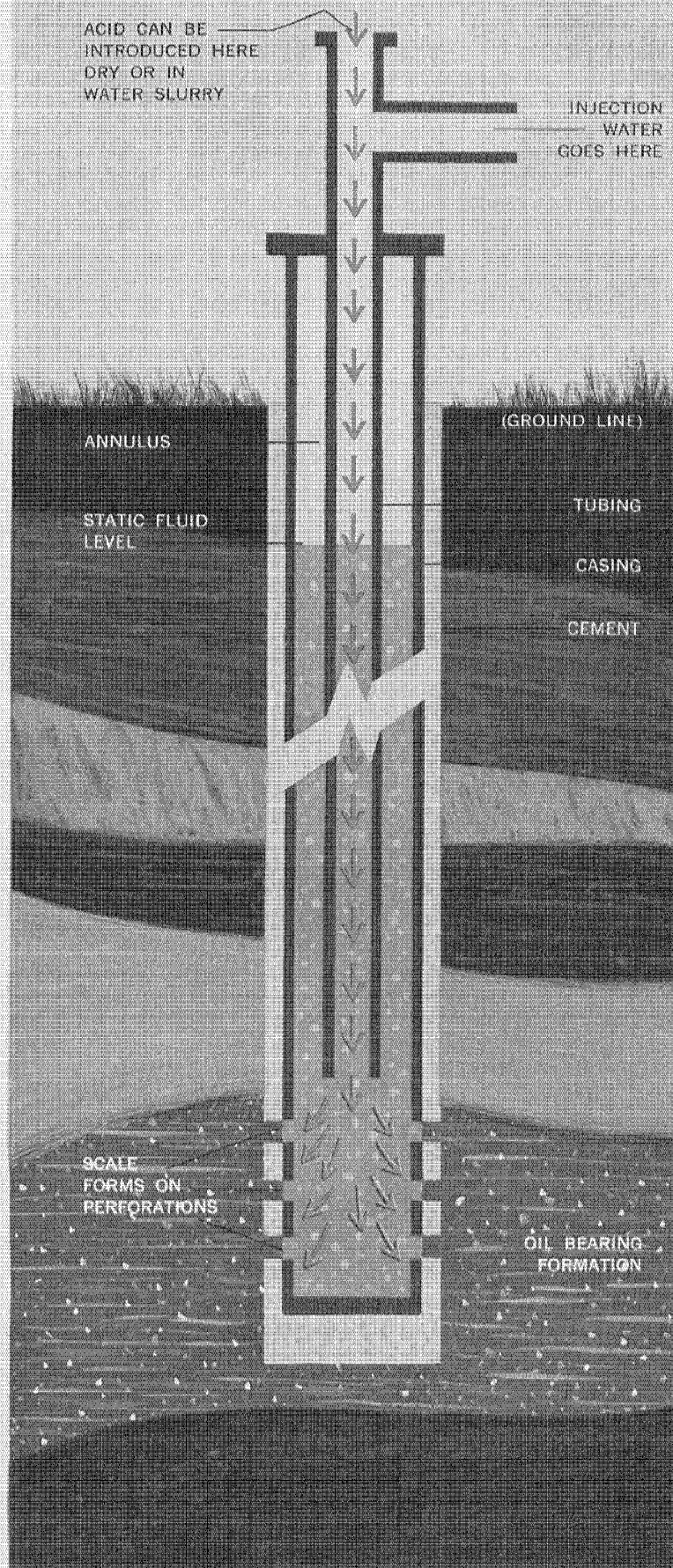
"What's more," he adds, "these dry-acid descalers can be kept right at the site in case emergency treatment is necessary—an important factor since few wells are obliging enough to be close to the highway." ■

PRODUCTION WELL



In production wells, where pumping is necessary to bring up the oil, sulfamic keeps downhole perforations free of carbonate scale.

INJECTION WELL



Sulfamic keeps openings clear in injection wells where water is pumped back into the formation to flush oil to adjacent wells.

BACKSTAGE AT THE

Products and performers are taking their places as Du Pont nears the premiere of its "Wonderful World of Color"

New York, N.Y.

Come Wednesday, April 22, the evening sky over this theatrical mecca will glow with a light visible for 200 miles. Equal to 340,000 auto head lamps, the powerful spotlight will open the most heroic variety show ever staged, the 1964-65 New York World's Fair.

A billion-dollar spectacular, the Fair will star a cast of thousands in a 550-acre set-

ting. Its colorful account of the world's ideas, customs and achievements will run from mid-April to mid-October, both this year and next, playing to a total of 70 million visitors.

Imaginative architects and builders have speedily transformed Flushing Meadows Park into a dazzling city of soaring arches, cantilevered beams and gleaming glass—in



FAIR

By HARRY E. DAVIS

istry"

all, 150 exhibition pavilions encircling the symbolic Unisphere, a 13-story, 250-ton stainless steel globe.

As showtime nears, spirited dancers gyrate to the rhythms of the limbo, flamenco and calypso in the quaint pavilions built for 50 foreign exhibitors.

Being readied are a geisha house, temples and pagodas and collections of jewels and

art from all corners of the world. Most foreign pavilions, too, will include restaurants serving native food and drink.

Elsewhere under the Unisphere, major states, New York City and the Federal Government are painting a 20-pavilion panorama of America. Sights will range from Indian to hula dancing, from old-time trains to space vehicles and models of fu-

turistic cities. States will likewise point with pride to reproductions of a lavish movie set, the aurora borealis and famous national landmarks.

American industry will be the largest exposition group, accounting for more than 200 of the Fair's 300-plus exhibitors. The firms' diverse displays, from a demonstration of atomic fusion to a candy factory, are being assembled in 35 giant showcases. These pavilions ring a huge reflecting pool, site of nightly music, colored fountains and dazzling fireworks.

Amid this industrial montage is the Du Pont Pavilion, a two-story, carousel-like building 180 feet in diameter.

Du Pont's show theme will be the "Wonderful World of Chemistry." Entertaining songs and dances blended with startling demonstrations will portray the chemical industry's origin, progress and contributions to mankind.

Currently, seven casts are rehearsing the variety segment, which will be presented more than 10,000 times in two 300-seat theaters. The casts rate as unusual, for they include six choreographed movie screens.

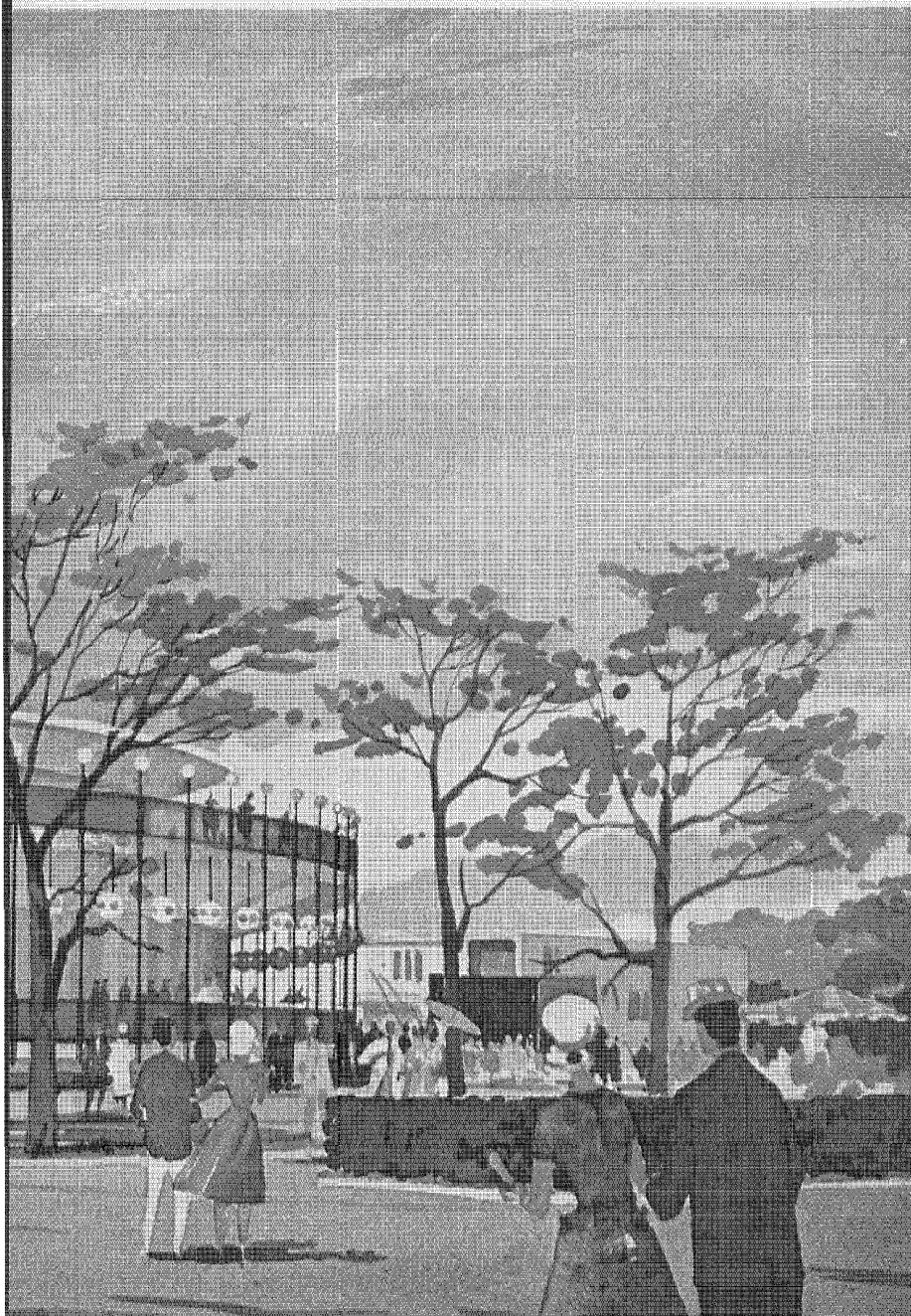
Wheeling freely over the theater stages, the screens will project humorous characters who sing and dance with live performers. Demanding perfect synchronization of images and actors, this interplay leads to such surprises as a screen character mystifyingly handing a bag of groceries to a live actress. In another scene, an actress hosing down an auto projected on one screen somehow douses a figure on another screen across the stage.

The lighthearted show is built around an original score written by director Michael Brown, who has penned music and lyrics for many successful Broadway and supper club productions.

Brown's whimsical short course on chemistry's evolution begins with the ancient Greeks. They're depicted as furiously pondering the earth's makeup but never testing their ideas. By contrast, frustrated alchemists seek to turn lead into gold by experimenting wildly and with little regard for logic. Du Pont's alchemist fares better than his Middle Ages contemporaries: his muddy potion congeals into peanut brittle.

The chaos of the past ultimately becomes chemistry with France's Lavoisier, who identifies the earth's basic elements and the formula for water. He also takes on a

continued





Show director Michael Brown and assistants consider last-minute revisions in musical score.

bright, young apprentice named E. I. du Pont, who later emigrated to America and founded a company dedicated to both thinking and testing.

Better Things are Born

Brown chronicles the results of Du Pont Company research in amusing skits. There's Grocer Goodfellow who tries delicately to shoo flies from food in a 1915 general store. His worries end when Du Pont introduces moistureproof cellophane, which in turn helped to usher in the supermarket with its attractively packaged and protected foods.

In another scene, a madcap musical trio of women salutes "Freon" propellents, which gave birth to the aerosol industry. Working push buttons on spray cans topped with whistles, the women swing into an off-key tune. Whereupon one spray can rebels, covering its handler with a foamy lather. The woman's distraught look turns to pure pleasure, though, when she licks her lips and discovers, "Butterscotch!"

At the 1939-40 World's Fair, Du Pont announced nylon. This year the company will unveil another exciting contribution to fashion: "Corfam" poromeric upper material for footwear.

Fashions in apparel will share the spotlight. Predictions of styles to come this summer and next year will be made by four noted designers, Donald Brooks of Townley, Oleg Cassini, David Kidd of Arthur Jablow, and Cecil Chapman. Clothing will capitalize on the properties of Du Pont fibers: nylon, "Orlon" acrylic, "Dacron" polyester, "Lycra" spandex and "Antron" nylon.

Audiences will end their Du Pont visit in a product arena where demonstrators will present a fast-moving show of "chemical magic." One example of the surprises planned will be a plain piece of fabric which, dipped into a solution, emerges as an American flag. The trick lies in Du Pont

selective dyes applied to the cloth beforehand and activated by the solution.

In a demonstration of heat resistance, a narrator will walk about a stage carrying a red-hot rivet. Visitors will discover that his hand is shielded by a paper-thin sheet of "Tipersul" fibrous potassium titanate.

In addition, the company has lined up an elegant white mink coat to register another product's advantage: the nondrip property of "Lucite" wall paint. The coat will serve as a drop cloth while a demonstrator standing over it confidently splatters dark blue paint on a wooden panel.

Several major products will also figure prominently outside Du Pont's own building. For example, 14 room settings in the Pavilion of American Interiors will feature carpets of Du Pont 501 nylon, plus upholstery, draperies and furniture cushioning of "Dacron".

The House of Good Taste, an exhibit of outstanding architecture and décor, will include upholstery and wall covering products of the Du Pont Fabrics and Finishes Dept. Du Pont paint will also protect the exhibit's house of tomorrow.

Lending added excitement to the Fair will be an array of amusements including a lavish ice show, a 90-minute review of American musical comedy and "Les Poupées de Paris," an hour-long puppet show.

Rides will abound. Among them will be "shooting the rapids" in a hollow log, a monorail and a simulated helicopter that rises 100 feet. The entire World's Fair will be seen from the Swiss Sky Ride, gondola cars winging on cables 112 feet overhead.

Although riders will look down on a spectacle lasting only two years, they will leave with a permanent legacy: better understanding among peoples of the world. ■



David Carter, a Brown aide, puts members of Du Pont cast through an original dance step.



Enrico Caruso tops off a fashion model's hair styling with a quality spray powered by "Freon".

Heady Success of Hair Sprays

*Quality aerosols powered by "Freon" find favor both with women
and with such noted hair stylists as Enrico Caruso*

At 9:45 sharp every Monday morning, a bevy of the world's most glamorous women converges on an unimposing brownstone row house on New York's busy East 55th Street.

An equally conservative blue canopy leading to the house's basement-level doorway tells why: the canopy's white inscription reads, "Enrico Caruso. Parruchierre."

Loosely translated from Italian, "parruchierre" means hair stylist, and Enrico

Caruso is recognized as one of the world's most talented. The beauteous women flocking to his salon are the reigning queens of modeling, each earning more than \$50,000 annually. Caruso's Monday artistry prepares them for the week's hectic posing for magazines and television.

Caruso's week, likewise, gains in tempo as it progresses. His crammed appointment book logs actresses, socialites and prominent businesswomen who'd rather be strick-

en from *Who's Who* than go to another hairdresser. Moreover, Caruso spends two days each week away from his salon, styling hair for TV commercials and advertising stills. The result is that whether you go to Broadway shows or supper clubs, the movies or sit at home watching television, you'll see his handiwork.

Caruso has been successful in the traditionally fickle world of fashion and glamor because he never imposes a precon-

continued



Fine, uniform mist is produced when "Freon" and alcohol are mixed in proper proportion.

Heady Success of Hair Sprays

continued

ceived style of hair on anyone. His philosophy is to sculpture a woman's hair to suit her face and personality, and never merely to go along with styling crazes.

"A hair trend or fad usually falls from favor quickly," Caruso explains. "Thus a fad-follower must continually change her hair, sometimes from bad to worse."

"Most fads give hair an unbelievable look. Either every hair is precisely and unnaturally in place, or tresses are wild and woolly and look like the hairdresser used trimming scissors missing some teeth."

By contrast, Caruso believes that a woman's hair should look alive—like it belongs to her. He explains: "Hair must appear soft and free. It must move naturally as a woman moves her head. It mustn't appear to be glued and pasted down or look like a mass of fine, bent wires plopped on her head."

Thus, once Caruso styles hair, he uses a high-quality hair spray to keep his workmanship intact but not glued. "Some hair sprays make even the most natural looking hair style look unreal," he says. "A good spray, however, keeps hair in place without

obviously holding it there. It doesn't make hair feel gummy or tacky and it permits you to comb or restyle without losing the curl.

"A good spray also comes out of the can in a fine, even mist so that it covers completely. And it holds best when it dries on contact with the hair."

This kind of performance is most likely, Caruso says, when hair-holding agents are sprayed by "Freon" propellents. "Freon" provides the push-button energy needed to propel minute, rapidly drying particles. Moreover, "Freon" is loaded into aerosol cans as a liquefied gas; thus a spray's particle size, drying time and pressure are the same from the first to the last squirt.

"Any top-notch hair spray is a precise blend of holding agents and a solution of 'Freon' and alcohol," explains A. H. Lawrence, Du Pont sales manager for "Freon" propellents. "The 'Freon' and alcohol mixture determines the fineness of the mist and its drying time. Too much alcohol, for example, leads to wetter, slower-drying sprays."

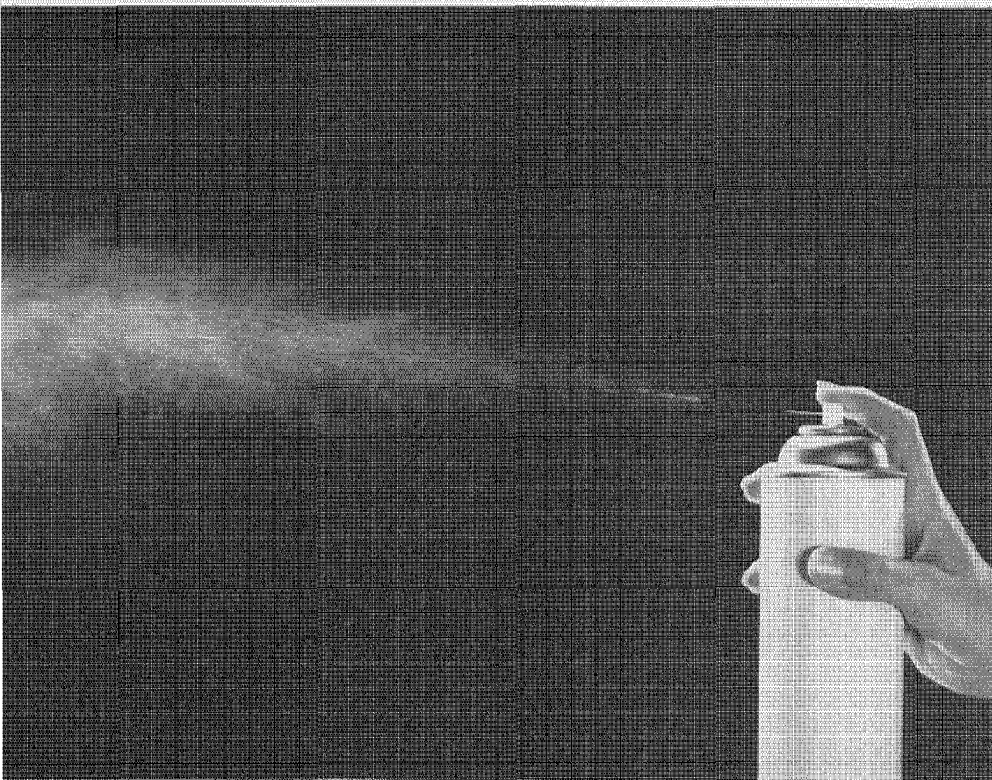
"Sometimes, in an effort to cut production costs, manufacturers try to substitute certain solvents for 'Freon' or water for

alcohol. But in either case, the spray becomes coarse and takes longer to dry. Fortunately, most manufacturers have concentrated on quality and they're being rewarded by a booming market."

Hair spray sales totaled some 270 million cans in 1963; this was 18 times the sales 10 years ago and double those for 1960. Currently, hair sprays account for 25 per cent of retail aerosol sales. In addition, hair spray last year outsold such other successful push-button products as shave lathers three to one and aerosol colognes and perfumes about five to one.

"It's the old story of building a better mousetrap," smiles Du Pont's Lawrence. "Most early sprays depended on a perfumed solution of shellac to hold hair in place. Women tried them and complained that they made hair stiff, gummy, difficult to comb and unnatural looking."

"However, manufacturers have steadily improved their products' holding agents, and the climbing sales curve shows that women are discovering these changes. The trend indicates there's even greater success ahead for hair sprays."

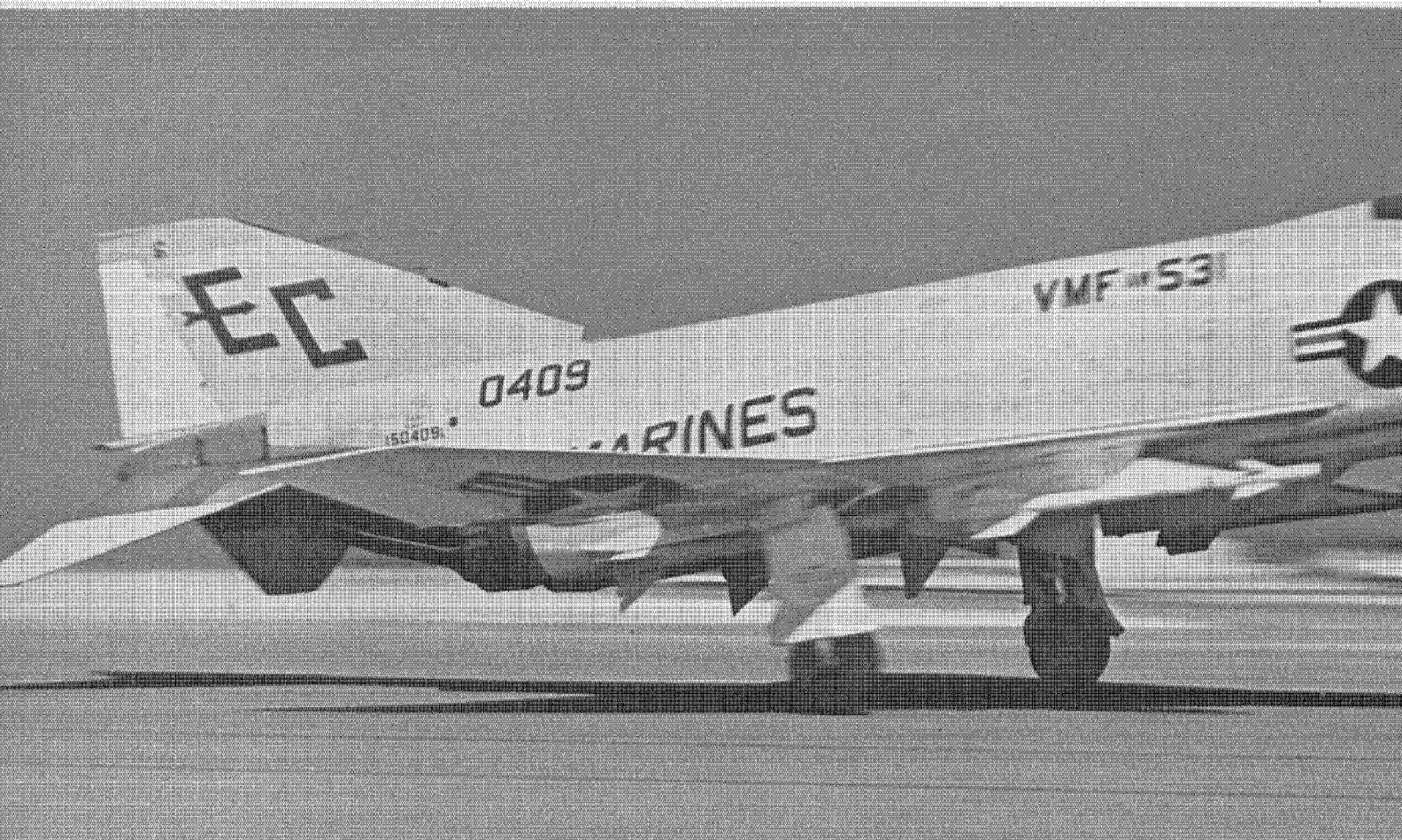


Coarse, wet spray results when too much alcohol or substitute ingredients are used in mixture.



The Poodle Cut, above, and Italian Cut, right, are two of the many Caruso stylings that sparked national crazes.





McDonnell's Phantom II fighter can cover more than 92 per cent of the earth's surface from carrier deck or land base without refueling.

EASING THE SQUEEZE

"Teflon" TFE-fluorocarbon resins help aerospace engineers achieve high performance and reliability

When the X-59 Airacomet raced off the runway at a secret test base at Muroc, Calif., on the morning of October 1, 1942, the U.S. entered the jet age.

First jet-propelled plane designed and built in America, the Bell X-59 startled experts with its initial test flight performance: 400 mph at 40,000 feet.

Today, the Airacomet's successors fly four times as fast and $2\frac{1}{2}$ times as high; they carry multiple-ton payloads and are equipped with complete radar systems. Their big brothers, the 100-ton-plus jet transports, wing across continents at speeds approaching that of sound, while passengers feast on gourmet dinners and view the latest Hollywood movies.

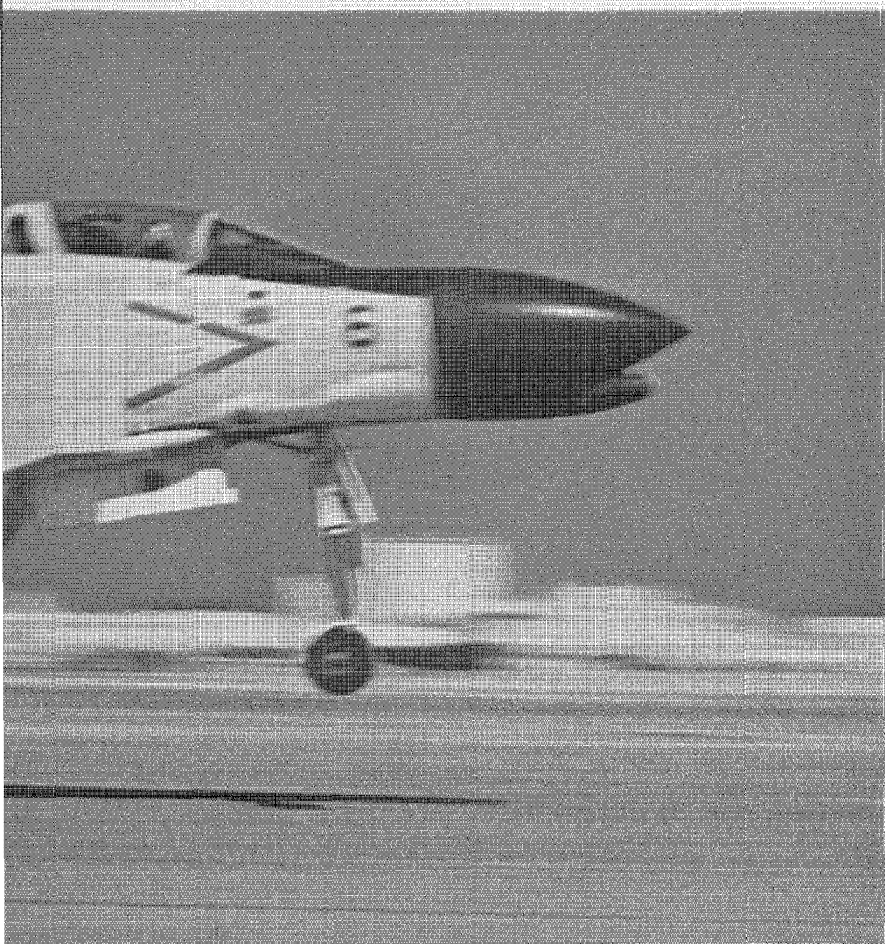
To achieve such performance, modern jets require extremely complex electronic circuitry. With external plane dimensions shrinking, manufacturers of military air-

craft had to find ways to decrease the size of bulky wire bundles without sacrificing performance or reliability.

For example, McDonnell Aircraft Corp.'s Phantom II fighter requires $10\frac{1}{2}$ miles of electronic wiring. The problem: there isn't enough room in the plane's airframe to practicably accommodate such a large quantity. Engineers at the St. Louis-based company found the answer in a smaller diameter hookup wire with the same voltage and current ratings as normal airframe wire. However, it lacked the mechanical toughness required with high internal wiring density.

After investigating various materials, McDonnell decided on a "Teflon" TFE-fluorocarbon resin as primary insulation for the basic hookup wire.

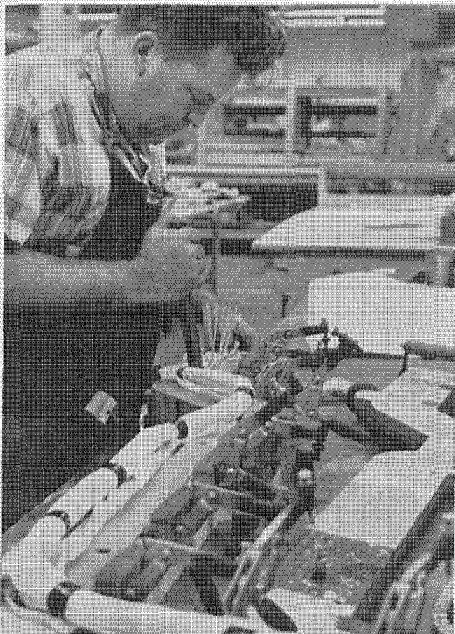
To insure maximum mechanical protection, a braid of "Dacron" polyester fiber



IN JETS

n today's equipment-loaded aircraft

Wiring bundles for Crusader jet are inserted in rigid plastic forms at Ling-Temco-Vought shop.



was woven over the wire bundle. The outer jacket was then impregnated with a fluorocarbon dispersion.

The result was compact wire harnesses with less bulk, greater compatibility with miniature hardware, and improved resistance to chafing, abrasion and heat. And according to McDonnell officials, the new harnesses have tested out to be five times tougher than a primary insulation of greater thickness.

"In addition to a one-third-diameter reduction in bundle size, the new harnesses have cut our wiring, maintenance and inspection times in half," a company spokesman points out. "Also, the low frictional property of 'Teflon' makes it easier to bend and move the harnesses into place on the airframes. We can even slip a single wire from the harness if necessary. And when repairs or splices are needed, a soldering

gun can be used to cut through the outer polyester jacket without fear of heat damage to the primary TFE insulation."

McDonnell assembles some of its compact wire bundles on three-dimensional layout boards that simulate the shapes harnesses will take in the aircraft and allow for proper wire length around bends and twists. Wire lengths in the Phantom II vary from 8 inches to 40 feet, with as many as 1,300 wires in a bundle.

A rundown on increased equipment, payload and operational capabilities shows why this high-powered jet needs 36,000 feet more wiring than its predecessor, the F-101 Voodoo.

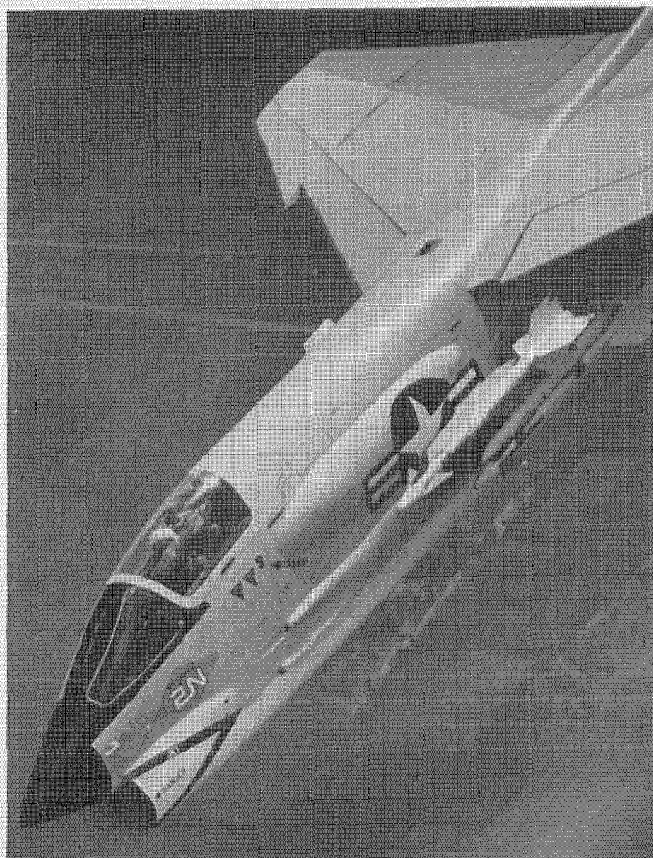
The Phantom II is a two-man, twin-jet fighter that can fly at speeds above 1,600 mph, or below 200 mph for ground support purposes. It has been clocked from a dead stop to 98,000 feet in less than six minutes. The versatile aircraft can carry unusually heavy loads of air-to-ground and air-to-air weaponry; its advanced radar system permits long-range target detection and automatic tracking under all weather conditions, day or night.

Ling-Temco-Vought engineers at Dallas were faced with similar wiring problems on another high-performance jet fighter, the F8U-2N Crusader. Equipped with all-weather radar, automatic pilot and increased armament, the F8U-2N required up to twice as much electric wiring as some earlier Crusaders. To achieve more compact harnesses, Ling-Temco-Vought developed a new hard-harness wiring system in which bundles of general-purpose hookup wire insulated with "Teflon" TFE resins are encased in a rigid cover of resin-impregnated plastic. This sticklike, hard-coated wiring harness can be molded into virtually any shape and formed to follow structural contours inside the aircraft. It requires less than half the space needed for conventional harnesses.

The hard-harness system, according to Ling-Temco-Vought, has reduced wire breakage, chafing and crowded installations; it requires minimum maintenance, is abrasion-resistant and represents a considerable weight savings.

With heat resistance a major requirement in the electronics-packed Crusader, Ling-Temco-Vought engineers turned to "Teflon" TFE resin for use in the hard harness. "We needed a material that wouldn't wilt when used in the 'hot' portions of the plane," says one engineer. "The wire insulated with 'Teflon' was rated for continuous operation at 392°F. This is much

continued



Insulation of "Teflon" TFE resins provides improved heat resistance in unique hard-harness wiring system aboard Ling-Temco-Vought Crusader fighter.

Easing the Squeeze in Jets continued

higher than the 250°F. rating of the conventional airframe wiring previously used.

"Also, the wire has a very large current overload capacity. Because they are closely packed," he adds, "adjacent wires act as a heat sink for any wire that is subject to a temporary current overload."

On active duty with the U.S. Fleet, the F8U-2N Crusader gives the Navy "near Mach 2" carrier-based defense capabilities. Revised lighting systems, improved instrumentation and push-button controls that perform many of the pilot's routine "talks" (holding altitude, holding ahead, etc.) allow for greater concentration on mission.

In commercial jet transports as well as military aircraft, the demand for high performance and increased reliability has resulted in complex circuitry requiring great lengths of wiring.

The Boeing Co.'s new 727 short-haul jetliner, for example, calls for about 51 miles of wiring. Most of this is general-purpose hookup wire insulated with a "Teflon" TFE resin.

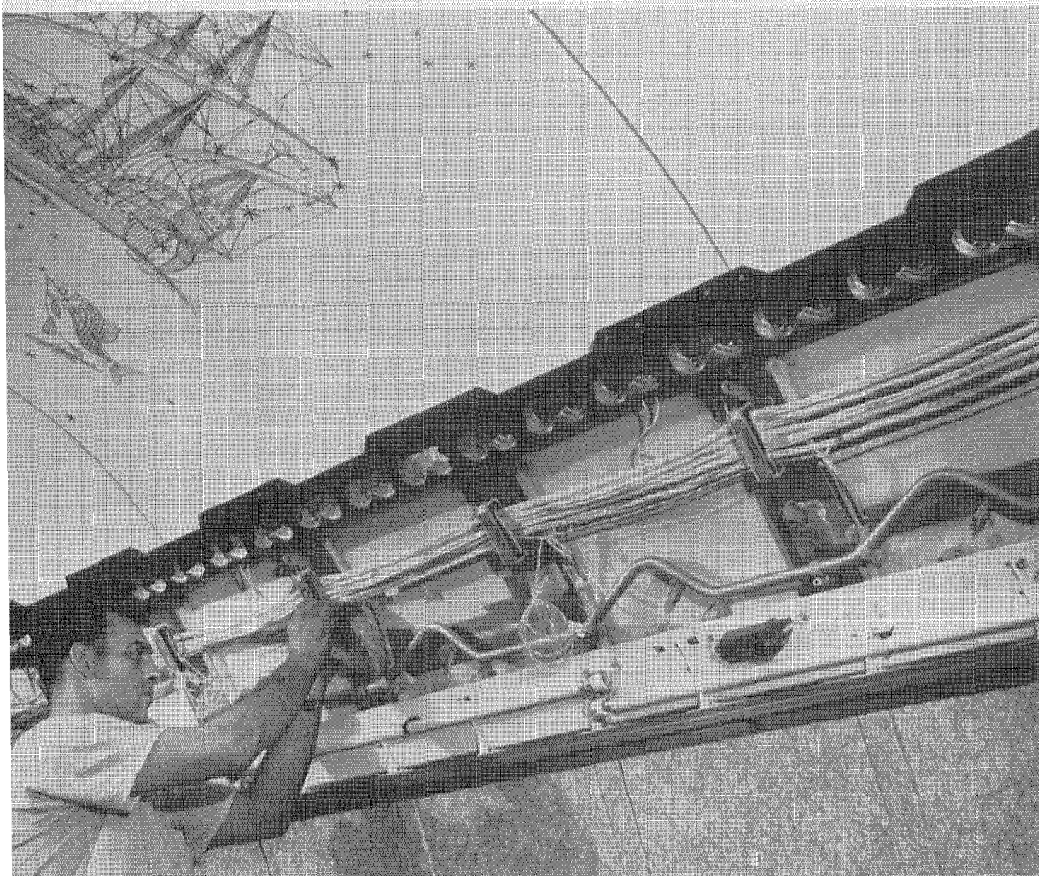
Says one Boeing official at the Seattle headquarters: "The new wiring with 'Teflon' weighs less and is more resistant to high temperatures; it has better abrasion resistance and requires less space than earlier types of wiring used. We're using quite a bit for black-box work and conventional hookups as well as in multiconductor bundle systems."

Smallest and most versatile member of Boeing's jet family, the 727 is designed to bring jet service to dozens of cities previously bypassed due to short-field capabilities. The new T-tailed transport takes off in less than half the runway required for bigger planes; with a range of up to 2,000 miles, it carries from 70 to 119 passengers at speeds up to 600 mph.

With products like "Teflon" TFE resins helping to advance modern aerospace technology, new tales of remarkable performance feats come pouring out of jet pilot ready rooms throughout the world.

Perhaps the most astonishing story came from a Navy pilot stationed near Naples, Italy, who reportedly took his F8U Crusader up to an altitude of 5,000 feet, remained aloft for 24 minutes, then made a smooth landing.

It was routine except for one thing—the jet's wings were folded all the time. ■



General-purpose hookup wire protected with "Teflon" TFE is installed along hat-rack area in one of Boeing's new short-haul jetliners. Circuitry in 727 requires about 51 miles of wiring.



Smallest and most versatile member of Boeing's jet family, the new T-tailed transport is designed to bring jet service to dozens of cities previously bypassed because of short-field capabilities.



Big shovel digs fragmented rock in 4-million-cubic-foot hole blasted by one shot at J&L's open ore pit at Star Lake, N.Y.

Economy-minded miners save costly steps in an open ore pit by

THE ONE-SHOT



Star Lake, N.Y.

The small boy waited for days to hear what local people said was going to be the "biggest blast ever" in the Newton Falls Ore Pit.

Still no boom.

Finally he strode bravely up to the Du Pont explosives representative. "When's it going to be?" he demanded.

"It's all over, son," the man said. "We shot it this morning."

A 4-million-cubic-foot hole had been blasted in the hard bed of the Adirondack Mountains' famous iron ore deposit. Yet few heard the shot, and fewer had felt it.

The villagers missed not only a spectacle but a major experiment in open pit mining by Jones & Laughlin Steel Corp.'s New York Ore Division, which supplies 22 per cent of the ore consumed by J&L's furnaces.

Traditionally, magnetite and martite iron ore is blasted from the quarrylike open pits in a series of small sections. "Such conventional cuts are made in a series of small shots, varying in size from a few hundred tons of ore at the top of the ramp to 20,000 tons at the lower, deeper part," explains R. G. Fleck, manager of J&L's New York Ore Division. "At this rate, it takes eight cycles of drilling, blasting and digging to mine a 100x600-foot area to a depth of 48 feet."

The operation is tedious and time-consuming, and for years mine operators have sought ways to reduce the steps required. "We decided that if we could blast the entire working area in one shot, great efficiencies would result. For example, we wouldn't have to repeatedly move our drills, shovels, trucks and pumps in and out of the pit."

But the depth the J&L men contemplated had never been opened by one shot in a mining operation. Thus the mine operators and Du Pont technical representatives began research six months ahead of the projected blast. The mine's floor was surveyed, and the 100x600-foot blast area staked out.

Wind direction, velocity and temperature affect sound propagation, so J&L set up regular communications with the Northeast Weather Service, Bedford, Mass., to acquire timely weather data.

Vibration engineers were called in and test blasts conducted to insure that vibration would be below the level that might damage nearby houses.

Finally, a month before the blast, drilling and loading began on 316 explosives holes, each 7 $\frac{7}{8}$ inches in diameter. The center of the blast area had 12 holes drilled to a

continued



Crews pour free-running Pelletol 1 into 56-foot-deep holes to supplement main explosive.

RAMP

By JOHN S. DUNK

depth of 60 feet; the remainder of the pattern fanned out in rows of 7 holes each, 56 feet deep.

Into the holes, J&L loaded a total of 318,160 pounds of Du Pont explosives. A typical blast hole was loaded with 14 cans of "Nitramex" 2H, Pelletol 1 and three "Nitramon" primers. The holes were topped off with 22 feet of stemming.

"Nitramex" 2H canned blasting agent was selected as the workhorse because of its high water resistance and density: many of the charges remained in the ground for over a month. In addition to its high density (1.8 gm./cc.), "Nitramex" 2H has exceptional time-tested qualities for shooting in hard material.

Waterproof, free-running Pelletol 1 poured into the holes supplemented the main charge and filled the annular space between the can and borehole wall.

Water-resistant "Nitramon" primers, designed especially for setting off explosive charges in cans, were put in the holes. "Primacord" trunk lines with "Primacord" MS-9 connectors were attached to the primers; these were the connecting links for all charges and provided the short interval delay firing system for the blast.

When all holes were filled and the weather reports indicated favorable atmospheric conditions for blasting, J&L cleared the area of equipment and personnel for a half-mile around. Connections were checked and tied together. Everyone was ready. At

11:40 a.m., the signal to fire was given.

Two-tenths of a second later, the blast was over. The charges in the 12-hole center fired simultaneously, followed by succeeding rows of seven holes each at nine-millisecond intervals. The combination of the delay firing and deeper center boreholes forced the broken rock toward the middle of the blast area. The result was that the ore rubble settled in a 55-foot-high center "muck pile" declining to 30-foot depressions at both ends.

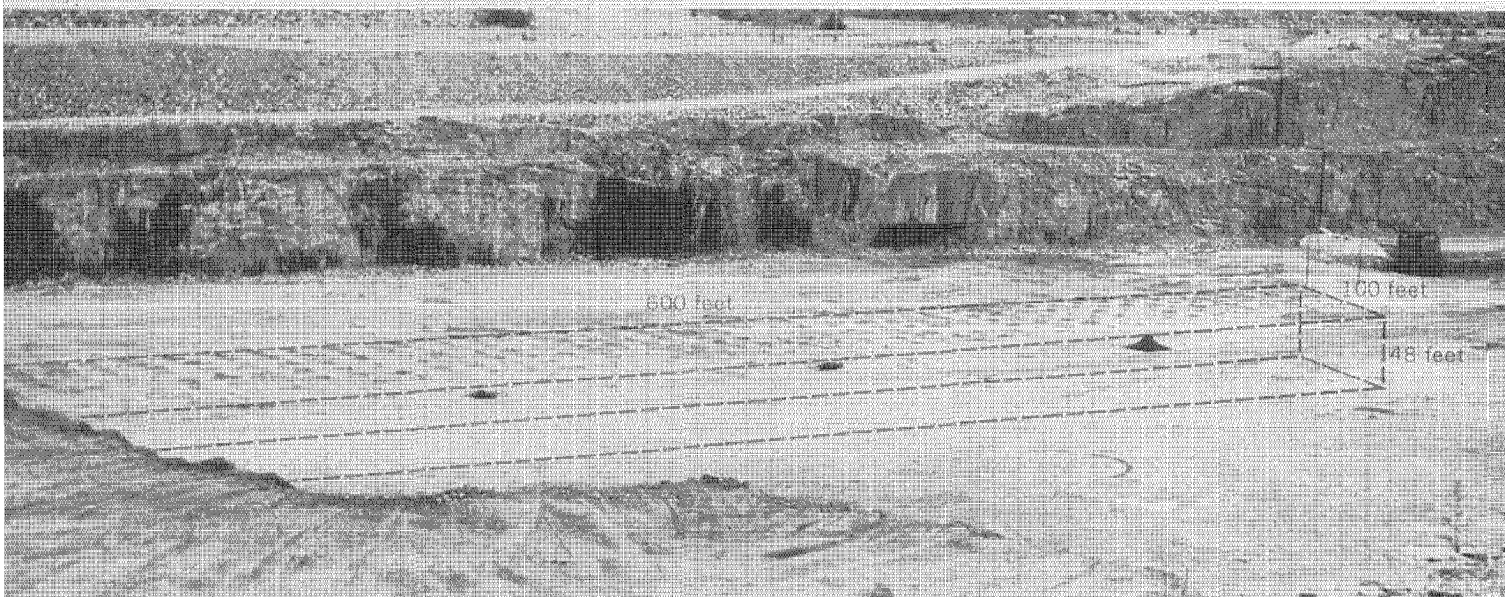
The hard, metallic ore shattered, leaving no large boulders in the main area. Vibration and noise were negligible.

Flying rock was minimal. A sump pump 200 feet from the blast area, barricaded for protection, remained untouched.

Big shovels dug down an incline of broken rock to form a road to the pit's bottom. J&L had expected the blast to yield 255,000 tons of ore. Instead, 330,000 tons were netted because overbreak on the sides of the blast area was better than expected.

"This blasting method proved to us that a great deal of time and money is saved in a one-shot operation," Fleck said. "Fragmentation was excellent so we had a high shovel productivity in digging. We plan to repeat the procedure this spring.

"What's more, with the noise, vibration and fly rock minimized, the blast was a public relations success. Why, if you weren't expecting it, you wouldn't even know the shot had been fired."



Area shown in diagram was blasted in one shot. Formerly, eight cycles of drilling, blasting and digging were required to mine an area this size.

It was the most breathless construction schedule in textile history.

Said Pacolet to Du Pont, we need an

"INSTANT" PAINT JOB FOR AN "INSTANT" PLANT

Blacksburg, S.C.

Just a year ago, the 1,100 acres comprised merely another parcel of fields and woods in the pleasant, rolling country surrounding this Cherokee County town. Five months and eight days later, the land had been cleared, leveled and dominated by the enormous, bustling \$15 million Magnolia Finishing Plant of Pacolet Industries, Inc.

Today the transition is cited widely as something very special by way of industrial construction. Engineers, for example, see it as a dramatic demonstration of the speed with which corporate forces can conceive and build when necessary; politicians and economists hail it as an illustration of free enterprise's creative flexibility; textile executives consider it to be a 383,000-square-foot technological landmark.

And among Du Pont paint specialists from Atlanta to Chicago, it's viewed as one of the most hair-raising, brain-squeezing, thoroughly gratifying problems to come their way in years.

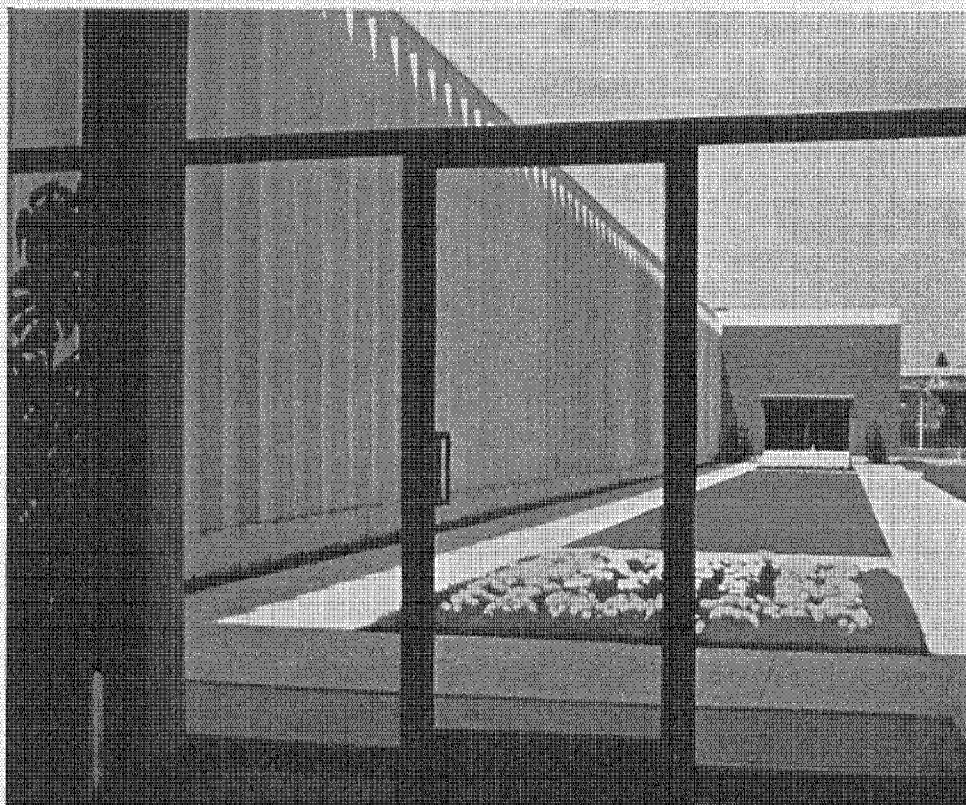
All the bustle was triggered in February 1963 with an exhaustive study by the Market Research Dept. of Deering Milliken, Inc., Pacolet's selling agent. The market for polyester-cotton blended fabrics is boom-

ing, ran the report, with continued growth in prospect. If, went the findings, continuous chemical process methods could be incorporated into a plant for finishing these fabrics, and if such a plant could be built and operating before fall, Deering Milliken could take advantage of the growing market by introducing new fabrics from a new plant just in time to meet the demands of apparel manufacturers aiming at the 1964 market. But speed was important in the highly competitive fabric market. All right, said Pacolet management, let's give it the old school try.

In "forced draft" construction projects, time is customarily saved by bringing traditional materials and design concepts into play. But on the Magnolia job there were many innovations, and speed had to be maintained despite these schedule-complicating factors.

A major consideration, for instance, was paint. What finishing materials should be specified for building and equipment? What kind of paint would provide a durable, easily maintained finish that could be applied over prestressed concrete walls and ceilings and resist the abnormal operating condi-

continued



Air of elegance is given to entrance area of new Magnolia Finishing Plant by flower beds, grass.

Handsome lines of 383,000-square-foot textile finishing plant give the structure an institutional, rather than industrial appearance.



Dry finishing area features ceiling painted with darker shades at edges, pastel shades at center to provide a cheerful, arching effect.



"Instant" Paint Job for an "Instant" Plant

continued

tions prevailing in the processing areas? What equipment finishes would best stand up under these same conditions? How could traditionally time-consuming painting programs be interlaced with accelerated construction schedules? How best to achieve the most efficient, durable finishes without compromising esthetics? The questions kept coming without letup.

The engineering department of Deering Milliken Service Corp., which had contacted Du Pont's Engineering Dept. for advice on construction materials, was counseled to check with Du Pont's Fabrics and Finishes Dept. for answers to the paint problems. The initial consultation with F&F sparked a blaze of collaboration that ultimately raced through every branch of Du Pont paint technology, from research to field sales service.

Du Pont's industrial maintenance finishes men saw the problem as basically

two-pronged: (1) the finishes had to meet unusually demanding exposure and design conditions; and (2) they would have to be specially formulated—on site, more often than not—so as to be applied in stages while construction went on all around. Consequently, the paint specialists specified "Corlar" enamel, a tough, catalyzed epoxy finish that provides a chemical-resistant, tilelike surface. Wall and ceiling areas, they decided, should have an application of high build gray, followed by one of the special colors as a topcoat.

The Deering Milliken Service Corp. color consultant was provided with hundreds of color chips, from which he selected 49 Du Pont Custom-Color hues. Quantity requirements for individual colors to go on both plant and equipment varied from a single gallon to several hundred gallons. While Du Pont labs and manufacturing facilities began work on the large-volume

lots, the color consultant took samples of the standard shades of "Corlar" into his own laboratory to work out mathematical formulas to achieve the colors needed in small volumes.

At the plant site, where Daniel Construction Co. had as many as 2,200 employees working a 24-hour schedule, paint crews moved in as soon as prestressed concrete sections went into place. But almost immediately there was a problem: a release agent used on the concrete molds reduced primer coat adhesion. Samples of this compound were flown to Du Pont's Marshall Laboratory in Philadelphia, where technicians established a solvent that would remove the release agent from the concrete prior to application of the primer. Adhesion thus assured, one coat of Du Pont vinyl plastic masonry block primer was sufficient to fill surface voids in the cement block walls. A subsequent coat of "Corlar"



To prepare the 49 colors specified by Pacolet's color consultant, painters and Du Pont technical representatives mixed hues on the job site.



Clean, almost hospital-like appearance of corridors in plant's office areas was achieved by coordinating construction materials, paint hues.

enamel in high build gray would prepare the surface for a final coat of "Corlar" in one or more of the 49 special colors.

All went well until painters began application of the final coat of white on ceilings. Using a mixture of equal parts of catalyzed epoxy white and activator, applied by airless spray which produces efficient one-coat hiding, painters found that wet fallout from the spray belabored workmen installing machinery on the floor below. Application engineers decided the only way to paint without interrupting machinery installation was to fall back on conventional air-spray, fogging on an initial coat of white, then returning another day to fog on the second coat.

Too time-consuming, schedule overseers ruled, since scaffolding for ceiling painting would have to be moved and later re-erected. All hands looked at the Du Pont industrial maintenance tech representative.

"Any suggestions?" the Du Pont man asked his Chicago laboratory.

Chicago had the answer: a new formulation in which six parts of "Corlar" epoxy mixed with one part of a new activator provided a single-coat finish with improved hiding power and dry overspray. With just two crisscross passes of the spray gun, the new material gave a tilelike finish that eliminated the need for a second coat.

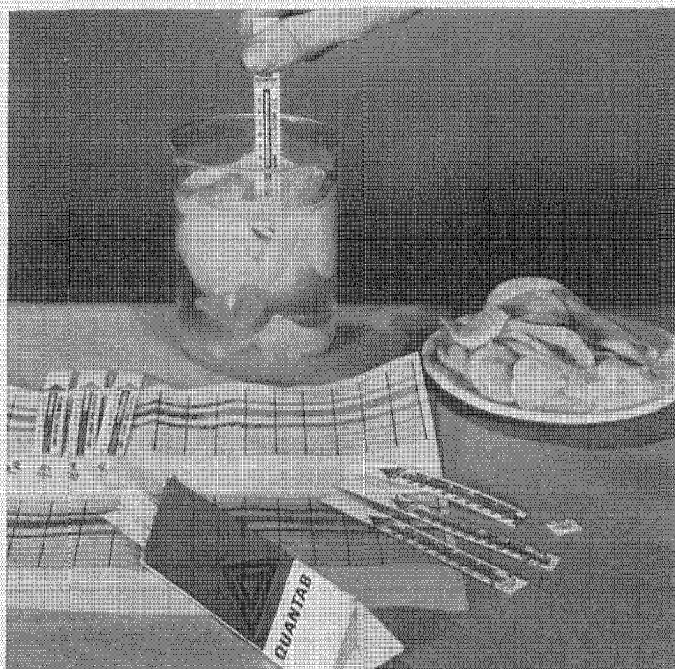
This poser had no more than subsided when another cropped up. The painting contractor was ready to apply the topcoat colors but could not locate equipment that would accurately measure the various components of the color formulas. Du Pont came up with a variation of its custom-color mixing machine based upon use of specially calibrated paint canisters that would dispense precise amounts of color in increments as small as one-sixty-fourth of an ounce. To achieve the exact colors spec-

ified by the color consultant, Du Pont industrial maintenance sales personnel used the device to mix the hues on the job site.

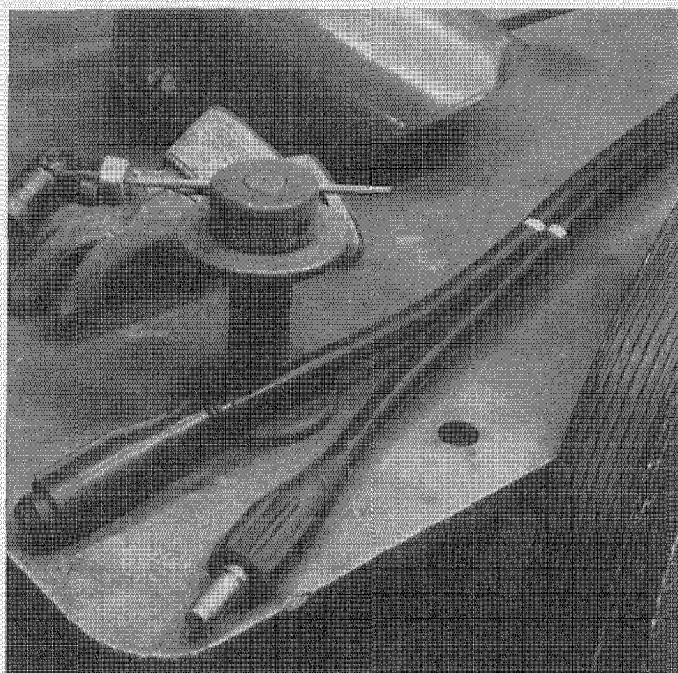
The painting, like other programs, is over now. Some 350 men and women are on the U-shaped production line which is designated to finish up to three million yards of fabrics a week. And, although it had never before operated a finishing plant, Pacolet Industries is being cited for what one industry observer describes as "a perfect blending, within the boundary of existing knowledge and material, of building, machinery and people."

One of the people is Herb Norton, manager of the southern sales region for Du Pont's Fabrics and Finishes Dept. For him, the Magnolia job represents "one of the best workouts we've had in a long time." Adds he, with an ill-disguised air of satisfaction: "Sort of a king-sized, instant paint job, so to speak." ■

WHAT'S NEW



Accurate analytical device: "Quantab", a new instrument that determines acidity, alkalinity and salt content of solutions and extractions, is now available from Linayer Corp., Detroit. Made of "Mylar" polyester film with a polyethylene laminate, "Quantab" requires no trained personnel or costly equipment, is activated by removing tip.



Twin welding cable: New, lightweight welding cable that combines electrode and return leads is being offered by the Kaiser Aluminum and Chemical Co., Oakland, Calif. Featuring parallel aluminum conductors insulated and joined by a one-shot jacket of rugged neoprene, cable provides improved ground connections, reduces safety hazards.

● **Better fitting hosiery:** "Cantrece" nylon, a new monofilament textile fiber, has been developed by Du Pont for improved fit and comfort in women's stockings. A totally different yarn with a special self-crimping property, "Cantrece" gives hosiery a lasting resilience that reduces stress strain and wrinkling. Soft and luxurious to the touch, "Cantrece" is available in 15 denier monofilament fiber for leg yarns and 45 denier for welt yarns.

● **New for furniture:** "Dacron" 76 polyester fiberfill batting for use in upholstered furniture is now available from Du Pont. Engineered for use over spring units, arms, backs and other inner constructions, the new product is offered in either conventional or needle-punched batting. Batts of "Dacron" 76 provide ease of handling, reduced waste and improved resistance to matting.

● **Molded milk cases:** "Tetra Basket", a strong, lightweight plastic delivery case that nests 18 half-pint Tetra Pak containers of milk, is offered by Milliken Tetra Pak, Spartanburg, S.C. Molded of "Alathon" polyethylene resin, the "Tetra Basket" weighs only two pounds, yet withstands rough treatment and is unaffected by temperature extremes.

● **Longer lasting filter:** Available for use by the paint, varnish and lacquer industries in final filtering operations is a new all-plastic filter that helps reduce replacement costs. Made by Technical Fabricators, Inc., Nutley, N.J., filter can be dismantled so that only outer screen need be replaced. Piping core of "Vexar" plastic netting and end plugs resist corrosion, can be reused many times.

● **A tan for all seasons:** Fabor Sun-Bathing Capsule of "Lucite" acrylic monomer permits year-round tanning, keeps away dust, dirt and sand. Designed for use wherever the sun shines, capsule is available from Fabor Robison Productions, Inc., Burbank, Calif., in durable, lightweight models for easy transportation and storage.

● **Accessory for safety:** The Remote Cell Adapter, a new extension device for use with the Du Pont 900 Differential Thermal Analyzer, makes possible the DTA study of materials where protective shielding or operation in a fume hood is required. Accessory also permits dry box analysis of extremely moisture-sensitive materials.



Colorful, colorfast casement: New Linford Casement fabric of "Orlon" acrylic fiber is color-styled with "Savalux" dyes for outstanding fastness to sunlight and laundering. Sheer, yet opaque enough to insure privacy, fabric by Cohn-Hall-Marx, New York, is available in a wide range of fashion colors.



Colorful Conversation

The talk at the table is all about color. Color on color. Color on white.

It's a meeting of the Du Pont Color Council, a cross section of specialized talents blending ideas from the fields of dyes, graphic arts, printing, selling, advertising and promotion.

Organized six years ago by the Du Pont Dyes and Chemicals Division, the Council set out to dramatize the power of color.

It first produced "Color on Colored Paper Criteria." With this basic data, designers and printers can now accurately predict and control printing on colored stock. Later the Council issued "White Paper Criteria," analyzing the variations in the hundreds of available white

papers and enabling the trade to reduce paper inventories.

Periodically, Council members meet in shirt-sleeves with representatives of some 30 paper mills. Out of these sessions have come complete new lines of colored papers as well as ideas for better presentation and promotion of established lines.

The Council also bats up suggestions for imaginative uses of paper in a series of publications called "Design and Colored Paper," and publicizes similar ideas through advertising in trade journals.

Its work exemplifies the many services—whether colorful or just plain technical—that Du Pont provides to the industries it serves.



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY