INDUSTRIAL DESIGN

10

October 1958 *$1.50 per copy*

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OCTOBER, 1958 VOLUME 5 NUMBER

10

INDUSTRIAL DESIGN

A monthly review of form and technique in designing for industry. Published for active industrial designers and the executives throughout industry who are concerned with product planning, design, development and marketing.

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Coming

IN NOVEMBER—A report on new developments in paper-making and its history as an art. Robert LeTourneau's uninhibited designs for giant machines.
IN DECEMBER—ID's Annual Design Review of the year's innovations in design.

COVER: A closeup of fiber glass strands and a silhouette of the Corvette suggest the subject of this special issue on reinforced plastics.

FRONTISPIECE: Workmen install the outer skin of the Ford Rotunda dome.

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LETTERS

A Bel Geddes anecdote

Sirs:
I would like to express my appreciation of your obituary story of Norman Bel Geddes and his career (ID, June).

Spending some four years in his office during the 30's, I too experienced his fanatical organization of pencils and paper clips while in frantic pursuit of a solution to some visionary and often impractical project. His War Game was legendary years before World War II, and it was said that a Russian general shot himself in remorse after losing a major battle.

Mr. Geddes' humor was famous, and my own assignments sometimes verged on the ridiculous. I recall an April Fool project wherein I was asked to devise a method of releasing houseflies simultaneously with lifting a bouquet of roses from a florist's box. My mechanics worked fine, but as the roses were placed in a refrigerator on delivery, the flies were less than active when the box was opened, and the project was not an outstanding success.

Whatever the design project, Mr. Geddes invariably came up with an inspired solution. There was never a dull moment with N. B. G.

L. Garth Huxtable
New York, N. Y.

More about electroluminescence

Sirs:
Your article on electroluminescence was well done, and should do a lot to acquaint designers with this exciting new light source.

I have done some work with Westinghouse research people on our Rayescent light, and there are a few points that might be worth passing on.

You are correct in saying all colors are obtainable, but the only really good red requires the use of a red filter. When the phosphor color alone is used, you have to settle for a rust or Indian red. All the other colors are true and strong. One point in the matter of color that everyone finds fascinating is the fact that different colored phosphors respond to different electrical frequencies. You can mix the phosphors applied to a Rayescent panel and by changing the frequency of the electrical current passing through the phosphors, you can vary the color of the light through quite a wide range.

One of the most important applications of this light source is in safety warning lights. At present, all the known sources of light will fail in time. Rayescent panels will grow dim with age, or if line voltage drops, but will never burn out completely. This "fail safe" feature has been of great interest.

While present light output to voltage input is somewhat disappointing, the theoretical limits of electrical efficiency is much higher than with any other source of light, and we are seeing constant improvement in this.

T. C. Knight
Appearance Design Department
Westinghouse Electric Corporation
Mansfield, Ohio.

Brussels reviewed

Sirs:
In reference to your feature on the Brussels World Exposition, Part II. (ID, August). What did it say?

There were some fine photographs, but too many words, a bunch of flighty observations tied together with a journalistic flair. When a point was made, such as the reference to a desired integration of exhibit and architecture, it couldn't have been briefer had it been a bibliography note. Most of the time the article sounded like it was going to make some monstrously important statements that never materialized. And the tail-end of the feature totally degenerated into a flag-waving bombardment of the Soviet pavilion.

Ralph Martel
New York, N. Y.

Sirs:
ID is to be congratulated on the excellent manner in which it presents its report of the Brussels Fair. Jane Fiske McCullough reaches poetic heights in her prose and the pages designed by Roberto Mango make a comprehensive and visual whole.

The entire series is a distinguished example of journalistic excellence.

John Vassos
Norwalk, Connecticut

Sirs:
Regarding your recent issue covering the Brussels Fair: I enjoyed your excellent impressional summary immensely.

Why is it, however, that we must wait for our European cousins to come up with a show of this scope before you will devote this much space to exhibition design?

There are approximately 2500 industrial exhibits viewed annually in this country and there are many excellent — almost brilliant—conceptions by top-notch designers in each.

Despite this, we who have made a career of this work, and who have no trade journal of our own to speak of, must rely on a sparse article here or there to satisfy our professional interests.

Perhaps ten or a dozen years ago this disinterest—or should I term it confusion —could have been understood. Essentially, we grew out of the sign and display industries. Actually we outgrew both. We are not interior decorators, yet we design interiors. We are not architectural designers, but we do design architecturally. We *are* industrial designers and our positions call for a varied comprehension of almost every industrial design material and technic known.

Certainly, it cannot be that an industry as substantial and lucrative as ours is to be ignored because of the temporary aspect of our creations. Is this year's adding machine, baby bottle, or moon satellite to be considered permanent?

Almost all industrial exhibition designers, I believe, review and acknowledge your publication regularly.

How about reciprocating?

Gerald W. Waxman
Warren, Ohio

Pogo said it first

Sirs:
The editorial in your August issue makes a very valid point—and prompts me to recall a statement some years ago by Pogo (who has no designs on anyone). He concluded that at this point in world affairs, the general public can do nothing but become "symbol minded."

I think he was right.

Jess Riggle
Cleveland, Ohio

Erratum

The IIT symbol was erroneously used in connection with the University of Illinois on page 12 of the September issue.

BOOKS

The funny hat: soldiers

New York by gaslight

ONCE UPON A CITY. *New York from 1890 to 1910. As photographed by Byron and described by Grace M. Mayer. Foreword by Edward Steichen. The Macmillan Company, New York*: 1958. 511 *pp. Illustrated.* $15.00.

In 1888 the Byrons arrived in New York from England, where the family had already established a flourishing chain of photography studios. For the next fifty-four years, the Byrons, father and son, photographed New York, for business and pleasure, and the Percy C. Byron collection, presented to the Museum of the City of New York when the firm closed in 1942, forms one of the pleasantest possible histories of the city. This selection of photographs of New York in its *belle siècle* was chosen by Grace Mayer, the Museum's Curator of Prints, and forms the basis for the current exhibition at the Museum.

Miss Mayer has accomplished her task with great care and affection, and the result is a large and beautiful book, filled with full-page illustrations reproduced in a sepia that emphasizes the already faintly archaic and fairy tale atmosphere of the scenes. All the old New York is here: Lillian Russell, the peddlers of Hester Street, Painless Parker, the street musician with his hand organ, the line of hansom cabs under the trees in Madison Square, the home-coming of the 71st Regiment in 1898.

As richly ornamented as Mrs. Havemeyer's Chinese drawing room, Miss Mayer's style is admirably suited to her subject. The text is a cheerful jumble of miscellaneous facts about the city, quotations from contemporary newspapers, snatches of music-hall lyrics. With the pictures, it recreates an innocent world that is remembered nostalgically by even the New Yorkers who never saw it. *V. McH.*

Skating in Central Park, 1895

An Italian firm honors the hat

OMAGGIO AL CAPPELLO (A TRIBUTE TO THE HAT). *Edited by Massimo Vignelli, Mario Carrieri, and Giuseppe Trevisani. The Borsalino Hat Company, Alessandria, Italy. Color plates.*

This remarkable book commemorates the 100th anniversary of the Borsalino Hat Company of Alessandria, Italy. While such memorials are common in Italy, this one is unusual for its lavish graphic work and for the originality of the presentation.

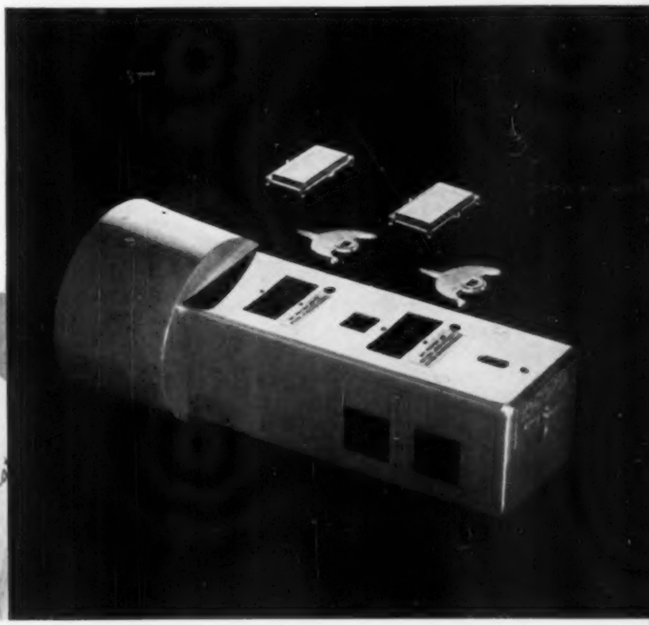
The book opens with sepia photographic end boards showing company employees in 1865 and with this brief comment set in a modest type: "We gathered in the plant's courtyard to stare at the photographer. The plant was the same we work in today although it's much larger now. This picture shows the men who, first in the world, stitched in a hat this trade mark: Borsalino." It ends with a remarkable mass photograph of the company's 3,000 present employees, which took six days to plan. (The editors explain that since each person in the photo had a predetermined place to stand, no one had to leave his job for more than an hour and the cost for it was kept under $1,600. They were proud enough of the finished results to include a small photo of the smokestack the cameraman climbed to take the picture). Between these two photographs the editors offer a variegated, graphically imaginative and sprightly history of, and tribute to, the hat—and to Borsalino.

The work of designer Massimo Vignelli, photographer Mario Carrieri and newspaperman Giuseppe Trevisani, the Borsalino book is organized as a show, with the rhythm of a capricious ballet. Following an introductory selection of black-and-white engravings in which hats appear on the most bizarre people and animals, a "museum" of color plates unfolds. Then the editors present engravings of more hats: the funny hat (above), the useless hat, the magic hat, etc. They introduce us next to a few Borsalino employees, and conclude with a history of the company.

Throughout, an emphasis on the human element gives a sense of the highly personal quality of the organization. To get this feeling Carrieri photographed individual employees and Trevisani recorded in the first person descriptions of their particular jobs. But to make the book interesting also to people outside the firm, and to impart a sense of the high quality of the Borsalino hat, twenty color plates —ranging from an Etruscan mural to a Picasso — of be-hatted figures were inserted in the volume. These fine, tipped-in, full-page reproductions are mounted on black paper and printed in as many as 12 colors. Halftone plates were run separately from the text so that editions could be run in four different languages. While the proofreading has been careless, and the English translation at times very curious, this detracts only a little from the graphic impressiveness of a handsome volume. *A.F.*

Dow plastics excel as basic design materials

COLORFUL STYRON® 475 provides a smart appearance and it bypasses corrosion problems completely in this new room cooler. The housing and three trays are vacuum formed of this versatile Dow plastic. This compact unit has high impact strength yet it's light enough to be carried by a child. The outstanding formability of sheet extruded from Styron 475 makes for ease and economy of production. The circulating tube is extruded from a formulation of Dow PVC resins.



TOUGH ETHOCEL® supplies all the qualities required of this unique headlight aimer housing. The super-high impact strength of Ethocel, under a wide range of temperature conditions, is ideal for rough-and-tumble treatment in garages and outside in cold weather. Dimensional stability provides excellent fit for parts as well as accuracy for the instrument itself. A glossy, easy to clean surface makes the housing attractive as well as practical—an important consideration in today's style-conscious market.

Seven different materials, dozens of formulations in the big family of Dow plastics offer many combinations of useful properties and a wide selection of colors. Keep Dow plastics in mind as a basic design material for your next project. For information about new developments in plastics, contact the Dow man near you. Or, write THE DOW CHEMICAL COMPANY, *Midland, Michigan, Plastics Sales Department 1516C.*

YOU CAN DEPEND ON DOW

NEWS

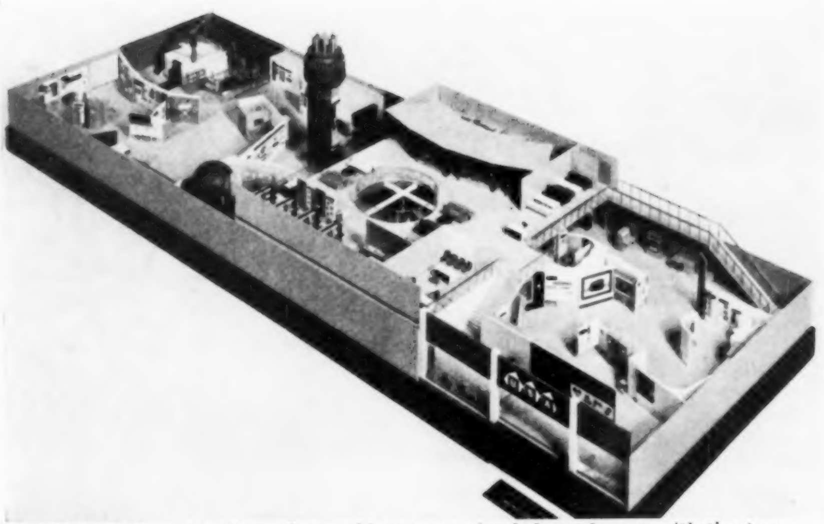
Teague designs U. S. atomic show

The largest display ever assembled on the peacetime uses of atomic energy went on view last month (September 1 - 15) during the second United Nations atoms-for-peace conference in Geneva, Switzerland. The U. S. exhibit, designed by Walter Dorwin Teague Associates under the direction of Walter Dorwin Teague, Jr., covered 18,000 square feet of the temporary building occupied by 18 other exhibiting nations.

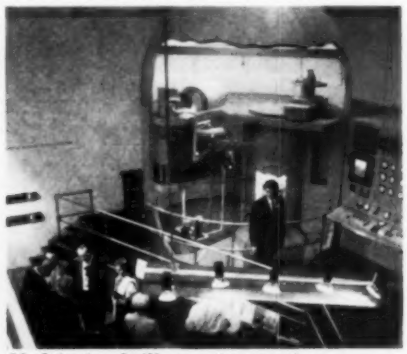
The U. S. display included 57 individual exhibits of a complex, scientific nature. In addition to models and displays of 14 reactors and the Triga (a "hot" operating reactor), the show featured the Argonaut —a do-it-yourself reactor which was actually constructed and put into operation during the first week of the show.

The five-man Teague design team, working closely with scientists and AEC staff, began planning for the show eight months in advance. They broke down the material to be presented into three areas, designating a color for each: blue-green—reactors, earth brown—the bio-sciences, and yellow —the physical sciences. Then they arranged exhibits so that traffic flowed from one area to another (see model, above). On the balcony (see model) they equipped a lounge with library and four miniature theatres which projected technical films in English, Russian, Spanish and French.

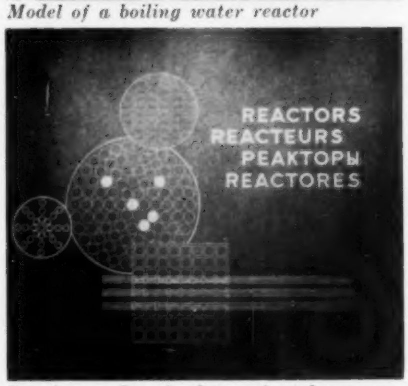
A special problem was adapting the Standard type face used on all panels to the Russian alphabet. The panel itself— an 8 by 3 foot aluminum and hardboard modular unit—was also especially designed for this show. Uniforms for the guides (a pearl grey wash-and-wear suit with white blouse, black shoes, yellow beret, and yellow ribbon tie) and a special logo (above) used on all publications were both designed by Teague.


Model of U. S. exhibit shows three subject areas plus balcony lounge with theatres

Entrance to American exhibition area


Model of a boiling water reactor


Balcony well looks into isotope laboratory.



Panel uses Standard type in 4 languages.


Silvermine *Benton*

IDI holds both National Conference and Silvermine meeting this month

The Twenty-first National Conference of the Industrial Designers Institute opened on October 8 at New York's Sheraton-East Hotel with a Design Materials Show, and will continue through October 10. Guests were formally welcomed by IDI officers at luncheon on Thursday, October 9, and Eugene Ayres, co-author of *Energy Sources—The Wealth of the World* discussed "New Power Sources for Design."

A panel discussion on the Brussels World's Fair has been arranged for Thursday evening at the Donnell Library. Panelists will include Jane Fiske McCullough, consulting editor of INDUSTRIAL DESIGN; Nathanial Becker, Becker and Becker Associates; Ben Grauer, radio and TV commentator; James Plaut (by tape recording), Deputy Commissioner of the Fair; André R. Willieme, Industrial Attaché for the Belgian Consulate General. Robert Redmann will moderate the panel.

At 9:00 Friday morning "Designing for Light Military Electronics" will be presented by designers George A. Beck, Leonard W. Seagren, and Robert C. Robb, all of General Electric. In the afternoon Edgar Kaufmann, Jr. will lead a discussion on "New Conflicts in U. S. Design." The conference banquet will be held at 8:00 p.m., when Senator William Benton will talk on "Design for Survival."

The Southern New England Chapter's Fifth Annual Symposium will be held at Silvermine, Connecticut, on October 11. With the World's Fair as a background, the theme this year will be "Design Universale," emphasizing problems of international design. Alfred Auerbach, President of Alfred Auerbach Associates, Dean R. McKay, Director of Communications for IBM, and architect Philip Johnson will be the morning speakers. The afternoon session will feature a panel discussion on "Design Universale," moderated by John Vassos. Panelists will include Claude Bungard, England; Yosinori Sinoto, Japan; Jaap Penraat, Holland; Hans Lindblom, Sweden; Krishna Doshi, India. ID will report the conference fully in December.



Whitney *Harris* *Agha*

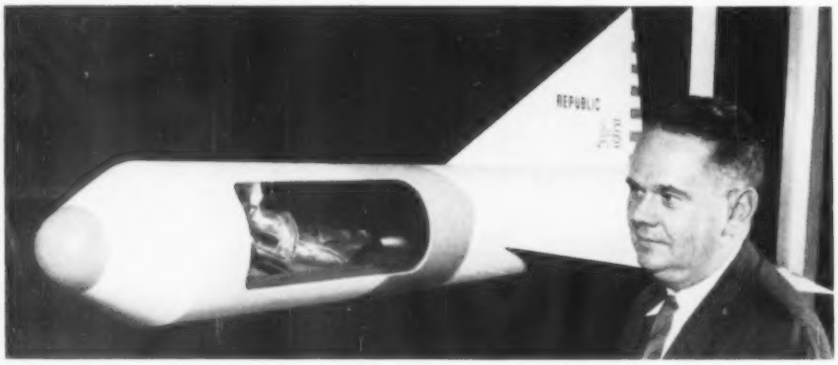
"Design Responsibilities and Directions" keynotes ASID national meeting

"Design Responsibilities and Directions" is the theme of the ASID Fourteenth Annual Design Conference to be held October 18 to 21 at the Bedford Springs Hotel in Bedford Springs, Pennsylvania. The first day's program will include president William Goldsmith's welcome, and a photographic presentation of the Brussels Fair. In the evening, a tribute will be paid to Charles E. Whitney, publisher of INDUSTRIAL DESIGN, who will discuss "The Designer as a Professional."

On Sunday author and humorist Sydney J. Harris will speak on "Design Responsibilities and Directions;" the theme will be elaborated on Monday morning with talks by graphic designer Saul Bass and museum director George D. Culler. At lunch Italian architect Enrico Peresutti will discuss "International Aspects of Industrial Design." Other Monday speakers will include Fred M. Hauserman, President of E. F. Hauserman Company; Robert E. Allen, President of Fuller and Smith and Ross, Inc.; and Victor P. Buell, Manager, Marketing Division, Hoover Company. They will discuss such varied topics as planned obsolescence, advertising and industrial design, and marketing directions. The dinner address, on "Design Problems" will be given by Dr. M. F. Agha, designer and consultant.

The final day of the conference will open with a discussion of "The Creative Process in the Design Professions" by Dr. Richard W. Wallen, Director of Personnel Research and Development Corporation, and Dr. Irving A. Taylor, professor of psychology at Pratt Institute. After lunch, member's wives will hold a panel on "How to be a Designer's Wife." Participants will include Mrs. Arthur BecVar, Mrs. Robert Hose, Mrs. Paul McCobb, Mrs. Jay Doblin, Mrs. Hugh Greenlee.

The Allegheny Chapter of the ASID will be hosts for the conference, and Samuel Scherr of Smith, Scherr and McDermott is chairman for the occasion.



N. Y. planetarium shows space ships

A model of a manned, hypersonic space ship (above) is the top attention-getter at a dramatic exhibit on space travel which will be open through February at the Hayden Planetarium in New York. The exhibition, called "You in the Space Age," was built by Gardner Displays, Inc. and has been lent to the planetarium by the Republic Aviation Corporation of Farmingdale, Long Island. Shown above with the model is Dr. William J. O'Donnell, chief of engineering and aircraft development at Republic.

The display includes 14 space ships which apparently "move" through a night sky as hundreds of stars pass behind them. They range in length from a few inches to six feet and in shape from a cigar to a Martini glass. The various ships have been designed for flights projected between 100 and 1,000,000,000 miles from earth. While the 100-mile ship (above) is a kind of dirigible-with-fins, the space platform designed to orbit at 100,000 miles is a disk-shaped object to be used as a service station for outer space ships.

Product development to be studied

"The Evolution of Products" will be the subject of a four-day (October 26-29) conference at Arden House in Harriman, New York. The meeting will be sponsored by the Institute of Contemporary Art, Boston, with the technical cooperation of Arthur D. Little, Inc., in an effort to develop a "working model" of the life cycle of products, and to develop an understanding of how product development exploits invention, engineering, design, patents, production, and marketing. The conferees will meet in six-man groups to discuss these areas. After each group reports to a general session and then develops its own "model," a master "model" of product evolution will be published.

Group leaders in the six areas will be: George Beck, an industrial design manager at General Electric (design); William E. Mahaffay, Whirlpool vice president (engineering); Worth Wade, patent attorney and chemist (patents); Edmund W. J. Faison, account executive for Leo Burnett Company (marketing); William J. J. Gordon, head of the operational creativity group at Arthur D. Little, Inc. (invention). The leader of this "production" group will be announced.

Cost of the conference is $300 per person. Further information may be obtained from T. S. Jones, The Institute of Contemporary Art, 230 The Fenway, Boston 15, Massachusetts.

Bell to test rocket-shaped booth

Designers at Bell Telephone Laboratories have recently completed a test model of the "Vistabooth," a rocket-shaped phone booth which gives the user maximum visibility. The booth has an aluminum frame and flooring; the lower section is blue aluminum, and the top half is an un-tinted plastic bubble dome. A recessed door may be pulled shut to give the user privacy. Officials at Bell say that the new booth will be field tested for possible indoor use as well as for use in such protected areas as railway concourses. Henry Dreyfuss was the consulting designer.

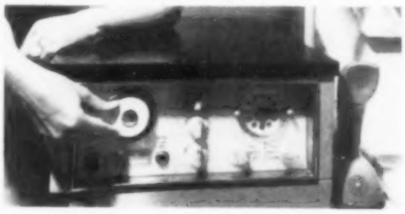
ID courses to be offered in Detroit

Two courses in industrial design will be offered for the first time this year by the Art School of the Society of Arts and Crafts in Detroit. Carl Reynolds (below), automotive designer, will teach a course in motor vehicle design, and Lillian Pierce (below), interior design consultant and ceramist, will teach a course in interior design.


Reynolds


Pierce

The school opened this year in a new building designed by the architectural firm of Yamasaki, Leinweber Associates.



Controls mechanize patient care

Minneapolis-Honeywell Regulator Company has introduced an automatic control center (above) that enables hospital patients to perform a variety of routine services without having to call a nurse. The control was developed by the Honeywell staff in collaboration with hospital officials in order to reduce the costs of patient care. A company official has called this "the first completely integrated system to apply, by mechanical means, the self-help concept to patient care." "By relieving nurses of 'hotel-type' services the new development not only should ease the nursing shortage, but also help solve the problem of mounting patient costs," said another official.

While lying on his back, the patient can use the control panel to raise or lower the height of his bed, open and close drapes, turn bedside light on or off, regulate room temperature, operate tv and radio, and talk to the nurse via a two-way intercom system. The control panel also includes a one-piece telephone. No retail price has been established for the center, but officials suggest a range between $500 and $600 (not including such associated equipment as the motorized bed).

Aluminum is TEXTURE

Texture finds unlimited expression in aluminum through a wide variety of mechanical, metallurgical and organic finishes.

Mechanical Finishes. *Polishing and buffing* give aluminum a mirror-like brilliance, bringing its natural luster to the highest peak. *Sandblasting*, in contrast, subdues its glow, produces a mellow matte effect. *Scratch-brushing* imbues the surface with a coarse-lined texture; a satin sheen emerges when a finer brush is used. *Barrel burnishing* produces a fairly smooth surface, useful on many low-cost items, and lends itself to high-speed, high-volume operations. *Hammering* gives aluminum the rich variegation of hand-wrought silver. *Embossing, coining and engraving* afford limitless pattern and design possibilities in sharp, clear, minute detail. *Perforating* is often used on screens and panels for unusual and interesting decorative effects. *Pattern rolling* offers a literally infinite variety of textured designs, including the coarse-grained "Butler-type" finish, developed by Alcoa to reproduce the effect of belt sanding, at a fraction of the cost.

Chemical Finishes. *Anodizing* converts aluminum's natural oxide film to a sapphire-hard coating having excellent wear and corrosion resistance, with infinite color, tone and texture possibilities. *Plating* can be performed with a full range of metals, using proper surface preparation techniques. *Chemical- and electro-brightening*, particularly useful with irregular shapes and curved surfaces, create the brightness of some buffed surfaces at lower cost than mechanical polishing. *Etching* with acids or alkalis offers a diversity of three-dimensional effects, from sparkling frosted finishes to smooth reflector surfaces. *Deep etching* creates intricate design patterns of unusual eye appeal. Use of *photosensitive resists* assures accurate and fine detail. With *masks, resists and stop-off methods*, numerous combinations of the above techniques are possible.

Stamped Embossing at Tassell Hardware—A leading fabricator of aluminum, Tassell Hardware Company works closely with Alcoa to provide you with a complete and knowledgeable source of aluminum design and fabricating information. Write: Tassell Hardware Company, 4135 Lake Michigan Drive, Grand Rapids 4, Michigan.

Metallurgical Finishes. *Spangling* aluminum with Alcoa's new controlled-growth grain process produces a glittering, multifaceted surface that reflects light from a thousand tiny mirrors; anodic colors can be added as desired. Certain *alloys* give important color and tone advantages; high purity alloys give clear, transparent, anodized finish; silicon alloys impart a gray tone, chromium a pleasing yellow tint, and manganese a brownish coloration.

Organic Finishes. *Painting, lacquering and enameling* aluminum, in clear finishes and opaque coatings, have both protective and decorative value. Paints and pigments have a high adherence to aluminum, making it an excellent base for all color coatings of the conventional type. Any durable paint, lacquer or enamel can be applied if the surface is properly prepared. Coatings can be dipped, brushed, sprayed or rolled on.

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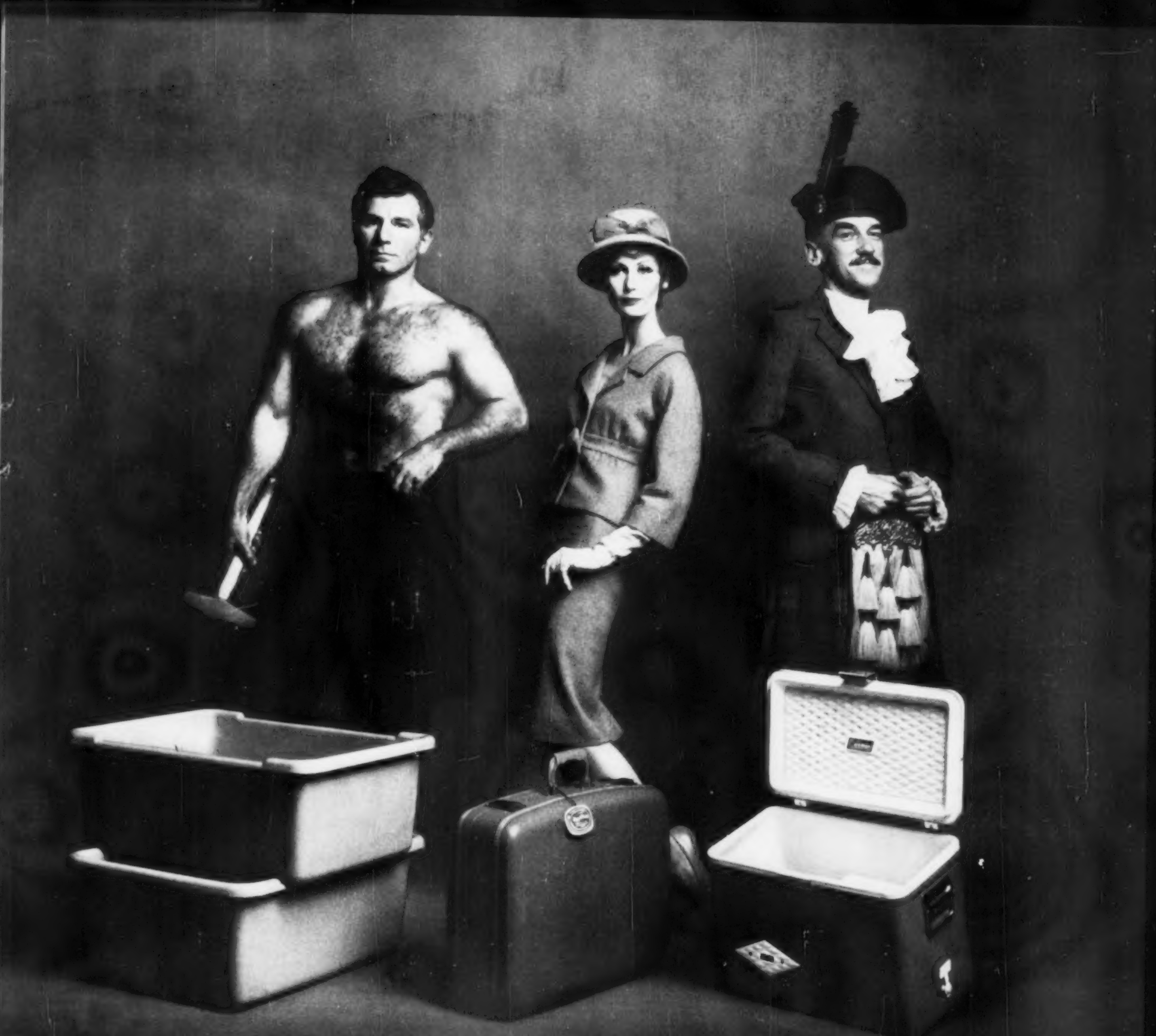

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William Pahlmann's "Spell of the Yukon" room combines Alaskan with modern motifs.

Home furnishings shown at Coliseum

The "Pageant of Color" theme in the Ninth Annual National Homefurnishings Show, which ran from September 11 through 21 at the New York Coliseum, was carried out in an entire floor of individually decorated room settings. Featured at this year's show was the Chromspun "House of Color" by Eastman Chemical Products, Inc., a completely furnished five-room house utilizing Chromspun fibers in products ranging from carpeting to shower curtains.

The individual settings competed for the visitor's attention through the use of intensely bright shades. Furnishings from exotic places and periods—African masks and Egyptian tables— were also used to capture attention. Most unusual in this respect was William Pahlmann's "Spell of the Yukon" room (above) which combined modern furnishing with purely Alaskan details. Artist Madi Blach carried out the Alaskan feeling in the bright ceiling of the igloo-shaped dining room and in the totem pole structure encasing a Franklin stove.

As part of the show's special exhibits the American Institute of Decorators presented four rooms from the Central States Region, the New England Region, the Southeastern Region, and the Western Region. Individual members of A.I.D. who presented rooms were Lester J. Byock, Mary E. Dunn, John Gerald, Mrs. Truman P. Handy, Edith Hernandez, Melanie Kahane, Ellen Lehman McCluskey, John Joseph Miller, William Pahlmann, Guy Roop, C. Eugene Stephenson, L. Raymond Toucher. In addition the Decorative Furniture Manufacturers presented six rooms, and a number of concerns had individual exhibitions of their products.

Entertainment center in the Chromspun house was by John Vassos for R.C.A.

Plastics conference to convene

The Eighth National Exposition of the Society of the Plastics Industry, Inc., will be held November 17 to 21 at the Chicago International Amphitheater. "Plastics for Profits" will be the theme.

The opening session, on Tuesday, November 18, will consider the uses of sheet formed plastics. C. C. Whitacre of the Midwest Plastic Products Company will preside. There will also be a management session, moderated by R. L. Davidson, of Kurz-Kasch, Inc., and a plastics-in-building session moderated by O. L. Pierson of Rohm and Haas.

The Wednesday program will begin with a cellular plastics session moderated by Dr. Maurice E. Bailey of the Allied Chemical Corporation. This will be followed by an international forum with speakers from Argentina, England, Germany, Italy, Japan, and Russia. A session on plastics in the appliance industry, moderated by Dale Amos of the Amos-Thompson Corporation, will close the day's program.

The entire Thursday program will be devoted to merchandising and distribution of plastic products and will be moderated by T. S. Lawton of the Monsanto Chemical Company.

In addition to the many addresses and panels there will be several receptions and dinners, and an announcement of the award winners for the Fourth Annual SPI Informative Labeling Contest.

At least two industrial designers — George Nelson and Franz Wagner—will participate in the program.

IBM initiates new ad campaign

IBM launched its new educational advertising campaign, "Mathematics Serving Man," last month with an ad built around the theme of Egyptian mathematics. The new program is a project of the IBM office of communications, in association with Benton and Bowles. Bill Buckley—Benton and Bowles art director on the IBM account --has supervised the program; designer Roy Kuhlman executed the ads and writer Hartley Howe did the text.

Other advertisements in the campaign will highlight great milestones in mathematics, beginning with Stone Age man's learning to count and ending with John Von Neumann's theory of games. A major objective of the program is to stimulate the interest of young people in mathematics careers and to increase awareness of the significance of mathematics in the modern world.

Printing scholarships announced

Three workshop scholarships for a second year's tuition in the fundamentals of typesetting, presswork and printing design have been established by the American Institute of Graphic Arts, a part of the New York School of Printing. The scholarships have been made possible through contributions of the Ingram Merrill Foundation, Time Inc., and the Reader's Digest Foundation. They will be awarded in May, to be applied to the following year's tuition. Classes opened this year in the school's new building at 439 West 49 Street, New York.

Cyanamid launches design bulletin

The first issue of "New Dimensions," a bulletin aimed directly at the industrial designer, will be published by the American Cyanamid Company this month. Subsequent issues will appear at irregular intervals.

The purpose of the publication is described in the first issue: "As a supplier we believe in the growing role of the Industrial Designer. We believe we can best relate Industrial Design to our customers—not by offering the free services of a stable of Designers, but by directly relating our development work to the problems of the Industrial Designer, supporting your work with our chemical knowhow, and offering useful knowledge of our products to you."

...designer's imagination thrives on these coatings... in products for work or play

Take a look at their properties, and you'll see why coatings based on BAKELITE Brand Vinyl Dispersion Resins stimulate so many new design ideas.

From glossy to textured, hard to resilient, their wide variety of formulations has opened up entirely new fields for coatings. One rugged type outlasted ordinary coatings tenfold in abrasion tests. Another is applied in quarter-inch thicknesses for cushioning—as well as for electrical insulation. Their chemical resistance has led to their use in lining chemical drums. Metal coated with these materials can be postformed—they won't crack, chip, or lose adhesion. Some types can be molded.

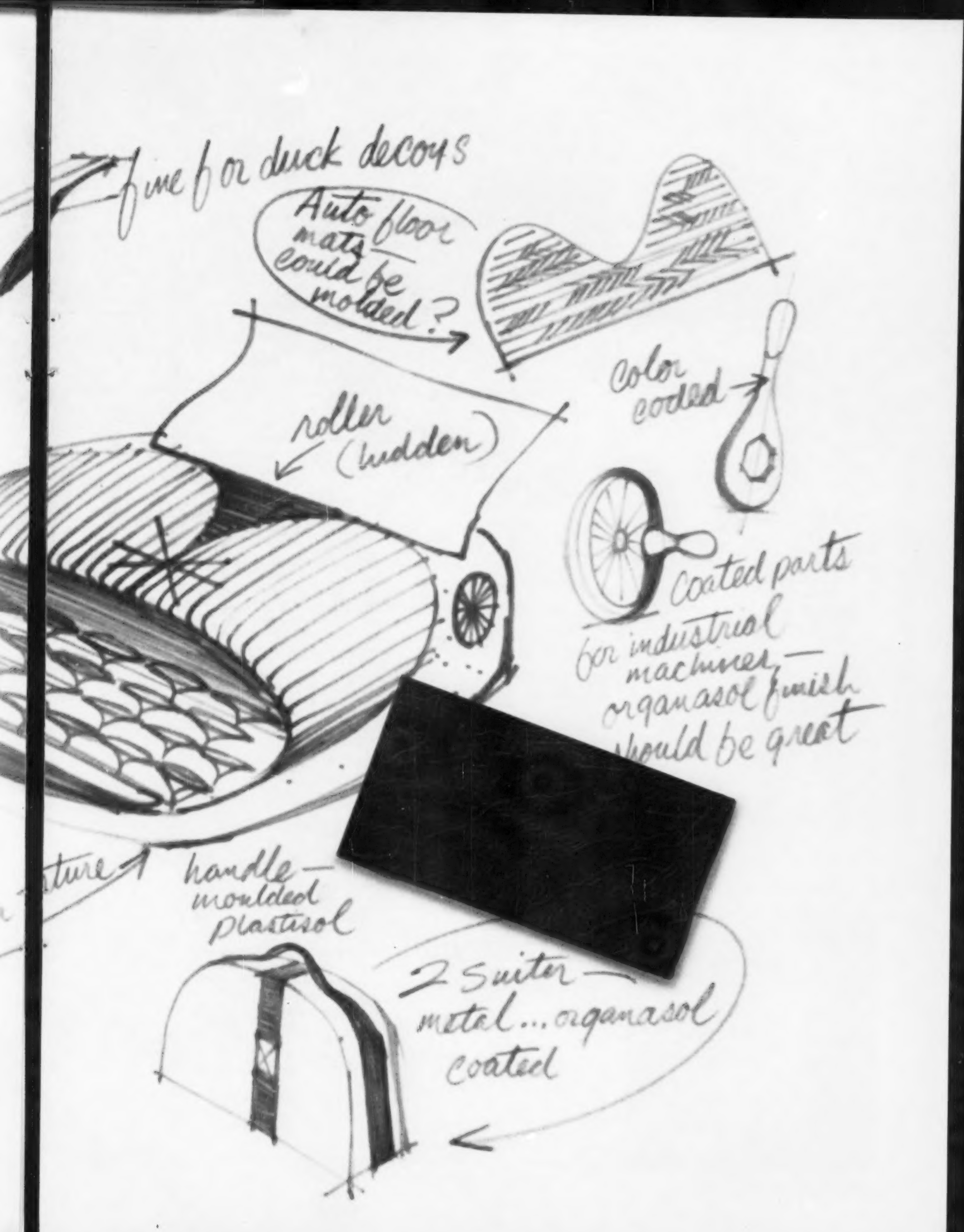
Learn how coatings based on BAKELITE Brand Vinyl Dispersion Resins can fit your product designs. Write for the names of coatings formulators who work with them, or for technical information on specific uses.

Address Dept. JB-45L, Bakelite Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Toronto 7.

It pays to design with coatings based on BAKELITE BRAND PLASTICS

UNION CARBIDE

The terms BAKELITE and UNION CARBIDE are registered trade-marks of UCC.


fine for duck decoys
Auto floor mats could be molded?
roller (hidden)
Color coded
Coated parts for industrial machinery— organasol finish should be great
ature
handle— moulded plastisol
2 Suiter— metal... organasol coated


Saiger *Bolté*



Thalheimer *Boutin* *Stoy*

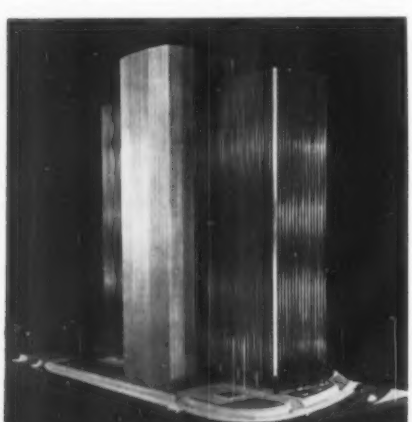
People

ELECTED: **Jack A. Thalheimer** (above), president; **Paul F. Kyack,** vice president; **Frederick Pyle,** secretary; **Meir Sofair,** treasurer of the T-Square Club of Philadelphia, oldest architectural club in the country.

APPOINTED: **Fred E. Hoffmanns** to Director of Engineering for J. M. Little and Asciates . . . **Howard Barsky** to the design staff of Industrial Design Affiliates . . . **James J. May** as design consultant to Startex Mills, Inc. . . . **Alan Bolté** (above) to the client relations department of Lippincott and Margulies . . . **Raymond P. Stoy** (above) packaging and graphics director for Hodgman-Bourke, Inc. . . . **Dr. Schrade F. Radtke** to direct the joint research program of the American Zinc Institute, Inc. and the Lead Industries Association . . . **Mrs. Mary L. Macie** as head of the Grand Rapids office of Schumacher, the fabric house . . . **Martin H. Gurley, Jr.** as new product analyst of the Vulcan Rubber Products Division of Reeves Brothers, Inc. . . . **Madelon Bedell** as director of public relations for Harley Earl, Inc. . . . **Alwin B. Newton** as director of engineering of York Division of Borg-Warner Corporation . . . **Lutrelle P. Wassman** as lecturer at the Institute of Design, Illinois Institute of Technoogy . . . **Nicholas T. Baldanza** as assistant to the president of Arnkurt Associate Engineers, model makers.

EXHIBITING: **William H. Campbell,** art director of the Pennsylvania Railroad, at the Philadelphia Sketch Club, a selection of paintings, experiments in plastic and three dimensional design.

RETIRED: **Harlow Curtice** as president of General Motors. **Frederick Donner** to replace him.



Gateway building in Pittsburg

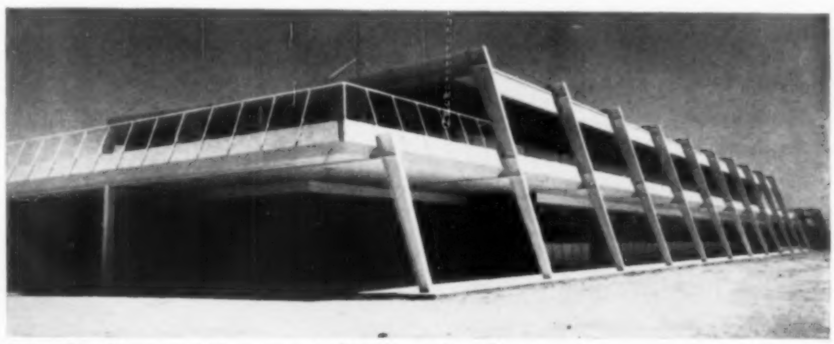
Events

The Center for Research in Marketing, Inc. will conduct a **Management Marketing Forum** for the Canadian Packaging Association on October 22. Subject of the forum will be "New Directions in Testing Marketing Effectiveness."

A **conference on epoxy resins** will be presented by the Upper Midwest Section of the Society of Plastics Engineers on October 21 at the Curtis Hotel in Minneapolis.

Awards and Competition

Paintings, designs, photographs, advertisements, and TV commercials are now being accepted as entries in the **14th Annual Western Exhibition of Advertising and Editorial Art.** Inquiries should be addressed to the Art Directors Club of Los Angeles, 30 South Kingsley Drive, Los Angeles 5.



John Jay Hopkins Laboratory in Northern San Diego

Camera magazine and the **International Asbestos-Cement Review** have announced a competition in which contestants submit photographs of recent buildings with asbestos-cement products in their construction. First prize is a Swissair ticket—Zurich/New York return. Information on the contest, which closes in March, may be obtained from *Camera,* C. J. Bucher Publishers Ltd., Lucerne, Switzerland.

Lightolier, Inc. has been awarded first prize in the "Most Interesting Lighting Job" competition sponsored by the Illuminating Engineering Society. Winning entry was the luminous ceiling created for the Seagram building in New York. It was designed by Noel Florence and a team of Lightolier design engineers.

Herbert C. Saiger (left) has been named Designer of the Year by Florida's Design Derby, Inc., a non-profit organization encouraging interest in design.

New Buildings

The Gateway Building (left), designed by Harrison and Abramovitz of New York, will be a 22-story stainless steel structure which will complete Pittsburgh's "Golden Triangle" redevelopment program by 1960.

The John Jay Hopkins Lab. (below) for Pure and Applied Science, a $10 million project of General Dynamics Corporation, will be completed this month. The laboratory will be used for research on thermonuclear reactions.

New Companies, Addresses, Names

NEW COMPANIES: **Design Dimensions, Inc.,** 1525 Eleanor Avenue, Toledo, Ohio. Officers will be Harold S. Boutin (above), president; Cecil G. Blank, executive vice president; Robert J. Aul, F. M. Gustafson, James E. Jones, vice presidents; Edward P. Stevens, secretary-treasurer . . . **Pan American Industrial Design Çompany,** Hato Rey, Puerto Rico. **Werbe, Fidler and Low,** 800 Livernois, Ferndale, Michigan . . . **Tarnawa Design, Inc.,** 348 East 49 Street, New York.

NEW LOCATIONS: **Roger Mark Singer,** 18 East 60 Street, New York 22 . . . **Harry and Marion Zelenko, Inc.,** 375 Park Avenue, New York 22 . . . **Kelly and Gruzen,** 10 Columbus Circle, New York . . . **Arnkurt Associate Engineers,** 210 West 29 Street, New York 1 . . . **Industrial Design Affiliates,** 221 North Robertson Blvd., Beverly Hills, California . . . **W. B. Ford Design Associates Inc.,** 600 Woodward Avenue, Detroit 26.

NEW NAMES: Organic Development Corporation to **Spectra-Strip Wire and Cable Corporation,** Box 415, Garden Grove, California . . . Hunt Lewis to **Lewis and Tweedie** (in partnership with Thomas D. Tweedie).

MEET A MATERIAL . . .

SO SHOCK-ABSORBING IT TAKES A LIFETIME OF SLAM-BANG ABUSE

Bumping along conveyors, slammed together on trucks and dollies, these Kennett materials-handling containers take a beating. But they stay on the job for years without cracking or breaking—and keep fragile parts from damage—because they're made of rhino-tough, resilient Vulcanized Fibre. That's not surprising. You *expect* rugged strength in Vulcanized Fibre. The surprising—and important—thing is Vulcanized Fibre's versatility. Prove this for yourself. Send for our new kit of samples and give them your toughest tests. We'll bet on your finding a product-improving idea. Others have been doing just that—for 99 years.

Here's the container that shrugs off abuse

Vulcanized Fibre is one of the strongest materials, per unit of weight. Yet it weighs less than half as much as aluminum. It's just the right material for materials handling receptacles. But it might raise your eyebrows to know a few of its other uses: delicate surgical instruments, chemically inert suture reels, arc chutes for lightning arrestors, flexible backings for abrasive disks, torque-resisting cams and gears, glass-smooth armor for textile shuttles, insulation for railroad signal relay systems. The list of applications is virtually endless.

In addition to light weight Kennett Receptacles, our own Lestershire Textile Bobbins are made of rugged, resilient, non-snagging Vulcanized Fibre.

Among engineering materials, Vulcanized Fibre is outstanding and surprisingly low in cost. It has superior arc resistance, low thermal conductivity, excellent resilience and high abrasion resistance. It can be formed or deep drawn into intricate shapes—and machined, polished, painted, embossed and combined with other materials, such as laminated plastic, aluminum, wood, rubber or copper!

Send for samples today. Let us know what use you have in mind. And if you want more information on Kennett Receptacles, ask for our booklet "Materials in Motion." Write Dept. D-10.

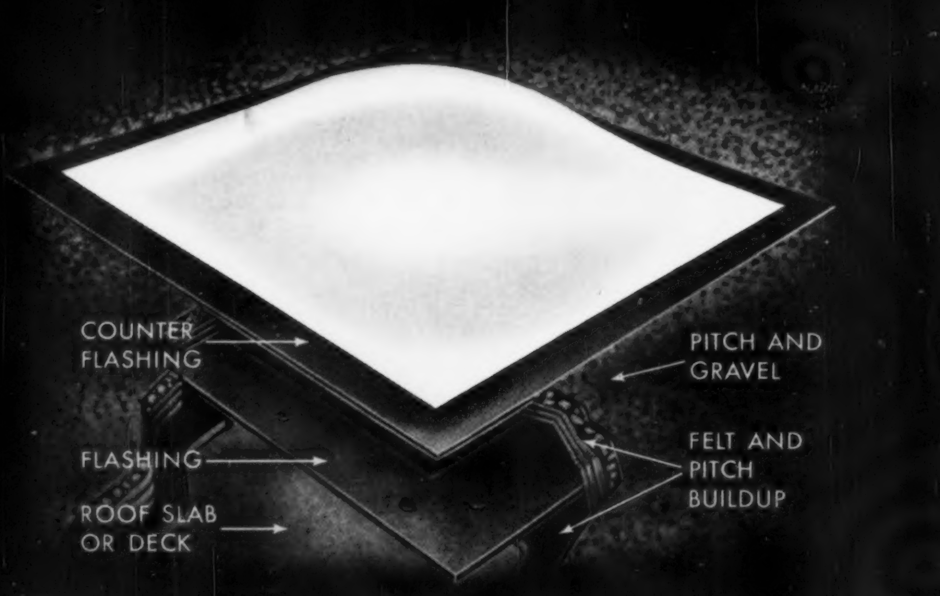
NATIONAL VULCANIZED FIBRE CO

WILMINGTON 99, DELAWARE

In Canada:
NATIONAL FIBRE COMPANY OF CANADA, LTD., Toronto 3, Ontario

Consolite

self-flashing double dome skylights



Consolite skylights are manufactured by Consolidated General Products, Houston, Texas.

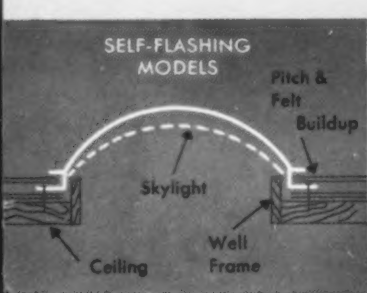
New double-dome concept in skylight engineering . . .

using glass fiber-reinforced

CELANESE POLYESTER RESIN

. . . exhibits

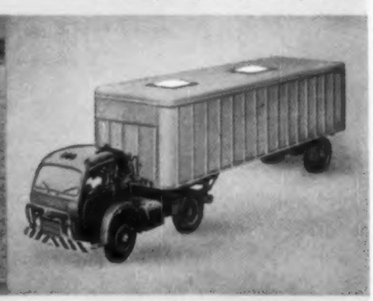
- Good light transmission and diffusion with less heat conductivity and little condensation . . .
- Excellent strength and durability; good resistance to weathering, rust, and corrosion; and . . .
- Lightweight, one-piece, self-flashing design lowers material, shipping, and installation costs . . .



Cross section showing double dome and self-flashing features of Consolite skylights.

Easily installed as integral part of roof. Especially adapted to built-up roofs.

More skylights, more light. Glass-reinforced polyester resins are natural light diffusers.



MobilDome skylights on trucks provide light for loading, unloading.

. . . A combination of all these advantages features the remarkable Consolite skylights that are made with (and made possible by) glass fiber-reinforced Celanese polyester resin. According to the manufacturer, only reinforced polyester resins, adapted to his unique design, can provide this *complete* combination.

The material's good diffusion properties combined with double-dome design provide better light and at the same time excellent insulating properties. Condensation is lessened. The dome exhibits excellent load bearing properties, good strength and shatter-resistance over a wide temperature range and is easily repairable if damaged. Consolite domes also resist rust and corrosion.

If you'd like to investigate how a remarkable combination of properties and performance characteristics might be teamed with an unusual design idea you may have for your product, write Celanese for information about reinforced polyester resins. Celanese Corporation of America, 180 Madison Ave., N. Y. 16. Canadian Affiliate: Canadian Chemical Company, Limited, Montreal, Toronto, Vancouver. Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Ave., N. Y. 16. Celanese®

Celanese polyester resins


COLOVIN VINYL-METAL LAMINATES
USED THROUGHOUT BRUSSELS FAIR
Residence Pavilion Exhibit — for walls, ceilings, partitions.
Metal Pavilion — for all exterior coatings, for ceiling of "outdoor marine" stand, for fountain of "corrosion" department.
Luxembourg Pavilion — for all the trimming of the air conditioning installation.
Civil Engineering Arrow — for covering the unique "drawbridge" door.
Aluminum Pavilion — vinyl-on-aluminum panels in open-air exhibits prove value of laminate for exteriors.
Park of Attractions — for multi-colored shower stalls, for insulating material, for movable partitions.
Medical Stands — for hygienic ceilings and walls in corridors, consultation rooms and laboratories.
PHOTO BY ESTABLISSEMENTS WOLDEC / SICKLES

THIS IS GLASS

a bulletin of practical new ideas from Corning

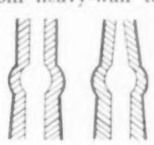
Hot tip!

This is a *glass* welding torch nozzle. You'll find them used on the inert gas welding rigs made by a number of up-to-date manufacturers.

Main reason for the *switch* to glass? You can keep close *watch* over the weld, *avoid* the kind of mistakes that can run into big money when you're working on expensive alloys.

Some of these welding nozzle tips are made out of VYCOR brand glass No. 7913, a 96% silica glass that's been *degassed*. Special firing to remove moisture reduces the tendency to deform at high operating temperatures.

All glass welding tips are fashioned from heavy-wall tubing that could be held as close as ±.001". Also, some pretty fancy machining and forming goes into them. One type calls for precision grinding of an outside taper, another for the same treatment on the inside—both for friction locking. And the tip we make for one firm has a bulb-like configuration to increase gas turbulence. All tips are fire-polished for added strength.



From all we've been able to discover, the men in the shop are quite enthusiastic about these rugged, heat-resistant glass tips that let them watch the welds go by. Likewise for the people who buy these tips from Corning and sell complete rigs to welders. They get what they need, when they need it, at a price that makes sense.

Special glasses, along with special techniques for either custom or mass production, await your appraisal. Which brings us to a standing offer: Bring us your knotty problem—product or process—and we'll see if we can't come up with a *glass* answer.

Or put some data at your fingertips by sending for Bulletin B-91, "VYCOR brand industrial glassware by Corning." In it you'll find all facts about infrared and ultraviolet transmission, heat and chemical resistance, and forms in which you can get these glasses.

How not to foul up the works

It's really very simple: If you're using spun insulation in electric motors, you have to keep the stuff from falling into the moving parts and fouling up the works.

Two things to keep in mind when selecting a material for this application: (1) It has to stand up to quite a bit of heat. (2) It *can't* be a conductor.

Some materials that are good insulators can't take the heat. Others function well at high temperatures but are not insulators.

Glass solves both problems. So, people who make electric motors build them with wedges made from PYREX brand glass No. 7740. (We supply the glass in rod form.)

This particular PYREX brand glass offers a number of useful characteristics. It is corrosion resistant and has a linear coefficient of expansion of 32.5 x 10^{-7} in/in between 0° and 300°C. Dielectric properties at 1 Mc and 20°C. are as follows:

Power factor	.46
Dielectric constant	4.6
Loss Factor	2.1

Wedges made from glass rod support spun insulation in electric motors. Glass is non-conducting and able to stand high temperature without deforming.

You can get PYREX brand glass No. 7740 in a variety of forms—pressed ware, blown ware, plate, tubing, rod and panels.

Mechanical, thermal, electrical, and chemical properties of this glass and 27 others are spelled out in Bulletin B-83. Check the coupon for a copy. Also ask for IZ-1, "Designing With Glass for Industrial, Commercial and Consumer Applications."

Blues in the white

Grand Coulee Dam is quite an impressive sight. It stands 550 feet high, and 4,173 feet wide. At night it's illuminated by 686 high wattage floodlights, covered with *colored front lenses*.

These lenses are red, green, blue, and yellow. And part of the lighting plan requires making *white* by *adding* red, green and blue.

That's where the trouble started. The equipment manufacturer required a very *precise* shade of blue. And despite years of experience in making colored glass, Corning had no blue on hand to do this job.

So our researchers came to the rescue. They developed a *special* glass and called it (for obvious reasons) "Front Glass Blue." Lenses made of this glass produced just the right shade. And along with the red, green and yellow lenses, they were *heat-resistant*, too.

Each lens used in this colorful spectacle measures 18 inches in diameter and weighs almost 7 pounds. All 686 were pressed from *standard* molds, delivered in record time.

O.K., you're not interested in color. Still there might be some glass or glass product that can be of help to you. Good introduction to the fascinating world of glass technology is the booklet, "This Is Glass." In its 64 pages you'll find facts and pictures that might give you some ideas. Remember: Corning can do almost anything with glass.

Corning means research in Glass

CORNING GLASS WORKS, 54-10 Crystal Street, Corning, New York

Please send me: B-91, "VYCOR brand industrial glassware by Corning" ☐ B-83, "Properties of Selected Commercial Glasses" ☐ IZ-1, "Designing With Glass for Industrial, Commercial and Consumer Applications" ☐ "This Is Glass" ☐.

Name...Title.................................

Company..

Street..

City...Zone..........State...................

WHAT MATERIAL

DRY CHOCOLATE DISPENSER. To meet special qualities in esthetics and strength, BAKELITE TMDB-5161 is used in molding the precision main parts of the new "Carnation" hot cocoa mix dispensers for use in the restaurant field. The high heat-and-impact resistance of this styrene material makes it completely washable, and insures accurate, trouble-free service.

Molded by Field Manufacturing Corp., Santa Monica, Calif.

IS ALWAYS NEW?

BAKELITE
BRAND
PLASTICS

. . . offering new freedom in design . . . and cost . . . and functional advantages!

It continually appears in *new* compounds and forms to meet new specifications.

It encourages the creative talents of design engineers, architects and interior and industrial designers.

You *know* the answer—*BAKELITE* Brand *Plastics*.

From the coatings on TV towers atop New York's Empire State Building to undersea oil rigs . . . from the packages on supermarket shelves to molded appliance parts . . . from Cup challenger yacht hull sealers to jet plane controls . . . *BAKELITE* Brand *Plastics* are solving new design problems.

And *BAKELITE* Brand *Plastics* almost invariably offer cost, production and functional advantages *as a plus!*

BAKELITE COMPANY WILL HELP YOU: Whatever your design area, no matter how unusual the qualities you require for forming, strength, rigidity, flexibility, insulation, corrosion resistance—explore the proven advantages of *BAKELITE* Brand *Plastics* and *Resins*. The material that's new all the time!

Technical representatives with years of training and field experience are available to discuss your special design problems. Write Dept. JF-51D.

THIS NEW AND DIFFERENT BLENDER, with separate compartments from which liquids are automatically mixed when poured, is easy to clean and hard to break. BAKELITE C-11 acrylonitrile-styrene-copolymer is used for the outer container, for strength, chemical resistance and low cost. The lid is BAKELITE Brand Styrene Plastic. Molded by Avsco, Inc., Excelsior Springs, Missouri.

Products of UNION CARBIDE *Corporation*

BAKELITE COMPANY, *Division of Union Carbide Corporation*, 30 East 42nd Street, New York 17, N. Y.
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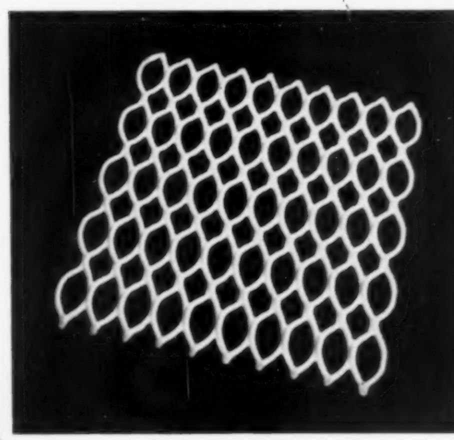
5051

OUTSTANDING NEW QUALITY

with CORVEL†

Fusion Bond Finishes



WIRE PRODUCTS

CASTINGS

STAMPINGS

• CORVEL Fusion Bond Finishes, applied by the fluidized bed process, now give these unique product finish advantages:

- Controlled thickness in one dip—from .005″ to .060″.
- Thorough coverage of corners, sharp edges, projections, joints and intersections—without bridging across gaps.
- Good adhesion to substrate surfaces.
- Resistance to corrosion and most chemicals.
- Premium appearance—multiple color selection, controlled sheen.
- Durable color and gloss.
- The RIGHT Finish for YOUR Product.

CORVEL Fusion Bond Finishes are powders specially formulated for use with the fluidized bed process. The part to be finished is first heated, then dipped into a fluidized bed of *dry* CORVEL powder. The powder, maintained in a state of whirling suspension, bonds by fusion on contact with the part.

CORVEL Finishes are now available in Cellulosic, Vinyl, Epoxy, Nylon, Chlorinated Polyether, and Ethylene base resins.

Fluidized Bed Process:

A new, patented production process for cladding metals and other materials with plastic resins—exclusively licensed in the U.S. and Canada by Polymer Processes, Inc., an affiliate company.

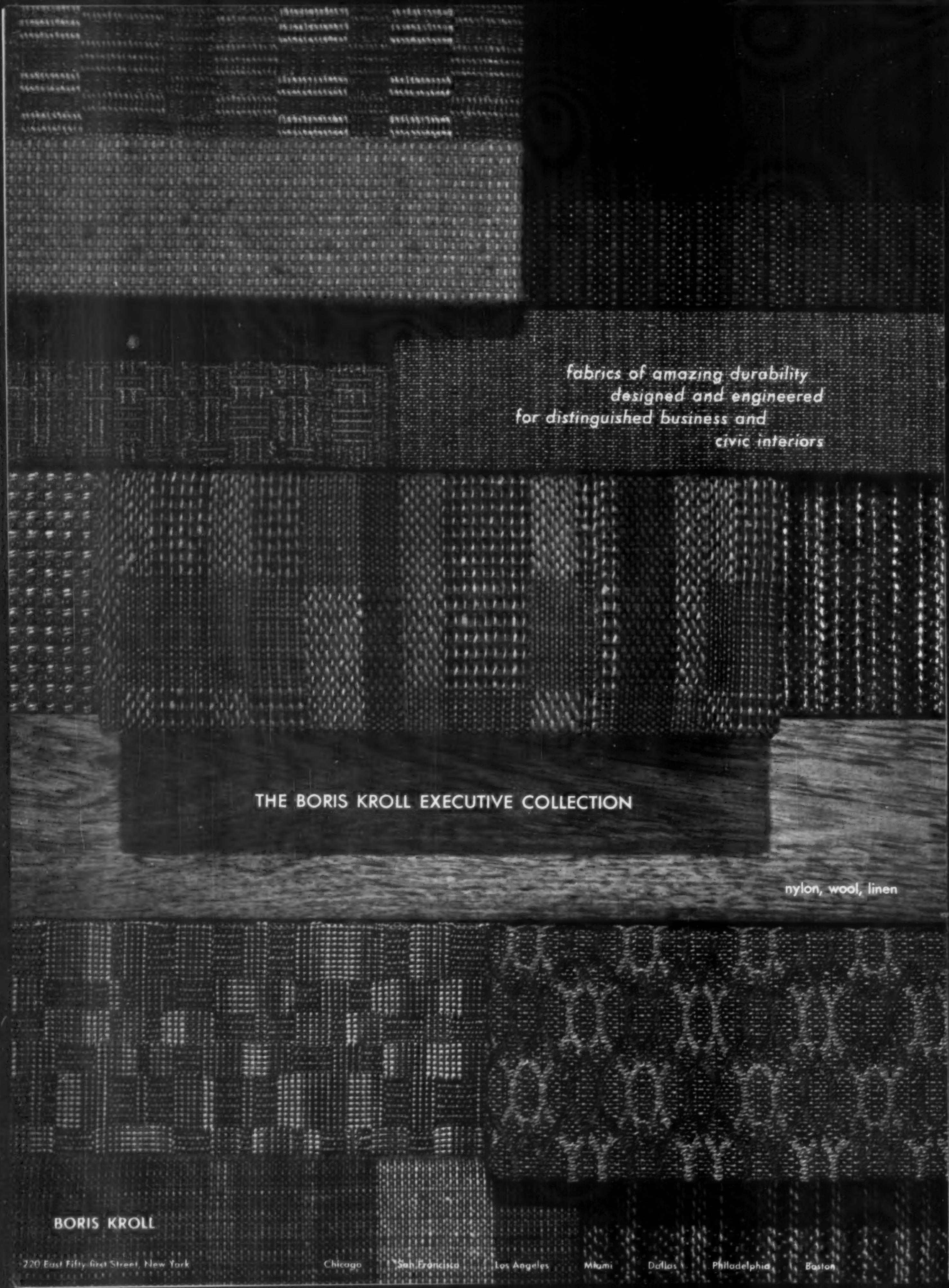
We invite your inquiry for product finish economy and improvement. Write today for our new CORVEL Bulletin.

NATIONAL POLYMER PRODUCTS, INC. / Reading, Pennsylvania

A subsidiary of The Polymer Corporation

POLYPENCO

†Polymer Corporation trademark for finishing materials



fabrics of amazing durability
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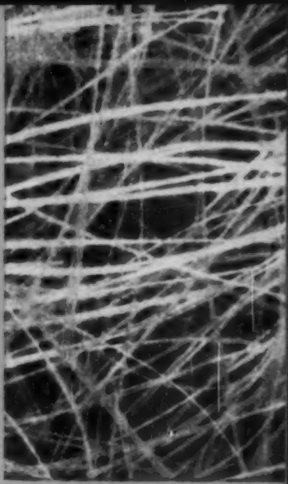


REINFORCED PLASTICS

Most industries have their roots deeply buried in history. Reinforced plastics as an industry, however, has little history to lead up to a statement about its potential or to draw attention away from its current shortcomings. This new industry can be isolated with little consideration for the contingent influences of past and present — an unenviable position, but one that affords a unique opportunity for analysis. Such close scrutiny obviously magnifies both the good and the bad. The following fifty pages seeks to be an objective appraisal of the products, the processes, and the people responsible for the industry's present status and for its future direction.

GREGORY DUNNE
ARTHUR GREGOR
DOUGLAS G. MELDRUM

Reinforced Plastics: an interpretation of an industry's growth

In the seventeen years since chance and wartime necessity combined to conceive reinforced plastics, two events have served to frame the material's public image. The first was the frenzied search during the early forties for new materials to take up the slack left by war shortages; the second was the decision of General Motors in 1953 to fabricate the Chevrolet division's futuristic Corvette sports car out of fiber glass reinforced plastics. The residue of these two circumstances was the mistaken impression that reinforced plastics was a specialty material suited only to the exigencies of wartime production or to the promotional machinations of a giant corporation.

In truth, however, the last two decades have seen the tiny industry lurch to the threshold of major material status. Projected figures show that the 1958 volume will approach the 200 million dollar level. Nearly one fifth of one billion pounds of resins and reinforcements will be used in home and factory, on highway and ocean, in the stratosphere and beneath the surface of the earth. Radar housings on the Nautilus and the luggage pods on the Boeing 707 will be molded from the same reinforced plastics that enclose television sets and ice cream freezer buckets.

The material that has spread itself over such a staggering variety of applications is essentially a combination of polyester resin and fibrous glass. Liquid polyesters are poured over a fiber glass form approximating the end-product shape. Under the influence of chemical catalysts, and heat, and (depending on the degree of resin activity) pressure, the resin molecules polymerize, converting from a liquid phase to one big solid mass that cannot be softened again by heat or chemicals. The polymerization locks the glass reinforcements into place, providing an inelastic backbone with steel-like strength for the more fragile plastics in which they are imbedded. The end result is an engineering material adaptable to shapes difficult or costly to produce in metal, unaffected by most corrosive agents, with a high strength/weight ratio, good heat, electrical, and sound insulation properties, and a high-impact strength.

Yet in spite of the imposing structural characteristics and accomplishments of reinforced plastics, the material has had a difficult, if not wayward, growth. In its short history, it has been over-exploited and underdeveloped, defensive in action but offensive in outlook, both damned and praised by designers and manufacturers, and the prey of industrial giants seeking captive outlets, and of wistful entrepreneurs searching for success on a prayer and a financed wing. But if the incongruities of its youth are no more unusual than those of other new materials, reinforced plastics offers an interesting phenomenon in the evolution of a whole new tradition in materials.

As the Plastics Decade (ID, June 1956) moves irrevocably into the Plastics Age, chemistry has become the governing factor in giving plastics equal status with the notural materials. With laboratory-spawned synthetics continuing to increase their volume, reinforced plastics affords a substantial case study of the greater acceptance of the chemical derivatives. In a larger sense, the reinforced plastics experience can be applied to the entire plastics industry, for the triumph or failure of a single synthetic derivative cannot help either enhancing or harming the plastic tradition.

There is, furthermore, a growing disposition within the reinforced plastics industry to insure against a repetition of the haphazard wanderings of its undisciplined, unguided past. It is widely felt that thoughtful reappraisal and constructive self-criticism are needed to dispel the jaunty rationalization that ". . . problems are our most important product." The industry is becoming increasingly aware that it cannot continue to blame its deficiencies on its relative youth, that it must justify itself competitively, that it must realize the plaintive speculation that it is ". . . a potentially lucrative industry waiting only for the proper solution to its technical growing pains."

An examination of the structure of the industry exposes the trepidation with which it views its own post-adolescence. For too many years the material has continued to increase its potential almost in spite of itself. An absurd lack of communication between molder and supplier has in most cases paralyzed any effort to meet the compelling need for standardization and basic ground rules of quality consciousness. Thus the industry was forced to stagger by trial and error through a multitude of applications—a process which has been characterized as ". . . apparently conceived by Stephen Leacock's legendary character 'who mounted his horse and rode off in all directions at once.' " Furthermore, it has had to compete with the war-fostered impression that reinforced plastics was an ersatz material brought into being by wartime restrictions, to be replaced in the Better World of Tomorrow. This combination of circumstances has served to anchor the material to a sense of public apathy from which the industry is only now beginning to break away.

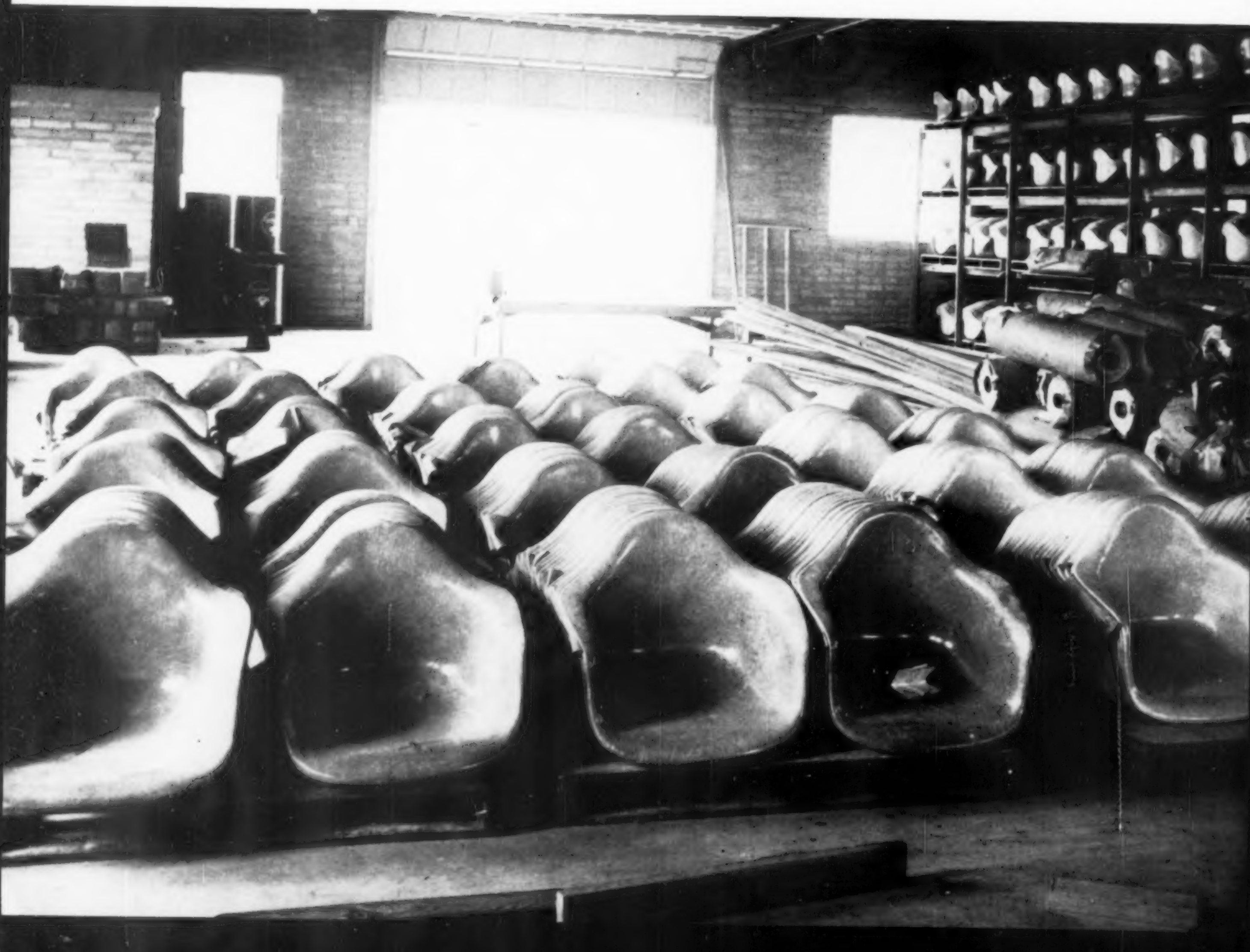
The ultimate responsibility for the future of reinforced plastics will fall to the basic material suppliers. These companies include more than two score resin makers (among whom are all the major chemical corporations), and six glass companies who have the risk capital and the fund of technical knowledge neces-

Photo: Morris Rosenfeld

Reinforced plastic sloop designed and built by Raymond Creekmore.

An interpretation

Chairs designed by Charles Eames for Herman Miller



sary to spearhead the breakthrough of reinforced plastics from its present doldrums. These are the same facilities which sixteen years ago, stimulated by the urgency of the war effort, created an infant industry.

The wartime beginnings

Early in 1942, the Air Force discovered a critical need for a protective shield for its self-sealing gas tanks. When penetrated by bullets or shell fragments, the inner rubber lining of the tanks was prevented from sealing the wound by the fingers of torn metal which held the hole open. After unsuccessfully testing leather, plywood, and a variety of impregnated cloths, United States Rubber Company, one of the largest of the producers of the self-sealing tanks, discovered that a combination of allyl carbonate resin developed by the Columbia Chemical Division of Pittsburgh Plate Glass Company the year before, and fibrous glass fabric from Owens-Corning Fiberglas, had passed ballistics tests with a near-perfect rating. In a matter of weeks production of the fiber glass liners had been started, though U. S. Rubber officials were not completely sold on the inordinately long cure time that the Pittsburgh Plate resin required. In desperation, U. S. Rubber scouted through the chemical community searching for a resin which cured faster than the Pittsburgh Plate material. American Cyanamid responded to the call for help, and took off its shelf a resin which it had developed five years before while looking for a paint material. Tests showed that it filled every requirement for the fuel tank liner: it cured comparatively quickly, was in ample supply, and was fairly easy to make.

The emergence of fiber glass as a structural component for plastics came in 1938 when the Owens-Illinois Glass Company and the Corning Glass Works decided to incorporate their "infant prodigy of over-indulgent parents" into Owens-Corning Fiberglas. For seven years previous to the birth of the new company, the parent firms had held a free exchange of information and communication on their independent scientific research into glass elements. Over the years this had turned out to be an expensive game, because although the natural competition between the two companies had uncovered many interesting new concepts in glass, the transition from concept to fact was hard to effect without a strong, central management to oversee the whole process of development. Thus the two major companies founded OCF to put their competition on firm footing.

OCF soon developed a strong, non-absorbent filament 15 times finer than human hair for commercial use in electrical insulation. But though the glass fibers would have been ideal for reinforcing plastics, the tiny strands broke when subjected to the heavy molding pressures necessary to shape the primitive molding resins of the day. Not until Pittsburgh Plate formulated the first of the large family of polyester resins which today make up 92 per cent of all the resins used in reinforced plastics, could a glass-resin combination conceivably be used as a structural material.

Under the stimulus of the wartime economy, dozens of small firms sprang up to mold the new wonder material in any number of military applications from tank liners to radomes. Government contracts were passed out by the score to new fabricators who needed only a medium-sized garage, a pair of sharp scissors, and a measuring cup to go into business.

Two years later, however, the fledgling reinforced plastics industry was suffering from a bad attack of post-war inertia. Under the slower pace of a peacetime economy, the government had cancelled its developmental contracts, leaving dozens of molders "at liberty," starved for a civilian outlet for their products. Most of the chemical companies were indisposed to finance the uncertain young industry while it struggled to find a market—except for a few like Rohm & Haas, Pittsburgh Plate, and American Cyanimid, who, despite losses, sought to refine and verify the value of the many materials developed haphazardly during the war. The future for reinforced plastics seemed tenuous, as a public accustomed to regarding plastics as cheap and expendable showed no inclination to accept a plastic material that was both expensive and "funny looking" because of the fibrous pattern which showed through the plastic finish.

The post-war slump

Yet there were still some optimists willing to take advantage of the infinite possibilities of reinforced plastics. Shaky financially, and weak technologically, the new molders came to fiber glass prepared to produce, but not to develop. The turnover was rapid. "It always seemed," one successful molder reminisced recently, "that the guy who was your closest friend at one of the early convention meetings would be selling socks by the time the next one came along."

The paucity of qualified personnel gave the industry a very flimsy framework. There were—and are—too many molders making a relatively small volume of products, with no standardization between them and with an almost total lack of quality consciousness. Because of the youth of the material, there have been no adequate precedents; this is one of the facts which has tended to give the entire industry an amorphous, directionless quality. Each new shape offers reinforced plastics a new series of problems which force the designer or engineer to build against the weakest part of the product. There is no definitive statement as to what reinforced plastics really can do, or how it will operate as a long-term proposition.

Forced to fight this delinquent reputation, the adherents of reinforced plastics chose to exploit rather than develop their new wonder material. "The enthusiasm of its converts," says Harry Darby, a vice-president of the Winner Manufacturing Company in Trenton, N. J., "led them to sell reinforced plastics as a new material which could do damn near anything. As a result, you too often had an inferior product made from a superior material."

Perhaps the largest single drawback to the further use of reinforced plastics has been its primitive production methodology. Though the years have proven the material's adaptability to large shapes, production volumes have been tied down by an overdependence on handwork—a deterrent which has kept reinforced plastics from exploiting its vast possibilities. With the limited exception of matched die molding, there has been no way to take advantage of the unlimited size and shape possibilities of reinforced plastics in the area of mass-produced goods. Yet in spite of the time consumed in preforming and curing a product before it goes into the mold, the matched metal die method holds the only real hope for reinforced plastics in high-volume production. An example in point is the gamble Robert S. Morrison, (page 57), president of the Molded Fiber Glass Companies of Ashtabula, Ohio, took when he entered the booming boat market in 1956. Morrison, who looks upon reinforced plastics as if it were a crusade, tooled up to mold the boats in matched dies, to the vast enjoyment of his competitors, who thought the risk not worth the threat of bankruptcy. Today, two years later, Morrison is producing 9,000 boats a year, or approximately 12 per cent of the total volume of the reinforced plastic boats molded.

But the failure of reinforced plastics to mechanize is a two-faced coin. Up to now the industry has not attracted the tremendous amounts of capital necessary to finance high-speed production methods. It is reasonable to expect that with the General Electrics and the Westinghouses beginning to show interest in the material, mechanization will follow as a result of their fund of production and technological knowledge.

The amazing paradox of the reinforced plastics industry in its formative years is that despite its lack of direction, it has produced an imposing number of well-conceived products. In the early post-war years, the industry subsisted on earnings from sales of fiber glass fishing rods (over 20 million sold since 1946) and reinforced plastic carrying trays. The first tentative steps in the molding of large shapes were taken with small plastic boats, an experience which was to prepare the industry for the automotive breakthrough in 1953. Decorative paneling, low-volume housings and intricately contoured furniture all served to free the materials from the stigma of military applications.

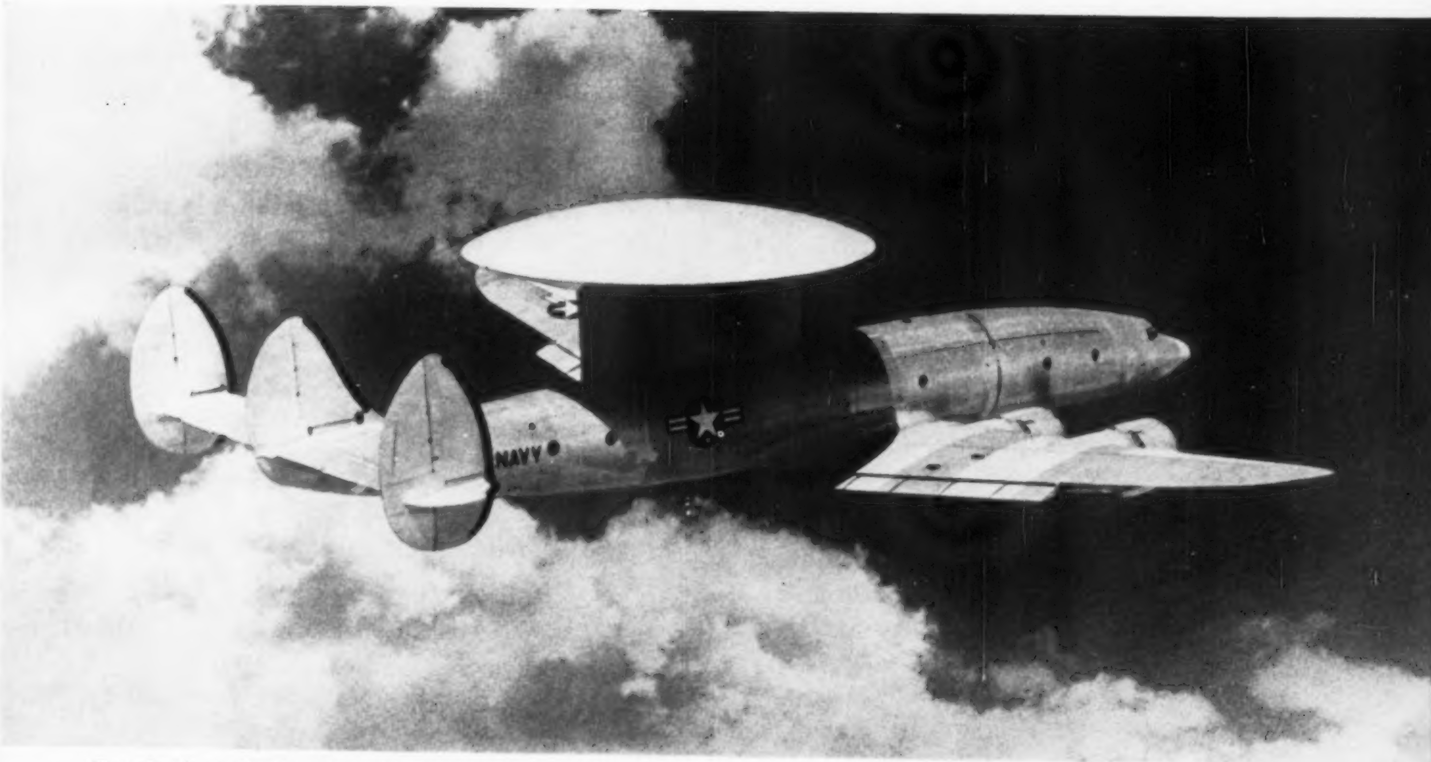
It was the production of the Corvette, however, which made reinforced plastics respectable. For years the industry had tried artfully to interest the automotive companies in the potential of plastic automobiles in a conscious attempt to attract the vital energy of Detroit capital and technical knowhow. Yet even when Chevrolet decided to style its new sports car in reinforced plastics after comparing its $500,000 tooling cost against the more than five million dollars that it would have cost to tool up for steel bodies, not all the automakers were convinced about the possibilities of plastics. *Fortune* quotes one G.M. executive as muttering that he didn't care if the Corvette were made from fiber glass ". . . just so they don't try to do it with any damned plastic."

The success of the Corvette points up the advantage of reinforced plastics in the fabrication of large, complex shapes in relatively low volume. Truck cabs and bodies, farm equipment, and small maritime craft lend themselves to a material that enables huge savings to be made in basic tooling costs. There is, furthermore, a growing suspicion among custom molders that the real future for the material in smaller pieces lies in the subassemblies of larger units; for example, the internal components of automobiles and aircraft, where reinforced plastics is used for some intrinsic advantages on which the sale of the product is not dependent.

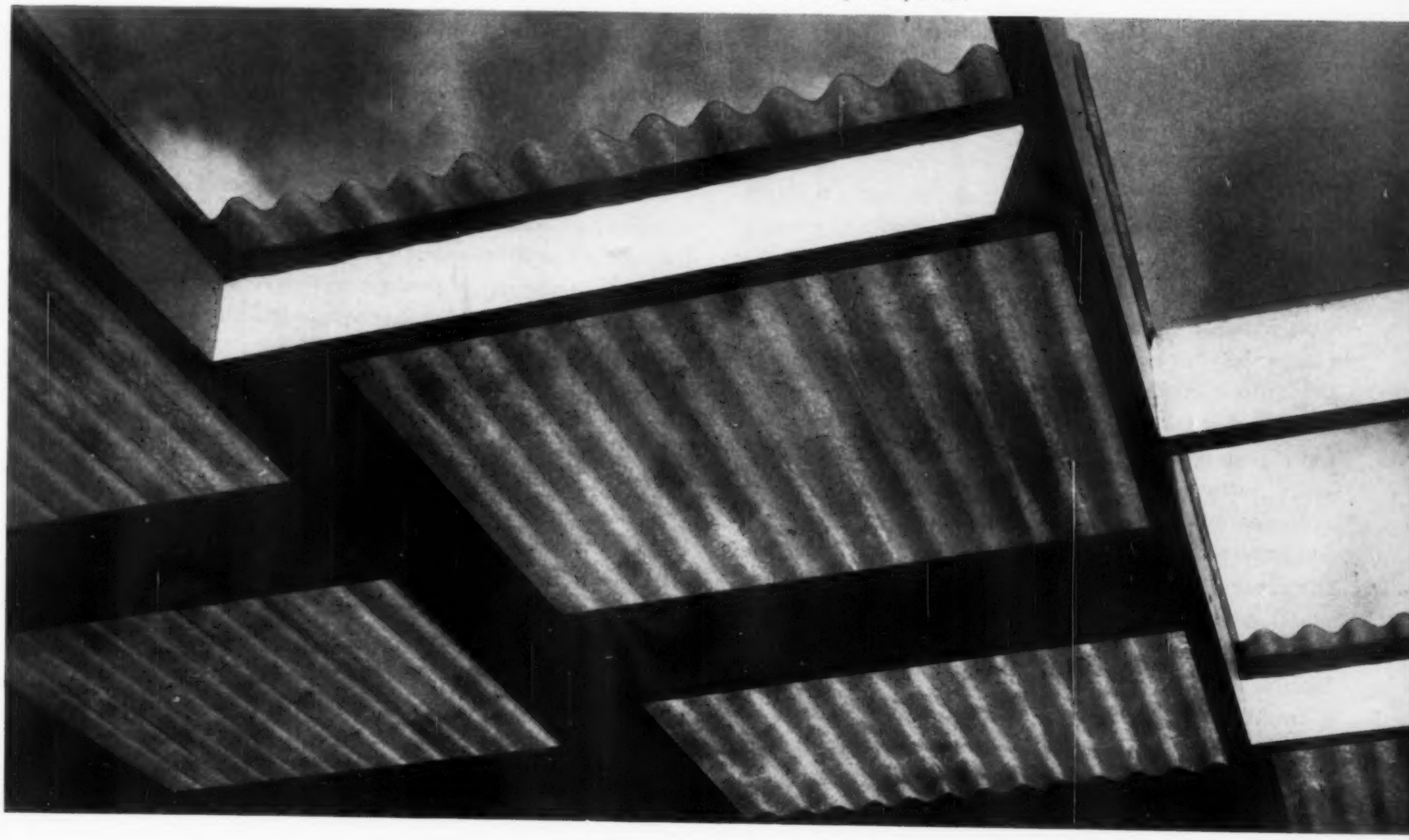
The difficult present

All questions about the potential of reinforced plastics become academic, however, if the industry does not cultivate the respect and counsel of the manufacturers, designers, and engineers who would specify the material for their products. Unfortunately, there has been a reluctance to accept reinforced plastics as a new entity which is divorced from all previous experience in product development. Thus designers have had to labor under the liability of bringing about public awareness of the material through utilitarian applications like trays and tubs in which only the property advantages of plastics, rather than a marriage of properties and form, were stressed. The industry needs to educate the designer in the full possibilities of reinforced plastics with regard to shape, color, and properties. Then he in turn can educate the consumer to the fact that appropriate form comes from the material itself, not from the material it replaces.

This places a large obligation on both designer and industry. It presupposes that the former will keep abreast of the latest developments in all the synthetics



Two classic applications for reinforced plastics are Air Force radomes and corrugated panels.



despite their multiplicity, so that he can fully exploit what is currently available to best suit his client's need. And because there is a tendency to over-criticize any new material, the latter must eliminate each area of criticism, as well as anticipate prospective censures.

This is a tall responsibility for an industry which molder Morrison characterized at the last annual conference of the Reinforced Plastics Division of the SPI as "woefully inefficient, woefully sloppy, and woefully ignorant." For too long, reinforced plastics has suffered from a crying lack of initiative. There is no easy solution for its deficiencies; it is not enough to pass the buck from molder to supplier to manufacturer. The future of this industry rests on the interdependence of all three.

There is a necessity to build greater engineering confidence in reinforced plastics, to establish well-grounded standards of reliability. The material suppliers cannot afford to minimize the importance of basic research with the petulance that led one materials executive to declare, "Hell, we can't allow our competitors to get a free ride on our research effort." Because reinforced plastics has no assured market — and a limited volume when compared to other chemical derivatives—top management has been negligent in developing fast-curing, fire-resistant resins with a tough finish. Management rationalizes this negligence with recourse to the all-but-senile argument of industrial competition. "Look," states one chemical manager, "there are 44 resin companies producing 84 million pounds of resin a year. You can't expect us to break our backs researching that drop in the bucket. Our stockholders wouldn't stand for it." Perhaps this is valid reasoning, but it appears as a pretty limp argument in the light of the vast number of unknowns which the major chemical companies have sought, found, and solved since the beginnings of the synthetics era. Reinforced plastics has demonstrated its possibilities in spite of the lethargic research effort. This in itself is justification for a more concerted effort to develop the material.

Moreover, there is a growing inclination within the industry to recognize that quality control has become the governing factor in the steady growth of reinforced plastics, and in the wider acceptance of its products. The prospective agenda of the next meeting of the Reinforced Plastic Division, to be held in Chicago in February, indicates that the industry realizes the necessity of setting up standardization yardsticks to increase lay confidence in the material. To date, this task has fallen almost by default to Owens-Corning. Their campaign has a two-fold objective: the first is to set up technical bench-marks of reliable design data; the second is to secure concrete evidence for the resin companies that the industry is capable of giving itself direction. Only then, OCF feels, will a joint research program be possible.

The first of the technical bulletins (on which Owens-Corning worked in conjunction with the marine engineering firm of Gibbs & Cox, Inc.) will be published in the spring of 1959. Conceived as an investigation into the potential of reinforced plastics in marine structures, the handbook will coordinate such variables as materials, methods, and design considerations into a reliable standardization guide. Subsequent studies will use the guidebook as a starting point whose results can be translated into all aspects of structural design.

Perspective

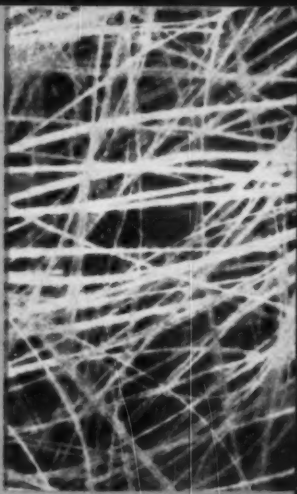
But an awareness within the industry of the sources of its troubles is a diagnosis without a cure. Molders must become more sales and marketing oriented, as well as more soundly staffed technically, to best promote the increased use of their product. There is a need for less diversification in product inventory so that each individual molder can realize the full potential of his line. There is a need for a greater promotional effort to woo the capital and technology of the huge corporations to reinforced plastics to help overcome the production obstacles. Larger and more specialized equipment is necessary to keep the industry growing. Raw materials should be more consistent, and the omnipresent problems of finish and assembly need to be clarified. A reservoir of competent personnel should be trained in the specific problems that reinforced plastics presents in order to encourage product initiative and to combat the industry's history of inadequate imitation.

As the journey through the Plastics Age gathers momentum, special heed is being paid to the designer. Owens-Corning has proposed a special service to the design profession "to furnish technical cooperation and advice regarding product techniques, advancements, [and] specific applications" regarding the increased use of reinforced plastics. The industry feels strongly that the ultimate competitors of reinforced plastics will not be the basic natural materials, but the related synthetics, whose adaptability it hopes will stimulate new ideas on form and structure away from the conventional rectilinear. Without the re-education and partnership of the designer in the possibilities of reinforced plastics, the industry will lag behind in the competition with her sister plastics.

Fiber glass car molded by Glasspar Company

J. S. Ward

One of the nearly 11 million reinforced plastic helmet liners made for the Army.



THE MATERIALS

Glass, one of the oldest materials known, and polyester resins, a new family of synthetics first introduced commercially in 1942, combine to make reinforced plastics a new and vital structural material. The difficulties of joining such diverse elements have created a number of unique problems: some have been overcome, many are currently retarding the growth of the industry, others must be anticipated before the industry's potential can even be grasped. The rapid rate of development of new reinforced plastics materials and the daily improvement of those in existence make standards obsolete almost before they are set. The industry is an impatient one, and it is learning that patience is essential for the full development of the only thing its future can be founded on — its materials.

GLASS REINFORCEMENTS: *statements and classification*

"Reinforced plastics has reached its point of reappraisal." Harold Boeschenstein, September 15, 1958

To say that Harold Boeschenstein has a stake in the future of reinforced plastics falls into the category of classic over-simplication. For Mr. Boeschenstein has been the president of Owens-Corning Fiberglas Corporation since the company was incorporated by the Owens-Illinois Company and the Corning Glass Works in 1938 to give management direction to the inter-company glass research which had been carried on by the two firms throughout the thirties. In the ensuing twenty years, OCF has grown into a multi-million dollar corporation, while reinforced plastics has become a 200 million dollar industry to which Owens-Corning annually sells nearly 75 per cent of the total glass reinforcements.

Harold Boeschenstein has been an active, prominent figure in the glass industry for nearly 40 years. After graduating from the University of Illinois in 1920, he became associated with the Illinois Glass Company, moving through the corporate structure in various sales and financial capacities until the merger of the Owens Bottle Company and the Illinois Glass Company in 1929 made him vice-president and general sales manager of Owens-Illinois Glass Company. When OCF was founded in 1938, Mr. Boeschenstein was selected to lead the company not only because of his broad background, but also because of his emphasis on diligent research and aggressive selling.

As the largest single supplier to the reinforced plastics industry, OCF finds itself by default the industry's guardian angel. "Because of the fragmentation of the industry into glass makers, chemical manufacturers, and fabricators of various kinds and dimensions," Mr. Boeschenstein says, "there have been more mistakes made, including those we made, than are normal with most new materials. Just because someone is using a new material doesn't mean that he necessarily uses it to best advantage or in the most effective way." Turning to the deficient communication within the industry, he goes on to say that ". . . there has been no clear responsibility as to whose job it is to develop compatibility between materials—resin and glass—and fabricating methods. OCF has come to realize its obligation to help bring these factors together and develop reliable technical data with respect to performance. We seek to avoid exploiting or giving support to unsubstantiated claims that result in failure. Through such leadership, we believe sound growth and development of the industry may be obtained on an accelerated basis, and the material may realize much broader usage."

Mr. Boeschenstein points to housings for small consumer products, pipes, plumbing fixtures, sports products, and vital uses in aircraft and missiles as areas which "we can move in and take" if reinforced plastics takes hold of itself. "This material has proven itself with due consideration to its liabilities," he adds. "We're on the threshold of a new era. Let's see what the material can do when it fully realizes its possibilities."

Glass, lime-alumina-borosilicate that is relatively soda free, manufactured in the form of fibers with diameters ranging from .00020 inch to .00100 inch, is the basic reinforcement for plastics. Glass fibers (or filaments) have greater mechanical strength but lower chemical resistance than bulk glass. Their tensile strength is about 400,000 psi, they have a modulus of elasticity of 10,500,000 psi, and a modulus of resilience that is a thousand times greater than bulk glass. These are outstanding properties, and they work together to make glass by far the best reinforcement for plastics, despite its high cost. To date no other material offers such an unusual combination of strength, flexibility, resistance to absorption and to swelling. Other materials, such as asbestos, sisal, and cotton, are sometimes used to reinforce, but only when necessary to obtain highly specialized properties.

Most fibers for the reinforcement of plastics are made by a process of mechanical pulling, a method in which molten glass flows through orifices in a bushing at the bottom of a furnace and is then mechanically pulled at very high speeds (5,000 to 10,000 ft. per minute) to form a filament during early stages of cooling. The diameter of the filament is directly related to the size of the orifices, the pulling speed, and the temperature of the glass. Short fibers are sometimes produced by a process that directs jets of air, steam, or hot gas at the stream of molten glass. And for extremely fine fibers, a mechanically pulled fiber is remelted and blown by

Comparison of Fibrous Glass Reinforcements

Type	General Description	Directionality	% Glass Content	General use	Relative Cost	Relative Usage
Reinforcing Mats	*Non-woven random matting*	*Non-directional*	20-45	*Simple contours*	*Medium*	*Great*
Rovings	*Rope-like bundles of continuous strands*	*Unidirectional*	50-70	*Preforming; Unidir. reinf.*	*Low*	*Great*
Chopped Strands	*Bulk, cut strands*	*Non-directional*	15-45	*Molding cmpd.*	*Low*	*Medium*
Milled Fibers	*Small filaments*	*Non-directional*	2-10	*Castings*	*Low*	*Very Small*
Surfacing Mats	*Non-reinforcing filaments*	*Non-directional*	5-15	*Surface Smoothness*	*High*	*Small*
Beams	*Parallel yarn matting*	*Unidirectional*	50-80	*Cylinders*	*Medium*	*Very Small*
Fabrics	*Many styles; with finish*	*Unidirectional or bi-dir.*	45-65	*High performance parts*	*High*	*Great*
Woven Rovings	*Coarse, heavy fabrics*	*Bi-directional*	45-65	*Boats*	*Medium*	*Medium*

Three basic types of glass reinforcements are shown above. Continuous strands, known as rovings, are cut for use in the preform process. Reinforcing mats (left) are made of chopped strands with a resin binder. Woven fiber glass cloths (right) provide very high strength; are made in many thicknesses and weaves.

a jet of very hot gas. A number of filaments are formed simultaneously (one from each orifice in the bushing). Since glass fibers are extremely susceptible to abrasion from one another, their surfaces must be lubricated and treated. In addition filaments must be bonded together to form a strand so they can be handled without becoming fuzzy, and a primer must be added to promote adhesion of plastic resins to glass.

Because of the somewhat unique qualities of glass, e.g., relatively low specific gravity, high electrical resistivity, no flammability, moderate thermal conductivity, and chemical inertness, the addition of fiber glass to a plastic increases its mechanical strength, stiffness, impact resistance, and dimensional stability, while giving it a wider useful temperature range. Within practical limits, these properties are improved essentially in proportion to the volume of glass present.

When strength properties of a material are considered, questions concerning creep, hysteresis, and fatigue arise. Glass fibers show neither creep or hysteresis at room temperature. Glass fatigue is different from the fatigue associated with metals. In the latter, a loss of strength occurs due to an internal adjustment to applied loads that is described as cold working. In glass, loss of strength occurs due to a surface attack by the environment. This is particularly noticeable when the glass is under load. By adequate protection of the surface, the diminution of strength with time can be reduced to a value approaching zero. Glass strands may either be placed directionally to resist specific loads, or in a random pattern for uniform strength in all directions.

Glass fiber reinforcements are available in a variety of forms for various applications and for use with different fabricating techniques. The cost, too, varies with the form the glass fibers are in.

Chopped strands, a low-cost form of glass fiber reinforcement, are strands that have been passed through a cutter and chopped into predetermined lengths from ½" to 2" long. This kind of reinforcement is usually used in the preform process or to make molding compounds.

Rovings are also low-cost and used in the preform process. They consist of a number of continuous strands wound on a tube to form a cylindrical package.

Reinforcing mats are of non-woven mattings made of chopped strands, or of continuous strands laid down in a random pattern. The strands are held together by stitching, or by a resinous binder, and are available in many thicknesses, with cost varying with thickness. Stitched mats are soft, drapable, and available in heavy weights, while bonded mats are stiffer but stronger. Mats made of continuous strands can be used to mold more complex shapes than the others because they are more flexible.

Milled fibers are small modules of filamented glass that have been hammermilled. They are available in lengths of from 1/32" to ¼" and are used primarily for reinforcement in casting resins and in resin adhesives.

Surface and overlay mats are used more to give a smooth surface than for reinforcement. Ranging in thickness from .010 to .030 inches, these mats stabilize the surface resin and allow a heavy resin layer to be used. Surfacing mats are stiffer than overlay mats because they contain more binder and are used only on flat or simply contoured surfaced. The latter and more drapable, since they contain less binder and can be used on complex parts.

Woven fabrics are the oldest type of reinforcement and, although more expensive than mats, they are still used extensively for their high strength and versatility. They are available in many thicknesses, weights, styles of weave, coarseness and glass fiber thickness.

Woven rovings are made in a variety of weaves and, while relatively new, are gaining popularity because they are thick and impart high strength to parts.

A general statement about the costs of various types of reinforcements for plastics could be "the greater the strength from the reinforcement, the greater the cost." There are exceptions, however, that depend on the desired characteristics of the finished product. Woven materials, for instance, give greater strength and are more expensive than non-woven reinforcement, but their strength is directional. If non-directional strength is desired, non-woven and less expensive reinforcements would be more satisfactory.

RESINS REPORT: MATTERS OF OPINION AND OF FACT

Earle S. Ebers, vice president of United States Rubber Company and general manager of its Naugatuck Chemical division, is one of the few members of the reinforced plastics industry who does not feel that the material is on the threshhold of adulthood. Rather he feels that ". . . this industry is still in swaddling clothes."

Although Ebers is hesitant to speculate on where the infant is going from here, he was one of the men responsible for its happiest birthday. A peculiar facet of our economy is the fact that practically everything fabricated is geared to the mass production mentality of the automobile industry. Detroit's money and brains are wooed with an almost grinding determination by smaller independent industries in their effort to share in its mass profits. Reinforced plastics was no exception. Early in 1952, Ebers made a national tour in a custom-built plastic car molded by the Glasspar Company in California. At each city on his route, he stopped to meet with reporters to present the plastic automobile not as a future possibility, but as an accomplished fact. In this way the automotive industry was conditioned to the potential of reinforced plastic cars eighteen months before volume production of the Corvette.

Ebers has been associated with U. S. Rubber for over twenty years. A Canadian, he received a B.S. degree from Dalhousie University in Halifax, Nova Scotia in 1931, and a Ph.D. from Harvard five years later. He joined U. S. Rubber as a research chemist in 1937.

As a former research man, Ebers is outspoken on the subject of reinforced plastics research. Because of the youth of the industry, he feels that trial and error must be the rule until the material has completely proven itself. Since the corporate structure of the suppliers precludes the possibility of non-applied research due to the limited consumption of reinforced plastics, molders are forced to come up with applications for which the glass and chemical companies can supply after-the-fact aid. Without product research initiative on the part of the molder, progress in the industry will be seriously frustrated. For, as Ebers concludes, the evolution of a new material is one in which "... the major supplier usually follows the entrepreneur."

In desperation, a reinforced plastics molder recently undertook a costly and time-consuming basic research project that he felt, with justification, was not his responsibility. An acute need for more complete and more conveniently organized information about molding resins prompted him to test all commercially available resins in his laboratory under consistent molding conditions. The results were collated and drawn up on a physical data chart which, for the first time, brought together and compared such properties as viscosity, hardness, flexural strength, and the other characteristics.

This molder was not alone in his complaint that the vast majority of resin manufacturers rarely give adequate information about their materials and, even more important, have no common basis for comparison. Terms such as "rigid" and "flexible" become more and more indefinite as the list of available resins grows; molders find that a resin dubbed "general purpose" by one manufacturer will have properties quite different from those of another "general purpose" resin made by another manufacturer. As a result, molders do not necessarily criticize the quality or performance of available resins, and furthermore, they do not necessarily welcome the introduction of a new resin (almost a daily event) with the open arms that might be expected from a growing industry. And the question that is frequently raised as to whether or not there are too many resins on the market will remain a moot one until some progress is made in resin standardization and in this descriptive terminology.

It must be acknowledged, however, that, although the availability of literally hundreds of different resins with broadly overlapping characteristics causes a certain amount of confusion, these resins have been developed in a sincere attempt by the chemical companies to produce materials that are better and easier to use. This multitude of materials are all included in nine basic types of resins for reinforced plastics: polyesters, phenolics, melamines, silicones, epoxies, alkyds, cellulosics, vinyls, and acrylics. Of these, polyesters are far and away the most widely used (of all resins for reinforced plastics, polyesters make up some 92%), with phenolics, epoxies, and the relatively new acrylics the only other types considered for anything other than highly specialized applications.

Polyester resins

Although the consumption of polyester resins by the reinforced plastics industry is very small compared to their use in the plastics industry as a whole, the increase of the demand is spectacular. During peak wartime production in 1945, 3,500,000 pounds of polyester resins went into reinforced plastics products. This fell off immediately after the war to 800,000 pounds in 1947, but rose again to 8,500,000 pounds in 1950 and to 78,000,000 pounds in 1957. This represents an average annual increase of the industry's polyester resins consumption approaching 40%, and it shows no sign of levelling off.

Since polyesters are formulated from a number of different alcohols, acids, and cross-linking monomers, an unlimited variety of resins can be produced with an equally diverse number of physical properties. Families of polyester resins are made by several chemical companies: American Cyanamid makes Laminac resins; Celanese calls their family Marco resins; there are Reichhold Polyite, Naugatuck Fibrin, Pittsburgh Plate Glass Selectron, Glidden Glidpol, Rohm and Haas Paraplex, and many others. These resins are formulated for both end-use performance and to give the best results in production according to the fabrication method used. For instance, at American Cyanamid, whose Laminac line is one of the more extensive, special promoters and inhibitors have been developed to control the rate of set and cure of their resins. With fabrication problems in mind, American Cyanamid has produced polyester resins with a minimal tendency to drain or drag on vertical surfaces; they have a solid-powdered resin for preform or glass-mat binding, and a high viscosity resin that minimizes flow in pressure molding operations. On the other end of the viscosity scale, they have low viscosity, fast-wetting resins for maximum penetration when spraying or brushing resin on glass cloth or mat. This list goes on, but is typical of the extent and variety of polyester resins available to the fabricator.

If polyester resins are divided into general categories according to their types, the following simplified chart is an indication of general areas of application:

TYPE	*CHARACTERISTICS*	*APPLICATIONS*
General purpose	*Rigid; low cost*	*General*
Semi-rigid	*High impact strength*	*Containers; trays*
Flexible	*Molding not rigid*	*Vibration damping*
Heat resistant	*Can operate at 500°F*	*Aircraft; missiles*
Fast cure	*For high production rates*	*Boxes*
Tack-free	*Can cure in presence of air*	*Boats; tanks*
Weather-resistant	*Good for outdoor use*	*Building panels*
Flame resistant	*Does not support combustion*	*Building and electrical panels*
Hot strength	*For high production rates*	*Containers*
High strength	*Very good properties*	*Aircraft*

Epoxy resins

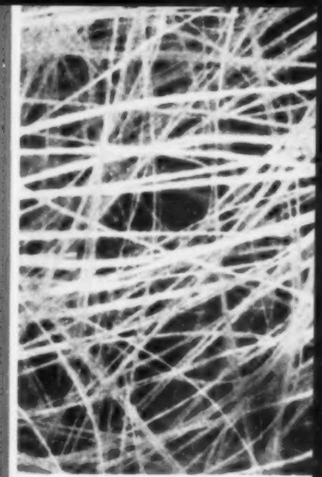
A great deal of attention has been paid to epoxy resins because they offer exceptionally high strength, low cure shrinkage, and very low water absorption. In spite of their high cost, they are being used more and more widely with metallic and mineral fillers for dimensionally stable tools for all kinds of metal forming, fabricating and assembly operations. The future of epoxy resins is unquestionably a bright one, particularly with recent price reductions.

General Resin Comparison

Type	**Molding Pressure Required, psi**	**General Use**	**Relative Cost**	**Relative Usage**
Poylesters	0-500	*General*	*Low*	*Very great*
Epoxides	0-500	*High strength*	*Medium*	*Medium*
Phenolics	15-2000	*Heat resistance*	*Medium*	*Medium*
Melamines	5-2000	*Fire resistance; electrical*	*Med.-high*	*Small*
Silicones	1-200	*Heat resistance; electrical*	*High*	*Small*
Polystyrene	1000-5000	*High production rates*	*Low*	*Small*
Acrylics	1000-5000	*Developmental*	*Medium*	*Very small*

FABRICATION TECHNOLOGY

The size, shape, and quantity of reinforced plastic products determine the way in which they are fabricated. The apparently simple process of taking a reinforcing material like glass fibers and combining, forming and curing it with the basic resin is complicated by such variables as curing time, molding pressures, temperature. Since inadequate control of these variables has thus far blocked high volume and economic production of reinforced plastic parts, they present a challenge that has become the main concern of forward-looking fabricators interested in more efficient mechanization. This chapter is a catalog of volume production processes, their possibilities and limitations.



PRODUCTION METHODS: *Mass-production is stymied by poor use of time*

Despite the newness of reinforced plastics, fabricating methods are generally primitive, messy and crude; involve a great deal of piece work and hand labor; and suffer from an acute lack of mechanization. Shops that employ little or no automatic equipment are typical, and those that do operate on a semi-mechanized production basis—they are generally the larger plants — are clearly the exception. Some equipment manufacturers have actually developed machinery which can combine several operations into a single-station process, but most reinforced plastic fabricators still persist in relying on their backward production practice. Shaping a truly contemporary material with outdated methods presents a curious paradox. What is the reason for it and who is responsible? The fabricators? The youth of the material? Lack of money? The short life-span of the industry? Mr. Ivan Brenner of the I. G. Brenner Company has this to say on these points: "Up until now the small operators could not afford, or were not inclined, to speed up their production methods. They felt that to mechanize might require outside capitalization, and they were afraid that this might mean losing personal control of their business. So they were satisfied with their market, their product, and their volume." But what of the larger operators, the companies whose yearly dollar volume is in excess of a million?

Mass-production in the reinforced plastic field is stymied by *time*: the time it takes a resin to cure, and the time lost in handwork—curing time often ties up operators, presses, floor space. Since reinforced plastics have not been in use for very long, precise predictions of their behavior under certain conditions of fabrication—such as temperature and pressure — are not available to manufacturers. This has certainly hampered any full-gear mechanization. But a small percentage of the industry, the large fabricators engaged in high volume production (Zenith, the Molded Fiber Glass companies, General Tire and Rubber, Brunswick-Balke-Collender, and others) have developed semi-mechanized production lines. They have done this not by developing new machinery specifically for the new material but by using existing machines—presses mostly—and adapting them to their needs.

The various fabricating methods for reinforced plastics are discussed on the following ten pages. They range from the very simple hand lay-up to the matched-die method—the most advanced process in terms of mechanization. Although each follows a basic procedure, adjustments are always made to meet the specific requirements of a product and the specific conditions within a plant. Special products are often tailor-made; on the other hand, different methods are sometimes used for some identical products, depending on the habits and equipment of the fabricators.

An important consideration in the choice of the method is the expense of manufacturing the mold.

The mold material, the selection of the mold, depends largely upon the production quantity. Plaster or wood can be used if the part is constructed by hand lay-up, and if no more than one or two pieces are needed. Plaster molds have a particularly short life and are used mostly for mock-ups and prototypes. For pilot runs, molds or dies for the molds are sometimes made of reinforced plastic — polyester or epoxy, often with metallic fillers. But for high-volume manufacturing, aluminum or steel dies must be used to produce the plastic parts.

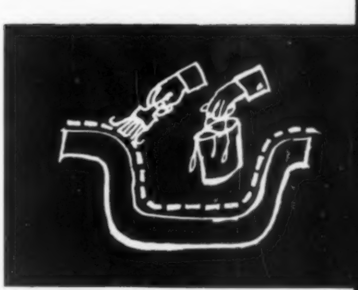
Most of the methods employed today for any volume production fail in the matched-die or bag-molding categories. How these methods differ, the conditions under which they should be used, and the type of products for which each is particularly well suited, are outlined on pages 55, 56, 60. But regardless of the product intended, the choice of method is determined by economy. The matched-die is a more highly mechanized method than any other, consequently the initial outlay for set-up is considerably greater: tooling is costly, and for each new product, equipment must be adjusted—notably the hydraulic presses—to meet the specific material and design requirements. All of this means that the production run must be adequate in volume to absorb the high set-up expense; or other factors, time expediency for one, must justify the initial outlay. There is another qualifying consideration that must be kept in mind when selecting matched-dies as a production means, and that is that the expense of the reinforced plastic material brings a reverse break-even point, beyond which it is no longer economical to mold a product in reinforced plastic.

The type of die used for a product depends on the shape and detail-design requirements of each item, and on quantity. Aluminum dies have been employed for quantities up to 10,000, in the fabrication of safety helmets, office fixtures, aircraft and marine parts, trays. Steel dies have, of course, a longer life, and can yield accurate contouring and close tolerances when used to manufacture such complex reinforced plastic products as pleasure craft, automobile and truck body parts, guided missile parts, furniture, etc.

A quick index to fabrication techniques historically significant, and those most used in volume production today, is given on the next page. The pros and cons of stepped-up mechanization in reinforced plastic product manufacture are further discussed on page 57 (matched-die molding viewed by R. Morrison) and on page 63 (bag molding by I. Scott). The section concludes with a chart on the best production methods for given requirements (page 62), and a guide to the design problems and limitations in selecting both the materials and fabrication methods for reinforced plastic products, details and definitions for designers, page 64.

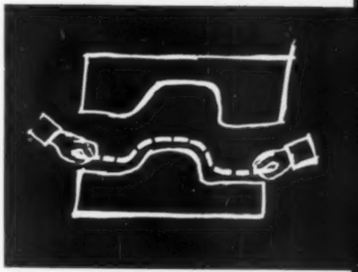
Hand Layup

Suitable for simple shapes in very small quantities. Original method for shaping parts in reinforced plastic; now used very widely for mock-ups and prototypes of volume production parts: boat sections, seating, some housings. Inexpensive plaster or wood molds quickly prepared. Method cannot be used in cases where both inside and outside surfaces of product require accurate contouring. High labor cost for any but very low quantity production. Poor uniformity—no two parts will be exactly alike. Details on page 54.



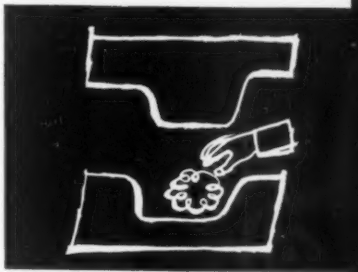
Matched Dies

For volume production large enough in quantity to absorb high costs for tooling, presses and matched metal dies. Two matched-die methods used: preform, and mat. Preform suitable for deep, complex pieces: housings, chairs (Saarinen, page 75), boats; mat best applied for flat parts of simple shape: trays, etc. Preforms manufactured in different ways; fabrication method used depends largely on product size. Good and uniform finish on both surfaces of product. Good reproducibility of dimensions. Details on page 55, 56.



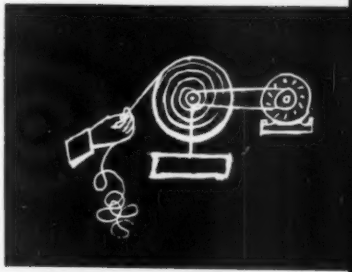
Gunk Method

Used with pre-mix reinforcements. For volume production large enough to absorb set-up costs for tooling, presses, matched metal dies. Good for parts with varying cross-sections in applications where high physical strength is not required. Suitable for small and medium-sized subassembly parts: e.g. in aircraft and automobiles. High production rates at low cost per unit part. Well suited for parts of complex shape where thickness of material can make up for poor physical strength. One of the most mechanized processes in use today. Details on page 58.



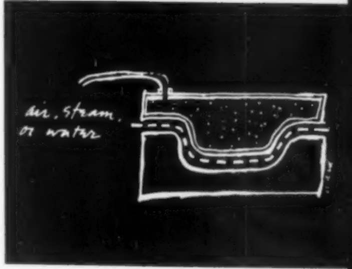
Filament Winding

High-volume production process for specialized parts requiring very light weight and high strength. Restricted in shape to round parts, spheres and cylinders, etc. Used in the manufacture of pressure bottles, pipes, hot water tanks, water softening tanks, etc. High strength due to very high glass content and unidirectional structure of the glass strands in the reinforced plastic body. Efficient manufacturing process but limited in the type of products for which it can be employed. Very little variety in surface contours possible. Details on page 58.



Bag Method

Suitable for medium-sized and big pieces for volume production not large enough to absorb high set-up costs for tooling and equipment of more automatic methods. Generally one male or female metal mold is used. Various pressures, atmospheric or higher, employed to shape materials to mold surface. Higher pressures make for improved physical properties. One surface of the part is somewhat irregular. Suitable for great variety of products including panels, large moldings, truck, car bodies. Details on page 60, 61.



First step in making reinforced plastic body by hand, is shaping the mold. Inexpensive wood and plaster male mold at left served to fabricate experimental car body for joint venture by U.S. Rubber Company and Glasspar Company, in 1952. (Above) roller is used to apply resin to reinforcement built over mold in hand lay-up process.

HAND LAY-UP

This original method of the industry is still in use today where quantity is small and tooling expense is to be kept at a minimum. The method is also known as low-pressure laminating, or contact molding; low pressure is used, and layers of fibers and resin are built up over the mold by hand. The fiber reinforcement, in cloth form or mat, is placed over the mold, usually made of wood or plaster, and the catalyzed resin is applied uniformly by brush or squeegee over the reinforcement saturated with the resin. Cure of the lay-up is effected at room temperature or may be accelerated in an oven. This process is very popular for product mock-ups.

The method has the following *advantages*: inexpensive molds can be made rapidly; minimum amount of equipment is required; very large parts are practical; design changes can be made inexpensively.

Disadvantages: operation is messy; large labor force required for any volume production; poor surfaces; patching and trimming often required; one surface more irregular than other; poor consistency of parts; high resin content makes for generally poor physical properties (strength, dimensional stability).

High labor cost makes hand lay-up process a very low-volume production method. Building up a large body by hand—glass mat is laid up against inside of female production mold, at right—is a clumsy and messy job. Curing can be accelerated to cut down time.

MATCHED-DIE METHODS

This high-volume production technique falls into two categories: matched-die with preform (below); matched-die with mat (next page). Both techniques use matching male and female molds on hydraulic, pneumatic or mechanical presses. A preform is a mixture of fibers and binder shaped on a mesh-metal screen (a type of mold in the shape of the part to be fabricated) in three different ways: plenum chamber, directed fiber method, water slurry method.

With the widely used *plenum chamber*, fibrous glass rovings are fed into a cutter where they are cut to a length between $\frac{1}{2}$ in. and 2 in. The cut fibers fall into the chamber where they are sucked onto a perforated screen as air is exhausted from beneath the screen — which rotates to ensure uniform deposition of glass. Mixed with the binder, the preformed shape is hardened by curing in an oven.

In the *directed fiber method*, the preform screen is situated on an almost vertical turntable, behind which an exhaust fan is installed. The cut fibers are "aimed" at the preform screen with a "gun" which consists of a cutter, a blower and a flexible hose. As the screen revolves on the turntable, an operator directs and controls the fiber flow; the binder is simultaneously sprayed onto the screen from the gun. This method is particularly adaptable for large parts. A production process using this method appears below.

In the least employed of the three, *the water slurry method*, chopped strands of fibrous glass are slurried in water containing cellulosic fibers. The water is exhausted to deposit the fibers on the screen.

The *advantages* for the matched-die methods are: uniform and high physical properties, good tolerance control and surfaces; low reject rate. *Disadvantages*: high cost of molds and equipment.

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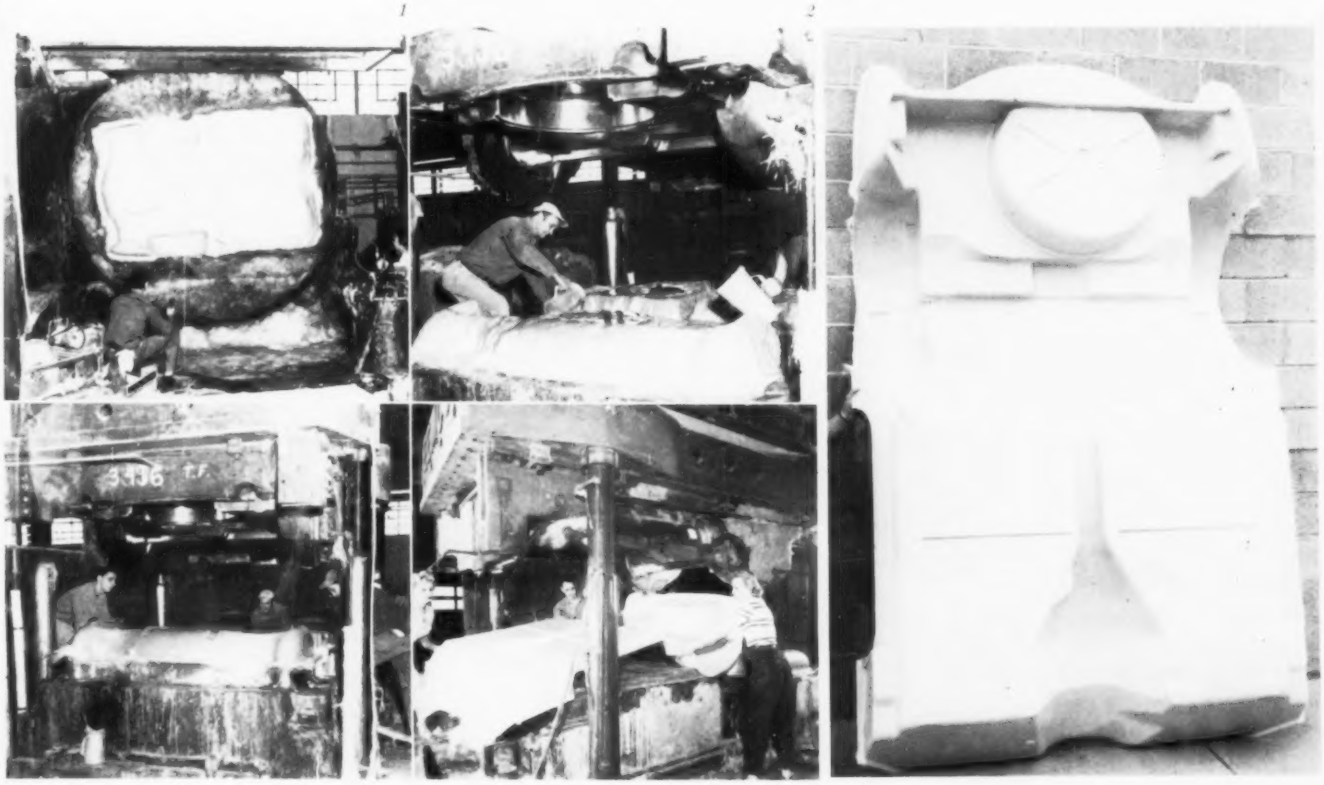

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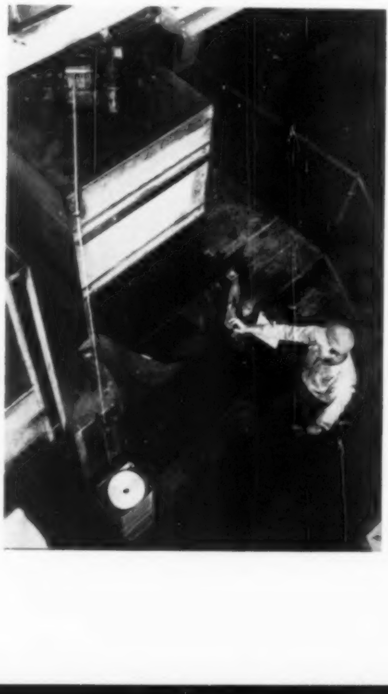
The underbody for the Corvette car was molded with matched-dies by the Molder Fiber Glass Body Company, Ashtabula, Ohio, in the following sequence: 1) the reinforcement is pre-formed on a rotary screen by the direct fiber technique; 2) after curing of preform, resin is poured over reinforcement placed in mold; 3) pressure and heat helped shape the body while matched-dies were closed; 4 & 5) finished underbody is removed and prepared for shipment to Chevrolet.

The plenum chamber method for forming the reinforcement is shown above. Here the fibers are deposited on the screen automatically. Fed from the top, the cut fibers are drawn onto the screen by a vacuum below it.

No preforms are shaped in matched-die method using fibrous mats as reinforcement. At left, mat is placed in press over male mold; resin will be poured before mold is closed and school chair part is formed. Chair molded by Brunswick-Balke-Collender.

The use of mat instead of preformed reinforcements greatly simplifies the matched-die method. It is the most automatic of all processes, but is restricted in its application to very simple parts with little draw. Parts can be shaped in the same presses used with preforms, but the complicated operation of shaping the preform is eliminated. Mats of fibrous glass are placed over the mold, resin is poured, the heated molds are closed. Since the pressure at which the presses are operated is high (50 to 500 psi), the molded parts have a high degree of density; high glass content is due to the mats. Advantages and disadavantages are the same as for the preform matched-die method given on the previous page.

Ivan Brenner of I. G. Brenner Company, developed this automatic rotary preform machine which combines preforming and curing in a single operation.



SPECIALIZATION AND DARING *equal dollars and sense*

Hidden away in northeastern Ohio and the Pennsylvania corridor bordering Lake Erie are the five Molded Fiber Glass companies operated by Robert S. Morrison. They bear the unmistakable marks of the small business enterprise: unimpressive, sometimes ramshackle plant facilities, a rugged shirtsleeve informality, and a dedicated lack of pretense about the business they are in. Morrison, a trim, smallish man in his medium forties, has managed to stamp his fierce competitiveness on the character of all his companies. He is not altruistic about the profit potential for the rest of the industry (as others claim to be); his primary concern is with a profitable present for his five firms. When asked at a recent assemblage of his major executives if all his companies were black ink operations, he glanced around the dinner table and remarked firmly, "They'd better be, or I'll fire somebody."

In the ten years that have made Bob Morrison the largest single molder of reinforced plastics, he has gratingly acted as a conscience for the entire industry, a fact which has hardly endeared him to his competitors. With grudging admiration, however, one of them has called him "... a lumber baron in an industry full of lumberjacks." Morrison strongly believes in specialization of both product and process, so that the molder is not spread thin either economically or technologically. He has never been averse to pointing to his own companies as examples of how a good, profitable reinforced plastics molding operation should be run. Each of the five companies—the Molded Fiber Glass Company, Molded Fiber Glass Body Company, Molded Fiber Glass Tray Company, Molded Fiber Glass Sheet Company, and the Molded Fiber Glass Boat Company—is completely autonomous, with Morrison as the leading stockholder, the binding element. These five companies support a nonprofit sixth concern — the Molded Fiber Glass Research Company (RECO)—which carries out basic research and testing for its five parents on quality control, formulations, and processes without getting directly involved in sales development or in-plant troubleshooting. Morrison is convinced that major profits in reinforced plastics molding cannot be made without such production specialization.

All five Molded Fiber Glass companies are tooled for matched metal die fabrication. At present time, they utilize between 85 and 90 hydraulic presses, up to 30 preform machines (some at the Boat Company with rotary turntables 205" in diameter), and 400,000 square feet of floor space. In 1957, the companies used 5 million pounds of glass and 7½ million pounds of resin for a gross of approximately $8,500,000. Projected figures for 1958 bring the annual gross up to $10 million.

From his perch of success, Morrison has been the industry's severest internal critic. Tired of complaining about resin quality, he anticipates that by the summer of 1959 MFG will be making its own polyesters consistent with the specific demands of each company's product categories. Such risks are nothing new for the Ohio molder. Financed by Owens-Corning, he took on General Motor's Corvette experiment in 1953, and when sports car production was sharply curtailed a year later, started digging successfully for other business in the automotive field. Equipment made idle by the Corvette recession was used to experiment in the small boat market with the result that the Boat Company is today the largest producer of fiber glass boats.

Morrison is completely absorbed in every facet of his companies. "I can't take too much time off from business," he says, "it's too much fun." As chairman of a local civic committee which sought to entice industry to his home in Ashtabula, Ohio, he took over a failing pulp company in the late forties, and ran it for two years without a salary, pouring into this first Molded Fiber Glass company much of the money he had made in ten years as a local Ford dealer. "I've always owned my own business," he says, remembering the golf course he ran during summers at Oberlin College, "and when you have your own money in something, you make it work." Because he has made reinforced plastics molding work, he is intolerant of the inefficiency and ignorance which have dogged fiber glass's youth. As he sums it up, "This is a business with an ever brilliant future, and an ever difficult present."

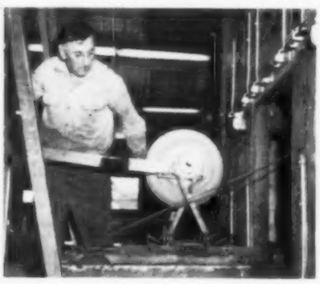
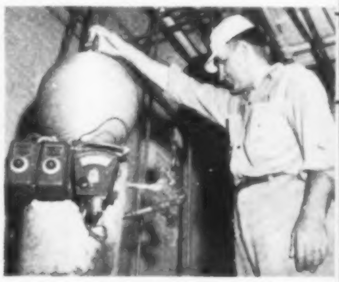
GUNK METHOD

In this method no mat of fibers or any kind of preformed reinforcement is used. Short, chopped fibers are mixed with the resin (hence the commonly used term: pre-mix method) before the mixture goes to the forming presses. The process is very similar to the matched-die method using reinforcing mats. Presses of the same type are used at a similar pressure range. Material is not built up by laminating. As a result this method lends itself to complex and unusual shapes with varying cross-sections. But parts that come off the pre-mix production line can be used only in applications where high physical strength is not essential. Since the fibers must be very short to flow through the resin, they fall into a haphazard arrangement. Consequently, the reinforcing characteristics are considerably weaker than in methods in which the fibers are deliberately arranged to give the parts a strong structural body. But for volume parts where thickness can be substituted for high unit strength, this method is particularly suitable. The process itself is very simple: the operator places a weighed quantity of the pre-mix compound into the mold, closes the press for the curing cycle, then removes the finished parts. The *advantages* here are: good contours; dimensional stability. *Disadvantage*: poor physical strength.

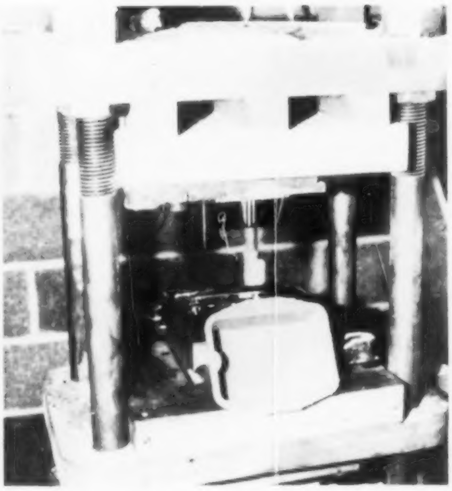
FILAMENT WINDING

High strength and light weight are the principal characteristics of this volume production method. In filament winding, the reinforcement —usually roving impregnated with resin — is wound continuously on a form whose shape corresponds to the *inner* structure of the part to be fabricated. After the resin has been cured, the form may be discarded or it may be used as an integral part of the product. The physical strength of filament-wound parts is very good and variable — the thickness of the parts can be controlled but must be uniform per part. Tensile strength can be unidirectional and exceptionally high (up to 120,000 psi). Since this method produces strong, lightweight parts, it has proven particularly useful for components used in rockets, missiles and aircraft (pressure bottles, rocket engine parts). Commercial pipe, wire wound tanks, and even furniture have also been successfully manufactured by this method when strength-weight ratio is important. Its *advantages*: good corrosion resistance; light weight, high strength. *Disadvantages*: little variety in surface contours; for round parts mostly; no sharp edges. For very large cylindrical parts a similar process, centrifugal molding, is used.



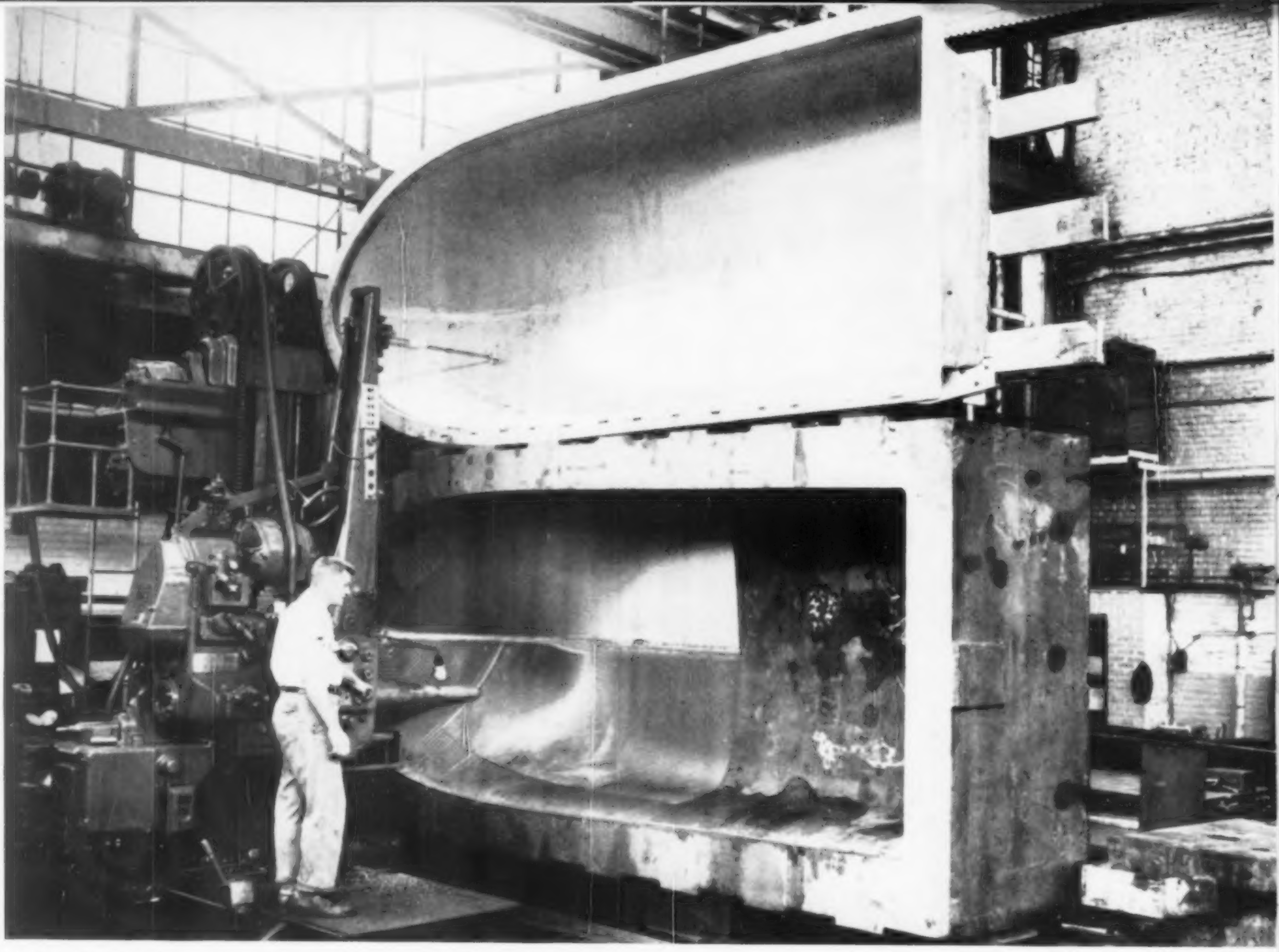
Filament winding of reinforced plastic pressure bottle at Apex Reinforced Plastics Div., White Sewing Machine Corp., Cleveland, starts with covering basic form with rubber gaskets (extreme left). Sealed, the rubber mounting forms interior of bottle. Resin-impregnated fibers are then wound on form (second from left) by pendulum type needle arm. Next, the sphere is placed in an oven, and basic form is melted out (extreme right) before bottle is finished, tested, and shipped.



Gunk molding starts with weighing of pre-mixed compound; amount needed per part is placed in mold, and simple, quick production cycle starts. Picture at right shows finished tray made of pigmented pre-mix at Atlas Powder Company, Wilmington, Del., by gunk molding.

An offshoot of filament winding, and similar to it, is the centrifugal molding process. It assures uniform wall thickness and eliminates all seams. Above, torpedo tube housing molded by Apex Reinforced Plastics. Similar shapes like hot water tanks can be centrifugally molded.

Spheres and round parts such as those shown below are best suited for filament winding production. These parts were made by the Structural Plastics Division of Aerojet-General.



Mechanite mold for pressure bag molding of basic hull of the 1959 Winner 15-foot line reinforced plastic outboards.

BAG METHODS—vacuum and pressure bag

In the bag method, a single mold is used — male or female — on which reinforcements and resin are applied and built up much as in the hand lay-up process. A flexible bag or blanket, of polyvinyl alcohol or rubber is sealed to the mold (or the mold is placed in a flexible envelope) and any gap between the mold surface and the membrane is evacuated. In the vacuum method, atmospheric pressure (14.7 psi) compresses the uncured material; in the pressure method, fluid pressure (usually compressed air) from 20 to 50 psi is applied against the bag. After the vacuum has been drawn or pressure has been applied, the parts are cured by ovens or with heated molds.

This method put reinforced plastic parts into volume production for the first time. Uniform parts with high glass content can be turned out with a minimum investment for molds and equipment. Presses are not used, extreme precision cannot be obtained, and consequently the method is best applied for large-sized parts where tolerances are not critical. The choice of pressure versus vacuum depends largely on the desired physical properties. Because of its greater pressure, the pressure technique yields greater physical strength and higher consistency of parts. The *advantages* for both methods are: moderate tooling and unit labor costs; uniform physical properties; part uniformity. *Disadvantages*: one surface irregular; messy process, moderate volumes.

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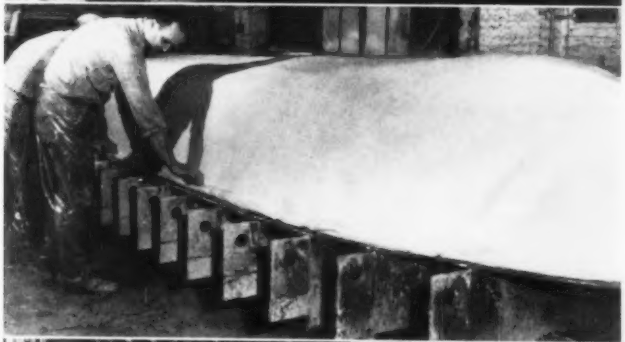

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Forming a reinforced plastic boat hull by the pressure bag method at Winner Manufacturing Company, Trenton, N. J., starts with: 1) *A mat of reinforcement is placed over bladder, which serves as the form for the inside of the hull. Before reinforcement is applied, bladder is covered with polyvinyl alcohol parting film to prevent sticking of laminate to form.* 2) *To strengthen specific hull areas, extra layers of mat are applied.* 3) *Resin is sprayed onto each layer of mat.* 4) *Final "tailoring" of mat before last coat of resin is applied.* 5) *Completed lay-up is rolled under mold; next, bladder is inflated to force lay-up tightly against mold.* 6) *Hull is removed from mold after curing under heat and pressure. Pressures higher than vacuum are applied when greater degree of surface smoothness is required.*

The proper selection of manufacturing methods *is determined by a number of basic factors. Fabricators are often limited in the methods they use by the type of equipment at their disposal. But ideally, size, shape and quantity of a product should dictate the method designers keep in mind and fabricators employ.*

	Equipment cost (includes tooling)	Volume	Unit cost	Size	Shape	Surface	Physical strength	Dimension tolerance
Hand lay-up	*low*	*low*	*high*	*all (large mostly)*	*simple*	*poor (one irregular)*	*poor*	*poor*
Matched-die methods:								
preform	*high*	*high*	*low*	*all (medium mostly)*	*complex*	*excellent*	*good*	*good*
mat	*medium*	*high*	*low*	*all (medium mostly)*	*simple*	*excellent*	*good*	*good*
Gunk method	*medium*	*high*	*low*	*small*	*complex*	*good*	*poor*	*good*
Filament winding	*medium*	*medium*	*low*	*small*	*simple (round)*	*good*	*excellent*	*good*
Bag methods:								
vacuum	*medium*	*medium*	*low*	*large*	*all*	*fair (one surface irregular)*	*fair*	*fair*
pressure	*medium*	*medium*	*low*	*large*	*all*	*good (one surface irregular)*	*good*	*good*

VERSATILITY AND VARIABLES GUIDE THIS MOLDER'S OPERATION

"The key word in reinforced plastics development and production," contends Isadore M. Scott, president of the Winner Manufacturing Company, "is 'variable'." Scott vigorously recommends that all designers and manufacturers investigating the potential of reinforced plastics consider this fact above everything else. Winner's experience has shown the necessity of coordinating the variegated determinants of volume, form, properties, and economies of production in order to make them work toward the successful application of the material. It maintains its own lab for evaluation and testing, while retaining the services of the Franklin Institute of Philadelphia to carry on basic research and development. These factors, along with utilization of varied production procedures, provide a firm foundation for sound molding.

Winner's production philosophy is certainly not singular in an industry that pontificates far better than it functions. What is unique is the high esteem in which the company is held by the material suppliers in spite of the virtual mystery surrounding its financial operation. Scott and his brother-in-law, Julius Rosenwald II, a vice-president of Winner and a member of the Sears-Roebuck family, bought the company in 1947, having decided after an eight-month search that reinforced plastics was the ideal new industry of the future. Winner is a closed corporation, with a conservative, old-line feeling about the vulgarity of publicizing financial details. Volumes, profit and loss, and growth patterns have never been subject to public examination. But because of its solid background, Winner has been spared the accusations of financial shenanigans with which less savory molders have in the past tainted the industry's reputation. Beyond the intangible of integrity, however, the company has won the respect of the resin and glass companies for its versatility.

Winner offers flexible production facilities equipped to produce in any one of five major fabricating methods: hand layup, vacuum injection, pressure or vacuum bag, and matched die. With such a variety of facilities, Winner can afford to approach individual problems on their specific merits, unlimited by the volume prerequisites of a single method. This adaptability permits a greater interdependence of the variables in either developing new products or replacing other materials in existing products. Thus Winner was capable of molding the eight structural els of the Monsanto experimental house of the future without hindering the higher production effort required for such items as chair frames or one-piece instrument covers.

There is necessarily a certain anonymity about a molder's products unless he has developed a line of proprietary items. Winner's public personality has been made with its bag-molded fiber glass boats, which range in size from 12 to 19 feet, and include special-purpose boats for water skiing and fishing. In 1957, 35 million people spent nearly 2 billion dollars on all phases of boating, including the purchase of 55,000 reinforced plastic outboard boats. Why plastic boats?

"People are sports-shirt conscious," claims Scott, a blocky, Phi Beta Kappa from West Virginia University. "The leisure ethic has become a way of life. Plastic boats just contribute to the pattern." With the first hint of spring, the boat is in the water with no time lost for caulking, painting, or scraping. Though old salts may view this abhorrence of the beauty of maritime labor as sacrilege, the leisure rationale is that a boat's place is on the water, not in drydock. From such an argument an industry was born.

Scott joined Winner in 1947 after wartime service in Africa, Italy, and Austria where he won the Legion of Merit, Silver Star, Bronze Star, and Purple Heart. He has a B.A. and an M.A from West Virginia University and a law degree from Washington & Lee.

Details and definitions for designers, an abbreviated dictionary

Consider using reinforced plastics for new products where the following characteristics of the material bear particular importance:

1) Corrosion resistance
2) Good heat, electrical and sound insulation properties
3) High strength/weight ratio
4) Low payload costs
5) Shape difficult or costly to produce in metal
6) High impact strength
7) Impregnated color

If on the basis of any of these material properties reinforced plastics has been decided upon, these are some fabrication problems designers should bear in mind:

1) Single-piece molds most desirable. Several molds or panels can be assembled into a single body with: fasteners; adhesive bonding (mostly epoxies).
   Fasteners can be attached by:
   a) drilling. Accurately located holes on side-walls of a mold are difficult to mold, therefore drilling is recommended where precision is required. *Do not* drill parallel to plies of a laminate. Lubricants and coolants are recommended.
   b) tappings. Should be avoided. For light duty, self-tapping screws are satisfactory.
   c) nut and bolt assembly is recommended wherever this fastening method is possible.

   Stamping, punching, blanking are possible with reinforced synthetic. Ability to get clean-cut edges in punched or blanked parts is largely dependent on the die condition and the glass loading. With good dies and medium glass content, the following relationship holds true in most cases:

   up to 3/32 inch thick—sharp edges
   up to 5/32 inch thick—well defined edges
   up to 1/4 inch thick—acceptable edges.
2) Allow generous radii wherever possible at intersections of planes or contour changes. Minimum inside radius for bag molding is 1/2 inch, for matched-die molding 1/8 inch.
3) Permit as much draft angle as possible. Minimum draft angle for bag molding is 5°, for matched-die molded parts minimum is 1°.
4) Design for constant wall thickness wherever this is possible.
5) Permit section changes to be gradual.
6) Generally allow reasonable tolerances.
7) Avoid undercuts or backdraft. For bag molding undercuts are possible, but with matched-die molding undercuts must be avoided.

Definitions

Binder . . . a bonding agent for mats or preform.

Catalyst . . . a substance which affects the rate of a chemical reaction and which may be recovered practically unchanged at the end of the reaction.

Cooling fixture . . . a device upon which an article is placed after molding to control shrinkage during cooling.

Curing . . . the process during which polymerization takes place, binding each of the main elements.

Filament . . . an individual rod of glass of sufficiently small diameter to be flexible, and of indefinite length.

Lay-up . . . the reinforcing material placed in position on the mold. Also, the resin-impregnated reinforcement.

Monomer . . . a simple molecule which is capable of reacting with like or unlike molecules to form polymers.

Polymerization . . . a chemical reaction in which the molecules of the monomer are linked together to form high molecular weight components.

Pre-compounded . . . pre-loaded with a specially designed resin to give specific properties.

Pre-form . . . the process whereby cut strands of roving are drawn by suction onto a shaped screen, sprayed with a binder, and cured in an oven. Also the article formed by this process. Done automatically and manually.

Pre-loaded . . . containing or combined with the full complement of resin before molding.

Pre-mix . . . pre-loaded strands in bulk or moulding compounds form, made with standard resins, usually on simple equipment. Commonly called gunk molding.

Pre-preg . . . pre-loaded mat or fabric.

Rod stock . . . glass and resin combined to give greatest strength in the longitudinal direction.

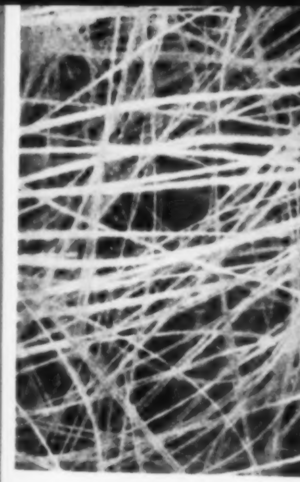
Spray-up process . . . resin and reinforcements sprayed simultaneously onto a mold or surface from a spray gun developed by the Rand Corporation.

Strand . . . the continuous bundle of continuous filaments gathered together in the forming operation.

Yarn . . . one strand which has been twisted, or two or more twisted strands which have been plied.

THE PRODUCTS

Materials and molding technology are means to an end. In the twenty year history of reinforced plastics, there have been an imposing number of ends, or products — many well-conceived, and many well-executed. From these products, experience with the material has grown, and precedents set from which to build and improve upon its capabilities. The potential of reinforced plastics has just been tapped. The following pages show some products which have tried to realize this potential.



TRANSPORTATION: STRONG, LIGHT BODIES CUT MAINTENANCE

Large, 31-foot stock cruiser at left illustrates the full extent of reinforced plastic use in boat construction. Not only the body but refrigerator, tanks and sink are made of fiber glass-reinforced plastic. Boat built by Skagit Plastics, Inc.

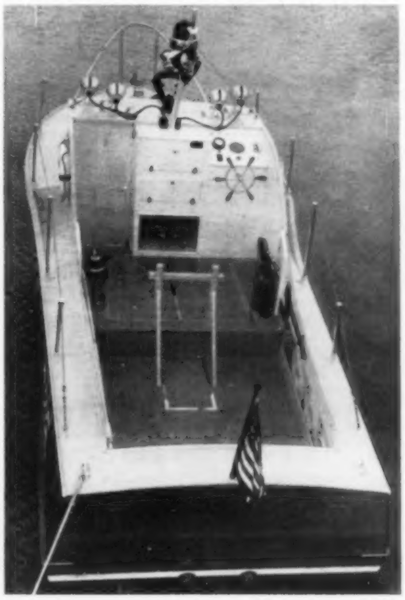
Fiber glass-reinforced hull of 28-foot tugboat above, permits craft to lie on mud flats at low tide; solvent-resistant properties of material prevent damage. Molders: Skagit Plastics, Inc., La Conner, Wash.

One way or another, reinforced plastic is being applied to the manufacture of some equipment in all the transportation categories, and is becoming increasingly popular as a structural material for boats, cars, trucks, and even small planes; in railroads it is as yet largely limited to passenger equipment. The reasons for its use in these products are the same, regardless of category. Seamless construction, one-piece moldings, flowing lines, compound curvatures—these mean a new set of properties and a new kind of freedom for the designer. For the manufacturer, use of the new material brings, above all, a vastly reduced tooling cost where moderate production quantities are involved; and for the consumer, the fact that he need hardly worry about periodic overhauling is no doubt the most attractive of the material's advantages.

The benefit of reduced maintenance is perhaps most evident in boats. T. S. Eliot's line, "The garboard strake leaks, the seams need caulking" could in no way refer to a boat made of the new material, which is not affected by acids, salts or bacteria. In water, be it sea or lake, the man-made material does not rot, rust, shrink or collect barnacles; the owner of a reinforced plastic outboard, sailboat, or cabin cruiser does not have to scrape, recaulk or paint to make his boat sea- and lakeworthy.

The fact that the material cannot yet fully meet the many specifications for strength, resonance, etc. set forth by the Interstate Commerce Commission has prevented a widespread application of reinforced plastics as a construction material for railway cars. But it is being used to mold large sections of cars, for seating, bed boxes, panels, etc. Some of these applications are illustrated on the following page.

The reinforced synthetic is also used in part construction for sections where light weight and high strength are desired. In the Coast Guard cutter at right, the hull is made of wood, but the entire superstructure is reinforced plastic.



Boat hulls are generally a single-piece mold. They are made by hand lay-up or in a pressure bag; matched-dies are sometimes used. The small outboard hulls below, at various stages of construction, are molded at Anchorage Plastics, Inc.

Steel-ribbed frame of the monorail coach above, in operation in Houston, Texas, is covered with reinforced plastic. The shell was constructed in sections by Consolidated General Products.

The Budd Company has used reinforced plastics for the hood and cab roof of the "Roger Williams" above, for seats and restrooms in the "Pioneer III" shown below.

Washrooms in the "Pioneer III" are molded of fiber glass-reinforced plastic in one large piece that includes walls, window frame and wash basin enclosures. Mold provides for quick assembly of all accessories, piping and wiring.

Body and canopy of mail delivery scooter, the Cushman "Mailster," was molded with glass-reinforced Celanese polyester resin. Appearance, sturdiness and moderate cost are main features of plastic "Mailster." Built by Molded Fiberglass Body Company.

In cars, trucks and trailers, the high strength-to-weight ratio—certainly one of the principal advantages of reinforced plastic—coupled with ease of manufacture, has in most cases resulted in improved economy. The payload capacity of commercial carriers is considerably improved, due to the lightweight material. In cars, the lowered cost factor is primarily due to the low manufacturing expense for quantities of under 15,000, these in addition to the design flexibility, have been the main arguing points for a greater use of reinforced plastic in this transportation group. Cut-down maintenance is also a consideration in favor of the new material in this product category. The material's ability to resist weather and most solvents has obvious advantages in trucks. Construction in this transportation category is mostly determined by size and shape, and falls roughly into three groups: flat panels assembled into bodies; bodies made of several molded sections; those made out of single molded pieces. Examples of each category are shown on these two pages.

All-plastic body of United Parcel Service delivery truck is made up of 22 parts molded separately by the vacuum bag technique. Use of plastic meant 60% saving in weight. Manufactured by Lunn Laminates, Inc., Huntington, N. Y.

Chassis and underbody of Renault's sports car "The Rogue," were molded separately, then assembled. Celanese Marco Resins were used exclusively for the lightweight, weather resistant body. One of the early all plastic body cars.

Refrigerated cargo unit Convert-A-Frate was made of reinforced plastic panels assembled as a box car. Made by Minnesota Mining and Manufacturing Company.

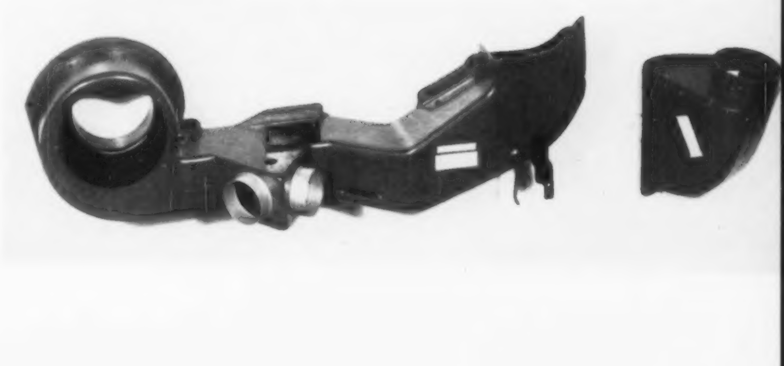
Main advantages of reinforced plastic United Parcel Service truck made by Lunn Laminates are increased payload and reduced maintenance. The pieces are riveted to give the appearance of a one-piece assembly.

Panel construction is used in this trailer body for the Celanese Corporation. Translucent panel makes it possible to read large type on packing cases stowed against inner sides of van. Made of reinforced Celanese polyester by Alsynite Company of America.

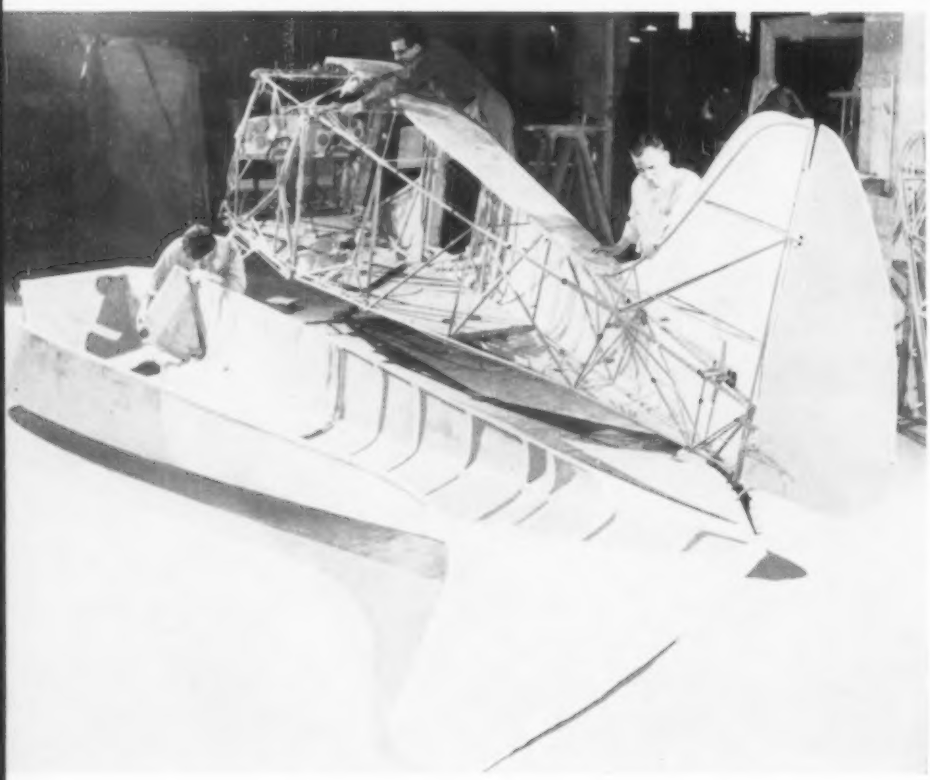
The new reinforced material has also found a market in trailer construction. The reasons for using it in this application are: light weight, good weather resistance, and low maintenance. Odyssey Trailer Company.

Heil's Frigid-Lite plastic transport tanks (above) for bulk milk transportation are molded in one piece. The plastic's high heat resistance is an added advantage in this application. Made by Heil Company, Milwaukee.

Automotive subassemblies, right, are often reinforced with sisal, a fiber much less expensive than the usual glass fibers. Sisal can only be applied in parts for which high tensile strength is not required. Complex shapes like this subassembly are molded by the gunk method. Made by Woodall Industries, Detroit.



Wings as well as body of Taylorcraft are a product of reinforced plastics. Made by Taylorcraft Inc., Conway, Pennsylvania. Richard Arbit, designer.



Plastic fuselage is made in two halves. Joined by an extruded, riveted splice-strip, the reinforced plastic fuselage surrounds the "bridge-type" craft frame.

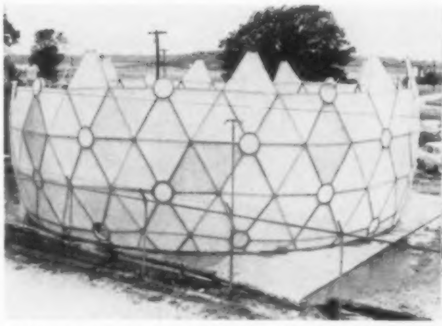
Doors of the Taylorcraft model are also made of the reinforced material. Each door consists of two moldings, the outside frame, and the inner lining. The armrest is part of the inner lining; single mold fits inside frame, facilitates assembly.

The fields of aviation and ballistic missiles holds great promise for the new structural material not only because of a high application potential but because of extensive research. In these fields where nothing can be left to chance, more is being done to define the behavior of the plastic under varying climatic conditions than in any other reinforced plastic product group. Under the aegis of the government, some of the large molders are exploring the insulation properties of the synthetic, its reaction to high temperature, etc. The heat properties of the material are a vast improvement over aluminum. At 1000 degrees, for example, the metal may lose as much as ninety per cent of its strength; plastic will drop no more than twenty to forty per cent. These characteristics make the reinforced material a "natural" for re-entry nose cones on ballistic missiles, and, in addition to light weight, provide greater durability and shock resistance on all types of aircraft. To date, reinforced plastic sandwich panels are used for bulkheads, floors, small bodies, etc.

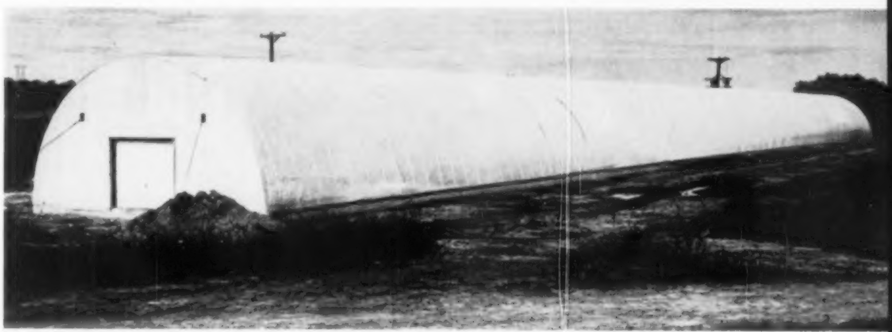
CONSTRUCTION: THE FUTURE IS TODAY

"Reinforced plastics is destined to be an enormously important building material," predicts Henry Dreyfuss, because ". . . nature isn't rectangular." Architectural form has been dictated by such building materials as bricks, boards, and beams — which suggest not only rectangular shells, but rectangular subdivisions within the shell. The structural synthetics permit softer forms, which are more in harmony with nature and which make better use of limited space. The prime example of this concept is the Monsanto house (bottom left) which allows gracious living in a comparatively small area. Dreyfuss goes on to say, "I think we may find ourselves forced to take a more flexible view of the function of a building. Why not design a house that expands and contracts with our space needs?" The contemporary housing ethic forces families to move into larger or smaller domiciles according to the fluctuation of family size and family income. Molded houses would permit adding or subtracting prefabricated units to the basic structure. "Think," Dreyfuss says, "what this concept would do for growing businesses that need new plant or office facilities."

Unfortunately the growth of reinforced plastic housing does not depend on forward-thinking designers. Materials must be modified in regard to fire resistance and strength to pass the stringent tests set by building codes for all new materials used in construction. But getting codes changed is such a frustrating venture into local politics that one major oil company recently shelved plans for a nationwide network of molded structures, rather than be stymied by years of litigation.

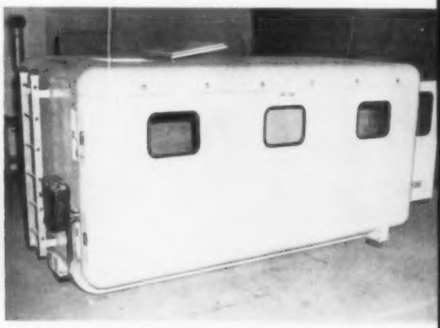


A four-story high geodesic sphere designed by Buckminster Fuller and molded by Lunn Laminates. It is 55' in diameter and will be used as a military shelter.



A 340' x 30' giant air-supported building built by the G. T. Schjeldahl Company from polyester resin reinforced by a grid of nylon fibers which prevents tearing.

The Monsanto House of the Future molded by the Winner Manufacturing Company, Trenton, N. J. It can be seen at Disneyland.

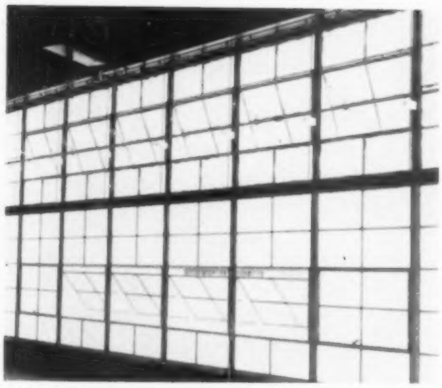


Reinforced epoxy portable shelter built for the Canadian army from Shell's Epon resin and glass mat.

Corrugated canopy at Detroit's Willow Run Air Terminal. Molded by Structoglas Division, International Molded Plastics.

Honeycombed curtain wall by Russell Reinforced Plastics Co.

Translucent Buffalo, N. Y. garage wall of shatterproof fiber glass made by Alsynite Company.



Tinted Rohm & Haas acrylic glazing from Structoglas eliminated glare in this plant.

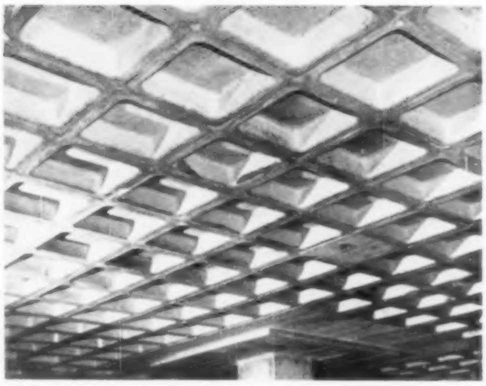
Postage stand made from fiber glass reinforced panels was shown at Brussels Fair.

75,000 square feet of fiber glass Alsynite panels clothe this Florida greenhouse roof.

Up to 1958, flat and corrugated sheet was by far the largest sustainer of the reinforced plastics industry. Panel manufacturers revealed in a study conducted by the Reinforced Plastics Division of the SPI that between 45 and 50 million feet of panelling had been sold in 1957. Considerably more than half this total went to industry, institutions, and business for glazing, skylights, and partitions. The remainder was used in such residential applications as patio and car port roofs, fencing, and decorative screens.

Research and test programs have recently been authorized by the Fiberglass Reinforced Panel Council to establish technical and commercial standards for panelling. New materials, such as Du Pont's 100 per cent acrylic, are expected to show increased weatherability for additional volumes in out-of-door applications, such as signs and street light reflectors, extending the already booming construction panel market.

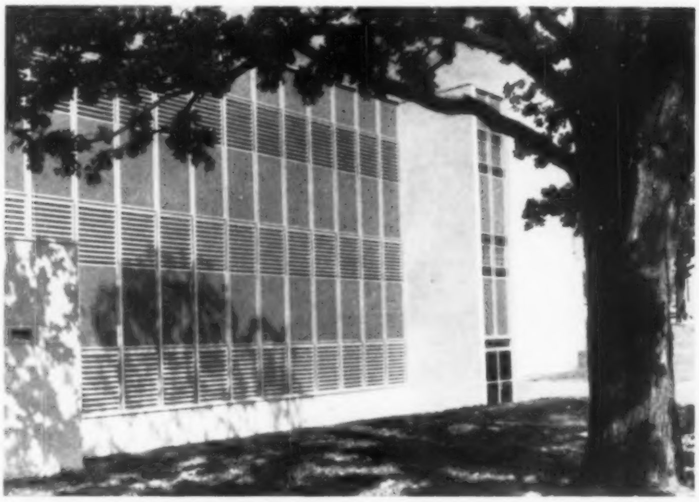
Until large-scale structural application using reinforced plastics are proved feasible, the material will continue to be tested in countless load-bearing construction areas. These uses, while giving promise of substantial future volume, represent but a negligible fraction of the 25 million pounds of reinforced plastics going into the construction market. But reinforced plastic curtain walls, waffle pans, and ceiling tiles allow extensive experimentation into what has been predicted as the largest single consumer of the material, the architectural market.



Reinforced plastics forming pans from Protective Plastic, Ltd. were used to form this concrete roof.

Weatherproof fiber glass skylights made from Celanese Corporation's Marco resin.

Stained glass effect given front wall of this church by multi-colored sandwich panels from Kalwall Corp.



Plastic faced concrete blocks, sandwich wall panels & acrylic windows at Monsanto Research Laboratory.

SEATING: FORM INTERRELATED WITH DURABILITY

A designer who wished to rid the home of "its slum of legs," a client responsible for balancing economics and esthetics, and a molder willing to work within the restricting limits of compatibility with manufacturer: these were the essentials behind the introduction of Eero Saarinen's pedestal chair which was molded for Knoll Associates by the Winner Manufacturing Company in 1957. Saarinen conceived the idea for his chair five years ago with a desire to "make the chair all one thing again. All the great furniture of the past has always been a structural total." But working within the framework of reinforced plastic molded shells with all their contour possibilities, most designers treated legs as a separate entity divorced from the form of the seat itself. "Legs became a sort of metal plumbing," Saarinen says. "Modern chairs with shell shapes and cages of little sticks below mix different kinds of structures. The pedestal chair tries to bring unity of line."

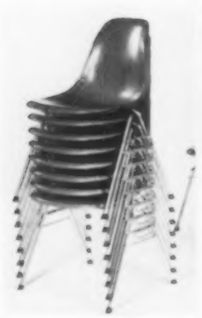
After considering the problems surrounding the basic idea of the chair, Knoll sent designer Don Pettit to Saarinen's headquarters in Bloomfield Hills, Michigan to assist the Saarinen organization in the development of drawings, models, and prototypes. Pettit was to spend the next two years in Michigan overseeing the project for Saarinen who, because of his architectural obligations, could not afford to devote his full time to the execution of the plan.

Meanwhile Winner was investigating finishes, colors, tooling and manufacturing costs, and the optimum combinations of materials to duplicate the master models provided by Saarinen for construction of the plastic prototypes. These prototypes were put through a series of "torture tests" at the Knoll testing station that went far beyond actual usage conditions in order to assure the durability of the chairs. From this, and through each succeeding phase of production, Knoll and Winner worked in closest collaboration. Knoll engineers set up shop in the Winner press room, supervising and suggesting improvements in the production process.

Steel, rather than aluminum, dies were chosen by Knoll in spite of their much higher cost because of their superior shear strength and dimensional stability. Dies were made, then returned for re-work to get more precise tolerances. Predictions that a perfect shell would be produced four weeks after the installation of dies went for naught as nearly four months dragged by with constant double checking of materials, temperatures, and pressures before a uniform quality shell could go into volume production.

The Saarinen - Knoll - Winner experience emphasizes the close coordination which the youth and inadequate precedents of reinforced plastics make necessary for the production of quality items.

Eero Saarinen, Florence Knoll, and the pedestal furniture. Above, prototype plaster molds.

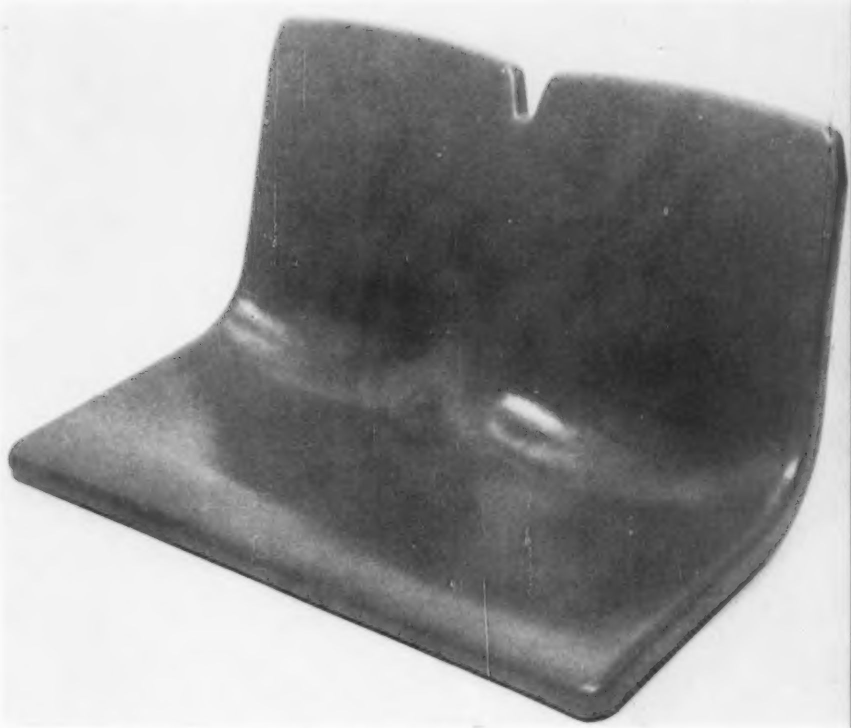

Three reinforced plastics chairs by Charles Eames (right and center) and Eero Saarinen (left). Both designers used the material in deference to reinforced plastics unknown molding limits which gave them greater design flexibility in achieving the final shape of the chairs.

Vandal-proof school desk and chair designed by Jon Hauser for Hawley Products from molded reinforced cellulose fibers.

Because reinforced plastics allows great latitude in designing comfortable contoured shapes with integral strength, color, and finish, it has been a natural material for both institutional and household furniture. Its durability makes it vandal proof in such applications as bus seating and classroom desk chairs where maintenance and replacement are key problems. In a more esthetic context, designers like Charles Eames and Eero Saarinen (above left) have utilized the potential of reinforced plastics by molding shapes which widen the comprehension of the material's ultimate formability.

The problems of expanding the markets for fiber glass furniture are primarily technical. Finishes which do not wear have yet to be perfected on a large scale, and at present, improved finishes generally mean added cost on top of a high material cost. This problem has absorbed the attention of the glass suppliers who see its solution as a major breakthrough to high volume production of reinforced plastic furniture.

Molded fiber glass chair designed by George Nelson and Company, Inc., for Herman Miller.



Maintenance-free bus seating from the Molded Fiber Glass Company for American Seating Co.

Filament wound reinforced plastic chair from Otto Molla Company.

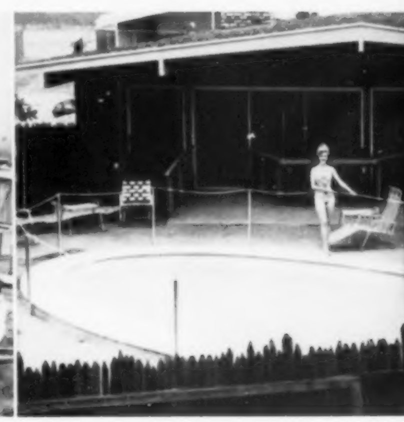
Dave Chapman, Inc. designed cafeteria for Brunswick-Balke-Collender

Protective plastic baseball cap worn by Joe Adcock, molded by Specht Plastics.

HOUSINGS THAT ENCLOSE AND CONTAIN

High strength and light weight make reinforced plastics particularly effective for housings. The hitting hero of the Milwaukee Braves, Joe Adcock (above), wears a reinforced plastic cap to protect him from beanballs; delicate instruments are carefully cradled in glass reinforced plastic carrying cases, which are not excessively heavy. Swimming pools molded of reinforced plastics looked very promising when they were first introduced. Their acceptance has not, however, been enthusiastic, a setback attributable more to inferior installation than to the material itself. Bathtubs, another large potential market, are being used in trailers because they are light, but they are a long way from wide acceptance for home bathrooms. One of the main objections is that many cleaning abrasives tend to roughen the surface, spoil appearance.

Paddock pool is molded in four large sections using Naugatuck Vibrin polyester. Sections are bolted together and lowered into hole dug in the ground.

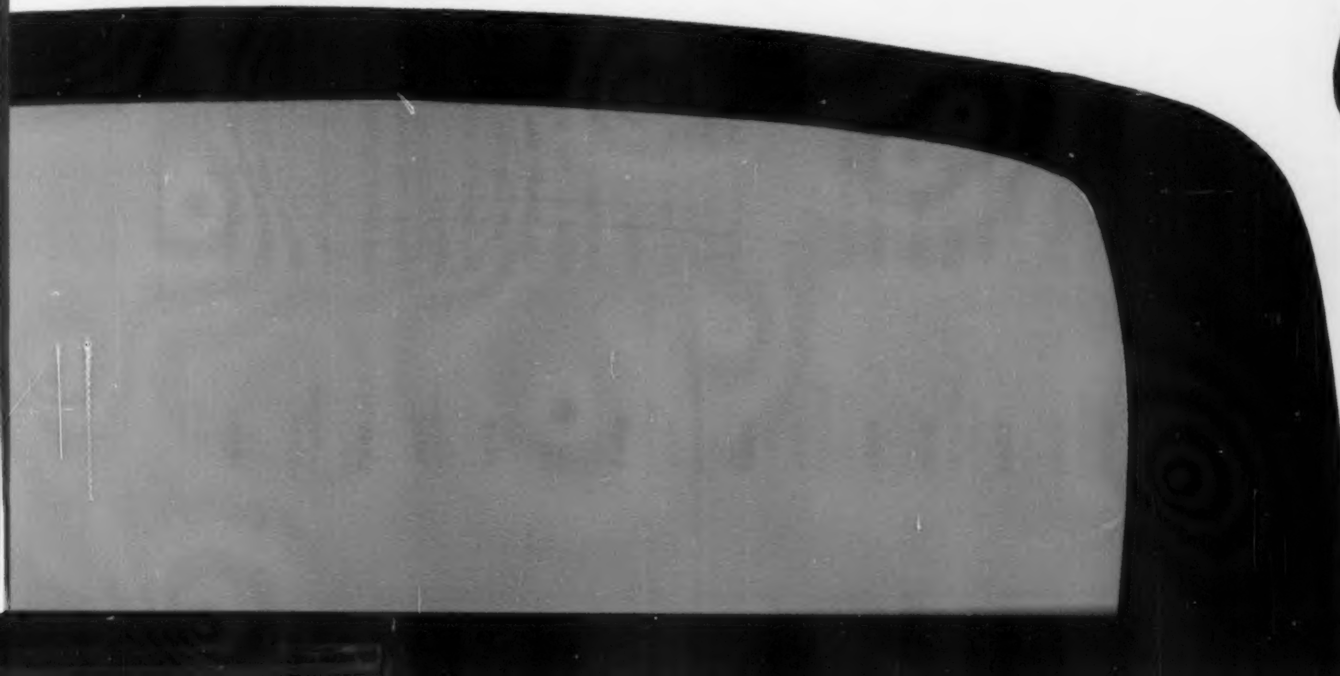


Inexpensive and light soundproof booth molded by Protective Plastics Ltd. and designed by Design Craft Ltd., both of Toronto, Canada.

Carl A. Strand, president of Strandglas, gives one of his 17-pound tubs a dry run. Designed for trailers, the tubs can be used in motels, cabins and cottages.

Evinrude outboard engine was designed by Brooks Stevens and molded by Outboard Marine Company

FORM *also follows material, and while any new material is likely to go through a painful period of esthetic misstatement, products of its early years often reveal an indigenous form. On these pages are silhouettes of reinforced plastic products shown elsewhere in this article. Their softer contours support the dictum that a material's appropriate form can never come from the material it replaces, but comes always from within itself.*



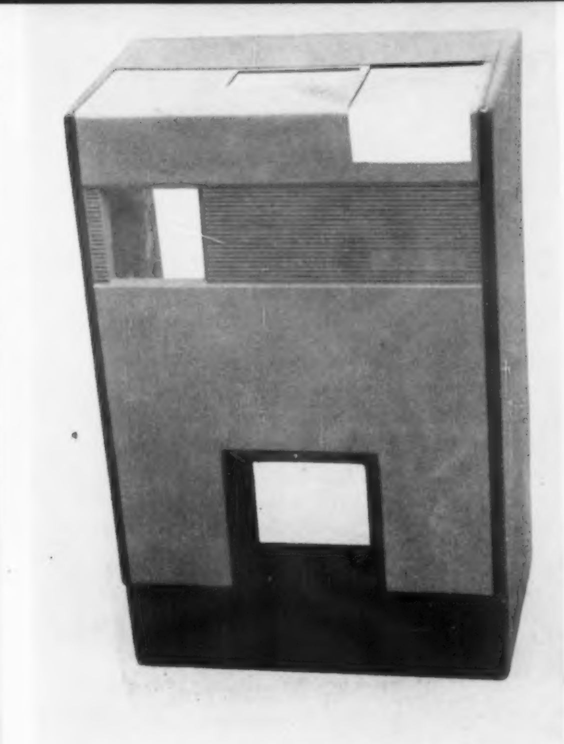
CHRONICLE OF A YOUNG INDUSTRY

YEAR	MATERIALS	FABRICATION	PRODUCTS
1941	Resin research leads up to:		**Large structures not previously practical became feasible**
1942 *1,000,000* *	**First commercial production of polyester resins**	**Low pressure molding introduced** Contact pressure molding possible	All products military including: radomes protective clothing electronic components fuel tank liners
1943 *1,500,000*	New resins with low pressure hardening properties		
1944 *2,225,000*	New styrene resin Glass fibers with very small filament diameter	**Low pressure bag molding introduced**	Industry searched for a civilian market when military orders plummeted **boat hulls introduced by Winner**
1945 *3,500,000*			experimental car body produced under Owens-Corning sponsorship
1946 *1,500,000*	Post war experimental period material developed rapidly under wartime pressure proven out in the laboratory		New civilian products made: **fishing rods** fishing boats trays
1947 *800,000*	**Tests with premix compounds at Bakelite**	Preforming developed	**Eames chair pioneered the seating market** Reinforced plastic panelling introduced
1948 *1,800,000*		**First substantial use of matched metal dies. Fiber glass mat used as the reinforcement.**	Low-cost one-piece chair by American Transportation
1949 *4,500,000*	**Resin with shorter curing cycles introduced** Resin with a complete cure cycle of 5 to 10		Peacetime uses expand rapidly — applications both good and bad boats become familiar

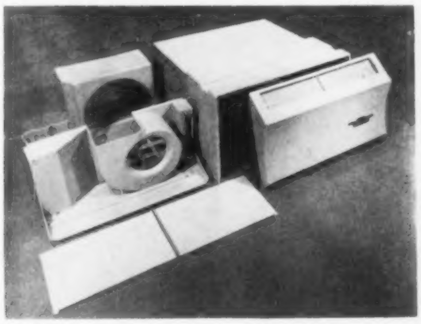
1949	*4,500,000*	**Resin with shorter curing cycles introduced** Resin with a complete cure cycle of 5 to 10 seconds for a ⅛ inch section		Peacetime uses expand rapidly — applications both good and bad boats become familiar transportation field expanding: end sections and kick plates for railroad seats
1950	*8,500,000*		**Gunk molding began to be used in volume.**	
1951	*14,000,000*	New alkyd resins introduced that are tasteless, odorless, have good electrical properties, high heat distortion points, good dimensional stability. Enamels easily applied for finishing.	Automatic preform machines developed by Ivan Brenner	Products began to take greater advantage of material: **washing machine tubs** **mower housings** **skylight panels** polyester chair (Herman Miller, molded by Zenith) won Museum of Modern Art low-cost furniture competition. refrigerator door linings
1952	*19,000,000*	U. S. Rubber introduced Vibrin X-1047 resin with added strength and high temperature resistance **General purposes resins introduced by American Cyanamid**		Airplane parts Chemical resistant products
1953	*26,000,000*	**Strength, corrosion resistance, and electrical properties of resins improved**	Progress in molding techniques for mass-production of electrical components	Electronic parts in big volume **Corvette bodies produced (10,300)** Reinforced plastics used for metal stamping and for jigs for metal fabrication
1954	*35,000,000*	Low pressure resin with temperature resistance up to 500°F introduced. New materials for reinforced plastic pipe developed.	**Continuous process for molding reinforced plastic panels and sheets.** Automatic preformer developed by Brenner	Reinforced plastic pipe Safety helmets, golf club heads, tote boxes, chemical containers, printed circuits, highway signs, bathtubs, taxi seats,
1955	*52,600,000*	Great deal of activity in the development of new resins for the production of sheets that are light stable, clear, and colorless. Light transmission important.		Milk tank trucks **Skylight, greenhouses, factory windows, patio roofs**
1956	*70,000,000*	Resistance to erosion from outdoor exposure improved. Several new premix compounds introduced to give better surface, greater strength.		Aviation: ducting, wing and fin tips, control surfaces Luggage, instrument cases
1957	*84,000,000*	Great increase in types of epoxy resins available.	New type of press and mold (Sterling Precision Corp.) capable of mass-production of large shapes that are void free.	Automobile tops Swimming pools
1958		Flexible glass fabric reinforceable polyester produced in rolls 150 ft. long. (Conoglas)		Linings for bins, tanks, freezers, trucks, freight cars

* *pounds of resin per year*

Housing for Atlas Speaker has acoustic and protective functions. Fabricated by Molded Fiberglass Co.



Complex, one-piece housing for IBM timeclock made by preform method by Molded Fiberglass Company.



Housing and several components in U. S. Air Conditioning Corp. air conditioners are made of fiber glass reinforced plastics.

Industrial tote boxes are one of the most widespread uses of reinforced plastics. Made by G. B. Lewis Co.

Battery carrying case has container molded with fiber glass mat and a top of premix compound. Molded by Firmline Products, Inc. for Perkin Marine Lamp and Hardware Corporation.

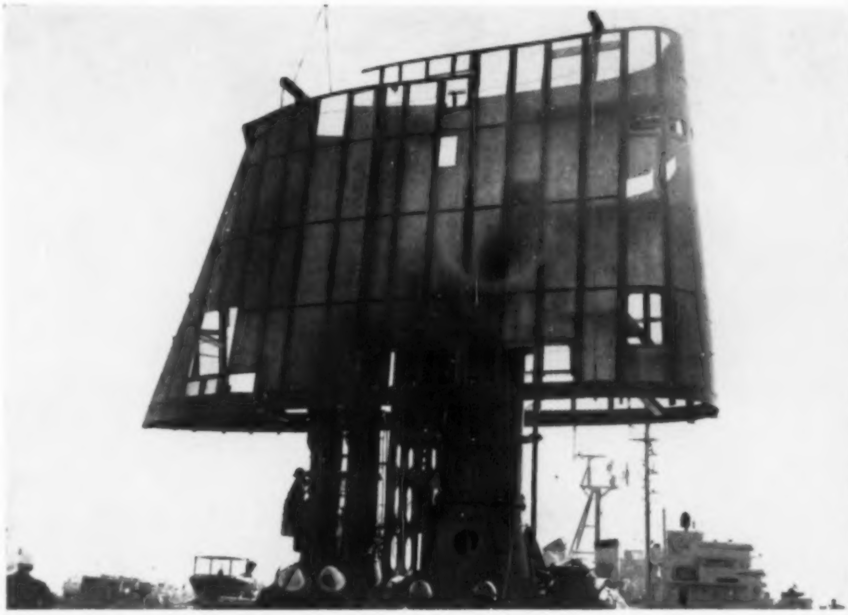
SPECIAL PROPERTIES PROMOTE NEW APPLICATION AREAS

Reinforced plastics underwent its most spectacular endurance test to date as a "sound window" for navigational equipment on the bow of the submarine Nautilus that recently made its heralded trip beneath the polar ice cap. Although details of the application are classified, it can be reported that reinforced plastics offered a unique and necessary combination of qualifications: it is strong enough to stand up under the enormous strain of pushing through icy waters at high speeds, yet it does not inhibit or distort high frequency sonar and radar waves. The latter advantage was the key to the underwater navigational system of the submarine.

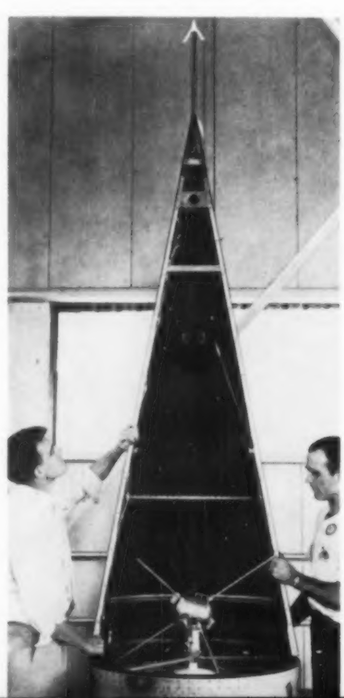
At another extreme, a reinforced plastic, composed of phenolic resin reinforced with asbestos, was used for the nose cone of the Vanguard satellite rocket, a choice of material that was based on light weight, strength, and high temperature resistance. Other technical applications, though less colorful, are equally significant. A great deal of progress has been made in the improvement of the heat, moisture, and chemical resistance of reinforced plastics. These properties open up vast new areas for use in industrial plants as tank liners, chemical filters, or as nozzles for corrosive liquid spray guns.

Electrical stability is another important asset in meeting the ever-increasing demands of the electrical and electronic industries. During World War II, the Navy recognized the value of reinforced plastics for electronic components when they were looking for a strong material with the necessary electrical properties that did not corrode under exposure to salt water, a test that shows many materials to disadvantage. This area has continued to expand and, with the advancement of mass-production methods, which were helped along by premix compounds and gunk molding techniques, is now a field where reinforced plastics is firmly established.

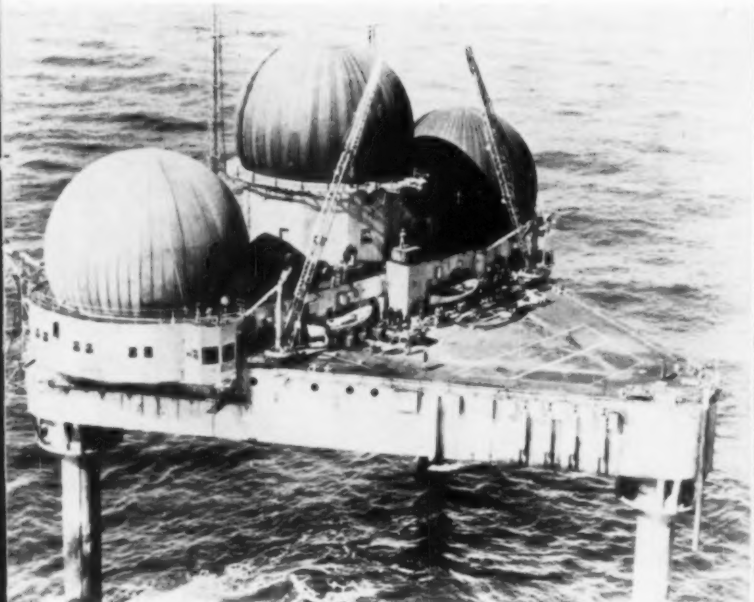
Developments in technical applications, though not in the public eye, are important indications of what might be expected in future consumer products.



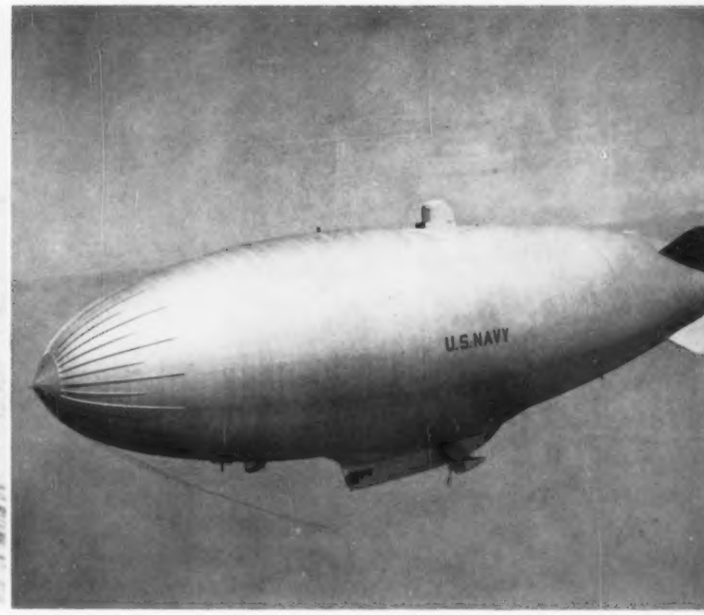
Submarine superstructure (top) protects radar, sonar and radio antennas, cuts down water resistance. "Sound window" on Nautilus is shiny portion of bow (above). Lunn Laminates is the molder of these parts for General Dynamics



Nose cone for satellite carrying Vanguard missile is made of asbestos reinforced phenolic for heat resistance.



Radar antennas on Texas Towers off the East Coast are protected by reinforced plastic domes. These man-made islands are a key part of the nation's early warning defense system.



Navy blimps bristling with reinforced plastic radomes are another link in the defense system. These domes are strong, do not interfere with high frequency waves, yet are light enough for blimps.

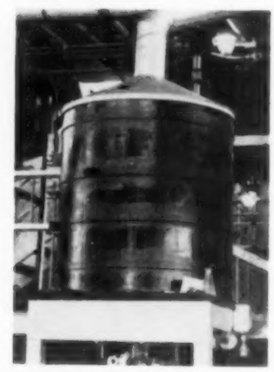
Premix compounds are used for Westinghouse transformer components molded by Carl Zehr Co. to reduce weight and size.

Reinforced plastic handle in Caddy welding electrode holder has excellent heat dissipation properties. Made by Erico Products Inc. using Celanese Marco resin.

Gutters and drainpipes are a promising new field for reinforced plastics. Those shown are made by Permanent Products, Inc. Owens-Corning is the national distributor.

Large fuel carrying tanks are made of fiber glass saturated with American Cyanamid Laminac resin. In addition to chemical resistance, reinforced plastic tanks have 1/3 more capacity than steel tanks of equal weight.

200,000-gallon underground storage tank for formaldehyde constructed of reinforced Laminac showed no signs of deterioration and no contamination of formaldehyde after 9 months of service.

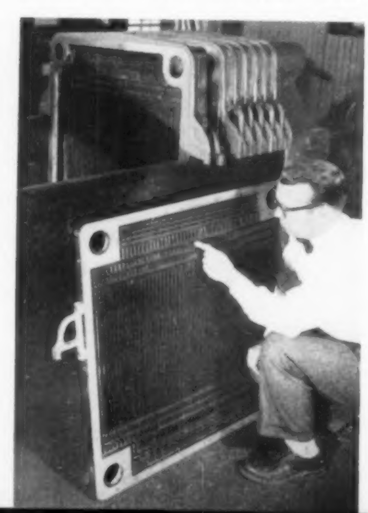


Chemical resistance of reinforced plastics vital for large tanks made by Haveg Industries for use in chemical plants.

Lightweight, corrosion and chemical resistance hold promise for the use of reinforced plastics for piping applications.

Drying tray for corrosive chemical intermediate is molded of American Cyanamid's Laminac polyester and glass fibers.

Filter platemolder from Atlas Thermaflow polyester premix is less expensive, lighter, has better finish and chemical resistance than metal.



POSTSCRIPT . . .

Four months ago, Industrial Design mailed 172 questionnaires to a cross-section of the reinforced plastics industry. A re-examination of the questions and our appraisal of their answers reveals a change in our attitude during the weeks the analysis you have just read simmered and took shape. To quote from an early memo written during a tour of molding facilities around the country: "This industry is sound asleep." But gradually gratuitously-offered opinion and miscellaneous information gave way before fact and considered interpretation. Acute criticism developed into an understanding of the problems of a new industry, and of the pertinent questions about it that begged to be asked. It is true that certain thoughtful segments of the reinforced plastics industry were aware of these areas of concern, but it was an awareness of subjectivity. Both molder and supplier have their individual stake in the future of reinforced plastics; because of this, their criticisms lack the authority of a more unified view. And for our part, there was the danger of over-objectivity, which could become either sympathy or reprehension. What are these questions about the reinforced plastics industry now so obvious after four months? It is reasonable to say that they break down into two groups, those beginning with "why," and those beginning with "how." It is easy for anyone to ask: why the failure of molder-supplier communications? Why no mechanization? Why no standardization? But it is difficult for the reinforced plastics industry to face up to "how" the "why" questions must be answered. "Why" brings justification; "how" brings solution. Only now is the industry accepting the responsibility for ridding itself of its lethargy. The evolution of this material is just beginning; new problems will continuously necessitate more questions which need more answers. Reinforced plastics cannot afford to be as tardy as it has been in meeting their challenge, for it is with these unknown questions that the future of a new industry is either won or lost.

DESIGNS BY SAUL BASS

To the uninitiated eye, the "penny-farthing" bicycle at the left has no rider. But to the millions of eyes reddened by a cinematic process called Todd-AO, the rider is easily identified. He is the Mexican comedian Cantinflas, and the whimsical old vehicle that represents him wheels recklessly through the credits trailer for the motion picture "Around the World in 80 Days." The man who put Cantinflas in his place—or, rather, who put his place in place of him—is one of the most widely acclaimed designers practicing today. His name is Saul Bass.

Last year the National Society of Art Directors named Bass "Art Director of the Year," and the New York Art Directors Club gave him its Gold Medal Award, and the San Francisco Art Directors paid similar tribute. This year the Los Angeles Art Directors honored him with one medal and seven awards. This shower of laurels is not in itself noteworthy, for Bass has in the last decade collected more medals than the early Audie Murphy. What is especially interesting is that, strictly speaking (or, for that matter, loosely speaking), he is not an art director.

He did, however, begin as one. After studying at the Art Students League in New York, Bass worked as an advertising art director there until 1946, when he went to Los Angeles to direct the West Coast art activities of Buchanan & Co. In 1952 he started his own office, choosing to remain in California because he and his biologist wife liked it there. Also, the West Coast offered a chance to do something that had never been done before: put life into motion picture titles.

Having in an unconventional way found success in Hollywood, Bass has since fallen victim to one of Hollywood's most notorious forms of poetic injustice: type casting. He has been so strongly associated with film triumphs like the credits for "The Man with the Golden Arm," "Seven Year Itch," and "Big Country" that he has become known as "the man who does those film titles"—much as Edward G. Robinson became known as the man who shot at cops from a black Packard, and for the same reason: he does it so well.

That he does other things well—in fact, that he does them at all—is an aspect of Bass's life that has been singularly unpublicized. Yet the following pages reveal him as a designer with a surprising range.

There is a suggestion of Saul Bass's range—and of the working methods he uses to achieve it—in the picture of him below, shot outside his Altadena studio. Normally he spends about two days a week in his Hollywood office, the rest of the time at Altadena, working on such projects as this one for Pomona Tile. This design might be called a "three-dimensional surface treatment," for the solution lay in exploring the *sculpture* of the surface and treating the tile wall as a bas-relief. The tiles respond to changes of light in a way that gives the pattern an unpredictable life of its own, and this, plus the sculpturing itself, opened up applications for both interior and exterior use in areas not normally tiled. Thus a single problem moves from a kind of graphics into a concern with architecture. (A more direct involvement in architecture is Bass's design, with associate Herbert Rosenthal, of the entire structure and interior of a veterinarian research center and hospital.)

Esthetic stubbornness

From the number of awards his peers have given him, and from the fact that he is so frequently sought out as a speaker at design conferences, it is clear that Bass has some claim to the trite but flattering title "designer's designer." What makes him so is less clear, for his practice is not common enough to be comfortably typical, nor is it impressively large. Certainly his creativity and mastery of craft are part of the reason. But not all of it, for there are other highly accomplished designers who do not get the kind of attention from their fellows that he does. Perhaps what makes Bass interesting to other professionals is that his success takes the form of a position—namely, doing largely what he wants to do. This is independence by design—an esthetic stubbornness. It is the same attribute that goes into dieting and other soul-strengthening activities: the ability to say no to what is bad for one's individual shape.

Bass can say yes, too; and in his work, affirmation is expressed in two ways: an eagerness to try new things, and a willingness to return to old territory until it is fully explored and exploited. Although each project challenges him to develop a unique treatment, he is not self-conscious about it. If a device that has worked in the past is *appropriate* to another design, he will use it unapologetically, rather than take a dozen artificial steps to avoid it. Last year he designed for Lightolier a Christmas card with a lovely snow-flecked barren tree in it. This year he incorporated a similar tree into the gift wrapping for Reynolds Metals (page 91).

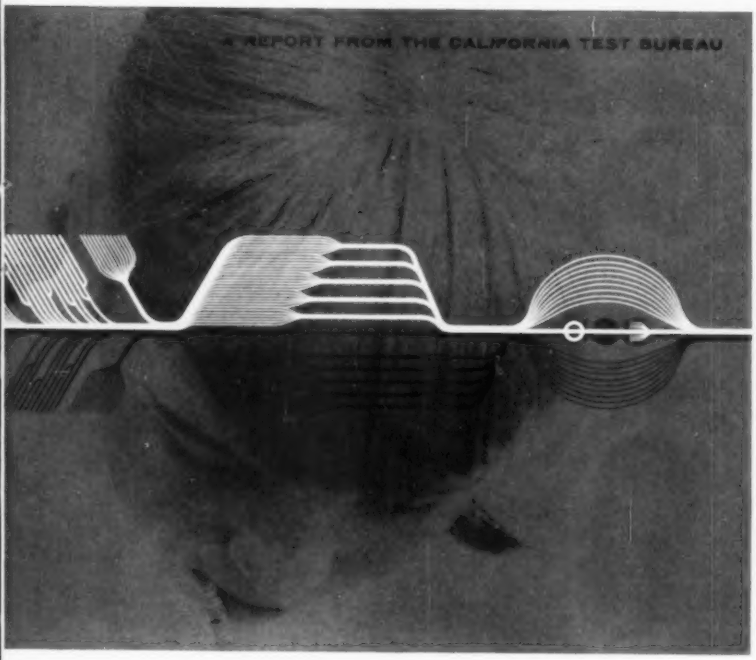
The poet Lloyd Frankenberg once observed that it is easier for a rich man to go through the eye of a needle than for a clever man to write poetry. In design, too, cleverness can be a trap. What often keeps Bass from falling into it is that although his work has been called witty and novel, the wit and novelty never appear as "ends" in themselves. Neither, for that matter, are they "means," exactly. He tends to eschew the gimmick—the device extrinsic to the design—in favor of conceptual expressions, however slight. The tear in "Bonjour Tristesse" (page 93), the playground freeway (page 94) that seems to parody the soberest urban dream highways, the fragmented but still firm legend "Truth" (page 81)—these are not tricks. Each is a formal extension of the whole point of doing the thing at all. Similarly, the interchangeable colored knob sets that brighten the hi-fi cabinets for Stephens (page 94) are an extension of the modular scheme that enables the manufacturer to insert technical improvements into the line without retooling, and the consumer to modify his set as new developments complement, rather than invalidate, his equipment.

Communicative warmth

Saul Bass is an unusual designer largely because he is an unusual personality—an intellectual with a sense of play. This has the effect of leading him to create forms that are at once cerebral and childlike, and that are satisfying on both levels. The preoccupation with arrangements of dots, bars, and swirls that has become part of his "style" is charged with both formal and emotional meaning. Bass's designs are not grim—and this is pleasant—but his lightness cannot be taken lightly. The lambency of his work is only the surface of a strong concern with people. What he wants to do about people is not only to help create a safer and more comfortable environment, but to generate a communicative warmth (he calls some of his designs "celebrations") because he believes that function is meaningless without emotional content.

If diversity has kept Bass from a rigid style (compare the tight "Swiss" packaging for Holmes Laboratories on the opposite page with the Lightolier flip-book next to it), his work nevertheless has a certain unity. What gives it unity is—to use one of Bass's favorite words—*flavor*. It is any designer's best insurance against dullness.

FARMS FOR PACKAGING PRODUCTS AND IDEAS



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1. *Cover of brochure for California Test Bureau uses as symbol a master diagram of test development superimposed on the head of a child concentrating.* **2.** *Ad for Container Corporation graphically reinforces John Stuart Mill's view of the pursuit of truth, by making a pattern of the word and components.* **3.** *Gift wrap and packaging for Reynolds Metals has 15 triangular cutter boxes nested to form drum. Bass and associate Phyllis Tanner did wraps, display, packaging and trademark.* **4.** *Promotional Christmas flip-book for Lightolier.* **5.** *Packages for Holmes Labs.*

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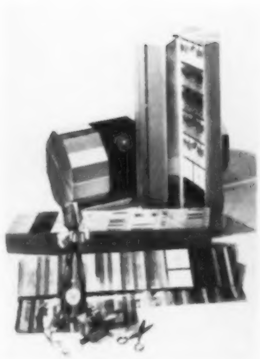

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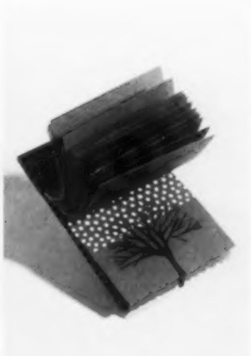

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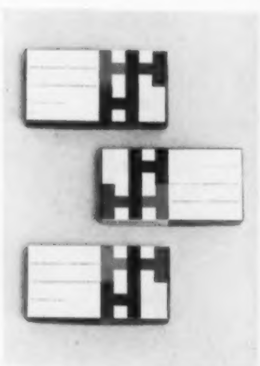

The flame and rose at the right was Saul Bass's screen test. (He passed.) Originally he had worked out the motif for the "Carmen Jones" advertising campaign, and producer Otto Preminger was sufficiently impressed to ask Bass—who had been arguing for some time that titles didn't *have* to be pedestrian—to work it into the title. The result was a crimson flame playing behind a black line drawing of a rose. The flame's slow undulation was achieved by shooting with a high-speed camera, and slowing it down to normal film speed.

For "Cowboy," which might be termed a "low-pressure" Western, Bass used period pen-and-ink drawings and typography to set the tone for a fairly realistic portrayal of the West. The strip shown at the far edge of the opposite page begins in a newspaper advertisement of a boot sale. The spurs on the boots pop and, as the camera dissolves to the open range, become twinkling stars, which in turn become twinkling brands. Eventually the brand finds its place on the rump of the cow. This title is in color—mostly ochres, reds, oranges and lavender—and a background musical score based on folk themes is closely cued to the visual action.

Although Bass's entry into the field of movie title design was triggered by his work for an advertising campaign, the process has since reversed itself in an interesting way. Now, often as not, the titles he designs become "trademarks" for the movie, and are integrated into advertising and promotional programs. The title for "Bonjour Tristesse," for example, opens with random forms, one of which becomes recognizably flowerlike and develops petals. The petals begin to drop until the entire screen is covered with a pattern of them. The pattern dissolves until only one petal is left. A girl's face then forms around it, and the petal is seen to be a tear: *Bonjour, tristesse!* The face, which was used as the movie's symbol, appears on page 93 as the design for a record album of the soundtrack.

Bass has no wish to specialize in motion picture graphics, but finds the work exciting, partly because "there is always a shock when you see the result." Also, "The addition of movement is a qualitative difference that makes for a totally different kind of experience, just as the added dimension makes a piece of sculpture or an industrial product different from a painting. In a publication piece, the design sits quietly while you wander around and into it—if you wish to. In film, it assaults your senses. *It* moves, and works *you* over, whether it takes a live action form, or an animated form, or a combination of both." More of Bass' opinions appear in the following dialogue.—*R.S.C.*

Mr. Bass, do you think . . . ?

May I interrupt for a moment.

What, already?

Yes. I have a request. You know, people have interviewed me before, and generally I find when I'm quoted, or when my statements are paraphrased, there's a certain "echo-chamber sound" that leaves me aghast at my pomposity. I beg you, please don't reveal me to myself once again.

Maybe it will help if we start with a skeptical question. You talk a lot about creativity, about the importance of taking chances and refusing to conform. What then are you doing in—of all places—Hollywood, where there are so many restrictions to inhibit creativity and individuality of expression?

What am I doing in Hollywood? I like the climate. As for creating in and from Hollywood, I don't think the problems are much different from those anywhere else—the same commercial pressures exist everywhere. The difference is that Hollywood is more public. Anyway, I'm not fighting for just a more personal expression. That's not the point of design. That becomes stylism. I don't want people to say, necessarily, "that's Saul Bass," but rather "that's somebody."

Why is it so important for them so say anything at all?

It's important that they *feel* something. The challenge in design is always to establish communication with human warmth—to create an emotional identification between the subject and the audience.

Well, that's the challenge in any art. But isn't design often concerned with items that don't lend themselves to anything as big as this? For example, you recently designed some tuna fish labels. Isn't it pretentious to say in this connection

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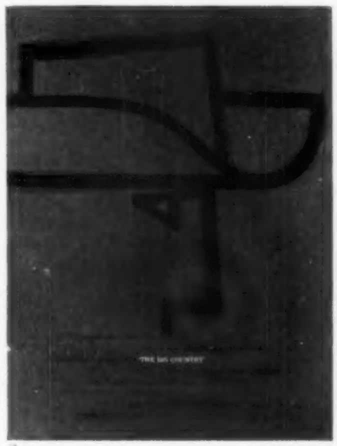

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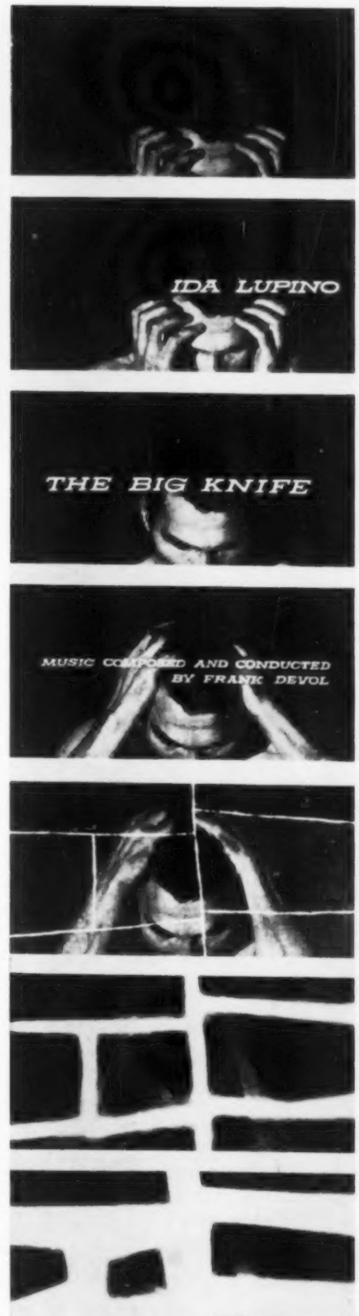
GRAPHIC DESIGN FOR HOLLYWOOD



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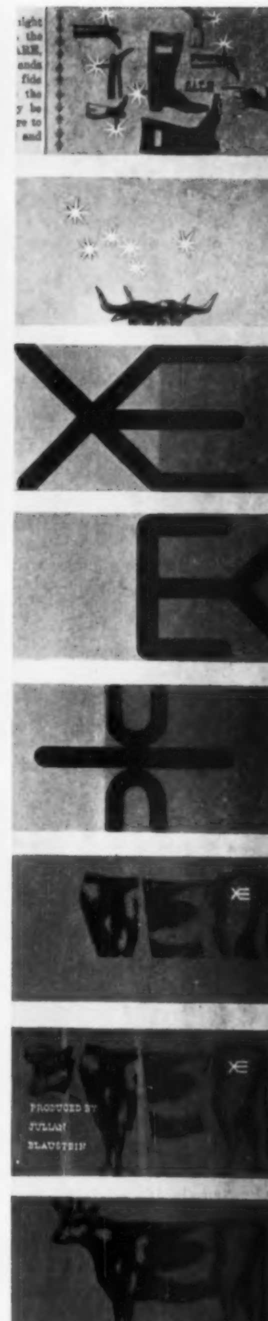

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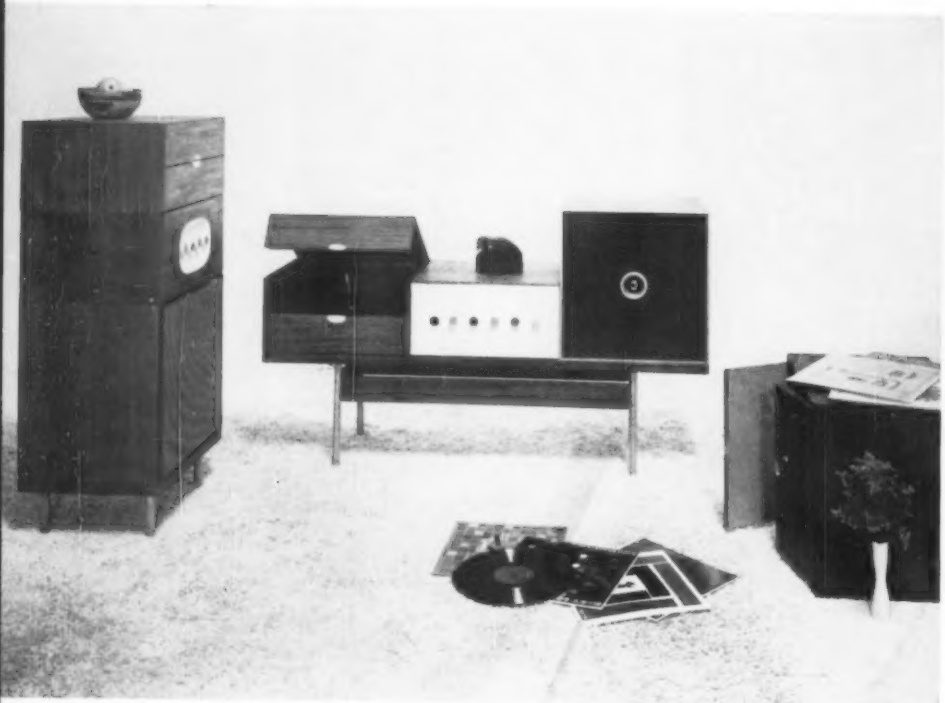
***1.** R.C.A. Victor record album of music from the soundtrack of "Bonjour Tristesse," Columbia Pictures.* ***2.** Poster for "The Big Country," released through United Artists.* ***3.** Frames from "The Big Knife," United Artists. Title opens on black screen showing top of man's head. Credits appear as camera pans down slightly to reveal that man is holding head in hands, in an attitude of inner torment. Immediately before the last credit, the screen cracks brightly, and the cracks widen to form a completely white screen on which the last credit appears, then fades in the sun of the opening scene.* ***4.** Frames from "Cowboy," Phoenix Productions-Columbia Pictures. Title attempts to generalize the lusty spirit and rich humor of the old West.*



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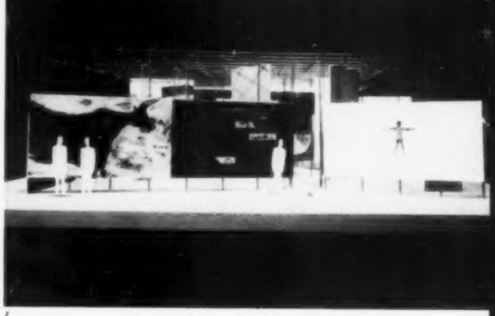
CABINETS, PLAYGROUNDS, AND PREHISTORY

1. *and* **2.** *Hi-fi line for Stephens Trusonic. Entire line is modular, designed so that each element can function visually alone or in any of unusually wide variety of relationships. Benches come in various lengths, two heights. Three sets of control knobs, in three different colors, come with each unit requiring knobs, enabling color to be integrated with interior decor. Associate: Fred Usher.* **3.** *Prototype playground for Longwood Redevelopment East Corporation. Designed for use in low-cost redevelopment projects, the playground is open in plan for easy parental supervision. Associate: Herbert Rosenthal.* **4.** *Model for traveling exhibit on "Art of Prehistory." As the spectator approaches the exhibit he faces at left a Lascaux cave-painting, and a graphic representation of the world of nature; at right he faces a symbol of man. The exhibit reviews the interrelationship of man, nature, art.*



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that you are trying to do anything with human warmth? All you're trying to do is sell tuna fish.

Ouch. That's a good point. Well, at least I didn't get sucked into the intellectual research trap of graphically translating classics like "rounded shapes have a more feminine connotation." I just made it a nice bright little fish. That seems to me to have more juice—human or otherwise—than lettering and shapes. However, there *was* a mountain of research behind the project, and I do try to avoid easy solutions, to choose design problems from which I can learn something.

Do you also try to choose design problems that you care about in a personal way? That is, would you do the titles for a movie you didn't like?

No. I take a film assignment on the same basis an actor does—I read the script first. I don't work for movies I don't believe in. Let me qualify this by saying that some of the movies I've done titles for have turned out to be different than I had expected. And there have been times when if I'd known what the final result was going to be like I wouldn't have taken the job.

You sound independent and uncompromising.

I try to be. But look, I don't want to sound heroic or moralistic about this. If I tend to resist compromise, it's because I have very little choice, since my big charge comes from doing things *another* way.

What qualities do you think a designer needs to achieve this kind of independence?

One quality: you have to be prepared not to be liked. Also it helps to be small. You mentioned commercial pressures a few minutes ago. I'm actively fighting the pressure to be big. I have had to ask myself: Do you want to be creative, or do you want to be an administrator of creative people? The answer is easy: I want to be creative. But it isn't long before your creative success leads to a large staff. So far I've been able to resist this with a small staff.

And the reward is independence?

The reward is that I can participate in each problem myself. You see, I believe that if you dig down beneath any of the creative myths of our time, you find that the creator rolled up his sleeves and went to work. I try to work as deeply as possible into the design concept. But since I don't want to lose touch with the heart of the thing, I'm often responsible for the details myself. And every design problem has a craft basis. If I hadn't myself fooled with cut paper, I would not have gotten the "Man with the Golden Arm" symbol. So I try to do as much as I can myself—the rest is done by others—and when the whole thing makes a neat package, I walk around it once on my knees, exhausted. When I do something well I can say, "I did it." When it's bad I say "I did that too"—but not too loudly.

Since you do so many different things, instead of sticking to a single specialty you're certain of, don't you take a proportionately greater risk of failing?

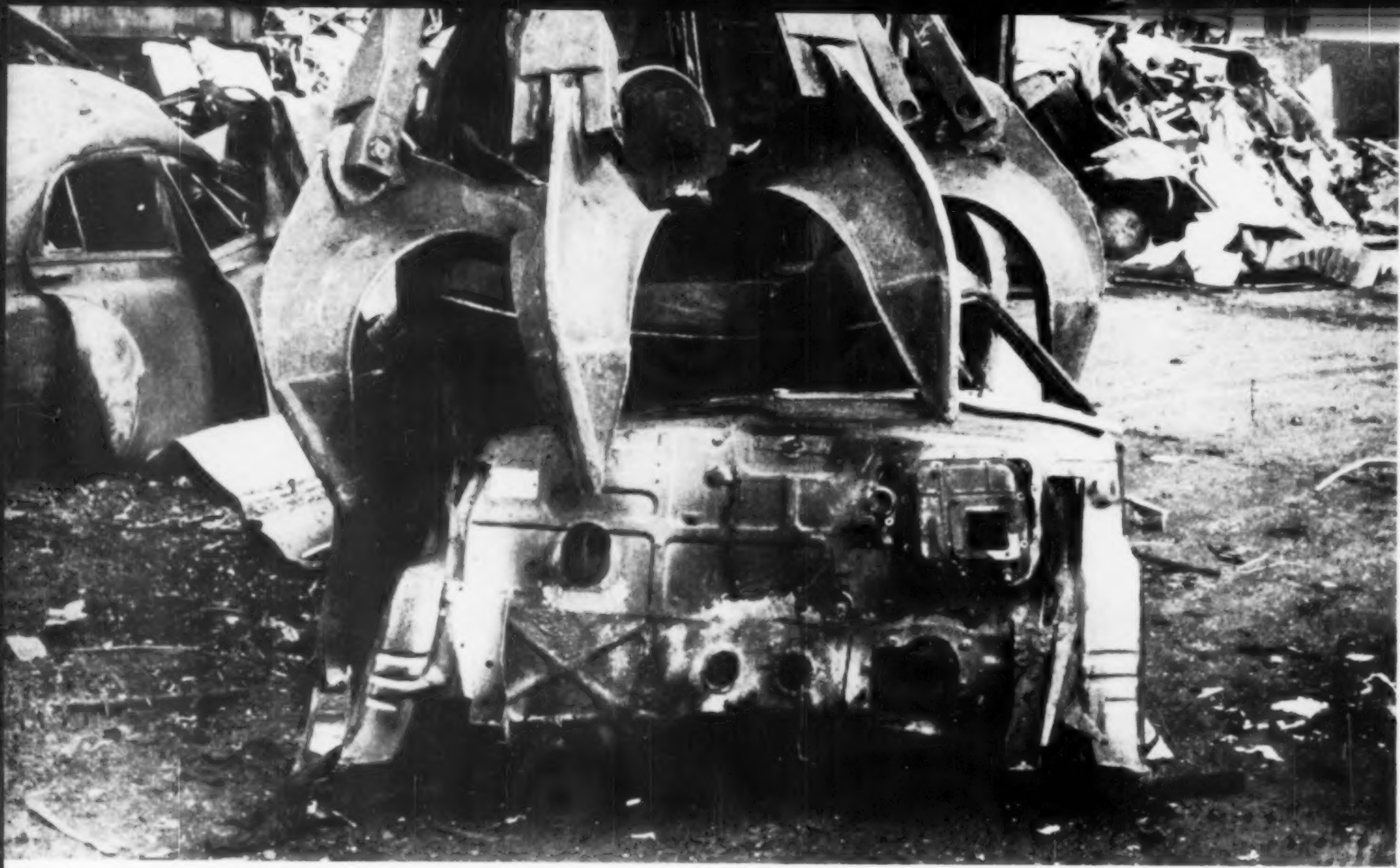
Yes, of course. But this risk is essential to the creative process. This is a problem in our industry today—so many people are too much afraid of failure. But we have got to have the opportunity to fail. And we have got to take the responsibility for failure. It's all part of maturing.

Do you believe then that versatility is really essential to creation—that the creative person has *to do new things?*

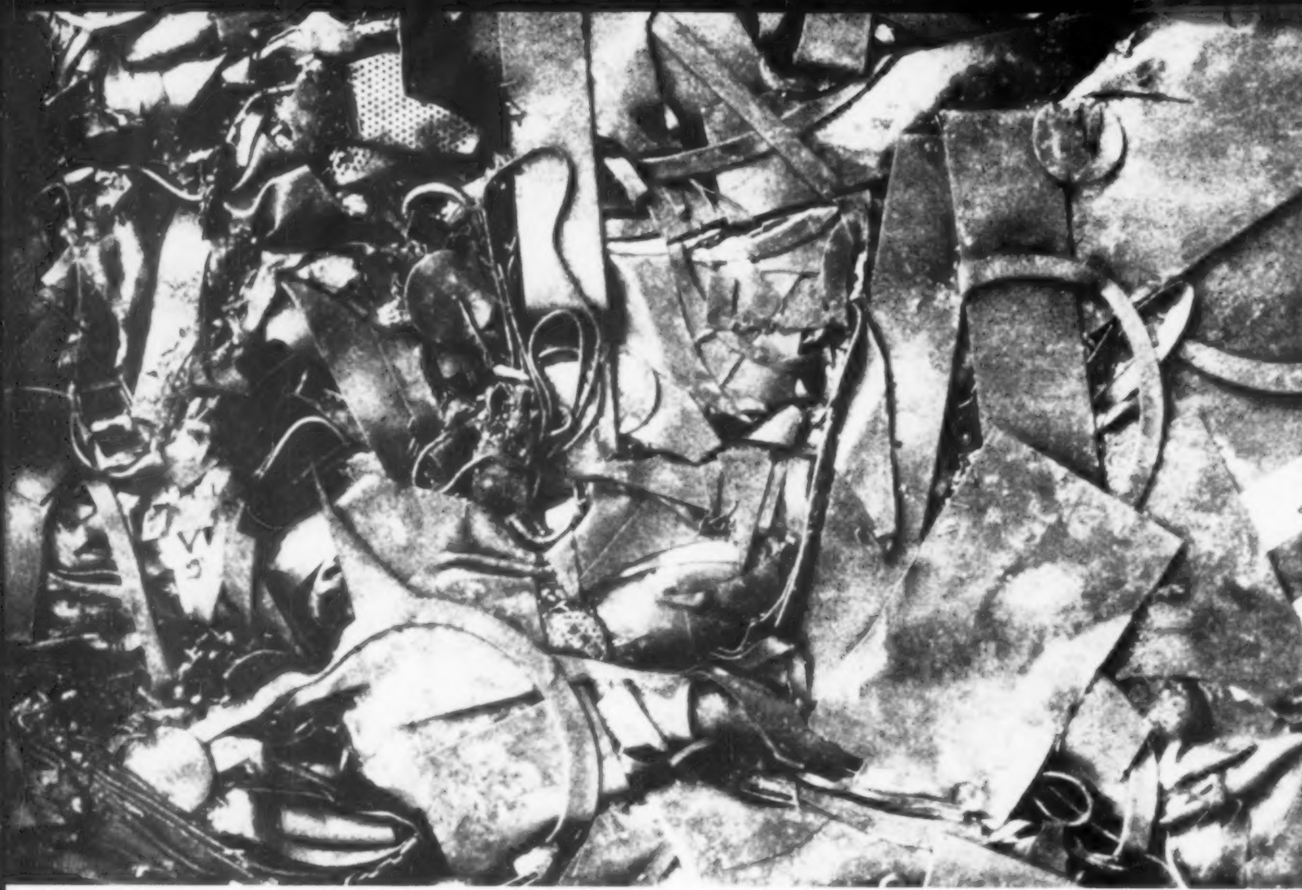
This may just be personal. I have a great desire to do all sorts of things I've never tried before. But child psychologists told me things about children's needs that led me, in the playground project (page 94) to design equipment that incorporated the principle of uncertainties, danger, unbalance. I don't think you can work creatively if you can't stand large doses of these feelings. Perhaps you even enjoy it as part of the process of resolution—getting eventually back to home base, like coming in to a cozy warm fire inside the house after having braved a storm. The trick, perhaps, is to stretch the uncertainty and danger to the furthest point possible without, at the same time, placing resolution outside your capacity. What that point is generally I don't know, but it has to be determined in individual design problems for a good solution. It's hard to generalize. All I can say is that *maybe* that's the way it works for me. And even if it is, I'm sure there are other elements involved that I haven't figured out.

As a designer, what are you after?

I'm after people—that is, I'm trying to reach them. Design is important to the extent that people are important, it matters only to the extent that it meets their needs. A design is just a detailed—sometimes even ridiculously small—expression of a profound cultural pattern, a pattern that is somehow affected by the ad, the book, the building. A lasting design transforms—if only to a very small degree—somebody's attitude toward something. I would like to make people feel something, to create that rapport which doesn't just dangle an image before the eyes, but opens up a successful communication. Our problems these days are not technical. Our problem is to learn how to provide people with experiences that will open them to growth.



JUNK *fascinates. Few men outgrow the wonder of the scrapyard—a rusty museum where old products go when they die. Later they are lifted by a monster claw, hurled into a compressor, crushed into squares, and piled into hard patterns like the mosaic shown here.*



Junk can be an eyesore, a business, or an adventure — depending on where you stand. It can also be an experiment in composition, as it is in this group of photographs by Joel Witkin. To the designer it is humbling to realize that everything shown here was once a product, and that in the impartiality of the ultimate scrapheap, Bauhaus and Borax come to the same violent and twisted end.




The new image of United States Steel

A new trademark, a Steelmark, and a corporate identity program are launched by U. S. Steel in a leviathan design campaign to unify and sharpen its image, to make people steel-conscious, and to win a greater share of the consumer market

"Today's steel is not yesterday's steel", Richard F. Sentner, Executive Vice President of Sales, said recently. "I suppose we've taken the tremendous advances for granted and assumed the public had an appreciation of them as well."

For the first time in its 46-year history, the United States Steel Corporation has undertaken an ambitious and far-reaching program of total corporate identity. Up until now its efforts in this direction were haphazard, at times half-hearted — but for the most part there was no strong concerted effort; rather there was a kind of identity-by-accretion. Behind the big change, from Topsy-growth to the more positive stand of using corporate identity as a forceful merchandising tool, are a new philosophy of U. S. Steel's position and a more dynamic view of steel.

As a part of this program, Big Steel had to consider what its image was before it could know what to do with it. Corporate identity, simply defined, is the sum total of all attitudes and impressions that people have about a given company, its products, and its service. Like trademarks, it has come to be regarded as the company's silent sales force. A program of corporate identity redesign is a kind of self-study — a Socratic "know thyself" with a twist, the twist being that for a corporation to know itself it must discover what *others* think of it. Without "others", there is no identity possible.

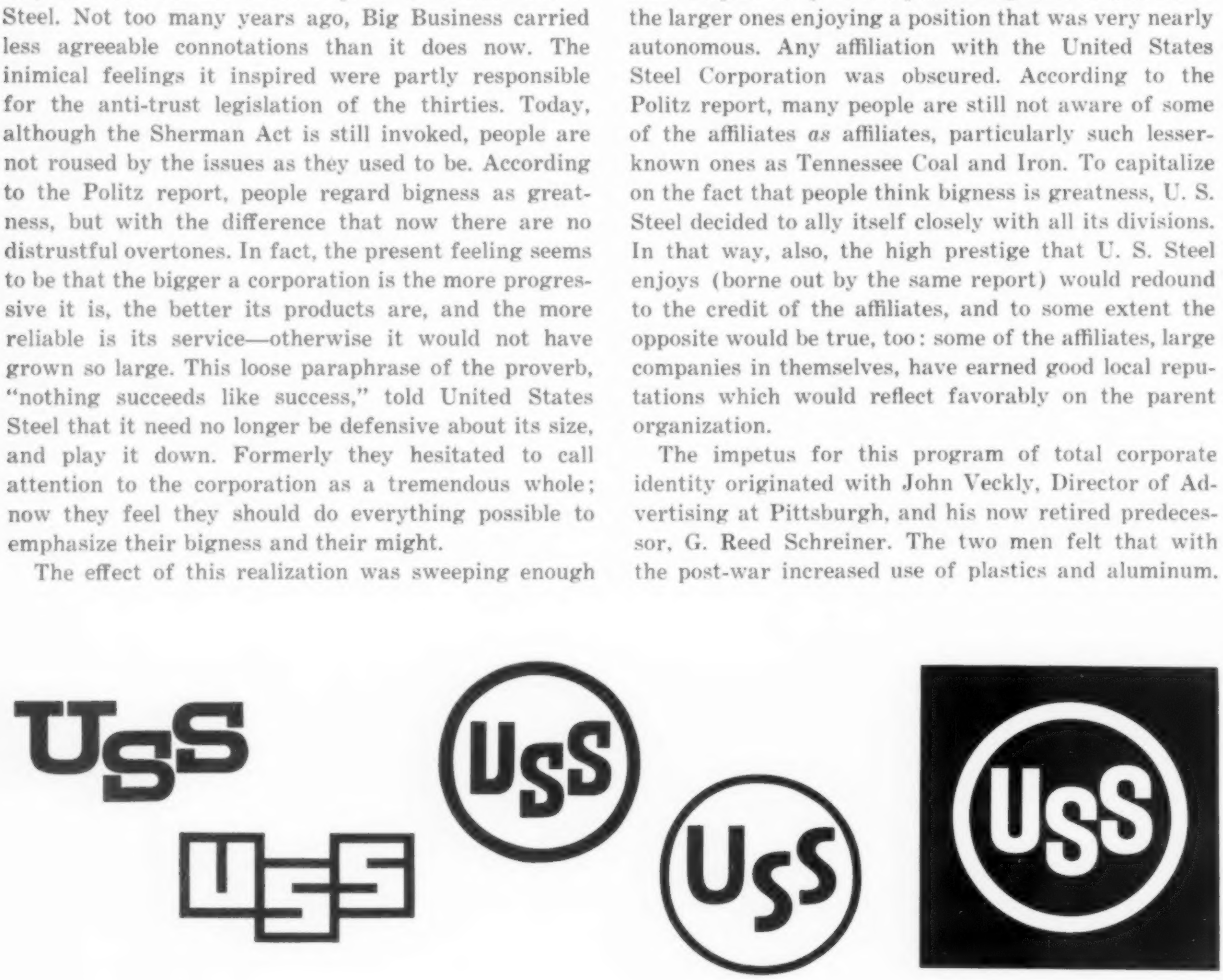
To this end, two-and-a-half years ago United States Steel asked Politz Research, Inc. to make a nation-wide survey of: a) what people think of steel; b) what people think of products made of steel; and c) what people think of United States Steel. Some of the answers they got from this survey were obvious ones; some came as a surprise; both were welcome: the obvious ones because they supported the conjecture and thinking that had already gone on, and the surprising ones because they provided Central Operations in Pittsburgh with the kind of information it needed to implement a new program of reappraisal.

Among the more obvious conclusions drawn from the survey—based on interviews with 4,000 people over 15 years of age—was that people think of steel as being "strong, heavy, and reliable, but not particularly modern or having good styling." Another somewhat obvious conclusion was that people tend to think of a material —as well as a corporation image—in terms of its end-products. Steel is usually thought of in its application to building construction, heavy machinery, bridges, and automobiles. The average consumer is not aware of the many other, lighter uses of steel, including pins and needles, or that there are some 10,000 types, grades, and finishes of steel in existence. A corollary to this finding was that the consumer tends to think of stainless steel—probably through associating it with pots and pans—as both a lighter and less expensive form of steel; of course the reverse is true.

The Politz report indicated something else, and this may well have come as a surprise to United States Steel. Not too many years ago, Big Business carried less agreeable connotations than it does now. The inimical feelings it inspired were partly responsible for the anti-trust legislation of the thirties. Today, although the Sherman Act is still invoked, people are not roused by the issues as they used to be. According to the Politz report, people regard bigness as greatness, but with the difference that now there are no distrustful overtones. In fact, the present feeling seems to be that the bigger a corporation is the more progressive it is, the better its products are, and the more reliable is its service—otherwise it would not have grown so large. This loose paraphrase of the proverb, "nothing succeeds like success," told United States Steel that it need no longer be defensive about its size, and play it down. Formerly they hesitated to call attention to the corporation as a tremendous whole; now they feel they should do everything possible to emphasize their bigness and their might.

The effect of this realization was sweeping enough to become the center of its new corporate identity program. When the corporation was formed in 1912 with the merger of the old Federal and Carnegie Companies and the acquisition of some small plants, the result was a chaotic conglomeration of some 13 major divisions. Each division continued to operate more or less independently of the parent organization, some of the larger ones enjoying a position that was very nearly autonomous. Any affiliation with the United States Steel Corporation was obscured. According to the Politz report, many people are still not aware of some of the affiliates *as* affiliates, particularly such lesser-known ones as Tennessee Coal and Iron. To capitalize on the fact that people think bigness is greatness, U. S. Steel decided to ally itself closely with all its divisions. In that way, also, the high prestige that U. S. Steel enjoys (borne out by the same report) would redound to the credit of the affiliates, and to some extent the opposite would be true, too: some of the affiliates, large companies in themselves, have earned good local reputations which would reflect favorably on the parent organization.

The impetus for this program of total corporate identity originated with John Veckly, Director of Advertising at Pittsburgh, and his now retired predecessor, G. Reed Schreiner. The two men felt that with the post-war increased use of plastics and aluminum,



Hundreds are designed, a few are culled for consideration: the one which seems most expressive of the new image is chosen.

and their phenomenally successful advertising campaigns, inroads were being made in areas of the market —notably consumer goods—that U. S. Steel could and should be exploiting. Veckly, armed with the Politz survey, which in many instances supported what he already thought, prepared the outline of the project. But he was faced with the touchy problem of persuading some of the more independent affiliates to accept recommendations for a change from a source they weren't used to and might resent: Central Operations in Pittsburgh.

With considerable astuteness, Veckly decided that the most politic and convincing approach would be to use a disinterested third party. The identity program was one that would need the services of a designer. In choosing, Veckly concentrated on design offices with heavy reputations. He felt that ideas could be advanced more persuasively by Central Operations if they were backed up by being "strongly recommended by a design authority." This restricted his choice in design offices, a choice that had a narrow range to begin with. For what U. S. Steel also needed was a design office large and well-equipped enough to handle the terrific volume and scope of a redesign job which, in effect, would simultaneously relate to 13 large companies; an office experienced in consumer areas of design; and one with the kind of experience that would enhance their

(Opposite page) The problem in the trademark and Steelmark was to convey the new image of steel—"a light, stylish, fashionable material" — purely through design. The rejected ones were thought to evoke undesirable images: heavy, cumbersome, or suggesting metals competing with steel.

UNITED STATES STEEL EXPORT COMPANY

USS CREOSOTE

On top, two of the clearer examples of old company signatures. The chaotic disparity between them is apparent. USS Creosote, which looks as though it were one of the major divisions of U. S. Steel, does not even have a subsidiary status: it is only a branch of a sub-division. Below it is a list of the 13 major divisions in their new uniform appearance, easily identifiable as to affiliation.

USS United States Steel

USS United States Steel Products
Division of
United States Steel

USS United States Steel Homes
Division of
United States Steel

USS Universal Atlas Cement Company
Subsidiary of
United States Steel

USS United States Steel Export
Subsidiary of
United States Steel

USS American Steel and Wire
Division of
United States Steel

USS Consolidated Western Steel
Division of
United States Steel

USS United States Steel Supply
Division of
United States Steel

USS Tennessee Coal and Iron
Division of
United States Steel

USS Columbia-Geneva Steel
Division of
United States Steel

USS Oil Well Supply
Division of
United States Steel

USS American Bridge
Division of
United States Steel

USS National Tube
Division of
United States Steel

USS Cyclone Fence Department
American Steel and Wire
Division of
United States Steel

working closely with advertising and promotion executives and with U. S. Steel's advertising agency, Batten, Barton, Durstine & Osborn. A few design offices were called; one, seeming to fit the bill, was chosen: the New York firm of Lippincott & Margulies.

Retained for design guidance and consultation, and to perform design work as assigned, L&M tackled as one of its first jobs the redesign of the trademark. Although there is no absolute connection between trademarks and corporate identity, they are traditionally related to each other. To change a corporate identity without changing the trademark and graphic material is not impossible, but there is the risk of having the symbol inaccurately reflect whatever new image of itself the company might wish to adopt and promulgate. The trademark's change is a starting point in many identity programs (akin to the idea of not pouring new wine into old bottles) because if you want a new identity, you usually design a new mark to embody its spirit.

Before beginning work on the trademark redesign, a team of L&M designers made a three-month tour of U. S. Steel plants and offices around the country in a review of more than 1000 pieces of printed material from the various units of the gigantic corporation. Taking an inventory of existing identifying material from all 13 major divisions, they discovered prodigious variations in signs, brochures, publications, advertising, and stationery which, when all assembled, amounted to a roomful of stuff. At times the variations in the material were so disparate as to convey the impression that there were several—difficult to tell how many—companies with different names and marks who, through a remarkable coincidence, had independently decided to use the letters "USS" somewhere somehow on their printed matter. Piling up only one copy each of the different letterheads alone resulted in a staggering pile of paper some 18" high.

Since the United States Navy has no record of the USS Man-Ten, it must be either the U.S.S. Man-Ten Company or the U.S.S. Man-Ten Division of United States Steel. It happens to be neither. Man-Ten is a brand name put, it almost seems, in that leading position to cause the maximum confusion in identity. The spirited avant-garde layout and art contribute to the confusion.

A "before and after". Although old Export Bugler is not as bad as USS Man-Ten job, logotype of former hardly resembles that of latter. New Bugler shows new trademark and layout spirit.

The new United States Steel trademark

To ask what makes a good trademark is a question so vague as to preclude the possibility of a satisfactory answer. A good trademark can be meaningfully created and sensibly judged only within defined limits and with known determinants. In this case, one of the limits was suggested by the Politz report: "It is undoubtedly the letters 'USS' which carry the burden of identification for the trademark. The greater the degree of verbalization a trademark has (letters, pictures, symbols) the greater its effectiveness in achieving the correct company identification." Complying with the Politz report (they had independently come to the same conclusion themselves), the designers at Lippincott & Margulies retained the initials throughout their scores of sketches for the trademark. The final one—now in use—is quite clearly based on the old: it is simply more contemporary-looking. The width of the letters is equal to the width of the enclosing circle, thereby imparting a graphic unity and a pleasing harmony to the symbol. The circle was widened somewhat, and the letters separated. The only other change was to drop the serifs in order to achieve the more modern and fashionable Gothic look. This design won out over its fellow candidates for several reasons, the most important of which was that it resembled its predecessor, thus providing continuity in identification. Another reason was that, in the opinion of Lippincott & Margulies, it embodies the new image of steel—a light, stylish material—that

U. S. Steel is promoting in its present campaign as well as embodying the new image of the slowly reorganizing corporation.

At this stage of the program, with the graphic changes suggested and the more difficult work of establishing the corporation's identity begun, the L&M Plans Board reviewed the project. For the U. S. Steel account, the Plans Board included: J. Gordon Lippincott, partner; Lawrence W. Stapleton, Executive Vice-President; Myron J. Helfgott, President of Package Research Institute, Inc., affiliated with L&M; Norman Schoelles, Vice President and Chairman of the Plans Board; Russell Sandgren, Design Project Director for the U. S. Steel account; and Joseph J. Murtha, liaison between L&M and U. S. Steel. On receiving approval from the Plans Board, the recommendations and sketches were taken to Pittsburgh for a meeting with management and BBD&O. The submitted work was unanimously accepted; however, Robert C. Myers, U. S. Steel's Director of Market Development, felt that with regard to the promotion of steel as a material—competing with aluminum and plastics for a greater share of the consumer market—something more was needed than just a trademark or a program of identity. The consumer had to be made aware that he was buying steel and using steel products in its multifarious forms. Steel had to be promoted as an omnipresent material with many-sided usefulness.

Some years back U. S. Steel attempted a campaign to promote steel in its first try at attracting a large share of the consumer dollar to the industry in general. The slogan they adopted for this purpose was: "Only Steel Can Do So Many Jobs So Well." According to the Politz report, the slogan has not done well at all. What Market Development wanted was a new slogan and perhaps a mark that would sell steel—anyone's steel. Beneath the surface altruism of this desire was the realistic reason as expressed by Sentner: "To the extent that this program increases the total steel market, U. S. Steel will benefit through its share of increased sales."

The Steelmark and a new slogan

The BBD&O agency conceived the slogan: "Steel — Lightens Your Work, Brightens Your Leisure, Widens Your World"; Lippincott & Margulies conceived the "Steelmark." The Steelmark—a kind of hallmark, as sterling is in silver—was designed in such a way as to make visual association with the new U. S. Steel trademark irresistible. Both marks have the same circle. The counterpart of the letters "USS" in the Steelmark are three hypocycloids colored yellow, orange, and horizon blue. And the juxtaposition of the lettering and the character of its face closely resemble those of the company signatures in the trademark.

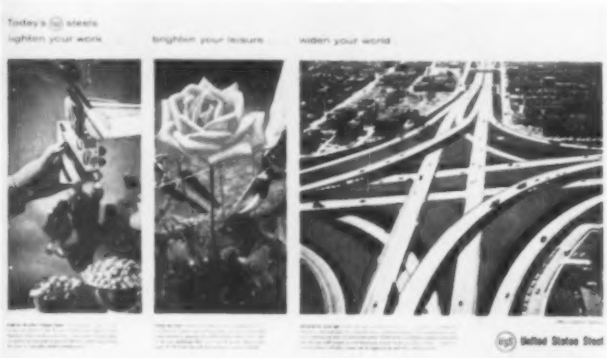
The mark is unregistered and may be used by anyone. But its use—at this point—raises questions. For example, would another large steel company use a mark which is U. S. Steel in origin; or would it, as its con-

"Before and after" tags. Essential information is entirely retained, but tags are more quickly legible, easy on the eye, and they bear a far stronger family resemblance.

tribution to a program to promote steel, devise a mark which would subtly (or unsubtly) relate to its own trademark? Another problem: how to put the Steelmark on a refrigerator, for example, of which only one of the elements is steel, and not have the manufacturer feel that it was detracting from his own (and in the circumstances more valid) trademark? However, there is the bright side, too: a small and relatively unknown manufacturer would find an advantage in having the mark on his wares—the obvious advantage of allying himself (even indirectly through the Steelmark) with the great United States Steel Corporation and gaining such reflected prestige as that brings, and it brings a lot.

So far the slogan has been promoted through television and to a more limited degree in space media, but the mark, in the form of labels and hang-tags, has not yet appeared on retail steel products—which is its ultimate role if it is to make the consumer more aware of steel as a material of infinite variety.

But the trademark and the Steelmark are only two elements of the larger picture of corporate identity. Graphic design goes all the way down the line. The redesign program includes brochures, house organs, tags, labels, stickers, stationery, catalogues, manuals, office forms, packages, color coding systems, and even brand names. This last is one of the more amusing areas of the program. What some of the affiliates had been doing in the past was to name a new product by



Brunt of the campaign — new image of United States Steel and steel as a material with a multiplicity of uses — will be carried by advertising and promotion. Ad shown is typical of new style.

adding to its existing title whatever new feature was being included. One of them ended up like this: "USS American Tiger Brand Wire Rope Excellay Preformed —American Steel & Wire Company"—followed somewhat feebly by the after thought: "United States Steel."

To change this chaotic state of affairs touches on one of the problems stated earlier: persuading the divisions to line themselves more sharply and effectively behind U. S. Steel. Some of the divisional heads have enjoyed their "top" position for so long that resistance to this program is, in some measure, expected from them. L&M's Project Director Sandgren, by way of illustrating this point, describes the outmoded way in which some of these old-time company executives comport themselves. "I was visiting one of the divisions one day when the twelve o'clock whistle blew and the superintendent of the plant and a few others and myself went downstairs to the executive lunchroom. Lining the corridor were junior execs, and behind them, in order of rank, were members of the staff below them. The superintendent strode in, and, after he entered the room, the others filed in behind him according to their status. When we got inside, everyone lined up behind his place at table and waited. The superintendent sat down—then they sat down. The superintendent was served—then they were served. The superintendent began to eat—they began to eat. It looked like something out of the 19th Century. I just couldn't believe my eyes. I thought to myself: 'If the superintendent is king in his plant, it's going to be tough as hell to make him submit to total corporate identity in which his organization will be only a part of a much larger one.' "

But the program of a single entity with subordinate divisions has begun to go into effect, and one of the first changes is the uniform logotype (page 103). The need for the more detailed changes will take longer and be harder to "sell" to the affiliates, and occasionally —for the time being—for good reason. For example, some of the companies have used their own system of color coding in their labeling or packaging for many years. To change these systems and devices overnight could be done only at the cost of great, and unnecessary, confusion to the affiliate organization.

Do's and don't's — the Graphic Standard Manual

Too much concern over ultimate detail, the designers feel, is not necessary. They have written a "Graphic Standard Manual" in which every aspect of the identifying program is thoroughly outlined. Typefaces are suggested (and others not recommended) for a given context and format. Style of visual composition for advertisements; the use and abuse of the trademark and Steelmark; positioning of the trademark and signature; manner of reproduction; systems of size relationships for advertisement signatures; identification for signs, displays, packages, office doors; product and brand relationship in identifying material; style and spirit of layout—all these are discussed with illustrations showing "right" and "wrong."

The purpose of this specification book is to provide control, and L&M does not regard it as harmfully restrictive: "Although it may seem that the standards in this manual limit the indivdual designer, they are not intended to inhibit his creativity. The intent is rather to . . . offer [him] unlimited opportunities to create modern, imaginative art work that will be appropriate to the particular design problem. . . ."

For the time being, while the program is still new, a certain amount of discipline and checking is maintained. Copies of all advertisements, brochures, house organs, and so on, are sent to Pittsburgh, where Veckly, assisted by Harold Hoffman and Robert J. Wilcox, respectively Associate and Assistant Directors of Advertising, review them. Members of the L&M staff, usually Sandgren and Murtha, are invited to Pittsburgh around once a month to go over accumulated material and judge its standards. Of the Pittsburgh staff, Hoffman, who has been described by Sandgren as "The Keeper of the Look," has the full-time job of seeing to it that local agencies and designers working for affiliates from coast to coast are upholding the standards of uniformity enjoined by the new manual.

What the designers do *not* want to do is to squelch individual differences in character by simply putting a huge USS stamp on all of them and calling that corporate identity. If the individual divisions did not retain their special idiosyncrasies, corporate identity would be easy to establish—mechanical, colorless, and antiseptic. Therefore, Hoffman and his associates as well as Sandgren approach these evaluative meetings with some degree of sensitivity. Their approach is based on the feeling that since U. S. Steel is a vast organization composed of many (relatively) smaller organizations, each division has its differences, its unique problems, and its modus operandi which should be respected.

This is one reason they feel that the ultimate detail work should be done by the divisions through local design offices. Besides, in a corporation of leviathan proportions, the work would be endless: it continues year after year with new tags, new labels, new stationery forms, new executive offices, new advertisements, ad infinitum. What L&M has tried to do is simply to standardize the approach to United States Steel's corporate design, bring disparate signatures into uniformity so as to leave no doubt as to their reference, instil a singleness of spirit into multitudinous material, and to some degree outline the kind of promotion and the kind of identity that would best represent the new image of their client.—*H. A.*

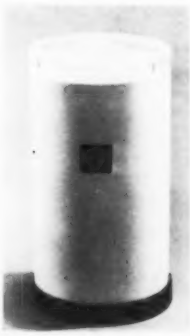
1930 *1934* *1943* *1953* *1958*

Europe honors designers in two contests

The Benelux Signe d'Or and Italy's Compasso d'Oro — the continent's trend-setting design competitions — signify a growing European emphasis on good design as the competition stiffens in both home and foreign markets

Chairs by Friso Kramer for N. V. deCirkel, Holland

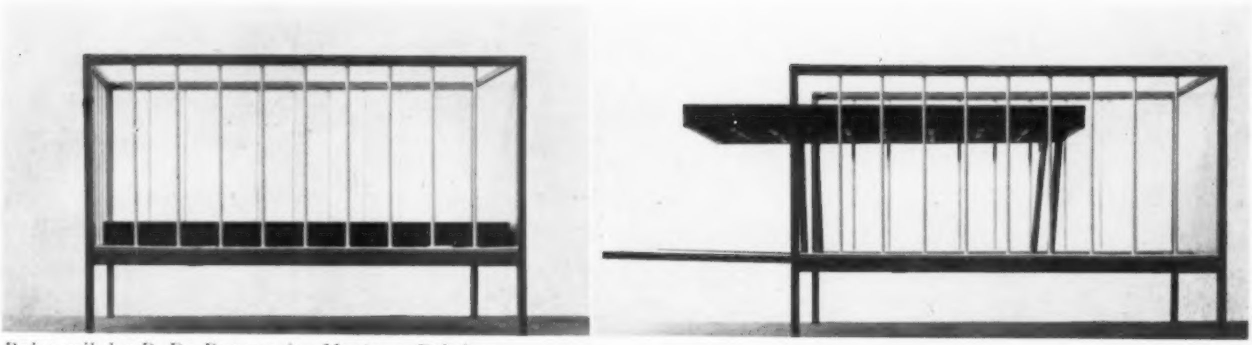
Sauce pan by S. A. Sartel, Belgium



Coffee grinder by Ateliers de Constructions Electriques de Charleroi, Belgium

Signe d'Or

Making its appearance for the second year, the Benelux design competition, Signe d'Or (Golden Signet), reflects an increasing consciousness among the common-market nations of Europe of the importance of good design. The competition also indicates European industry's awareness (160 entries this year with prizes going to 10 Belgian products and six from Holland) of the competition's importance. Products came in varied materials — textiles, ceramics, plastics — and ranged from the electric motor (opposite) of heavy industry to a trimly designed coffee grinder (left) for the housewife. This year the Signe d'Or was characterized not so much by novel ideas (though these were present —as in the baby crib (opposite) whose mattress comes up to table height when the front panel is lowered) as by a refinement of style and careful attention to detailing in the design.

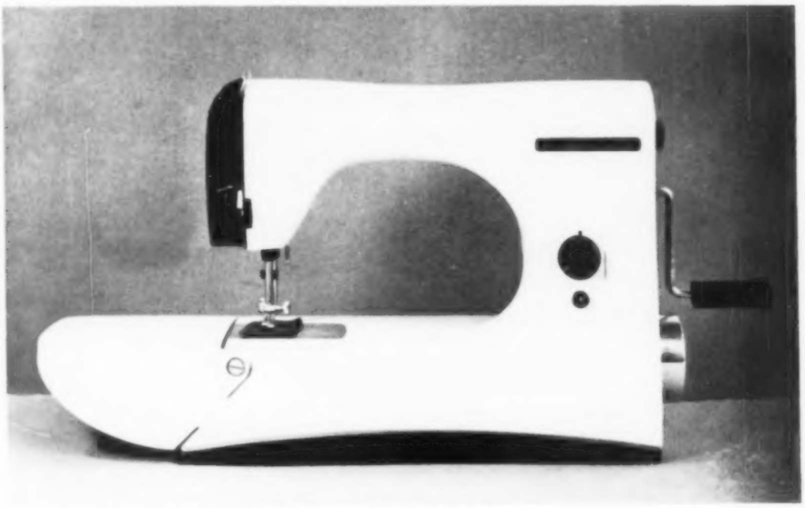


Baby crib by P. De Bruyne for Mertens, Belgium

One-half-horsepower motor by Constructions Electriques de Beaumont, Belgium

Compasso d'Oro *emphasizes refinement and ingenuity of Italian work*

The Compasso d'Oro, an older version of the Signe d'Or sponsored by Milan's famous department store, La Rinascente, had an unusually large number of entries last year. The 235 firms which participated submitted a total of 12,000 articles. Of these 45 were chosen for special recommendations while the actual Compasso d'Oro award went to designs by Gino Colombini, Vinicio Vianello, Ruth Christensen, Benso Cesarino Priarollo, and Marcello Nizzoli. The National and International awards were given to Pinin Farina and Finnish designer Kaj Franck for the consistently high quality of their work as a whole. The jury included Aldo Borletti, Cesare Brustio, Franco Albini, Pier Giacomo Castigloni, and Ignazio Gardella.



Sewing machine by Marcello Nizzoli for Necchi

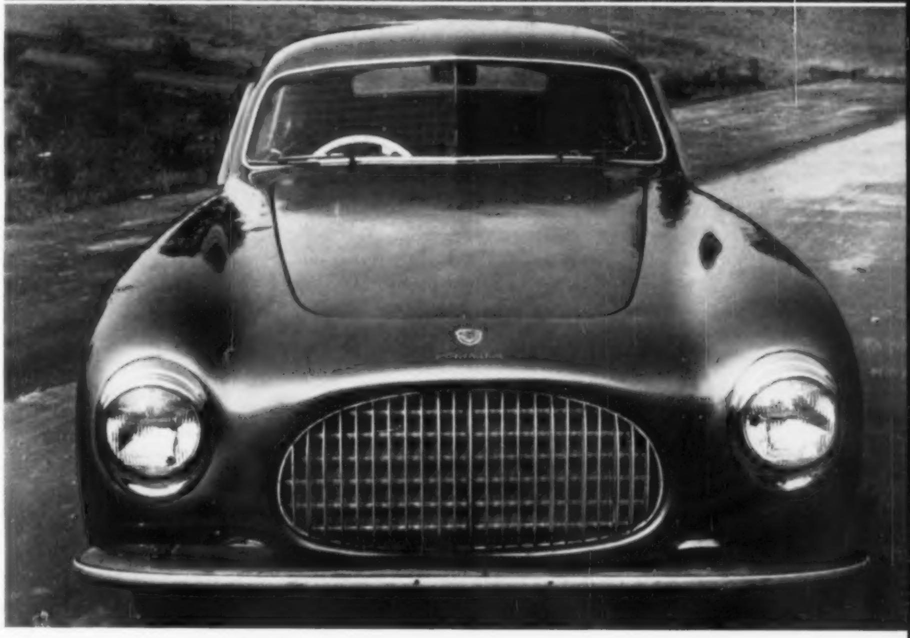
Four deck suitcase designed by Natale Beretta for Lavorazione Artigiana

Ski boot by Benso Cesarino Priarollo for Calzaturificio Giuseppe Garbuio

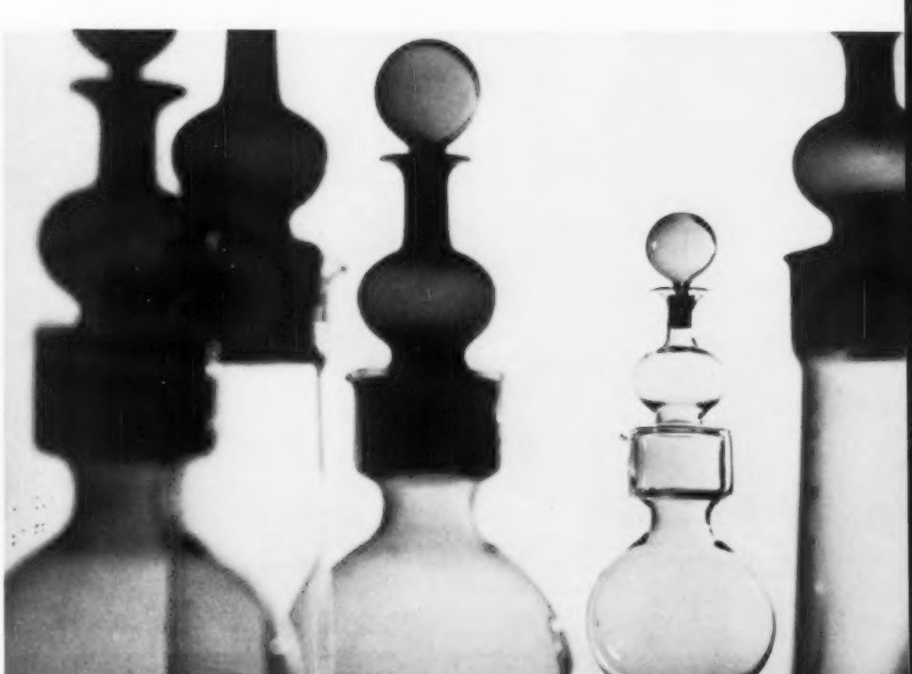
Crystal flower vases designed and produced by Vinicio Vianello

Farina's Lancia Gran Turismo, **1951** *(top) and the Cisitalia,* **1946**

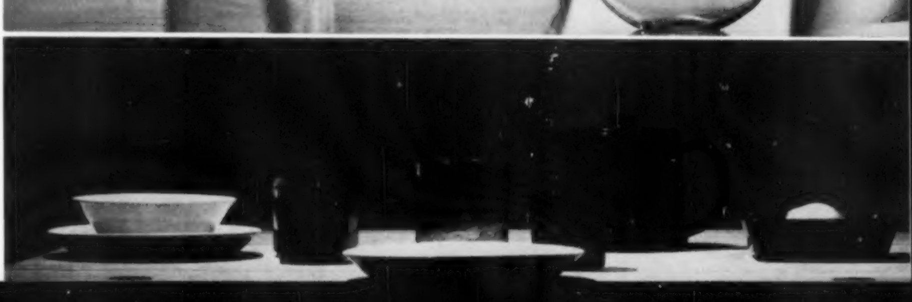
Pinin Farina, *Grand National award winner of the Compasso d'Oro, is perhaps most famous for his design of the Cisitalia coupé (opposite). First produced in* **1946** *at the Pinin Farina Coach works in Turin, the car has been a pacesetter of the Italian automotive school. The Museum of Modern Art has called it one of the "six outstanding cars of our time." Breaking away from the boxiness of the early classic car with its separately articulated elements, it established the "envelope" idea in body design. The body here becomes a smooth metal skin drawn tightly over a compact frame. In the Cisitalia, as in other Farina designs, decoration is used sparingly, with emphasis on sculptural modeling.*



Kaj Franck, *winner of the Grand International award, is a designer for the famous Wartsila-Arabia ceramics concern and for Wartsila-Notsjo Glassworks. Though his early work was in the field of furniture and lighting design, he now concentrates on glass and ceramics—and has been a revolutionary force in both fields. He has consistently sought to produce inexpensive household ceramics, attractive enough for the dining room yet sufficiently practical and sturdy for the kitchen. As a result his ceramic work is popular throughout the world. Introducing the idea of non-matched table sets, Franck developed supplementary pieces of different colors but with many possibilities for combinations. In his glasswear also Franck likes to use color, imaginatively transforming the demands of utility into striking forms.*



Franck's juice bottles for Wartsila-Arabia, **1957**, *and table set for Wartsila-Notsjo Glassworks,* **1952** *(bottom)*



Manufacturers Literature

Aircraft Rotary Actuators. Airborne Accessories Corp., Hillside, N. J. 4 pp., ill. Lists engineering information and dimensional data on the new modular design rotary actuator, designated Series R-12.

Chemiseal Mechanical Seal. Bulletin AD-164. The Garlock Packing Company, Palmyra, New York. 8 pp., ill. Lists types, optional designs, specifications and installations of the new seal.

Drafting Templates. Timely Products Company, P.O. Box 146, Basil, Ohio. 8 pp., ill. Presents full line of symbol, circle, ellipse, alphabet and other templates used by architects, builders, engineers, draftsmen, students and others. Size, scale, description and uses, and price are shown for each.

Exide-Manchex Stationary Batteries. Bulletin 6205. The Electric Storage Battery Company, P.O. Box 8109, Philadelphia 1, Pa. 8 pp. Reviews design improvements in new line of stationary batteries.

Fabricating Facilities. Taylor Fibre Company, Norristown, Pa. Booklet entitled "Why," 12 pp., ill. Shows how Taylor is equipped with coil-slitting machines; hand, power and guillotine-type shears; press brakes; various saws; fly-cutters; punch presses, lathes, engravers and the like for efficient handling of any conceivable fabricating requirement.

Fiberglas Sleeving and Tubing Guide. Textile Products Division, Owens-Corning Fiberglas Corp., Department 860, 598 Madison Avenue, New York 22, N. Y. Contains a Selection Factor Chart; Nema Standard Sizes and Identification of Grades and Summary of Performance Characteristics; photographs of typical applications; government specification information; information on types of Fiberglas sleevings and tubings, including properties and applications; and Nema definitions and classes.

Leak Detectors. Bulletin GEA-6817. General Electric Company, Schenectady 5, N. Y. 12 pp., ill. Describes the characteristics and applications of leak detectors for locating leaks in any system or component under pressure or vacuum. Special emphasis is given to a new control unit which can be used with any of the four detector heads.

Materials Handling Problems. Bulletin GC-58. The Rapids-Standard Co., Inc., 342 Rapistan Bldg., Grand Rapids 2, Mich. 43 pp., ill. Detailed explanations and drawings point up specific uses for Rapistan conveyors and special-accessory equipment in manufacturing, storage, retailing, wholesaling, construction and shipping operations.

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Manufacturer's Literature

Open Floor Grating and Stair Treads. Reliance Steel Products Company, McKeesport, Pa., 16 pp., ill. Complete engineering details, from panel sizes, weights and safe loads, to surface treatments and fastening methods are included.

Photographic Materials for the Reproduction Field. Association of Photo Sensitizers, Inc., 51 East 57th St., New York 22, N. Y. 48 pp. Lists types of silver sensitized papers, films, cloths used by industry in the reproduction of engineering drawings, templates, etc., and for silk screen, visual projection, offset duplicating and in other reproduction techniques. Lists materials produced by virtually all manufacturers and major distributors for industrial users.

Plastic Steel Emergency Repair Kit. Devcon Corporation, Danvers, Mass. 4 pp., ill. Covers complete chemical and physical properties of this product, with illustrated case history type applications.

Products for the Plastic and Allied Industries. Chemical Development Corp. Danvers, Mass. 12 pp. Covers complete line of adhesives, coatings, anti-static agents, cleaners, lubricants, and related products for use with most plastics as well as with wood, metal, glass, and other materials.

Roll-Kleen Air Filter. Farr Company, P.O. Box 45187, Airport Station, Los Angeles 45, Calif. 8 pp., ill. Contains detailed information about the component parts of the air filter. Operation controls relating to Roll-Kleen automatic filtration are described as well as engineering data and maintenance factors.

Steel Tubing. Catalog CS-59. Ohio Seamless Tube Division of Copperweld Steel Company, Shelby, Ohio. 8 pp. Describes seamless and electric-resistance welded steel tubing in mechanical, aircraft mechanical, airframe, and pressure grades.

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ACCOMPLISHED INDUSTRIAL DESIGNER *with successful record in consumer products, industrial equipment and furniture, seeks challenging position. Imaginative coordinator, supervise development through all phases. Pratt graduate with nine years experience in production, materials, human engineering. Location preferred; New York, New Jersey or Connecticut. Box ID-203,* INDUSTRIAL DESIGN, *18 East 50th Street, New York 22, New York.*

Help Wanted

ARCHITECTURAL AND DESIGN PERSONNEL AGENCY—MURIEL FEDER—*A personalized placement service for top level architects, designers, draftsmen, interior decorators, and home furnishing personnel. Selective contacts arranged in a confidential and professional manner. Interviews by appointment. 58 Park Ave., N. Y. MU 3-2523.*

HELEN HUTCHINS PERSONNEL AGENCY—*Specialist Professional, Sales, Administrative Personnel, for Industrial, Architectural, Interior Designers; Home Furnishings Manufacturers, Distributors, Stores, Publications, etc. Helen Hutchins' long association with a leading industrial design organization insures intelligent screening. 767 Lexington Avenue, New York. TE 8-3070. By appointment.*

MANAGER—INDUSTRIAL DESIGN (*Headquarters East Coast*) *Must be creative with broad experience in radio and TV cabinet design, possess originality with materials, colors, metal finishes, component arrangements, etc. Requires supervisory ability. Must have a sixth sense for successful commercial designs. College graduate. Starting compensation: $20,000 to $25,000. Box ID-204,* INDUSTRIAL DESIGN, *18 East 50th Street, New York 22, New York.*

Miscellaneous

FRESH IDEAS IN TOY DESIGN NEEDED *by a leading manufacturer of educational toys. Large eastern firm, marketing a prestige line, interested in any new marketable toy idea. Excellent royalty and fixed fee arrangement along with necessary facilities to promote and advertise any item in production. All ideas will be given personal and prompt attention. If interested please write for submission forms. Box ID-200,* INDUSTRIAL DESIGN, *18 East 50th Street, New York 22, New York.*

PRODUCT DESIGNER—*product and tool planning service in reinforced plastics—formerly with two significant molders of successful applications—Coordinating from initial concept of a reinforced plastic product through design, specifications, tooling, costs, pre-production, quality control. Warren Diebold, 9886 Humphrey Road, Cincinnati 42, Ohio. SY 1-9689.*

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Distinguished Industrial Designers interpret the expanding role of design in industry . . . how form, technique, and appearance have emerged as major factors in volume manufacturing and marketing.

"Through acute awareness of human values the industrial designer becomes a natural catalyst in the constantly changing challenge between people and things."

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Don Dailey Associates
Evansville, Indiana

For Your Calendar

Through October 19. The 3rd Annual Exhibition of Silvermine Interior Designers Associates—room settings incorporating paintings and sculpture by artist members. Silvermine Guild of Artists, New Canaan, Conn.

Through October 22. "German Architecture Today." Smithsonian Institution Traveling Exhibition. Rhode Island School of Design, Providence.

Through October 22. "European Glass Design." Smithsonian Institution Traveling Exhibition. St. Lawrence University, Canton, New York.

Through January 4. "New York from 1890 to 1910," as photographed by Byron. Museum of the City of New York.

October 14-16. The 13th annual Packaging, Handling and Shipping Show at the Chicago Coliseum.

October 15-16. New England regional conference on technical and distribution research and development at the Hotel Somerset, Boston. Sponsored by The New England Council in cooperation with the Small Business Administration and the U.S. Department of Commerce.

October 18-November 2. The 6th Tunis International Fair. Theme of U.S. exhibit: "Progress under the Sun."

October 20-21. Seminar on production control, sponsored by the National Institute of Management, Inc., at the Mayflower Hotel, Washington, D. C.

October 20-24. National Business Show at the New York Coliseum.

October 21. Regional Technical Conference of the Upper Midwest Section of the Society of Plastics Engineers. The subject is epoxy resins. At the Curtis Hotel, Minneapolis.

October 22. Management Marketing Forum conducted by the Center for Research in Marketing, Inc., New York, for the Canadian Packaging Association. King Edward Hotel, Toronto.

October 24-November 14. "The Architecture of Japan." Contemporary Arts Center, Cincinnati.

October 26-29. Conference on "The Evolution of Products" at Arden House, Harriman, New York. Organized by the Institute of Contemporary Art, Boston.

October 26-December 7. International Ceramic Exhibition presented by Syracuse Museum of Fine Arts to celebrate the 20th anniversary of the Ceramic National. Syracuse Museum of Fine Arts, Syracuse, New York.

October 27-31. National Metal Exposition, Cleveland Public Auditorium.

October 27-31. National Furniture Design Show. American Furniture Mart and Merchandise Mart, Chicago.

November 1-16. 1958 Design Derby, Architect International Bureau, Dupont Plaza Center, Miami.

November 6. 1958 Regional Technical Conference of the Philadelphia Section of the Society of Plastics Engineers. Subject: "Advances in Injection Molding." Sheraton Hotel, Philadelphia.

November 10-12. The 13th Technical and Operating Conference of the Steel Founders' Society of America. The Carter Hotel, Cleveland.

November 13. Regional Technical Conference of the Southern California Section of the Society of Plastics Engineers. Subject: "Plastics Trends in Building Construction." Ambassador Hotel, Los Angeles.

November 13. "The Origins of Abstract Architecture." Lecture by Sibyl Moholy-Nagy. The Architectural League of New York, 115 East 40th Street, N. Y.

November 17-21. The 8th National Plastics Exposition. International Amphitheatre, Chicago.

November 21-December 18. "Good Design for Christmas". Contemporary Arts Center, Cincinnati. Well-designed objects suitable for Christmas gifts.

"The new look in BRECK shampoo packaging! Beautiful, lightweight, unbreakable, plastic jars, molded from

MARLEX*"

Designed and blow-molded by PLAX, this attractive 6-oz. widemouth contour jar has strong, thin walls that are shatterproof and chip-proof . . . safe in the bathroom . . . perfect for travel. The new tapered contour design is easy to hold, and the surface is gentle to the touch.

In addition to being first in the cosmetics field with this revolutionary new package, Breck saves more than 5 pounds per case in shipping weight, since the new jar has 1/10th the weight of a comparable opal glass jar!

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*MARLEX is a trademark for Phillips family of olefin polymers.

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