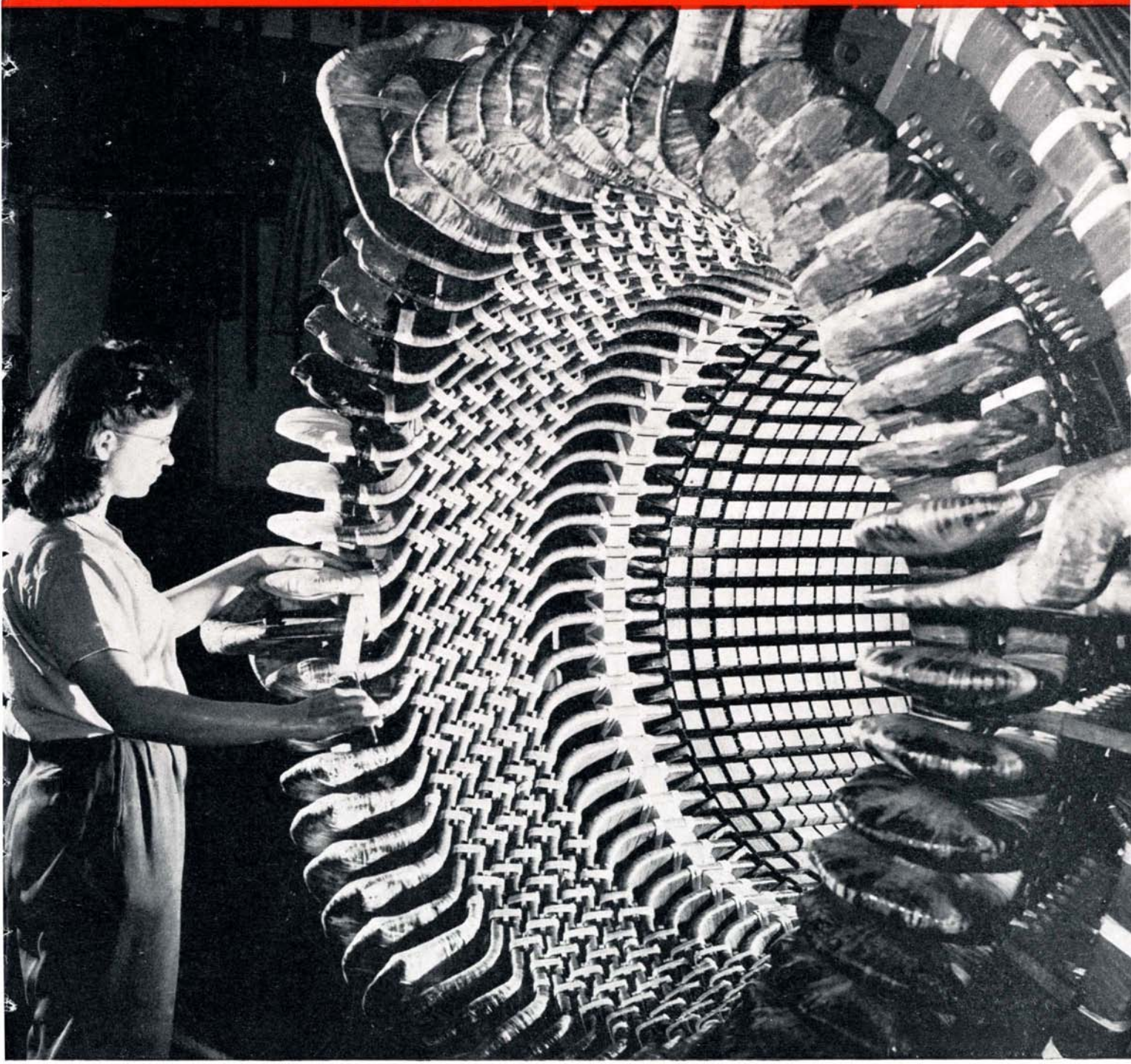
Scientific American

NOVEMBER
1946

✦

35 Cents
a Copy

REPORTING THE PROGRESS OF SCIENCE AND INDUSTRY



Power for 35,000 Persons . . . See page 193

NEW DESIGN TECHNIQUE INCORPORATES DUREZ

Convincing evidence of the modern trend towards functional design is effectively revealed in these illustrations of the old and the new Belfone "Maestro" intercommunication units.

Notice how the hard, "mechanical" look of the prewar Belfone has been replaced by an attractive molded Durez plastic housing that gives this new product an air of superior quality, as well as supplying it with many other physical benefits required by the manufacturer.

What This User Wanted

In this connection Mr. Floyd W. Bell, President of Bell Sound Systems, Inc., comments interestingly . . ."Our new design offers many functional advantages in addition to its beauty. The rounded top of the new Belfone eliminates the natural tendency to pile papers and other material on top of it, building up insulation and hindering the free circulation of air. Since the many curved surfaces and encircling louvers would be impractical in wood, the cabinet is being molded of Durez. Its over-all attractiveness makes it suitable for use on the finest executive desk. The durability of Durez ends for all time the many disadvantages of old-fashioned flat-top housings and the scratching to which wood is susceptible. In addition, its imperviousness to atmospheric conditions provides undiminished lasting beauty."

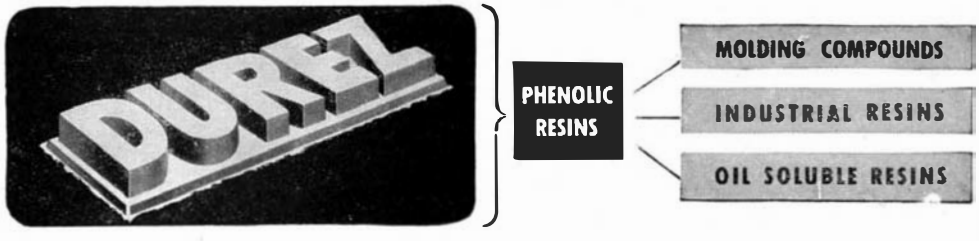
Unlike other housings of this type which are molded in one piece with an open bottom or back, the new Belfone housing consists of two pieces comprising the front and back sections. These are molded separately and assembled with molded end flanges in a slot. Molds for producing this unique construction were developed by Bell engineers in cooperation with the Plastics Division of Continental Can Co.

What You Can Get

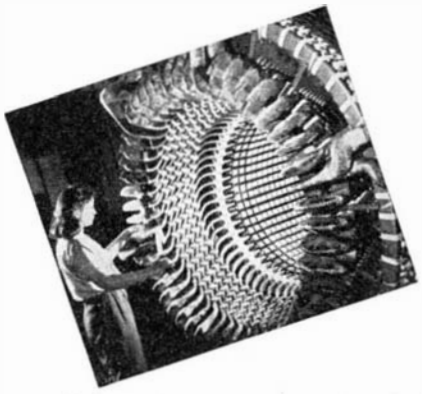
The general-purpose Durez plastic used is one of more than 300 multi-propertied molding compounds developed by Durez laboratory engineers. Heat resistance, dielectric strength, non-resonance, and impact resistance are some of the important characteristics inherent in all Durez phenolic plastics.

We'd like to work on any of your problems that phenolic plastics may solve. The competent counsel of experienced Durez technicians, as well as a library of proved product development data, awaits your enquiry.

Durez Plastics & Chemicals, Inc., 111 Walck Road, North Tonawanda, N. Y.
Export Agents: Omni Products Corporation, 40 E. 34th St., New York, N. Y.



PLASTICS THAT FIT THE JOB



INDUSTRIAL DRAMA: One stage in the construction of a 43,750 KVA Westinghouse turbo-generator, capable of supplying the electrical requirements of a community of 35,000 population.

Scientific American

Founded 1845

In This Issue • November 1946

50 and 100 Years Ago in Scientific American 194

Previews of the Industrial Horizon ..... A. P. Peck 196

METALS IN INDUSTRY

Brightening the Surface ..... Fred P. Peters 197

Stamped Motor Parts ..... 200 — Uniform Metal Powders 200

Steel Descaling 200

CHEMISTRY IN INDUSTRY

Plastics and Fires ..... Foster D. Snell 201

Plastics Oyster Shells ..... 203 — Coal Acids 204

Colored Rubber ..... 203 — Plaster and Plastics 204

Freon Flame-Quench ..... 204 — Air Disinfection 204

ENGINEERING

Moisture Meters Move Up ..... Edwin Laird Cady 205

Handy Hydraulics ..... 207 — Actual Limits: Shop Limits 207

AVIATION

Ideas in the Air ..... Alexander Klemin 208

Arrow-Like Wings ..... 210 — Aircraft Static 210

ELECTRONICS

Electrons Guide the Loom ..... Vin Zeluff 211

Plant-Truck "Intercoms" ..... 213 — Aluminum Welding 213

PLASTICS

Covering Up With Plastics ..... Charles A. Breskin 214

Structural Plastics ..... 216 — Plastics Hinges 216

PETROLEUM

Oil Heat for Industry ..... John Smith 217

Piston-Ring Oiling ..... 219 — Synthetic Fuels and Oils 219

IN OTHER FIELDS

New Vitamin C for Old ..... Barclay Moon Newman 220

Parts Washer ..... 222 — Pure Air in Rail Cars 224

Steel on Farms ..... 222 — Flame-Cutting Distortion 224

DDT Use ..... 223 — Phase Microscopy 224

Industrial Refrigeration ..... 223 — Industrial X-Ray 225

NEW PRODUCTS AND PROCESSES

Dial Gage ..... 226 — Electrical Tachometer 228

Liquid Soap ..... 226 — Rayon Fabrics 229

Expansive Bit ..... 226 — Star Time 229

Forming Brake ..... 226 — Plastics-Glass Sheets 229

Water-Repellent Film ..... 226 — Bench Press 230

Arc Welding Head ..... 227 — Silver Alloys 230

Inks for Rubber ..... 227 — Fruit Counter 230

Scissors Sharpener ..... 228 — Load Mover 231

Aluminum Paint ..... 228 — Battery Water 231

Nylon Rope ..... 228 — Tap Breakage 232

Rotary Planer ..... 228 — Industrial Pumps 232

Short-Run Parts ..... 228 — Disk File 233

Current Bulletin Briefs 234

Our Book Corner 236

Telescoptics 239

Subscription Rates:

ONE YEAR—$4

TWO YEARS—$7

THREE YEARS—$10

Canada 50¢, foreign $1 per year additional

WHEN you change your address, please notify us immediately, giving your OLD as well as your NEW address. Postal requirements are such that our subscription files are arranged geographically, not alphabetically. Because of this, failure to give your old address may result in delaying receipt of copies.

SCIENTIFIC AMERICAN, November, 1946. Vol. 175, No. 5. Owned and published by Munn & Co., Inc. Orson D. Munn, President; I. Sheldon Tilney, Vice-President; John P. Davis, Secretary-Treasurer; A. P. Peck, Assistant Secretary; all at 24 West 40th Street, New York 18, N. Y. Entered at the New York, New York, Post Office as second-class matter June 28, 1879, under act of March 3, 1879. Additional entry at Orange, Connecticut. Published monthly by Munn & Co., Inc., 24 West 40th Street, New York 18, N. Y.

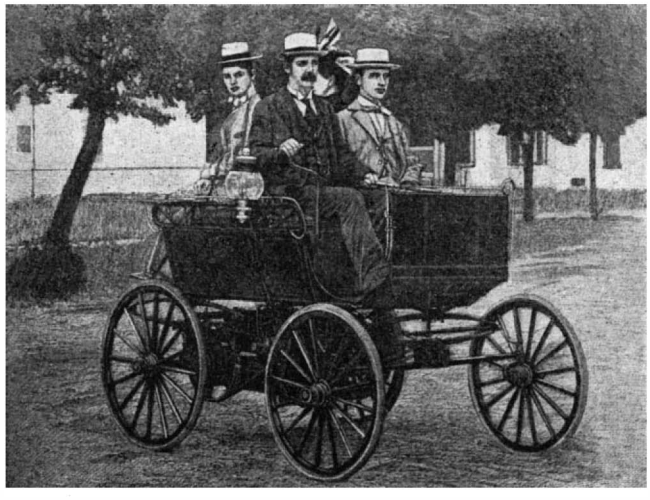
50 Years Ago in . . . SCIENTIFIC AMERICAN

(Condensed from Issues of November, 1896)

INVENTIONS VS. LABOR — "It is no doubt true that when a new invention is introduced which revolutionizes some particular art or branch of business, it at first decreases the number of persons employed in that particular line; but that is only temporary, for in a short time the result is a cheapening of the product, a greatly increased demand for it, because of this cheapening, and then necessarily an increased demand for laborers in that line, and almost universally at increased wages. Statistics show this to be true beyond the possibility of a question."

SCIENCE CO-OPERATION — "The time is certainly ripe for the establishment of a great international association for the advancement of science. The various national associations have shown by their recent fraternal exchange of courtesies that they are prepared for it and are fully alive to the benefits which it would confer."

HORSELESS CARRIAGE — "The horseless carriage herewith illustrated is a compact and well proportioned vehicle which has been giving good service during the past few weeks on the country roads of Michigan. It is driven by a five horse power gasoline motor which is placed underneath the box. In attaching the motor to the carriage, care has been taken



to avoid any direct attachment to the box, so that when it is running the vibrations shall not be communicated to the passengers . . . The fuel supply is located below the engine and has no connection with the box, special care being taken to prevent any possibility of explosion . . . The carriage was invented by Mr. R. E. Olds, the general manager of the P. F. Olds & Son Engine Works of Lansing, Michigan."

WIRED GLASS — "Some tests recently made to determine the fire resisting qualities of wired glass, i.e., glass containing in its texture woven wire netting . . . showed that glass of this kind is capable of withstanding a high temperature, very much higher than ordinary glass, without melting or losing its continuity, even when suddenly drenched in a heated state in cold water . . . The capability of the wired glass to withstand a temperature beyond the melting point of glass appears to be attributable to the fact that the network of wire in the glass acts as a good conductor of heat, and thereby prevents the accumulation of sufficient heat to melt the glass."

WASHING MACHINE — "A machine designed to rapidly force the washing liquid many times through the clothes with the least possible expenditure of labor or power, and without danger of injury to the clothes has been patented . . . The water is forced through the clothes by reciprocating perforated plungers or dashers whose squared shafts slide in and turn with the hubs, there being on one of the hubs a pulley to be connected by belt with a source of power, or the machine may be operated by hand."

SIAM RAILROAD — "With the exception of the short narrow gage line to Paknam, the railway now under construction from Bangkok to Khorat is the only railway in Siam. It is to be the first of a vast ramification of lines designed to distribute civilization to the most distant portions of the kingdom."

TESTING — "No more valuable move has been made, of recent years, by our railroads, than a recognition of the fact that it was necessary to know accurately the character of the material they were using, both in track and rolling stock; so that at the present time all first-class roads either have a testing bureau, as a special department of their own organization, or employ one of the numerous testing bureaus."

BRANDY — "The largest brandy still in the world is at El Pinal vineyard, in San Joaquin County, not far from Stockton. Part of it has been built about four years and the other part was finished only a short time ago. . . . The grape juice or wine is pumped from vats to a tank. From there it simply passes through a series of heated chambers in the form of a vapor and comes out in the shape of brandy. . . From the time the wine leaves the tank until it comes out as grape brandy only ten minutes is occupied. In the old method of distilling it used to take about three hours."

BRIDGE CARS — "The new electric motor cars to be operated on the Brooklyn Bridge, and which are to take the place of the old switching engines, are being tested, and so far have proved successful."

OIL — "More than 2,700 oil wells were bored in Indiana in 1895, and hopeful, well informed men expect that enormous total will be surpassed in 1896. The oil industry of Indiana is coming to be one of the greatest in the State, and it is confidently predicted in some quarters that the State will soon rank with Pennsylvania and Ohio in the quantity of oil annually taken out of the ground."

100 Years Ago in . . . SCIENTIFIC AMERICAN

(Condensed from Issues of November, 1846)

TRANSCONTINENTAL — "There has recently been a large meeting at the room of the Board of Trade, Pittsburgh, to hear an explanation, from Asa Whitney, Esq., of his project to connect the Atlantic and Pacific Oceans by railroad."

WORKING CONDITIONS — "A factory has been established at Bradford, England, to be conducted on an improved system. The operatives are required to work only ten hours, and with the factory are connected an excellent school and other means of instruction, with improved wholesome accommodations for boarding, lodging, &c."

BUILDING — "In the course of eight months, not less than twenty-five hundred brick houses have been erected in Pittsburgh, including many noble and costly factories."

PRINTING PRESSES — "We are satisfied that there is yet an open field for improvements in printing presses, and should not be surprised to see one introduced, by which the pressman can operate the machinery by double treadles while his hands are employed in feeding the machine."

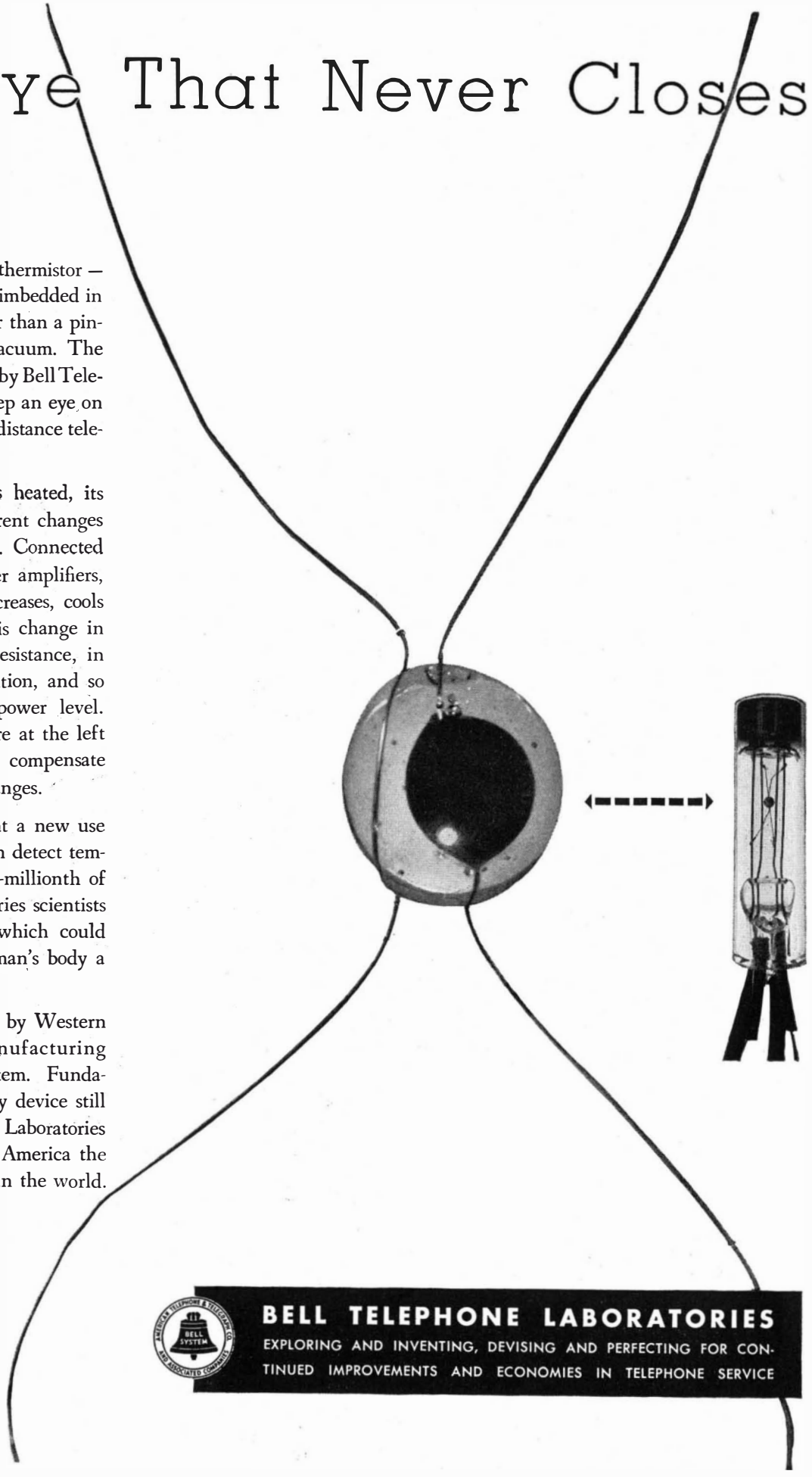
The Eye That Never Closes

You are looking at a thermistor — a speck of metallic oxide imbedded in a glass bead hardly larger than a pinhead and mounted in a vacuum. The thermistor was developed by Bell Telephone Laboratories to keep an eye on the amplification in long-distance telephone circuits.

When a thermistor is heated, its resistance to electric current changes rapidly. That is its secret. Connected in the output of repeater amplifiers, it heats up as power increases, cools as power decreases. This change in temperature alters the resistance, in turn alters the amplification, and so maintains the desired power level. Current through the wire at the left provides a little heat to compensate for local temperature changes.

Wartime need brought a new use for this device which can detect temperature changes of one-millionth of a degree. Bell Laboratories scientists produced a thermistor which could "see" the warmth of a man's body a quarter of a mile away.

Thermistors are made by Western Electric Company, manufacturing branch of the Bell System. Fundamental work on this tiny device still continues as part of the Laboratories program to keep giving America the finest telephone service in the world.



BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

Previews of the Industrial Horizon

By A. P. Peck

PATENTS STILL STYMIED

HEART of industrial America is the United States patent system. Upon the protection given by this system depends the incentive to invent, to improve, to progress. Yet, as pointed out on this page, September 1946 issue, the powers-that-be placed serious war-necessitated handicaps on the operations of the Patent Office and then, tortoise-like, moved but slowly to remove them.

Our September note called attention to the wide separation of parts of the Patent Office. Since those lines were written, announcement has been made that the units in Richmond will be moved closer to the Washington units—within three and a half miles, to be exact. But this is not enough. Essentially the operations of the Patent Office must be on assembly-line principles if peak efficiency is to be realized. Even with the latest move, the examining divisions will still be separated; the shuttling of papers, examiners, and inventors will continue. Try this system on an industrial production line and watch output decrease. That is exactly what has happened with the Patent Office. Latest official figures show that over 114,000 patent applications are awaiting action—not the mere 11,000 mentioned in our September item as the result of an errant typographical figure.

For the sake of emphasis we repeat: The Patent Office must be consolidated, returned to its pre-war efficiency. An approach to such consolidation is not enough; the physical consolidation must be complete if our patent system is once more to function properly.

LOCOMOTIVES IN PRODUCTION

SPEAKING of the Patent Office as a production-line operation brings to mind the first mass-production plant for locomotives just put into service by the American Locomotive Company. Up till a couple of months ago, locomotives were assembled by the gang method: Materials and men were concentrated at one point where the behemoth of the rails gradually took form. Now, under the assembly-line procedure, the unit proceeds along the line, with sub-assemblies being made in shop bays. These bays, in turn, feed the main line so that complete locomotives emerge at the end.

Formerly it was thought that locomotives were too large, too bulky, to lend themselves to assembly-line construction. But the mechanics of the job have been worked out. They point toward a broader expansion of the underlying principle of increased efficiency through stabilization of worker position and wider application of conveyors of one type or another to carry the assembly from point to point as parts are added.

INCREASE PRODUCTIVITY

OUR EDITORIAL forte is applied technology but all too often the ideals and aims of the technologist become inextricably involved with human nature. Strikes of the moment are a case in point. Perhaps we over-simplify—but over-simplification is frequently refreshing in the welter of conflicting and selfish opinions—when we point to the basic premise that increased productivity of the individual industrial worker would automatically put an end to practically all of the disputatious points which breed strikes and industrial unrest. Still over-simplifying, it seems that labor in general wants to produce less for more wages. This just doesn't make sense. Productivity—not money—is wealth. The tools are there. The industrial plant is there. Management is willing. Technological knowledge is available. Only human nature—and a disregard of the principles of economics—stands in the way of increased production and consequent increased wealth of the nation as a whole.

BETTER SURFACE COATINGS

STILL in the experimental stage, but pointing inexorably toward a new horizon in the surface coating field, is the work that is being done by General Electric with silicone paints. The whole field of silicones, in fact, holds increasingly great promise. These inorganic materials, with excellent temperature and corrosion resistance characteristics, as previously reported in these pages, are making their impress on many fields of industry, ranging from elastomers to lubricants to plastics to paints.

But to get back to the silicone surface coatings: Extensive service tests of silicone paints indicate that they will give virtually "life-time" finishes to such durable goods as automobiles, refrigerators, stoves, furniture, industrial machinery, and the like. The coatings will withstand temperatures from far below zero to over 550 degrees, Fahrenheit, without losing their luster or changing color. Silicone paints promise as great a revolution in the surface-coating business as was brought about by the nitro-cellulose lacquers in the early '20s.

STRAWS IN THE WIND

WHILE pre-fabricated houses may some day become an important factor in the low-cost housing field, present cost of these houses in general is no lower than conventional homes. . . Micro-filming, plus punch-card filing, promises high efficiency and compactness for industrial files. . . Premiums of all kinds, low in cost but high in human interest, are increasingly successful in promoting consumer goods. . . Home air conditioning will not get the reception it deserves until a better appreciation is reached by both manufacturer and user of all the problems involved. . . "Research," says Charles F. Kettering, "is the process of finding out what you are going to do when you can't keep on doing what you are doing now."

Scientific American
NOVEMBER • 1946

Brightening The Surface

Complete Assemblies, Intricate Designs, Wire Articles, and a Host of Other Mechanical-Buffing "Problems" Can be Electrolytically Polished at Low Unit Cost. Particularly Practical is the Facility with Which This Method Adapts to Existing Electroplating-Production Equipment

By FRED P. PETERS
Editor-in-Chief, *Materials & Methods*

EVER SINCE some siren of antiquity first found it both pleasant and useful to study her reflected beauty in a metal mirror, industry and the arts have aggressively sought new methods of producing lustrous, mirror-like surfaces on metals. Today, dazzling bright finishes are found not only on mirrors and on reflectors but also on hundreds of other articles where the appearance of the product rather than its functional reflectivity is the chief consideration.

For generations, mirror-bright surfaces on jewelry, cutlery, silverware, and so on—and in modern times on cocktail sets, golf clubs, windshield wipers, and other impedimenta of civilization—have been produced by mechanical polishing or buffing methods. Often these operations are an aftermath of electroplating, the general procedure being to produce the brightest possible plated surface and then to finish this surface to a brilliant luster by mechanically or manually rubbing the surface against wet or dry polishing cloths, buffing wheels, impalpable abrasive powders, and similar materials.

Recently, a new technique, electrolytic polishing—or electropolishing, for short—has come into in-

Courtesy Rustless Iron and Steel Division, American Rolling Mill Company
Intricate stainless-steel jewelry is made possible by electropolishing methods

creasing use for parts or products that are relatively difficult or expensive to polish effectively by conventional methods. Electropolishing also has certain advantages of its own which make it competitive with mechanical polishing for some types of work, although for other jobs the orthodox buffing or polishing methods may sometimes be simpler or more economical.

Electropolishing is, in a sense, electroplating in reverse. The part to be polished is placed in a suitable solution where it functions as the anode—rather than the cathode, as in electroplating. A cathode of some other conducting material completes the cell. When the electric current is passed through the part, acting as the anode, into the solution, a thin film of metal is removed from the surface of the part—in electroplating metal is added to the surface.

The normal surface of a piece of unpolished metal consists of microscopic hills and valleys. In electropolishing, the passage of current tends to remove more metal from the hills than from the valleys, and this leveling effect is responsible for the increased brilliance. The longer the operation is continued—up to a certain point—the more level and the brighter the surface becomes. Electropolishing is susceptible to close control and has been as successfully used for precision industrial work as for the production of surfaces remarkable for their beauty alone.

Electropolishing features that appeal to many users include finishes that are pleasingly lustrous without being garish; economical application to certain products, parts, and shapes such as wire forms that are difficult to polish economically otherwise; and the production of bright finishes in corners, holes, spiral grooves, knurled surfaces, and other inaccessible portions of metal parts. The latter locations are often almost impossible to reach by mechanical polishing or buffing methods.

The process also has other advantages or purposes that are as yet of lesser importance. Some of these are its ability to remove burrs or sharp edges, the slightly improved corrosion resistance it effects in some metals, its applicability for electrolytic "machining"—to remove a microscopic layer of metal for dimensional reasons, or to improve surface smoothness—and its faculty of revealing seams or irregularities in a surface that might otherwise remain hidden.

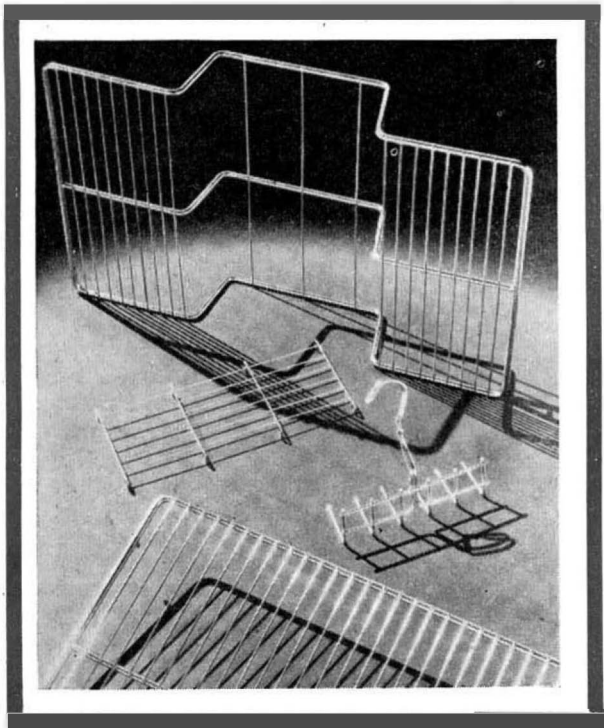
• LOOKING AHEAD •

Greater design freedom — decoratively, functionally — with limitations of mechanical polishing eliminated . . . Many-fold expansion of electropolishing installations . . . More electrolytic "machining" on extreme-precision products . . . Increased use of welded-wire construction.

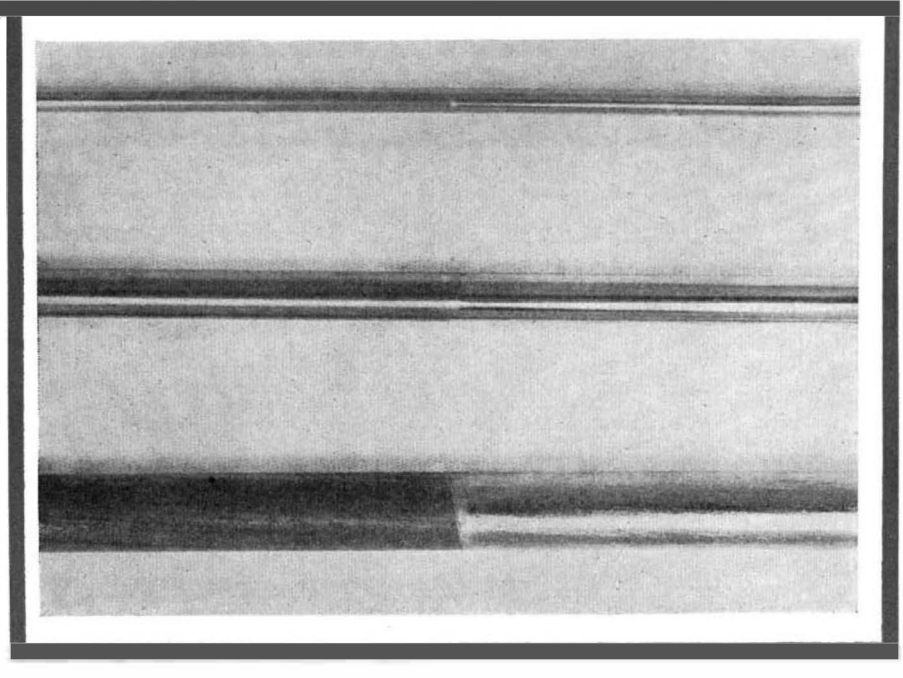
TWO METHODS COMMON—Commercial electropolishing has been applied primarily to stainless steels, for which it is economically in a better competitive position than it is for some of the other softer, easier-to-buff metals. It is, however, increasingly used for other metals and alloys, and some new and interesting processes for these have recently been developed.

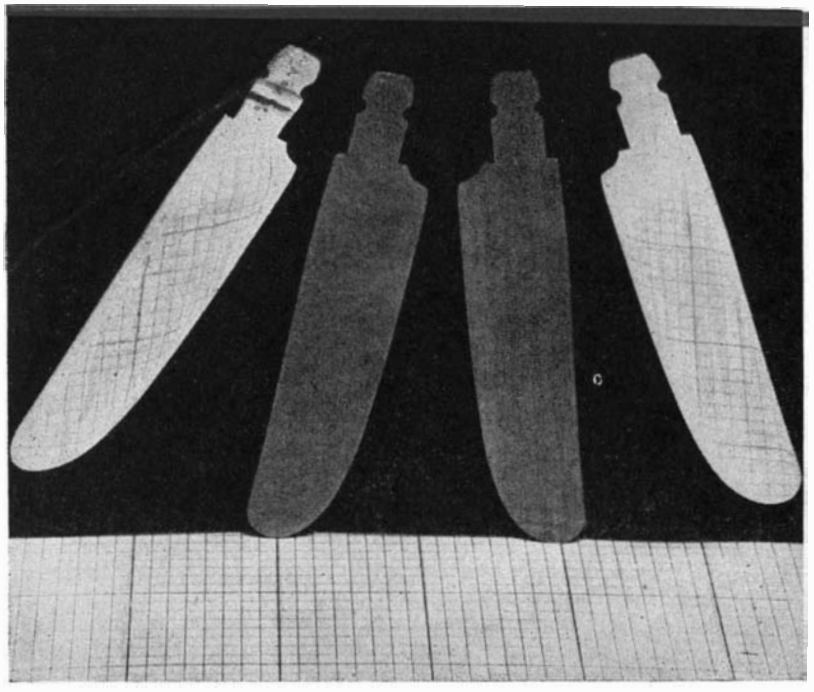
For stainless steels the electropolishing process most widely used in this country is the patented citric-sulfuric acid process of Rustless Iron and Steel Division of American Rolling Mill Company. The sulfuric-phosphoric acid process, patents on which are owned by Battelle Development Corporation—an affiliate of Battelle Memorial Institute—though less used on stainless than is the Rustless process, has been used commercially on a host of other metals as well, and thus has special interest because of its versatility.

The Rustless process for stainless steel employs a solution of 55 to 60 percent citric acid, 15 percent sul-



Refrigerator shelves (left) of welded stainless-steel wire, almost impossible to polish manually, gleam brightly after quick electropolishing treatment. Samples of wire used (below) show dull unpolished surfaces on left; ends on right have undergone electropolishing. Illustrations courtesy Rustless Iron and Steel Division, American Rolling Mill Company





furic acid, and the balance water. Operating conditions depend on the composition, surface characteristics, size and shape of the steel, amount of luster desired, and other factors. Direct current at 6 to 12 volts, and current densities of ½ to 1 ampere per square inch are used, bath temperatures being held between 185 and 200 degrees, Fahrenheit.

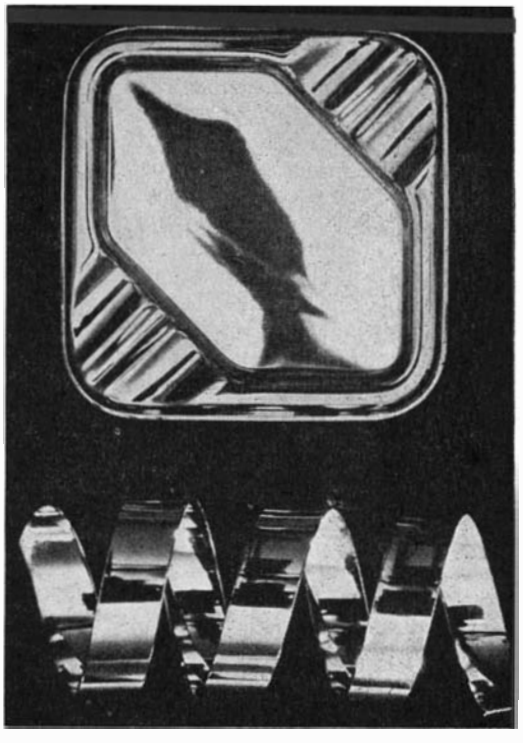
The time of immersion necessary to achieve a specified luster varies with the original surface and the current density. Even one minute is sufficient to improve the luster, but five- to ten-minute periods are usually required to produce full luster on initially smooth work. Rough surfaces may take 10 to 15 minutes. An important point is that electropolishing by any process will brighten a bumpy or coarsely rough surface, but it will also leave it still bumpy; the degree of smoothness of an electropolished finish is related to the smoothness of the original surface.

The Battelle solutions, using mixtures of sulfuric and phosphoric acids, are of considerable commercial interest because they can be applied to the electropolishing of many common materials—carbon steel, alloy steels, stainless steels, aluminum, brass and, to a limited extent, zinc, copper, nickel silver, and other alloys without changing the solution or with simple changes in the proportions of the constituents.

POLISHING COSTS CUT — Silver has recently been added to the list of metals that are being commercially electropolished through the separate development by Westinghouse (Scientific American, September 1946) and by Arthur D. Little, Inc., of alkaline processes applicable to this metal. The Arthur D. Little process, which employs an alkaline cyanide bath similar to that used for plating silver, has been used for over a year by Oneida Ltd. on silver tableware with notable improvement in quality and reduction in operating cost. A special advantage of this installation is that spoons, forks, knives, and so on can be electropolished on the same racks on which they are electroplated.

Indeed, the applications of electropolishing to already-plated metal represent one of the most promising fields for the new process. In such instances, electropolishing often eliminates a hand-buffing operation, since it can be performed automatically in tanks on the same production line as the electroplating tanks. This was found especially valuable in the case of one electric appliance parts manufacturer, for example, who forms certain parts out of cold-rolled steel, bright-nickel-plates them, then electro-buffs—instead of mechanically buffing—and finally chromium plates the parts, achieving an entirely satisfactory and attractive chromium finish with a cost saving of one to five cents per unit.

Another likely application for electropolishing is for costume jewelry. Intricately shaped brass parts may be electropolished prior to plating them with a thin coating of gold, which may or may not require a final light pass on a coloring wheel. For cheap or novelty costume jewelry the gold plating may be omitted and the item simply finished brilliantly in electropolished brass, at a total production cost often as low as one half cent per piece.



Silverware industry finds source of economy and product improvement in electropolishing. Knife blades in outer positions (above) show results that are possible without mechanical buffing. Decorative items (right), too irregular for economical hand buffing, polish up as well as the simpler knife blades when electrolytic methods are used. Illustrations courtesy Battelle Memorial Institute

COMPLEX PARTS POLISHED — An exceptionally intriguing use for the process which recently received much publicity is for stainless-steel jewelry. One novelty jewelry manufacturer does a rushing business

producing bright and shiny electropolished stainless bracelets, earrings, belts, jewelry cases, watch bands, chokers, hair-bands, and similar articles. These he makes from stainless-steel wire by braiding it, forming and twisting the heavy braids, cutting, welding where required, and electropolishing to give a brilliant finish. Electropolishing actually makes this application possible, for it is the only method capable of producing a brilliant luster on all the loops, crevices, and interstices of the braided metal.

The electropolishing of stainless-steel refrigerator shelves made of welded wire and strip is one of the outstanding applications of this process, and was the first to be accomplished in large commercial volume. Here the process is not only highly economical—because of the much higher cost of polishing wire forms mechanically—but also serves to remove the weld discoloration that was virtually impossible to obliterate mechanically. One large, semi-automatic installation of the Rustless process for this purpose produced up to 5000 electropolished trays per day.

A good example of the versatility of the Battelle process is its use, after assembly, for electropolishing an automobile windshield-wiper arm which combines in the assembled unit stainless-steel stampings, carbon-steel extension bars, inserts and springs, and brass parts. Excellent overall finish is obtained by electropolishing the assembled unit for two minutes in one bath, at the rate of 750 per hour. The same tank also electropolishes 3750 wiper blades per hour and the average electropolishing cost is about one half cent per piece.

Again, refrigerator ice-cube trays of aluminum are electropolished after forming, the inside and outside of the trays being done simultaneously at an electropolishing production cost of around three cents per tray. In the case of electropolished aluminum reflectors, light reflectivity—especially to ultra-violet light—is reported to be better than that of mechanically polished aluminum reflectors.

At the present time there are more than 100 commercial or pilot-plant electropolishing installations in operation. The companies involved include large and small manufacturers; the installations are of all types including automatic, semi-automatic, batch, and hand-operated; and the materials and forms handled run the whole gamut from stainless steel, through aluminum, down to carbon steel, in the form of forgings, stampings, castings, bar, rod, wire, sheet, and fabricated parts.

But this is only the beginning, for many companies hitherto watching from the sidelines are about to install units, and at the same time important improvements in processes are ready to be introduced.

⊕ ⊕ ⊕

STAMPED MOTOR PARTS

Replace Castings for Light, Welded Unit

MADE largely of steel stampings, a new electric motor will be proportionately smaller and lighter than conventional motors. Castings will be replaced by stamped and pressed steel parts welded together. Latest machining practices will be used and the power plant will meet all standard motor-design requirements.

UNIFORM METAL POWDERS

In Ultra-Fine Grades, Gain High Density and Strength

FOR MOST commercial uses of powdered metals, the fineness of metal powders are precisely rated by giving mesh sizes down to —325 mesh —the powder that will pass through a sieve having 325 squares per square inch. Powders finer than this are usually not graded, simply being reported as —325 mesh.

This finest classification of commercial powders is considered unsatisfactory by many fabricators because of shrinkage and non-uniformity problems associated with it. Here, powder mixtures that pass through a —325 mesh are not just one size, but a mixture of sizes ranging all the way from 1 millionth of an inch up to 44 millionths in diameter.

Dr. H. H. Hausner of New York University has recently demonstrated that the ultra-fine particles can be produced to a specified size such as two microns instead of a broad size-range and that two-micron powder has distinct advantages as to uniformity of processing behavior. Ultra-fine copper powder, in particular, permits the manufacture of larger powder-metal parts because the pressure applied per unit of area can be lower. In addition, uniform ultra-fine powders lead to parts of higher density, hardness and mechanical strength.

STEEL DESCALING

Being Successfully Accomplished With Sodium Hydride Bath

STAINLESS STEELS, tool steels, and other alloy steels are being descaled by treating them in a fused caustic soda bath containing sodium hydride. This work is now being done at several stainless and alloy steel mills with considerable improvement in quality and material-economy.

In operation, sodium hydride is added to a bath of molten caustic soda and the scaled material held in the bath at, for example, 700 degrees, Fahrenheit, for a time ranging from a few seconds to half an hour. The metal is quenched from the high temperature into a water-tank, the mixture of surface salts and loosened scale being thrown off the surface to leave a uniform matte finish.

The process, developed and controlled by Du Pont, is notable for the large amount of time it saves in descaling or pickling alloy steels.

Quenching stainless steel wire after treatment in sodium hydride tank at right

Plastics and Fires

Although No Longer Novel and Unfamiliar, Plastics Materials Have Met Occasional Opposition on the Grounds that They are Too Flammable and Raise Gas Hazards in Fires. Tests Disprove Such Views and Show that Plastics are No More Dangerous than Most Other Substances

By FOSTER D. SNELL
Foster D. Snell, Inc.

BECAUSE plastics now appear in our homes, our offices, our businesses, and are an accepted part of our daily living, it is pertinent to inquire whether they expose us to any new hazards, particularly those from fire. Careful investigation has been made of this latter possibility and searching tests reveal neither any new hazards inherent in plastics nor any old hazards that they have perceptibly increased or even affected. These points are important, because the utility and variety of plastics as well as the quantities available are mushrooming into a huge business.

The plastics industry has expanded headlong, and the trend continues at an only slightly slower pace. With a 100-million-dollar plant expansion now going on, next year's production of plastics is expected to reach five times that of 1939. Current output is about a billion pounds a year. It is easy to forget that this is an expansion and not something entirely new; that only a comparatively few plastics appear in almost infinite variations of form and utility to serve thousands of purposes; that people have been living with plastics and meeting them in their homes and factories for a quarter of a century and more. It is also easy to develop a fear of what seems unfamiliar, and in this fact rests the value of dispelling that unfamiliarity with a report that proves plastics to be no more hazardous in fires than ordinary materials plentiful in every home and building.

A list of present commercial plastics extends almost indefinitely, but in the sense of practical fire hazard, the different synthetic resins composing them differ hardly more than the several varieties of wood such as oak, birch, pine, or balsa. The nature of any added fillers also may affect the flammability and the fire hazard of plastics products, but these, too, do not perceptibly increase the danger. Indeed, no synthetic-resin has been found more flammable or more dangerous in a fire than wood, even in severe tests.

NATURE OF COMBUSTION — The composition of the plastics necessarily determines the decomposition products formed from it during a fire, and hence the individual fire hazard. In a fire, the oxidation process of combustion usually occurs in three steps: destructive distillation; partial combustion; and complete combustion. The first two steps occur when access of air is severely limited, and the third step when an excess of air is present, as from a strong draft. These steps are practically important, since each produces different types of toxic gases.

Destructive distillation characterizes a smoldering fire with a relatively little air available to it. The heated material only partially decomposes. Gases, the kind depending on the chemical nature of the burning material, are given off, leaving a residue consisting largely of carbon, soot, and charcoal. Particles of the soot form characteristic dense smoke.

The second step, also characterized by dense smoke, consists of the union of carbon with oxygen to form the highly poisonous carbon monoxide. Since this gas is odorless, it is extremely hazardous.

In the third phase, ample air supplied to the fire burns any flammable gases present—carbon monoxide and those formed by destructive distillation. Plentiful oxygen burns carbon monoxide completely to harmless carbon dioxide. Other gases may be formed, depending on the nature of the burning material. The gaseous products of complete combustion generally are far less dangerous than those of partial combustion. For example, such toxic nitrogen compounds as ammonia formed by incomplete combustion will burn to harmless nitrogen and water vapor if sufficient oxygen is available.

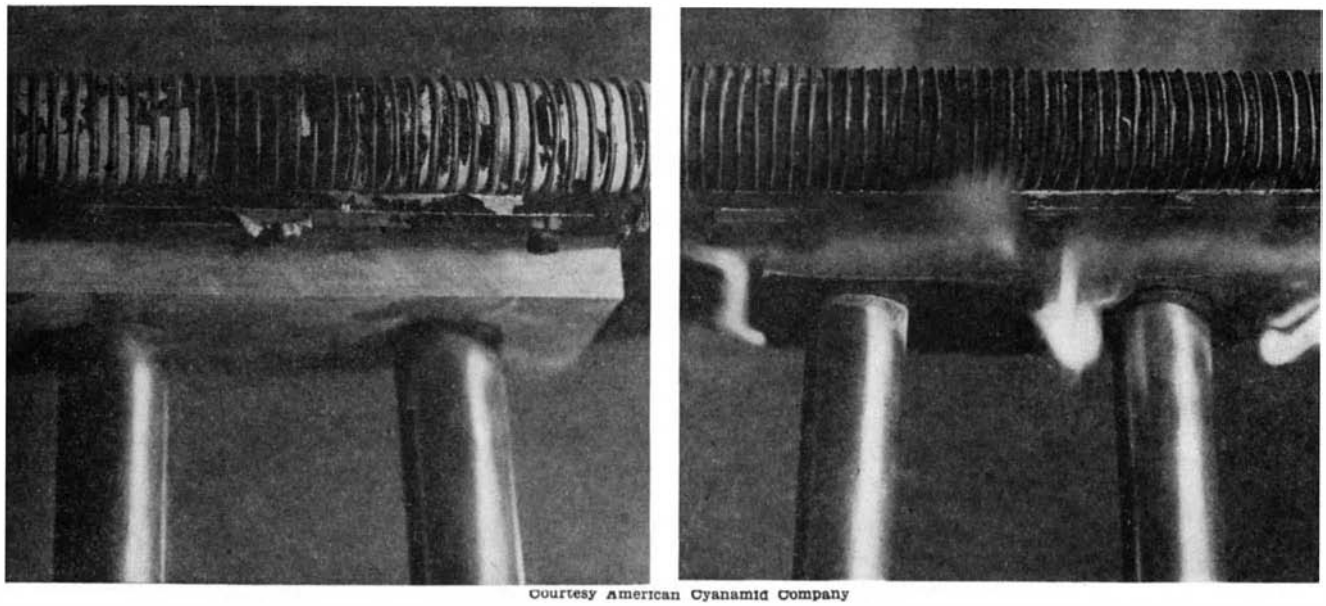
IGNITIBILITY AND FLAMMABILITY — Synthetic plastics generally are more difficult to ignite than wood. But whether a material will burn, and at what temperature, depends both on its chemical nature and on its physical form. Nitro groups, for instance, promote ignitibility, and Celluloid, which contains such compounds, burns very readily in thin sheets—more readily than paper or absorbent cotton.

Physical form may be even more important than composition. A fine powder is easier to ignite than a porous mass, and the latter in turn fires more easily than a compact solid. Kindling burns more readily than a log, even from the same tree. The same principles also apply to plastics.

Comparative tests indicate that synthetic-resin plastics generally are less flammable than wood. But hard rubber is much more easily ignited than any of a long list of synthetic plastics tested. Cellulose acetate is the most flammable plastics, except Celluloid, and the most easily ignited. Yet it is the base of safety film used in home motion-picture projectors and the Celanese of which dresses are made. Obviously a material which has been so widely and variously used is not seriously dangerous.

The relative ignition temperatures of some common materials have been determined in relation to plastics. Newsprint ignites at the lowest temperature (easiest to ignite), pine wood is next, then leather, then cellophane, and finally cellulose acetate which is more difficult to ignite than any of the common materials named.

Once ignited, cellulose acetate may burn vigorously, depending on the nature of the plasticizer present. Methyl methacrylate, Plexiglas,



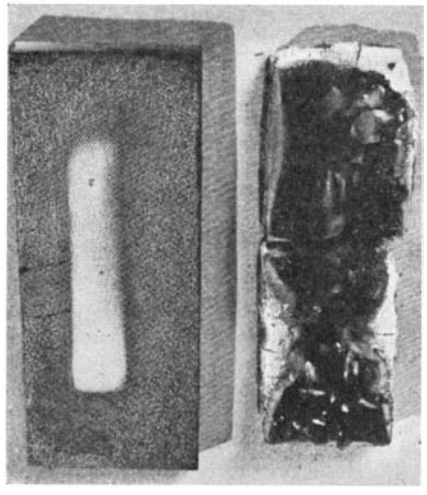
Courtesy American Cyanamid Company

At temperatures of 500 to 1000 degrees Fahrenheit, a glass-filled melamine laminate and a similar block of cloth fabric-filled phenolic laminate (left and right above) show importance of selecting filler and plastics to fit job in hand. Two samples (right) are same blocks; glass-filled laminate is practically undamaged after one hour of heating, fabric-phenolic is badly charred after only ten minutes

burns quietly at first and then more vigorously as it is decomposed by heat. Urea-formaldehyde and melamine resins burn with great difficulty, and the flame goes out when the material is removed from the source of heat.

FILLERS INVOLVED—Plastics commonly contain both resins and fillers. These latter may be flammable or non-flammable and their effects may be quite as important as those of the resins. A phenolic resin laminated with a paper base caught fire under test at the same temperature, 1100 degrees, Fahrenheit, as cellulose acetate. More difficult to ignite—that is, requiring a higher temperature—was a molded-phenolic plastics filled with wood flour; next was a molded-phenolic filled with asbestos; and another requiring an even higher temperature 1500 degrees, Fahrenheit, was filled with mica. This series demonstrates the effect of the filler in a family of poorly combustible plastics.

These tests emphasize the difference between organic and inorganic fillers. Paper, cotton, and wood, all organic, will burn by themselves. Asbestos and mica, inorganic minerals, will not burn. All synthetic resins, except the partly inorganic silicones, are entirely organic and burn if subjected to a sufficiently high temperature. A plastics com-



posed essentially of a resin and a filler will therefore burn more easily if the filler is combustible than if it is not.

Small sample slabs of several commercial plastics were held in direct contact with a luminous gas flame to test their behavior. Cellulose acetate, rated as a slow-burning material, melted while burning; flaming drops fell from the sample and continued to burn as they fell until completely consumed. Methyl methacrylate and polystyrene plastics behaved much the same. Flame progressed from bottom to top of six-inch samples of cotton-filled phenol-formaldehyde plastics after about five minutes' contact with the flame. The samples then continued to burn without flame. A wood-filled phenol-formaldehyde plastics, similar otherwise, failed to carry flame the entire length of the sample, but did show an afterglow. An asbestos-filled phenol-formaldehyde plastics, also similar otherwise, burned only during contact with the flame, the asbestos filler thus apparently suppressing flammability. A urea-formaldehyde plastics burned during contact with the flame, but stopped burning shortly after the flame was removed. Most samples of vinyl plastics burned only during application of the flame.

HAZARDS FROM GASES — Very little experimental work has been reported on the actual combustion products of plastics. Nevertheless, the nature of these products can be deduced from their known chemical compositions. Apparently plastics first break down under heat into much simpler compounds, which may be the same as the original starting materials but usually are not.

In the preliminary stages of heating, phenol-formaldehyde plastics, the Bakelite family, presumably give off small amounts of phenol and formaldehydes, both toxic at certain concentration levels. Combustion of both phenol and formaldehyde in the second stage of the fire produces carbon monoxide.

Indeed, carbon monoxide is the greatest danger from poisonous gases at the average fire, whether in the home, office, theater, store, or warehouse. It is formed by the incomplete combustion of all organic materials—including all kinds of fabrics, whether clothing, rugs, or upholstery, of cotton, wool, linen, silk, or rayon; all kinds of wood; and all kinds of plastics. In an unventilated space, the concentrations of other toxic gases which may be formed are ordinarily insignificant in comparison with that of carbon monoxide.

Wood burning in a closed space gives 2 to 6 percent of carbon monoxide; simultaneously fractions of a percent of formaldehyde and of acetic acid are formed. Hence, wood burning without ventilation, and without a draft to carry off the gases

produced, is much more dangerous than phenolic plastics burning under the same conditions because the wood burns more readily.

Safety moving-picture, photographic, and X-ray films, commonly cellulose acetate, may produce as much as 2.5 percent of carbon monoxide, a concentration quickly fatal. Newspaper burned under the same conditions yields about the same amount of carbon monoxide and hence is just as dangerous as the acetate plastic. Or to put it the other way around, the acetate film is no more dangerous when burned in the absence of excess air than newspaper. Both acetate film and newspaper will give carbon dioxide and water when burned completely.

All plastics based on compounds which contain nitrogen, except Celluloid, produce hydrogen cyanide and ammonia on incomplete combustion. Such plastics include urea and melamine resins, and nylon. Usually phenol-formaldehyde plastics contain nitrogenous compounds which also decompose to ammonia and cyanide. The maximum safe concentration of hydrogen cyanide is 20 parts per million, but 100 parts per million of ammonia are safe.

NITROGEN COMPOUNDS — The fire hazard of nitrogen compounds through the evolution of poisonous gases, particularly hydrogen cyanide, is not new but has long been known. Nitrogen-containing plastics are dangerous and they will produce hydrogen cyanide by destructive distillation. But so will other materials long familiar. Wool, silk, fur, leather, cheese, and milk powder, among others, all contain nitrogen compounds and will produce hydrogen cyanide on destructive distillation. Experiments with such materials lead reasonably to the conclusion that plastics containing nitrogen are no more dangerous in a fire than wool or leather.

During a fire, a closet full of woolen suits is a much greater potential danger as a possible producer of hydrogen cyanide than a whole set of Beetle or Melmac dishes. A small, closed den furnished with several pieces of leather-upholstered furniture and shelves of leather-bound books is also a potential source of hydrogen cyanide during a fire.

No one need, on this account, discard leather furniture or refuse to buy new leather articles. Neither need women discard silk and nylon hose for rayon, merely because silk and nylon yield hydrogen cyanide in a fire and rayon does not. The conditions under which silk and nylon yield hydrogen cyanide would necessarily produce carbon monoxide and ammonia as well, and clearly a dangerous concentration of hydrogen cyanide would be unavoidably accompanied by dangerous concentrations of carbon monoxide and ammonia. Since all of these toxic gases burn completely with plenty of air and become harmless products, only during destructive distillation or incomplete combustion are poisonous gases evolved from these nitrogen-containing materials.

Wool also contains sulfur which may yield toxic hydrogen sulfide during the first and second stages of a fire and toxic sulfur dioxide during the third stage. Rubber, both natural and synthetic, also contains sulfur. But none of the common plastics do.

NO INCREASED HAZARDS—Some plastics—Vinylite, Koroseal, Saran, among them—contain chlorine which may form hydrochloric acid in a fire. Still others, the glyptals, are formed from glycerine and yield poisonous acrolein on partial combustion, just as do butter, lard, and cooking fats.

Destructive distillation or partial combustion of plastics thus, obviously, yields toxic gases; but these, with the single exception of hydrogen chloride, are identical with those formed under similar conditions from such familiar materials as wood, leather, silk, wool, and fats. All yield carbon monoxide as their major toxic product and this gas continues to constitute the predominant fume hazard of all fires. Other toxic gases probable in fires of either plastics or the older familiar materials are ordinarily small or even negligible as compared with carbon monoxide, which can be considered as quite unaffected whether plastics are present or not.

Clearly then, plastics introduce no new hazard into the fires of 1946 which did not exist in those of 1936, or of 1916, or even of 1896. Here, evidently, is a whole series of new developments that will make our lives easier and better without at the same time exposing us to any new hazard—even from fire.

PLASTICS OYSTER SHELLS

Lighten Shipping Weight, House Live Oysters for Days

SUBSTANTIAL economy in shipping oysters is reported through the use of plastics cases for the succulent bivalves after they have been removed from their heavy natural shells. The idea is to remove the oyster from the shell and immediately place it in a light-weight plastics duplicate of the shell.

Tests have shown that the oyster will continue to live for many days under refrigeration in artificial shells made of some of the newer types of highly resistant plastics, and these can be shipped at a small fraction of the weight of the natural shells. Thus it is planned to ship to remote points only good looking half shells and to leave all other shells as near the point of origin of the oysters as possible.

COLORED RUBBER

Toughened by White Substitute for Carbon Black

POWDERY silica, suitable for incorporation into rubber stocks can be made by burning a colorless organic liquid, ethyl silicate, to produce silicon dioxide, or silica, in very fine particles similar to a smoke.

Under the electron microscope the particles are seen to be of the same size and shape as superfine carbon black, which is also produced by a combustion process. The new material, however, is white and partly translucent.

Ethyl silicate burns to give a white deposit of fumed silica on the plate

Its physical similarity to carbon black makes possible its use as a substitute for carbon black in the compounding of rubber. Here, the silica performs in exactly the same way as carbon to give the rubber increased tear and abrasion resistance, and higher tensile strength. It will be possible to make strong rubber goods of any color with the new material since the silica will not interfere with the color.

Commercial utilization of fumed

silica will not be realized until mass production reduces the price. It is presently much more expensive than carbon black, officials of The B. F. Goodrich Company, developers of the new material, point out.

FREON FLAME-QUENCH

Better Than Other Gases as Fire Extinguisher

A REFRIGERANT employed in some large air-cooling systems, Freon 11, can be used effectively to extinguish gasoline fires and prevent explosions. Other inert gases which have been tested and ranked in descending order of their effectiveness as flame-quenching agents are Freon 12, Freon 21, carbon dioxide, automobile-exhaust gas, and nitrogen.

Of the Freon series, dichloromonofluoromethane or Freon 21 probably is the most commonly used in refrigerating and air-cooling systems. Freon 11, the best flame-quenching agent among those tested, now is used in centrifugal compressors, feasible only for large refrigerating or air-cooling units. The investigations have been carried out by the Bureau of Mines of the Department of the Interior.

COAL ACIDS

Foreseen as Inexpensive Ingredient for Plastics

POWDERED bituminous coal, oxidized with gaseous oxygen in the presence of aqueous alkali, forms, in a new process, polybasic acids which go into solution in the alkali. Acidification followed by solvent extraction yields the acids in the amount of 60 percent of the weight of the coal charge.

The acids are a mixture of aromatic acids which behave chemically like phthalic acid in forming plastics. They are recovered as a light yellow to brown powder.

The process is now in the pilot-plant stage at Carnegie Institute of Technology. Since the raw materials are all cheap and abundant and the process applicable to large-scale manufacture, extensive use of these acids is foreseen in the production of plastics, plasticizers, and other organic compounds.

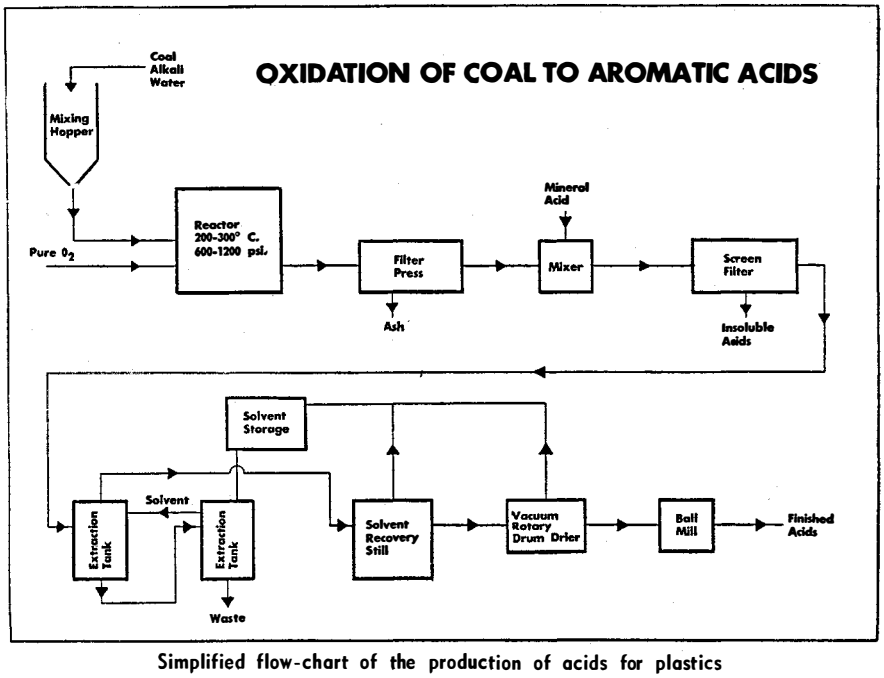
PLASTER AND PLASTICS

Are Combined for Greater Strength

IMPREGNATING plaster of Paris with resins constitutes a new use for plastics and results in products applicable to the field of ceramics.

Two techniques are used for indurating plaster with plastics: with one, solutions of the resin are made up and the plaster is added; with the other, resin in a dry state is mixed with the plaster of Paris and water is then added. The latter technique limits the selection of resins to the melamine and urea types. The result of the process is an improved product which has acquired the durability of the plastics without sacrificing plaster's low price advantage.

Most earlier efforts to pre-combine plastic with plaster of Paris encountered some loss in ease of handling the plaster—either because of greater problems in mixing, accompanied by lumping and formation of gas pockets in the final castings, or because of delay in setting of the plaster and in the development of good early strength.



Simplified flow-chart of the production of acids for plastics

Another process, the impregnation of finished plaster castings with various resins uses a low viscosity furfural resin, developed exclusively for the purpose. Furane resins possess excellent wetting properties, and will readily penetrate into plaster. Application is either by immersion or brushing on the final shape. Water soluble phenolic resins can also be employed, and after the water has been removed may be effectively cured to develop good strength properties. The combination, however, lacks both the strength of the furane resin impregnated types and the ability to take high operating temperature for appreciable periods.

Furane resins contain no solvents, and although they may be cured ultimately at room temperature, heat curing is recommended. When full impregnation is practiced, the resin impregnated plaster is heated slowly not only to avoid stresses, but also to prevent sweating out of the resin on the outside surface.

When maximum impact strength is desired, cotton or glass wool is added to the plaster of Paris before pouring. Subsequent curing with furane resin will then give a structure capable of taking much mechanical abuse. Application of furane resins to dry plaster of Paris forms does not result in any build-up on the surface of resin. The processes described were reported to the Society of Plastics Industry, by J. Delmonte.

AIR DISINFECTION

Accomplished by Vapor from Lacquer Solvent

TRIETHYLENE glycol, a chemical largely used as a solvent for nitrocellulose lacquer and as an intermediate in the manufacture of plasticizers, is now recognized as an effective bactericide. In tests, one gram of it vaporized in 200,000,000 cubic centimeters of air rapidly killed the organisms responsible for pneumonia, influenza, streptococcus infection, catarrh, colitis, and other diseases. Preliminary results show that it may even control tuberculosis and the common cold.

At the concentration used, the material is not harmful to persons or animals, fabrics, or painted surfaces. The glycol is effective only at fairly high humidities, which leads to the theory that the moist surface of the organism attracts the hygroscopic chemical, which coats the germ with a lethal layer.

Units suitable for vaporizing the glycol in houses, schools, hospital wards, and so on, are manufactured by the Rogers Diesel and Aircraft Corporation.

Moisture Meters Move Up

By EDWIN LAIRD CADY

Portable, Quick-Indicating, and Inexpensive Instruments—that Show How Wet, or Dry, a Material Really is—Take Guesswork Out of Jobs Ranging from Painting Walls Through Multi-Color Printing

AN EXPORTER got several car loads of dehydrated pea soup as far as the Atlantic seaboard. Then he put in a frantic call for a moisture meter. An inspector had opened a package of the food, found that it contained more than the permitted amount of moisture, ordered further drying before export shipment.

The drying was done, the packages re-sealed, and the food sent on to Europe. A moisture meter, a handy device which costs less than $250 and is as easy to use as a foot rule, first had shown how much drying needed to be done, then had proved that it had been done.

A painting contractor made an agreement to paint the plaster walls of an office building and have the job done in five days so the new tenants could move in. He too was in the market for a moisture meter. Knowing that if his work failed to stand up after the paint had been on for a year or more he never would get another contract from that realty company, he had stipulated that he was to be permitted to delay his contract if the plaster was too damp for good painting.

The building superintendent said that the plaster was dry enough, the painter said it was not. To settle the point, they bought a moisture meter of a model costing less than a set of good paint brushes. They went over all of the walls with this, found some surfaces which had less than the 5.5 percent of moisture which is the top limit for good painting of plaster, found other areas with more moisture than that. Then they worked out a schedule by which the dry areas would be painted first and the wet ones be given more time to dry out.

From that day on, the realty company specified the use of a moisture meter in every painting or other wall finishing contract. The meters also find damp spots which show that pipes are leaking, roofs are defective, or outside walls are seeping. They show just where walls ought to be better insulated to cut down condensation or "sweating." Moisture meters find dampness troubles while they still are small, permit large maintenance bills to be headed off.

• LOOKING AHEAD •

Extensive use of moisture meters in food production—from farm, to packer, to retailer. . . Better printing jobs and fewer "off-register" color runs. . . Safer storage of coal, grains, and other combustibles. . . More accurate lumber seasoning and closer matching of lumber to end-use climates.

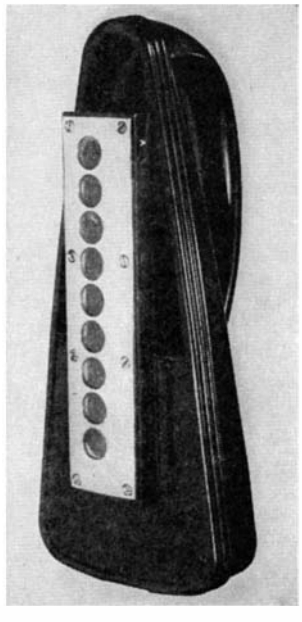
FURNITURE SUITS CLIMATE—One of the furniture companies studied such experiences by several realty companies, came up with a new philosophy which may change segments of the whole furniture industry.

The new idea is to go to large real estate companies all over the country, study the records of the moisture conditions that their meters have found inside buildings, then build furniture of woods having moisture contents controlled to fit "room climates."

Everyone has had the experience of having the drawers of a new piece of furniture stick and jam or else get so loose that they are hard to handle, while an old bureau behaves perfectly. And nearly everyone has shipped old furniture from one section of the country to another, only to have it start misbehaving like brand new.

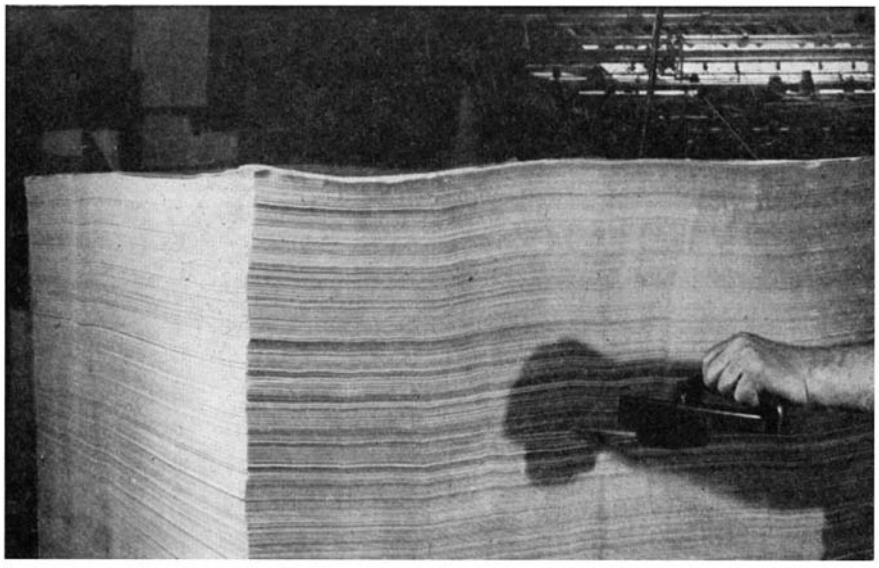
The reason is that wood will take on moisture from a room which is damper than itself, give off moisture to a dryer room. The dampened wood swells and warps, the dried wood shrinks. Let a piece of furniture grow old in one climate and it becomes balanced to conditions; in more technical language, it becomes "stabilized to average conditions."

Furniture made according to this



Contact side (left) and meter side (right) of a surface-type moisture meter. Variety of applications necessitates many different instrument designs

Courtesy Cambridge Instrument Company, Inc.



latest notion will be pre-stabilized. By using plenty of moisture meters in the lumber kilns and in the furniture factory the moisture content of each piece of wood will be closely controlled. Furniture intended for the damp climate of New York will have a higher moisture percentage, pieces to be shipped to arid Arizona will have much less moisture, every region will have its specific moisture gradient. The result will be that, no matter where it is bought, brand new furniture will behave as well as if it had stood in one room for years.

MOISTURE-METER FARMING — Farmers have picked up the moisture-meter idea. Instead of depending upon the vagaries of sun and wind to dry their alfalfa, hay, grain, and other feed crops, they are installing recirculated-warm-air drying sheds which are as closely controlled as many an industrial installation. The sun can bleach out some of the food values; the race to get the crop in before an unexpected rain storm arrives can lead to the storing of materials which are so damp that later they will mildew or rot. But with handy moisture meters telling just how much moisture needs to be removed and recording the process of mechanical drying until the moisture balance is proved to be ideal, the highest food values can be obtained and spoilage reduced.

Based on such use of moisture meters on the larger and better farms and ranches, a whole new industry of building crop drying and conditioning equipment is growing up. This industry is so new that relatively few, even among the farmers, have heard of it. But let present business conditions reverse themselves so there is an over-supply of plywood, sheet steel, and other suitable wall materials for drying rooms and there will be a rush to develop this market which the portable moisture meters have made possible.

Checking moisture content of stacked paper (above) before printing helps ensure accurate register of color. Bayonnet extension (right) is used for such tests and for grain, cotton, and other products to take "middle-of-material" measurements

PAPER FIRST—The paper industry was one of the first to take hold of highly accurate, portable moisture meters. Paper is very susceptible to moisture content and conditions. Get too much moisture into it and it will wrinkle. With too little it is weak. Such standard tests as tensile, bending, bursting, and folding strength, are meaningless unless the tester knows the moisture content of the paper. And that content will change with every prolonged variation in the relative humidity of the surrounding air.

Paper makers used to use oven-drying tests—weighing a sample of the paper, baking the moisture out, and then weighing the dry sample to see how much moisture was lost —for all of their control operations. They still use the ovens for highly sensitive laboratory tests. But an oven test can take hours where a portable moisture meter needs only seconds. By the time the oven test was finished the moisture conditions often had changed. The moisture meter tells what is going on right now.

Fabricators of paper, such as makers of milk cartons—"paper milk bottles"—and of other paper boxes, check moisture content continually. And they avoid many losses and wastes which used to occur when they had to judge moisture content by guess and by feel.

The paper is specified to have certain moisture content as shipped from the mill. But this can change if the paper encounters extremely humid or dry conditions en route to the fabricating plant. In any case, such specifications must be within limits of percentages and it is wise to know exactly what the moisture content is as the paper starts down the production line. Exact control must start with exact knowledge.

As the paper proceeds from one process to another, through rolling, slitting, printing, creasing, waxing, and assembling machines, it is checked by moisture meters and moisture may be added or removed at every step. Too much moisture means trouble when printing and waxing. Too little, and the paper will shear instead of creasing, especially in modern high-speed creasing machines.

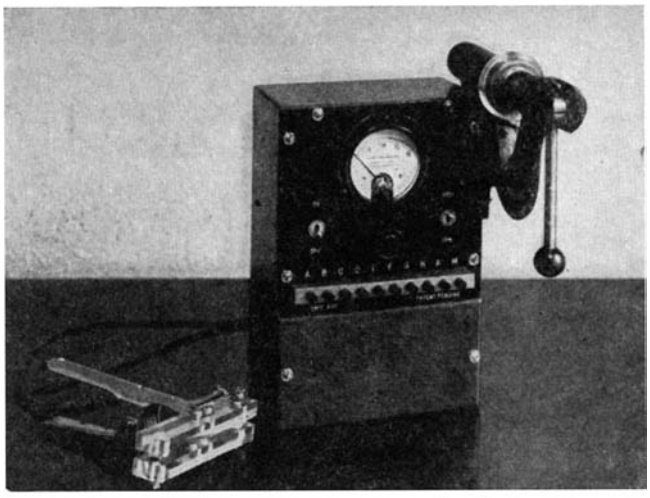
Ordinary printing shops are using moisture meters, and will use a great many more of them when adequate supplies of parts permit more meters to be made.

The important point in the print shop is to have the paper at a moisture content which corresponds to the relative humidity of the room. Paper changes in dimensions slightly as it takes on or emits moisture. It also changes in its readiness to take ink and to permit the ink to dry.

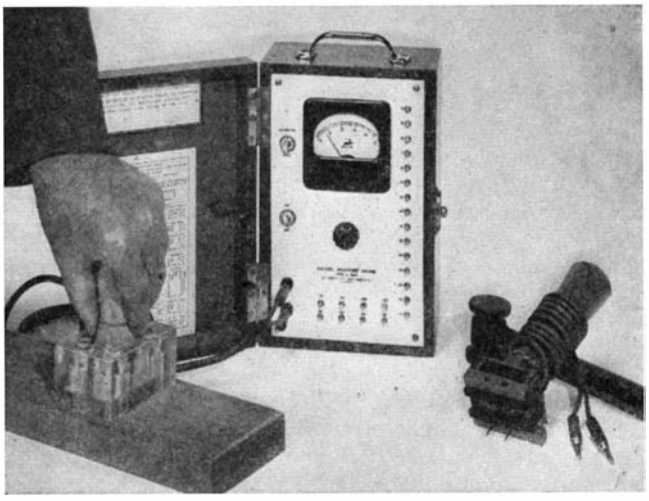
When only one color is to be printed, the problem is merely that of taking ink and of drying without offset, excepting in those rare cases where the relative humidity within the shop changes so drastically that the paper will curl or become wavy. But when two or more colors are to be printed, and the second color-run must be in register, then the changing dimensions can be damaging.

The top sheets of a pile of paper will change quite readily. Paper takes on or gives off moisture very rapidly and the sheets exposed to the air soon are in equilibrium with the relative humidity of the air.

What the printer needs to know is the condition within the pile and



Meter with clamp-type contacts (left) is used for determining moisture in single sheets of paper as, for example, when paper is passing through dryer in mill. Another instrument (right)



is shown with a "press-down" contact for testing wood—springs in contact provide even pressure. Spike contact seen at right is tapped into wood with hammer to get under-surface readings

whether or not he is going to find the first sheets printing one way and the succeeding ones another. For this he uses a portable moisture meter with a bayonnet-like blade which can be thrust between the mid-sheets without damaging them. This meter first tells him the relative humidity of the room, then that of the middle of the paper stack. From a comparison of the two he knows whether to go on and print or hang the paper or otherwise bring it into equilibrium with the relative humidity of the room.

FIRE HAZARDS—Moisture in coal and in some other materials can be a source of chemical changes which generate enough heat to cause spontaneous combustion. In other materials the absence of moisture can be a fire hazard.

Here the moisture meters must be highly sensitive. Often they operate within one tenth or less of the range which would be practical for lumber or paper.

The makers of moisture meters have highly practical sales set-ups for meeting such conditions. Their usual procedure is to ask the prospective industrial customer to send in samples of exactly what he wants to check, and tell how and under what conditions he wants to check it.

The samples are dried carefully under laboratory conditions, and instruments are calibrated especially to measure their rates of drying.

A study also is made of the physical application of the meter. It may need pressing down of a contact upon the material, or squeezing of thin materials between the faces of a clamp, or holding of a powder in a cup, or driving of tiny spikes to get below a tough surface and find the interior conditions, or running of a roller along a material which is to be in motion.

Many of the resulting applications are highly secret. Others, like the use of meters for purchasing raw materials, are so wide open that the type of meter to be used and the method of using it are specified in purchase contracts.

Purchasing agents who are moisture-meter wise refuse to pay goods prices for excess moisture. They will bore a hole into the middle of a bale of cotton and extract a core, plunge an instrument into a bale of hair felt, check up almost any moisture-bearing material which is bought by weight.

Only a few years ago moisture meters were curiosities. In a short time they will be as common as micrometers. There is no industry which cannot benefit in many ways by the closer and more facile measurement of moisture.

HANDY HYDRAULICS

Come as Light, Portable Units to Multiply Manual Power

ONE MAN can apply tons of power just by using his own muscles, if he applies it slowly enough. This fact, known to the ancients who used hydraulics to move the arms and legs of stone statues in their temples, is also being applied to thousands of brand new services right now.

The new applications come from recently designed, portable, hand-operated hydraulic rams. Such rams never could have been made without the modern metals and fabricating processes which can produce great strength with light weight and low bulk. But with a ram of modern type one man can lift a huge crane off from its bed for repairs, move a freight car, separate enormous dies without hammering, straighten a shaft without removing it from its bearings, and perform thousands of other tasks which require force without shock or speed.

ACTUAL LIMITS: SHOP LIMITS

Differ as Machine Tools Give Closer Performance

THE OLD-TIME way of handling dimensional limits along production lines was to let the machines work clear up to the limits with the expectation that no more than 10 percent of all output would be beyond the limits and therefore rejected.

Behind that philosophy was the fact that old-time machines were hard put to it to hold any close limits while working at high speeds. Limits wise, the product designers were away ahead of the abilities of the machines and the only way in which the machines could be run at a profit was to give them all the tolerances they could have.

Today the situation is reversed. Dozens of different kinds of machines can work at higher limits than the designers need and still produce at top speeds.

The tendency, then, is to set limits closer than the actual ones and to warn foremen when the actual ones are approached. If actual limits are plus .001 or minus .001 inches, the shop limits will be set at plus .0008 or minus .0005 inches, for example, and the foreman warned when these limits are exceeded. The result is production with seldom or never a rejection.

Ideas In

Although Many Authorities State that Private Aviation is Progressing Nicely, Others Submit that the Pace is Plodding. The Latter Maintain the Path is Blocked by Designer-Manufacturer Reluctance to Move Out with New and Sometimes Revolutionary Plane Designs and Accessories

OF ALL phases of modern aviation private flying probably has advanced least rapidly. Some authorities contend that this is because airplane constructors and designers have been reluctant to take up such new ideas as, for example, the tricycle landing gear, simplified "two control" systems, and a number of other design features of more recent origin. The plane constructors, on the other hand, say that they are constantly improving their designs and that progress should be a matter of evolution and not revolution.

ROADABLE PLANES — A typical case in point is the "roadable airplane." One objection which people frequently make to private flying is that a car is needed to get to the airport, and another car is needed at the other end to reach the destination. The objection is well grounded and the natural query is, why not build an airplane which will be as useful on the road as in the air, just as the amphibian can make use of a landing field or water base.

Theodore P. Hall, Chief Research Engineer of Consolidated Aircraft, not only designed such a combination aircraft but the hybrid has been built and successfully flown by Willis Brown, of Southern Aircraft. Whereas some roadable planes have been designed so that the wings were carried along with the plane when it was converted into an automobile, the Hall-Brown craft follows another favorite plan of detaching the wing, tail, and propeller units at the airport when the flight is over. This leaves a practically conventional automobile at the pilot's disposal.

The "Roadable" has a gross weight of approximately 1800 pounds; with a 130-horsepower, 6-cylinder air-cooled engine it has a top air speed of 128 miles per hour and a cruising speed of 110 miles per hour. The wing span is only 30 feet. In the air the craft does not differ very much in appearance from a conventional airplane, except that the usual fuselage is replaced by a short, automobile-like body, and the tail surfaces are carried on two booms mounted on top of the wing. The wheels, three in number, are left partially exposed in flight, the engine is located at the nose of the body, and there is a propeller of the usual type. Rudder pedals are employed, and a steering wheel which controls the ailerons and elevator in the air becomes an automobile steering wheel on the ground. When the wings, tail surfaces, and propeller are removed, the effect is that of a neat coupe, with all the conventional automobile controls including a clutch, brake, foot throttle, and so on.

Although the objectives of this design are thoroughly worth while and the tests have been entirely satisfactory, it is possible to advance a few arguments against the project. The combination will be more expensive than an ordinary Cub; and performance will not be quite as good as that of an airplane of similar power and passenger capacity because the automobile part of the craft necessitates more weight and more aerodynamic drag. Also, there is considerable additional mechanism. For example, there are two clutches—one for the propeller and another for the rear-wheel drive.

Any combination of functions, as in the "Roadable," usually means complexity. The plane, as such, will not be as good as it might be, nor will the car be as good as others on the road. Furthermore, it will be very easy to take the airplane wings and tail surfaces off, but there remains a question of whether there will always be good enough mechanics at the airport to guarantee safe flight afterwards. These, of course, are valid objections. But similar objections were made when the amphibian was first suggested, and the amphibian is commonplace today.

JET PROPELLERS—Another radical departure, a small plane to be powered by a jet-driven propeller, emanates from the Cleveland Aircraft Engine Laboratory of the NACA. The plane would be a tailless machine, with the propeller at the rear. Airscoops in the leading edge of the wings would lead air in-

Roadable plane, still experimental, matches popular concept of what such a craft should be on most points—price excepted. Wing-tail unit and propeller are taken off at airport; a mechanic must reassemble them to body before next air trip

The Air

By ALEXANDER KLEMIN
Aeronautical Consultant; Research Associate,
Daniel Guggenheim School of Aeronautics, New York University

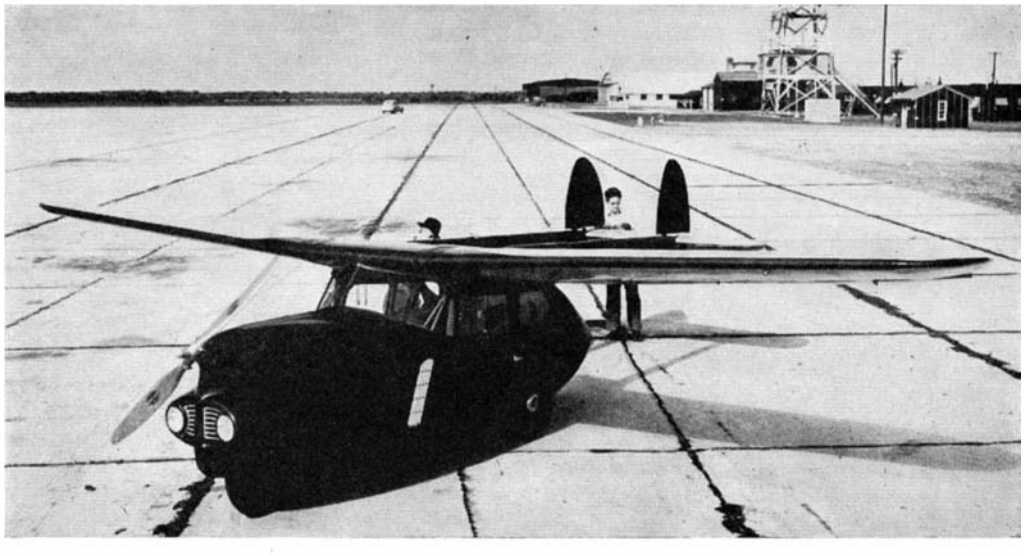
• LOOKING AHEAD •

Practical, workable, airplane-auto combinations. . . Jet-power applied directly at the propeller tips. . . Eventually, a completely "natural" single control. . . Take-off and landing aids for short-run, down-town airports. . . An aircraft-accessories market rivaling the automotive field.

to the propeller hub. Here, the air would be compressed by centrifugal action during its passage through hollow propeller blades towards the tips. Fuel would be injected into small combustion chambers near the tips and the mixture would be ignited electrically. Hence, rapidly expanding hot gases would push out through nozzles at the tips and the nozzles, tangential to the blades, would impart a revolving motion. As conceived, it would be an extremely simple powerplant without the conventional carburetor, opening or closing of valves, magnetos, or timing problems—without anything, in fact, but the propeller, the ignitor, a few passages, and the combustion chambers. Admittedly, the efficiency would be low, and more fuel would have to be burned for a given power than in the usual engine. But nearly any fuel—kerosine, for example—would do, and the lightness of the power plant would be a genuine compensation.

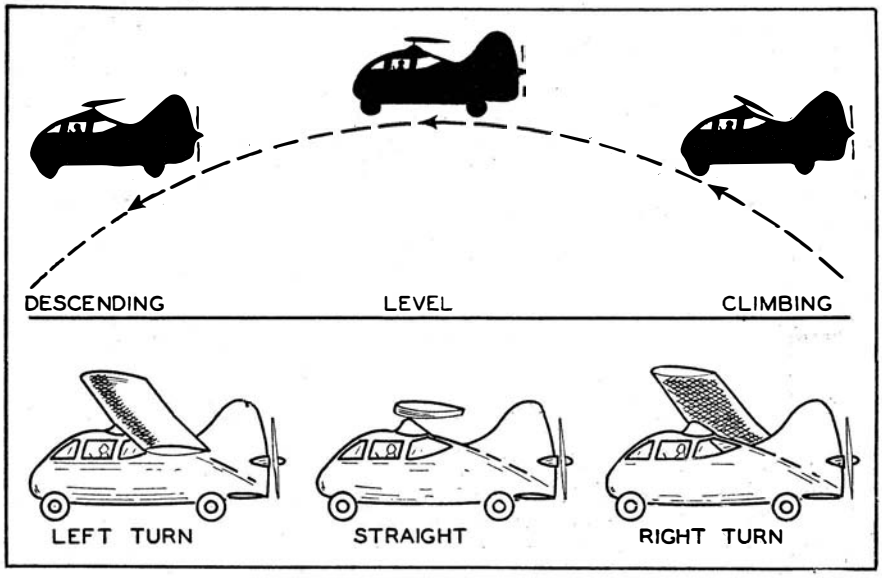
In connection with such a device it should be remembered that jet reaction is only efficient when the moving body has a high velocity, close to the velocity of the issuing gas. Therefore, it would be necessary to realize something close to equality between the speed of the products of combustion and the speed of the propeller tips. Other questions surrounding the idea are: will compression by centrifugal force be sufficient or must some other means be employed for increasing compression; will the hot exhaust gases rushing out at high speeds be dangerous; and will the nozzles have a satisfactory service life?

ROOM FOR IMPROVEMENT—One major problem in light-plane flying is getting in and out of small fields. Grover Loening, Special Consultant to the NACA discussed this problem at a recent meeting of the Institute of Aeronautical Sciences. Mr. Loening did not advocate a radical change in plane design, but rather the use of landing and take-off aids. It was suggested that a small cable operated by an electrically-driven catapault drum would get the ordinary light plane off in an amazingly short distance. For landing, the use of a simple arresting device—



Home scene (above) depicts busy man leaving for airport where hybrid craft will be converted to a plane (right) for a fast business trip. From technical viewpoint, neither car nor plane is as efficient as non-convertible types

Photographs courtesy Southern Aircraft Company



Spratt wing, a current "single-control" experiment, pivots entire airfoil on universal joint. Idea appears good; mechanical execution may prove difficult

four or five cables that would catch a hook on a plane just as in a carrier-deck landing device—was proposed. Simplicity would point to the incorporation of landing and take-off features in the plane itself, but simple devices of this character may hold some promise.

From the standpoint of unconventional control systems, there is the Spratt wing which may work out for light-plane application. The early aviation pioneers who used gliders for their studies —Lilienthal, Pilcher, and Chanute— secured control by shifting their center of gravity relative to the wing. Now there has been designed, built, and flown a small airplane in which control is obtained by shifting the wing relative to the center of gravity. In this craft the wing is mounted above the fuselage and is allowed freedom both about a transverse axis and about a backwardly inclined axis.

Tilting the wing backwards effects longitudinal control and causes the plane to climb, while tilting the wing forward brings about descent. Lateral or turning control is obtained by tilting the wing down on the right or left. Thus, it is possible to have but one control with the one stick guiding the plane up or down or sideways while the fuselage always retains the same level condition for greater passenger comfort.

Mechanically, this design is not quite so simple as it sounds. Mounting the wing above the fuselage and giving it universal freedom poses structural problems, and the positioning of the axis involves considerable study, tunnel testing, and careful free flight tests. Nevertheless, the Spratt wing does have the possibility of providing the simplest single control.

In addition to unconventional methods of designing the light plane itself, there is other research in the light-plane field which merits attention. In fact, the Civil Aeronautics Administration, the Aircraft Owners and Pilots Association, and the Aircraft Industries Association have submitted a whole series of pertinent problems to the NACA. Some of these should be attacked by inventors, and others by designers and manufacturers. Oil companies, for example, have a standing challenge to produce safer fuels of a type which would decrease or eliminate fire hazards, yet have all the efficiency of the best gasoline. Manufacturers of electric-lighting equipment are being asked to provide light, high-powered landing lights. An inexpensive, light-weight radar collision-warning indicator would be a great boon when small-plane flying really gets under way.

Other problems which invite solution include: Fan cooling of enclosed engines; windshields with smooth water clearance, doing away with the need for wipers; non-icing fuel systems; still lighter small-plane engines, perhaps of the two-stroke type; small gas turbines for private planes; and more comfortable seating arrangements in the cabin.

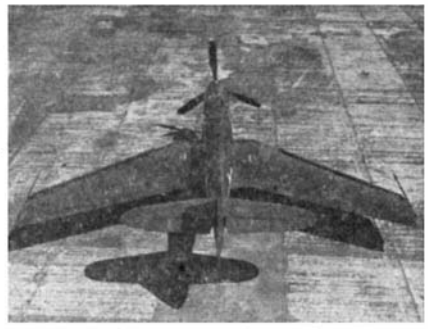
It is apparent that the widest scope exists for the application of all manner of industrial talents both within and without the realm of the airplane proper. Were all such opportunities for aircraft and accessory research grasped, it would most certainly make a great difference in the further progress of the light plane.

ARROW-LIKE WINGS

Represent New Approach to Compressibility Problems

JET PROPULSION; thin, blade-like airfoils; and other developments have carried airplane speeds well beyond 500 miles per hour — once thought to be the top limit because of air compressibility effects. Another approach to this problem is now being tried in the form of swept-back, arrow-shaped wings. Here, it is reported, if the "arrow" is sharper than the compressibility shock wave, many of the shock effects disappear.

Wind-tunnel tests of the design have proved satisfactory enough to prompt flight tests of a wing swept back 35 degrees on a modified Bell P-63. The experimental work has been carried on jointly by Bell Aircraft and the United States Navy Bureau of Aeronautics.



Swept-back wings may solve problems

AIRCRAFT STATIC

Stems from Broken Snow Crystals and Friction

SNOW produces radio static in an airplane because snow flakes do not follow the airflow pattern of a plane in flight, but instead hit the plane and at high speed break into a number of fragments. On breaking up, the flakes produce the static electricity which drowns out all other radio signals, according to Vincent J. Schaefer of General Electric Research Laboratory. Some of the electricity is carried by the snow from the atmosphere and some is created by friction. When the snow hits the leading edge of the wings or passes through the propeller at speeds of 200 to 500 miles per hour, fine ice dust is produced with attendant frictional electricity. It is this static electricity and its radio interference that is the greatest hazard in flying through a snow storm.

The actual impact of the snow is not dangerous nor does it accumulate on wings or other surfaces after the manner of ice.

Electrons Guide the Loom

Although an Ancient Art, Textile Making is Finding in Electronics a Wealth of New and Better Methods to Produce Flawless Fabrics and Keep Complex Mill Machinery Running Smoothly Without Breakdown

By VIN ZELUFF
Associate Editor, *Electronics*

• LOOKING AHEAD •

Extensive application of induction heating to heavy-fabrics manufacture. . . Reduction in second-grade cloth losses as electronic "stop-motions" are applied more generally. . . . Greater thread uniformity as a result of increasingly accurate testing technology.

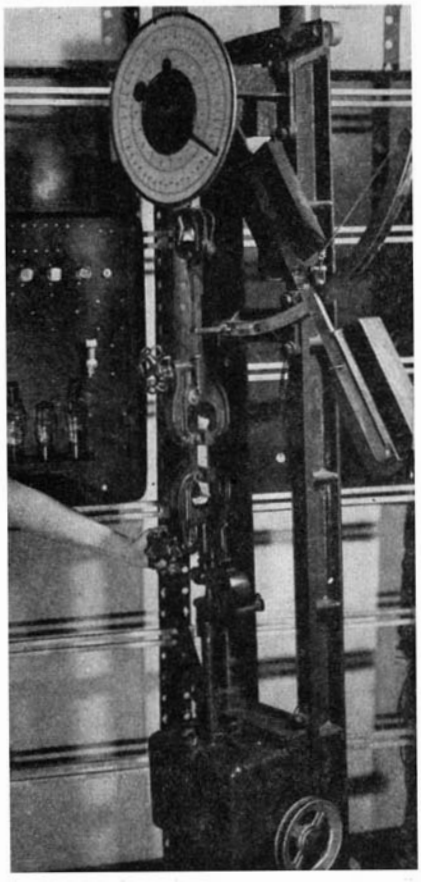
OF THE large number of new and improved types of electronic equipment which have been introduced to the textile industry, some have found wide use; others are still so new that only a few installations have been made. Equally important, many of these applications give promise of being suitable for modification and use by other industries, and in this group are the electronic yarn tester, "stop-motion" set-ups, stroboscopic observation techniques, and the use of high-frequency heating for steaming, drying, and so on.

TO BREAK A THREAD—To assure uniformity in the manufacture of yarn, constant checks on humidity, temperature, material quality, and similar variables are necessary. But even with all of these factors established and controlled, it is still vital to make periodic samplings and tests of the finished yarn.

Early yarn-testing methods ranged from suspending a weight by a yarn sample held in the hand to various calibrated arrangements of balances, springs, pendulums, and like mechanisms. Of these, the pendulum appears to have retained its popularity and, with modern features, is still used.

Basically, the pendulum yarn tester combines the pull of two jaws to hold and break the yarn which is streched vertically between them. In operation, the jaws move apart; one is driven by an electric motor and the other by the action of the pendulum in moving a ratchet. When the thread under test finally breaks or pulls apart, a pointer shows the degree of strain or load exerted by the jaw attached to the pendulum.

One of the disadvantages of this type of machine is that the pendulum arm which increases the loading "bumps" its way in steps through the loading cycle and does not provide a constant rate of loading. Also, fabrics of different stretch characteristics cause the pendulum to move at correspondingly differing average rates.



Electronic control (on wall) insures steady loading of yarn tensile tester

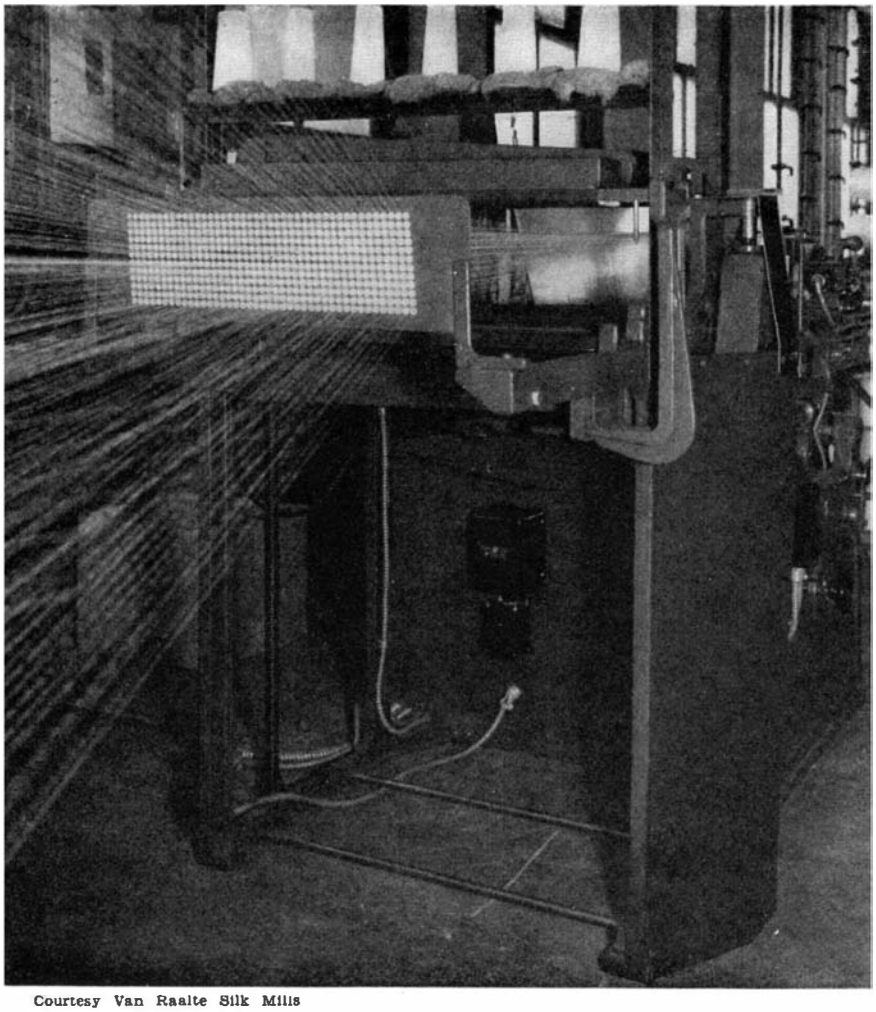
To extend the working range of the instrument, an electronic control has been successfully devised as an attachment to the standard pendulum-type tester to permit constant-rate-of-load tests to be run. Here, the movement of the pendulum through its arc causes an increasing electrical voltage to be applied to an electronic rectifier tube. The resultant direct current is then applied to a capacitor and an electronic control circuit.

Should the test specimen be capable of considerable stretching, movement of the lower jaw will be largely absorbed in the stretching, and the pendulum will tend to move at a rate slower than required. But when this lag develops, current passed by the capacitor decreases, as does the current and the voltage impressed on the grid of the speed-control tube. Thus the motor is immediately called upon to increase speed. As a result, the lower jaw is driven downward at a more rapid pace and the rate of travel of the pendulum is caused to increase to that required to maintain a constant rate of loading.

Conversely, if the specimen has a low-stretch characteristic, the pendulum attempts to move along too rapidly, and the control operates to decrease motor speed. The system is capable of handling fabrics possessing a wide range of stretch characteristics.

KEEPING FLAWS OUT — Although breaking a thread is a useful means of testing it, a broken thread in a textile machine used for spinning, weaving, or knitting is a serious occurence that drastically lowers the market price of the material. For efficient loom operation, such accidental thread breaks must be detected and the machines stopped immediately; "stop-motion" mechanisms are used for this purpose.

Most stop-motions are electrical, with their action depending on the making of a positive electric contact at the instant a thread breaks. Should there be a delay in this contact, or otherwise faulty action, the broken end will pass on into the



Courtesy Van Raalte Silk Mills

Broken threads here could mean flaws in finished cloth. Electronic amplifier boosts signal from low-voltage contacts to actuate "stop-motion" mechanisms

finished goods and result in an imperfection.

The mechanism used to detect thread breaks must be small and light, easily set and adjusted, and must not interfere in any way with the normal thread motions. At the same time, it must be safe from both the operator and fire hazard viewpoints. These stipulations dictate the use of a low-voltage, low-power control circuit.

Air in textile mills, however, is laden with lint and dust and is also highly humid. Under these conditions, the contacts on the usual gravity-operated stop-motion drops may become fouled and operate improperly. Hence a device that will make contact infallibly in spite of these conditions, and at the same time introduce no new hazards, is required for complete stop-motion protection. An electronic relay does exactly this on textile beamer machines. Just before the threads come to the beamer, each thread passes through a hinged eyelet, called a drop switch. When the threads are wound on the beamer they are in tension and hold the drop switches in an open position. When a thread breaks it is no longer in tension and the drop switch, its weight unsupported, drops to the metal bar.

The contact with the metal bar causes a minute current flow in the input circuit of the relay tube. This current, only a few microamperes, is amplified by the tube which in turn operates a relay in the output circuit. The relay then opens the coil circuit of the motor switch and stops the beamer machine. Entirely satisfactory operation is obtained even if the resistance through the stop-motion contact circuit with the metal bar is as high as 500,000 ohms.

The electronic relay stops a beamer almost instantly should any one of 500 threads break. Such relays are equally applicable to beamers handling several thousand threads, and can be used in other industries where dust, lint, and high humidity limit the use of conventional contacts.

OBSERVING MOTION — Many defects in the spinning room of textile mills are concealed by the rapid rotation of the spindles on the frames. These defects include slack bands and tapes, spindles that need oiling, crooked idlers, split or worn bobbins, uneven or mixed yarn, and a multitude of other possibilities. All these faults can be detected with the Strobotac, an electronic instrument developed by General Radio Company. Providing a rapid and accurate means of directly measuring speeds between 600 and 14,400 revolutions per minute and, by indirect methods, speeds up to at least 50,000 revolutions per minute, the unit is particularly adapted for checking speeds where the end of the shaft is not accessible or in cases where the power is limited. It can also be used for stroboscopic observation of moving objects.

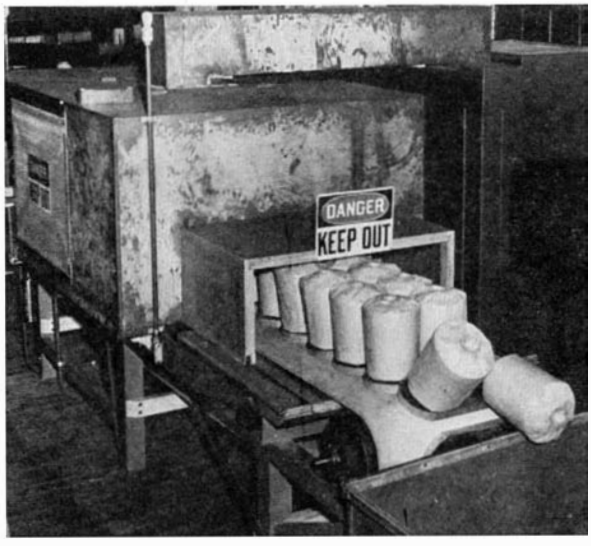
This electronic instrument consists of a flashing lamp, a power supply, and an oscillator for controlling the rate at which the lamp is flashed—all in a single assembly. By turning a dial graduated directly in revolutions per minute, the frequency of the oscillator and hence the flashing speed of the lamp can be adjusted to any value between 600 and 14,400 per minute. In use, the instrument is held so that light from the lamp falls on the part to be observed, and the knob is adjusted until the moving part appears to stand still. When this point is reached, the speed may be read directly from the dial.

If the dial is set at twice the actual spindle speed, two images will be seen. The moving part is then carefully observed for any apparent motion which would indicate an abnormal operating condition.

One textile expert estimates conservatively that use of the instrument permits an increase in spinning room production of 3.5 percent with no increase in cost per pound of yarn. At the same time, it permits production of yarn of better quality, with a reduction of from 1 to 2 percent in second-grade yarn.

HIGH-FREQUENCY STEAMING — The twist of rayon yarn for automobile tires is now set in several plants by high-frequency heating units and in a fraction of the time normally required by other methods. Also, greater uniformity of twist is obtained.

The heating units are 15-kilowatt electronic power generators used with specially engineered applicator equipment. To set the twist, cones of rayon taken from the twister are wrapped in wax paper so as to form a fairly water-proof package. The cones are then placed in an inverted position on a wooden block attached to an endless conveyor belt. Each block has two holes drilled to permit the tops of two cones projecting from the yarn-packages to be inserted. The conveyor belt, moving



Cones of twisted-rayon tire cord, wrapped in waxed paper to hold moisture, are passed through high-frequency oven to set twist. Heavy, hard-to-handle fabrics may be dried easily in roll form by electronic heating methods

at a rate varying from three to nine inches per minute, carries the cones into a cage.

In the cage the cones pass between a solid copper bottom plate which, with the cage, constitutes the "cold" or ground electrode, and a top plate that serves as the hot electrode. Between these two electrodes exists the high-frequency electrical field which causes the moisture within the yarn on the cones to vaporize. The wax wrapping holds the moisture and in effect steams the yarn, thus setting the twist.

The "hot" electrode of the electronic power generator is a copper grid placed about one inch above the tops of the cones on the 30-inch conveyor belt. This grid design prevents condensation of moisture which would drip and possibly cause arcing. Most units have plates which average 10 to 20 square feet in area and workers are protected from the "hot" electrode by a housing or cage about eight feet long which covers this part of the conveyor.

Radio-frequency voltage across the load is of the order of 10,000 volts, and the temperature rise in the load is about 100 degrees, Fahrenheit, depending upon the type of rayon being treated. The frequency between the plates ranges from 2 to 10 megacycles and causes agitation of the molecules of the rayon, generating heat by means of molecular friction.

Output of an electronic twist-setter of this size runs about 18,000 to 25,000 pounds for a 24-hour day. Output of smaller size units is correspondingly less, these being available in ratings of two kilowatts and greater.

Textile plants tests so far conducted with electronic heating equipment show that resin-impregnated fabrics may be cured either in roll form—the entire roll of fabric being placed in the dryer—or in long, flat, continuous lengths. Curled selvages are eliminated by this electronic form of drying. Also, uniformity of curing is obtained because temperature may be controlled accurately. The resin deposited on the innermost section of the fabric structure receives the same degree of heat as that on the outside. Laminated fabrics can likewise be cured in roll form, the same advantages being gained in curing impregnated fabrics.

It is because of this great versatility of electronic applications—testing, protective devices, equipment maintenance, and heating, among them—that the textile world today looks to electronics for even greater aid in performing delicate operations at ever-greater speeds.

PLANT-TRUCK "INTERCOMS"

Boost Efficiency of Hauling Operations, Reduce Confusion

In the several-acre large Toledo plant of Spicer Manufacturing Corporation, power-driven trucks for moving materials were constantly getting lost in the shuffle. Quick communication was needed between operators of roving empty trucks and a central point from which trucks could be sufficiently dispatched. An intercommunications system, made by Executone, Inc., solved the problem.

Seventeen substations, each with an intercommunicator, were located at strategic points to give complete coverage of the plant. Each truck operator, on completion of a job, pulls up to the nearest station and calls the dispatcher to report that he is ready for another assignment. In the morning, each driver takes his truck to an assigned substation and waits there for the first order of the day. With this system much time is saved and all trucks are utilized more efficiently.

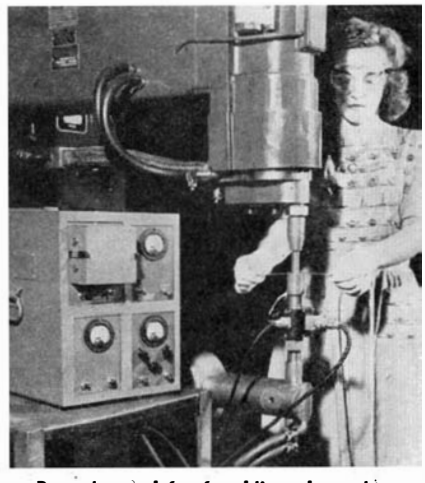
The simple, electronic communication system gives practically all the advantages of having two-way radio on each truck, yet costs much less.

ALUMINUM WELDING

Too Fast for Eyes, Checked By Electronic Detector

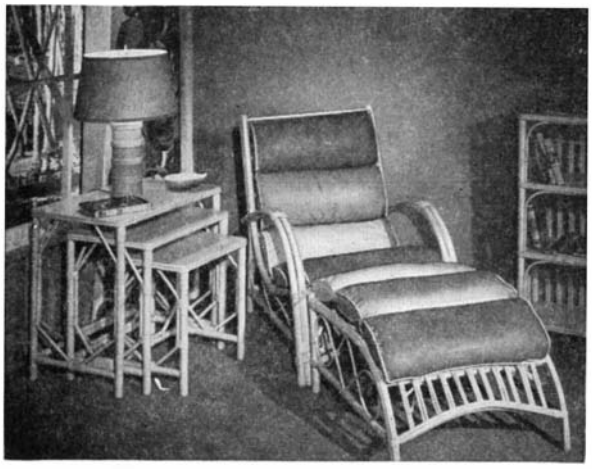
Resistance-welding machines used in fabrication of aluminum primary structures for aircraft must be checked monthly to insure meeting specifications for this critical industrial welding application. The fact that the entire welding cycle requires only a fraction of a second, during which several events occur that must be accurately timed, makes visual inspection of finished work impractical as a criterion for correct adjustments of the controls. A new electronic technique known as current-force recording has solved the problem by making available to the operator a pictorial record of each change in current magnitude and weld-squeezing force during the split-second duration of a weld.

Application of electronic monitoring to a welding machine involves



Recorder at left of welding electrodes gives detailed history of each weld as a check on adjustment of controls

substituting a special electrode holder on which are resistance-wire strain gages for measuring forging pressure and a meter-shunt for measuring welding current. These detecting units are connected to an amplifier-oscillograph unit capable of making six different traces simultaneously on 3½-inch wide photographic paper or film that is pulled through by a motor at a speed of approximately 10 inches per second. The detecting-recording instrument is made by General Electric Company.



Courtesy Ficks Reed Company and Textileather Corporation
Water- and stain-proof—a vinyl-covered lounge chair

Covering Up With Plastics

By CHARLES A. BRESKIN
Editor, *Modern Plastics*

Possessing a Trio of Virtues—Beauty, Durability, and Easy Handling in Fabrication—Vinyl Covering Materials are Proving Themselves to Be Husky Competitors in the Upholstery and Protective-Covering Field

DESIGNERS and manufacturers in wide variety are today concerned with what kind of covering may best be used in their products. The covering problems involved range from upholstery for domestic furniture to passenger-car, taxi, and truck paneling and seats; from suitcases, camera cases, golf bags, and footballs to decorative surfaces used in restaurants, theaters, and institutions.

The number of products in which the consumer expects colorful and efficient protective coverings grows larger by the day. And according to many of the top authorities in the industries supplying material to cover this wide assortment of merchandise, one answer lies in more and more plastics—supported and unsupported vinyl sheeting—for all of these applications and many others as well.

BY ANOTHER NAME — Plastics upholstery is not new. In the past it has been known under such diverse names as artificial leather, leathercloth, leatherette, art leather, and others that connotate simulation of leather. In existence for 30 years or more, this type of plastics upholstery consists of a fabric base coated with nitrocellulose and generally known as pyroxylin. It is used as upholstery largely for flat slip seats on stools, dinette chairs, hassocks, office chairs, metal furniture, theater seats, and outdoor furniture. In the automotive industry it is used for kick pads, trim, and seat upholstery.

Rubber-coated fabrics have also been used extensively in upholstery for institutional furniture, truck cabs, and other applications where heavy-duty service is encountered. But with the advent of vinyl resin in large quantities, coupled with expert knowledge of its processing, acquired by manufacturers during the past few years, plastics have found a wider field as an upholstery and covering material. And the upholstery and coverings fields have found a new and capable material.

Just how important the vinyls can be in this, and in other fields, is evidenced by the fact that today vinyl-resin production is greater than that of any other group of plastic resins, with the exception of the phenolics. The latest production figures issued by the Bureau of Census indicate that 12,000,000 pounds of vinyl resin were turned out in just the one month of March 1946; and the producers say they are months behind in their orders.

VINYL UPHOLSTERY — The vinyls used for upholstery are the higher chloride content, heavier molecular-weight resins such as The B. F. Goodrich Chemical Company's Geons or polyvinyl chloride, and the Bakelite Corporation's vinyl chloride-acetate resins known to the trade as VYNW. Another is polyvinyl butyral as produced by the Monsanto Chemical Company and E. I. du Pont de Nemours and Company, Inc. And still another is vinylidene chloride or Saran, manufactured by the Dow Chemical Company. This last named has quite different characteristics and is produced in the form of monofilaments that are subsequently woven into a cloth which enjoys wide popularity as upholstery.

The lighter weight sheeting or film and the finer monofilaments which are beginning to make their appearance in such diverse forms as luxurious brocades and table-cloth covers are not discussed here for the very reason that their range of applications is so varied as to merit separate treatment.

Beauty, durability, and ease of maintenance and handling are the characteristics which manufacturer and consumer alike seek in covering materials of all types. And beauty, durability, and ease of maintenance and handling are definite characteristics of vinyl material—be it in sheet, coating, or woven-fabric form.

Processors and manufacturers report that service tests indicate that no material heretofore used has had the same three-fold ability to withstand flexing, folding, and abrasion. Some materials might be better in one category but none in a combination of all three. A properly plasticized compound on a fabric backing, for example, has been known

• LOOKING AHEAD •

Strong popular welcome for upholstery fabrics with transparent coatings that "wipe" clean. . . Less shabby furniture in industrial reception rooms and offices because plastics coverings hold color clear through. . . Wide substitution of vinyl for rubber coatings; advantages are resistance to oil and grease. . . Extensive application in institutions, theaters, restaurants where sanitation is vital factor.

to resist more than 1,000,000 flexings in comparison to previously used coated fabrics that flexed from 50,000 to 500,000 times before breaking. The trend here, as in other fields ("Tests or Traditions" Scientific American, October 1946), is away from mechanical tests in favor of actual-use tests where the material is put in a taxi cab or on a piece of furniture that gets rough usage in some such place as a company reception room.

But whether in the laboratory or on furniture in constant use, vinyl leaves no doubt of its age resistance which is undoubtedly its most remarkable characteristic. A specimen of almost any age can be made to look like new by washing. It has been exposed to more than 800 hours of Florida sunshine and 200 hours of activated ageing in various testing machines without showing loss of any of the brilliant color that is such a selling point with the ultimate consumer. Cracks that are the inevitable result of ageing in many other materials do not show up in properly processed vinyl sheeting, for example, at any age. To the end, vinyl sheeting retains its soft, luxurious feel that is so different from that of any other material.

Ease in cleaning is usually a selling point no matter what the ultimate use. Vinyl upholstery and cover materials can be washed with soap and water; ink, grease or oil, blood, medicine, fruit juice, acids, and a score of other soiling mediums can be wiped off without leaving a trace. The sheet vinyl is waterproof and particularly resistant to salt spray, a fact which widens the possible uses to include boat upholstery and seashore cottage furniture.

Another valuable property of vinyl-chloride materials is that they will not support combustion. If maximum flameproofing is desired, special compounds can be used so that the material will not burn even when held directly over a flame.

Each of the vinyl upholstery materials has its own peculiar merit which can best be brought out if each type is dealt with separately.

SUPPORTED AND UNSUPPORTED FILM — Film-type vinyl upholstery may be either a coated fabric or an unsupported film. Many upholsterers advise that both supported and unsupported vinyl sheeting are easy to work with because they cut like fabric, can be easily draped, and there is little waste compared to that involved when cutting leather. Also, scraps can be used for trim and decoration.

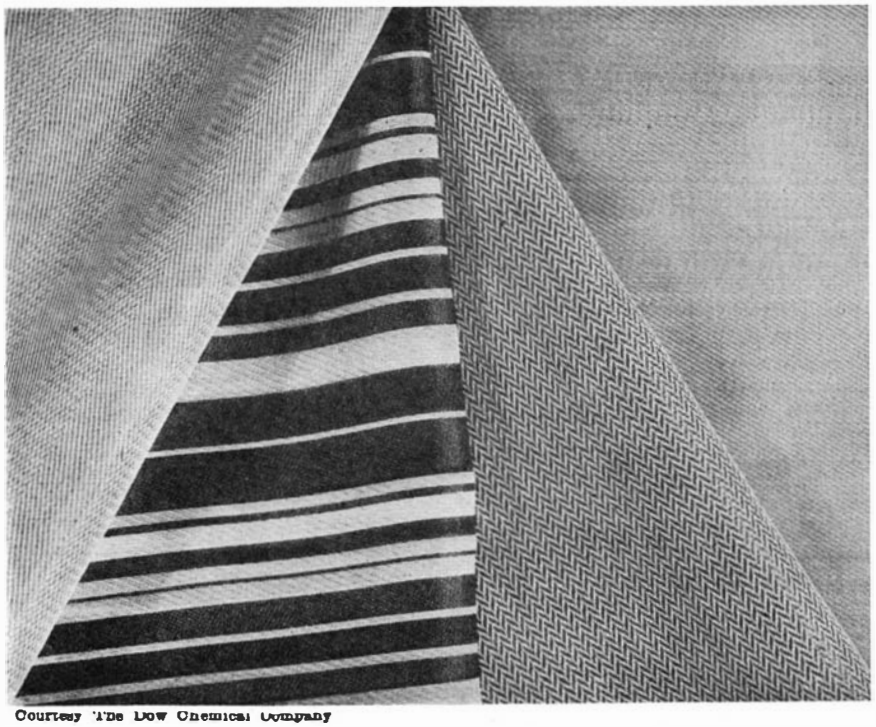
It is questionable whether vinyl supported or unsupported sheeting will ever supplant leather in top-grade upholstery. A long-standing partiality exists toward leather for certain uses. There are, however, all kinds of leather and the less preferred types used in less costly applications will almost certainly have difficulties competing with vinyl.

The competition from natural rubber coatings is not expected to be too severe because, as vinyl processors contend, rubber is not as resistant to oils, grease, and perspiration as vinyl and is faced with the handicap of dull colors. Pyroxylin coatings, however, are expected to continue to hold a large share of their present market volume because of the price factor and their fitness for many uses not involving severe flexing.

Today, the principal categories of furniture upholstery are slip seats, as in dinette chairs where the upholstery is rigid and drawn tight; the semi-rigid type such as a stiff seat with boxing that does not col-

Courtesy Pantasote Company, Inc.

Vinyl-fabric wall covering (right) is productive of unique color and space effects. Saran-monofilament textiles (below) clean readily and wear long



Courtesy The Dow Chemical Company

lapse; the flexible type where the side boxing collapses; and the pliant type where cushions are filled with down or sponge rubber.

It takes little imagination to see how vinyl supported or unsupported sheeting fits into the requirements of these four types of covering. It is easily worked, and its flexibility makes it easy to fashion around corners, curves, and edges. Also, it can be stencilled or printed to give a fabric-like effect which is of considerable value for interior design in cocktail lounges and other places where a fabric finish is desired but a hard surface required.

Vinyl sheeting can also be used as webbing with tubular aluminum, chrome, or wood for outdoor use. Although designers were of the opinion that webbed furniture was but a stop-gap when materials were scarce, consumers have taken to it and the demand is continuing to increase.

TRANSPARENT COATINGS — The application of transparent coatings to suitable fabrics is something new in upholstery. It enables upholsterers to pick almost any printed figure or dyed fabric, have it coated with clear butyral, and applied to the furniture frame just as they wish. And the consumer won't need to worry about dirt on light-colored upholstery because chairs or sofas may be sponged off with soap and water to remove any stain or spot.

Polyvinyl butyral, the type of vinyl used in this coating, can be applied by calendering or spread coating. It imparts to even the most inexpensive fabrics a soft texture and body not usually found in coated textiles. And the fabric may be washed and ironed frequently. The coating cannot, however, be successfully applied to fabric with a heavy pile such as automobile upholstery nor to any other deep textured material, nor to straight acetate rayon, although viscose can be coated very successfully.

The three principal claims made for the vinyl butyral as a fabric coating are transparency, low modulus of elasticity, and adhesive qualities. After applying this resin, the fabric hardly appears to be coated; yet it is water-proof, stain-proof and highly abrasion resistant. Color possibilities are infinite in either transparents or opaques. In comparison to more elastic rubber, vinyl butyral is a dead material and, when distorted, its recovery is slow. It is this characteristic which gives an extreme softness and warmth of texture to the treated fabric. Moreover, because of the resin's adhesive quality the processor is able to obtain a quick and comparatively easy bond to difficult fabrics such as glass, Fortisan, nylon, and high-count cottons.

A very new application of butyral is as a coating for upholstery webbing. Yet another is as the coating for twisted paper which is then woven into chair seats and so-called grass rugs. In this latter process, a tissue type paper is slit into streamers one inch wide, then wound and twisted through a cone shaped die from which it emerges in a roll about 1/16 inch in diameter. This paper may be coated with butyral before it is cut or after it is rolled and the resulting material can be handled on weaving machines.

Vinyl upholstery is only just beginning to make itself known in the furniture and covering fields. But its success thus far with both the manufacturer and the public is encouraging. In fact, the word "plastics" used in connection with upholstery is almost a guaranteed attention getter. The story is told that at one furniture show an exhibitor labeled his chairs as "artificial leather" without attracting attention while another with the same type material called it "plastics upholstery" and was swamped with visitors.

⊕ ⊕ ⊕

STRUCTURAL PLASTICS

Need No Timber Support, Hampered by Building Codes

With the current urgency of building programs, great stress is being put on the possibility of new materials filling part of the breach caused by the shortage of established building materials. A case in point is the publicity given a structural-plastics material developed for housing by Lincoln Industries, Inc., which has thus far been used in the construction of a number of sample houses, some with four and five rooms, others with nine.

The single thickness panels—the form in which this structural plastics is produced—consist of an expanded plastics core with aluminum faces. Coming in either two- or three-inch thicknesses, the panels are said to have good insulation qualities, high strength, and a weight less than one half that of cork. The honeycomb-like core is made of Kraft paper impregnated with a plastics resin and the cells of the core are bonded to the aluminum skins with a synthetic-resin adhesive.

To facilitate the assembly of the panels to form the walls or the flat roofs of the sample houses, the sandwich panels are produced with flanges. Because of the light weight of the material it is possible for the walls themselves to carry the weight of the roofs and the panels, doing away with the need for supporting timbers.

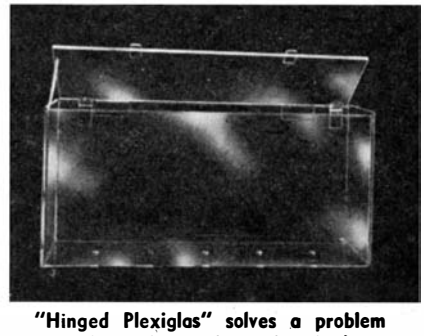
Although the aluminum outer facings of these panels will take paint, the unpainted skins are said to reflect the heat of the sun and add to the cooling qualities of the structure.

Established building codes are today the big stumbling block to the extended use of this structural-plastics panel. Based on conventional materials, these codes require a certain wall thickness regardless of the strength of the material. When this difficulty is settled, however, Lincoln Industries estimates that it can retail a four-room house, made of this structural plastics, for approximately $3000. This figure is expected to include the cost of kitchen and bathroom equipment, but not the heating system.

PLASTICS HINGES

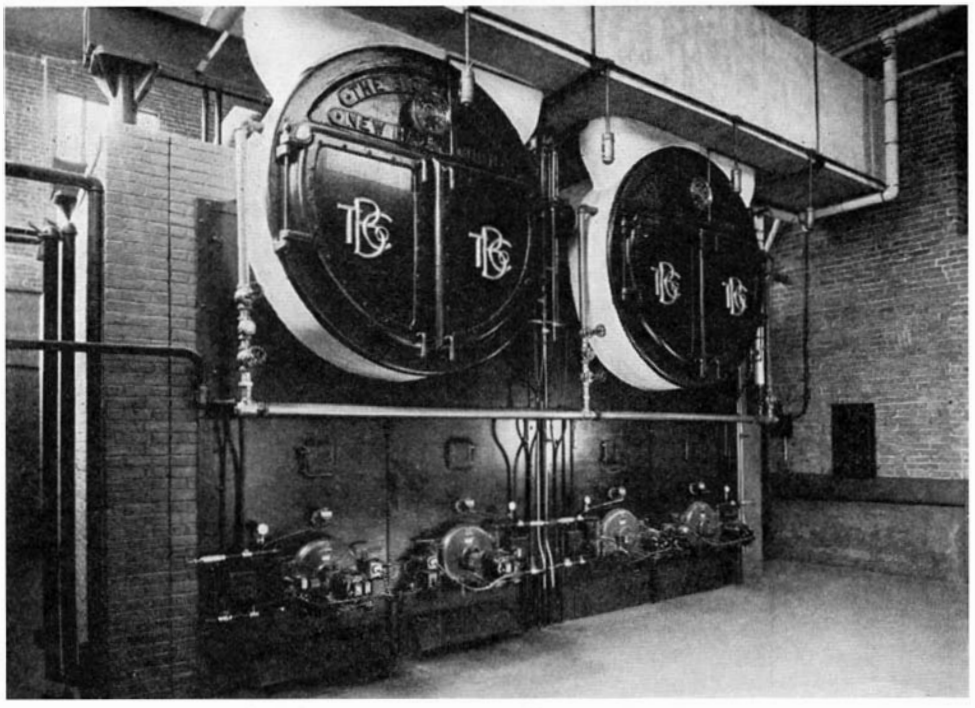
Employ Flexible Vinyl, Avoid Metal and Screws

For hinging acrylic boxes without marring their appearance with metal hinges or screws a new method called "hinged Plexiglas" involves laminating Vinylite to Plexiglas, neither of the materials being affected in physical or chemical properties by the process. A thin sheet of vinyl, 0.020 to 0.12 inch, is laminated to a ⅛-inch thick sheet of acrylic. Then the acrylic is sawed through, leaving the vinyl sheet untouched to serve as the hinge.



"Hinged Plexiglas" solves a problem in making plastics boxes by eliminating need for metal hinges and screws

Amplex Plastics Corporation is now utilizing the process developed by the Willson Plastics Division, Willson Magazine Camera Company, in the production of an acrylic box for the hosiery industry. The box is designed to hold spools of nylon thread which is fed through holes in the bottom of the transparent case.



Heavy-oil burners heat large buildings almost without attention, can be started up or shut down quickly to suit requirements dictated by occupancy of the structure

Oil Heat For Industry

For Quick, Flexible Heat and Convenient Handling and Storage, Heavy Residual Fuel Oils are Unmatched. Automatic Controls, Now Improved By Electronic Systems, Relegate Furnace Firing to a Secondary Place that Permits Closer Attention to the Actual Processing Work In Hand

By JOHN SMITH
Sales and Research Engineer
Gilbert and Barker Manufacturing Company

• LOOKING AHEAD •

Cleaner industrial plants and environs as more firms switch to oil. . . Less space devoted to fuel storage on expensive industrial property. . . Reduction in temperature fluctuations in public buildings and apartments. . . Fewer damaged heating plants as automatic controls reduce the importance of human factors.

INDUSTRIAL fuel-oil burners are rapidly gaining favor and an impressive number of installations are being made in a surprising variety of trades as equipment becomes available. The reasons and advantages that have prompted this "swing to oil" are not only numerous but also are straightforward and logical. Oil contains more heat units for a given volume than any other common fuel. This point, coupled with the fact that it is a liquid—easily handled with a minimum of manual labor—gives oil the feature of requiring about half the storage space needed for a solid fuel of equal heat content. Moreover, oil may be economically handled even when stored at a distance from the furnace that would be impractical with coal and to industries faced with major waste-disposal problems the absence of ash is a blessing.

Other advantages of oil as an industrial fuel are based on the technical convenience of a fire that starts instantly and allows working steam pressure to build up quickly. Conversely, oil fires can be extinguished immediately. In apartment blocks and public buildings, fully automatic burners can be installed so that a minimum of attention is required from operating personnel. Hence the time normally devoted to other types of heating plants can be used on more profitable duties. Similarly, when oil firing is used in such operations as processing furnaces, the automatic burner and temperature controls are a distinct advantage in that they leave the operator free to observe the process and maintain a closer check on it.

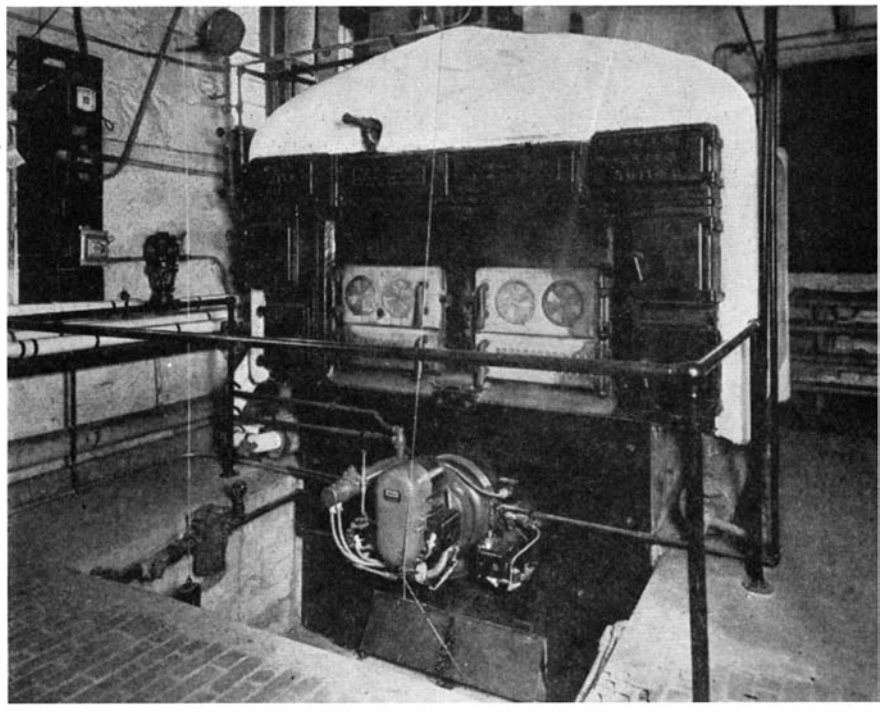
Such technical and convenience features as these have brought oil to ever wider use in industrial processes. Included in this long list of industrial applications are the forging, welding, and melting of metals; baking, hardening, tempering, annealing, bluing, soldering, and enameling in a variety of fields; and heating tanks, lehrs, and cracking-off machines in the glass industry. Chemical and petroleum refineries employ oil as a processing fuel; ceramic manufacturers use it for firing kilns; and oil has become the almost universal fuel for transportation by water.

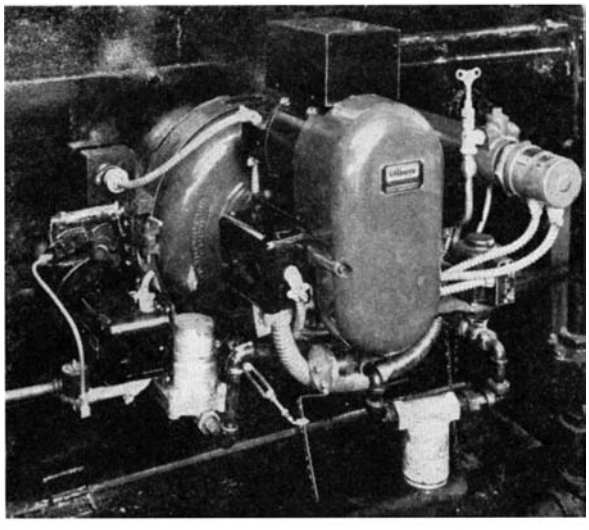
BURNER TYPES — To exploit efficiently the inherent advantages of oil as a fuel, a considerable amount

of research and experiment has been needed. Although oil burners consuming residual fuel oils have been in use for many years, during most of this period these burners were operated manually or semi-automatically. Fully-automatic operation of burners using residual oils was long considered to be impractical.

Over recent years, however, great progress was made in applying automatic control to heavy-fuel oil burners. This progress was not due to any radical change in burner design but rather to steady improvement of existing types. Improvements in the operation and reliability of automatic combustion safety controls have also been a contributing factor. The result has been highly satisfactory operation of fully-automatic oil burners and a greatly widened field of application for their use.

Residual fuels are classified by Commercial Fuel Oil Standards as numbers 5 and 6. They are the products which remain after all of the lighter and more valuable petroleum products have been refined from the crude oil.





Automatic burner controls, seen on two industrial installations (above and left), obviate need for close regulation by fireman and allow more accurate management of process heat. Electronic circuits are now finding wide application and supplanting older control devices

Residual-fuel oil burners are classed according to the method used to atomize the oil. The three most widely used types are the horizontal rotary cup, the steam atomizer, and the mechanical-pressure atomizer. In the horizontal rotary-cup type burner, the fuel oil is broken up by centrifugal force; that is, the oil is thrown off the edge of a rapidly spinning, horizontal conical cup. The steam atomizer makes use of the heat and velocity of the steam to break up the oil into small particles. In the mechanical-pressure atomizer the desired effect is obtained by forcing the oil through an atomizer tip at fairly high velocity and pressure.

The horizontal rotary, spinning-cup type of burner is gaining in favor because of its integral design. From an economical and mechanical standpoint, such a burner has the desirable feature of embodying its own oil pump, motor, fan, and electric oil pre-heaters all in a single compact unit. In practice, the burner mounting plate is secured to the boiler front in such a way that the main body of the burner and housing is hinged, which permits it to be swung out for rapid inspection of the spinner cup and facilitates easy cleaning or removal. Also, when several burners of this type are required in one boiler or furnace a separate oil pump may be used to supply oil to all the burners according to the requirements of each.

ELECTRONICS EMPLOYED — Of primary importance in automatic-burner operation is the method used to ignite the fuel oil after it leaves the spinner cup. The most successful and reliable method appears to be the gas-electric ignition system. In this system, an electric spark is used to light a gas pilot. The spark is produced at the tip of an electrode by a high-voltage transformer having an output of 5000 volts and 23 milliamperes in the secondary circuit. A gas valve, controlled by a solenoid coil, opens simultaneously when the spark is started. In the sequence of operation the electric spark lights the gas, producing a fairly large flame. The gas flame is in close proximity with the fuel oil being thrown off the spinning cup; consequently the oil is lighted from this gas flame and combustion starts. After the oil flame is well established, the gas-electric ignition goes off and combustion is maintained by the heat from the fire box and the burning oil.

In the early days of automatic-burner development there were many oil flame failures due to faulty ignition. Here, the application of electronic controls to industrial oil-burner installations has, within a comparatively recent period of time, resulted in vastly improved burner operation, particularly in pilot-light protection. With electronic controls, if the gas flame fails to ignite for any reason, the burner is automatically shut down and cannot be started up again unless the operator makes a visual inspection and corrects the cause of flame failure.

Electronics are also being applied in combustion-safety controls for the protection of the boiler or furnace in case of abnormal conditions. If, for example, the flame should be extinguished or should change from its normal characteristics in any way, the combustion safety control

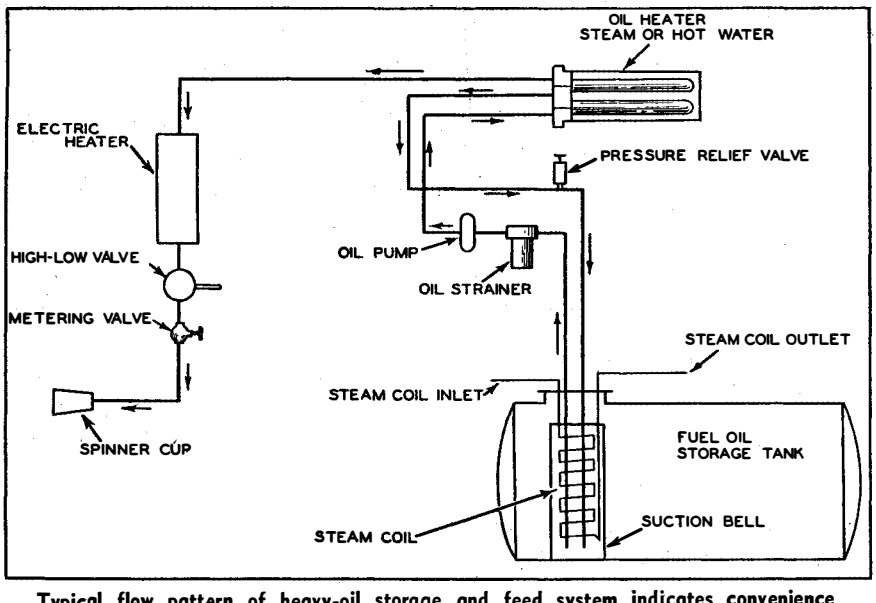
will automatically shut the burner down. Other controls of this type involve an automatic water feeder and a low-water cut-off device that can be installed for boiler protection. The water feeder replenishes the water supply to the desired level in the boiler, while the low water cut-off functions to shut the burner off in the event that the water level becomes dangerously low.

PUMPING AND STORAGE—Residual fuel oils are difficult to pump at normal atmospheric temperatures. Consequently, heaters must be used to raise the fuel oil to a temperature suitable for pumping. For this purpose a steam or hot-water coil is usually located in the fuel-oil storage tank. A temperature of 100 degrees, Fahrenheit, is generally sufficiently high to permit the oil to flow. To insure proper atomization of the oil a further increase in temperature is required after the fuel oil leaves the pump and before it is admitted to the spinner cup. This may be provided by electrical heaters, steam, or hot-water heaters, or a combination of all three.

The installation details of an industrial oil burner and the selection of the proper sequence of operation varies so widely with various applications that a competent engineer of wide experience must be chosen to do the planning. The proper selection of combustion controls, combustion-chamber design, fuel-oil system, and the type of burner to be used requires careful consideration and expert knowledge in order that the user may receive the ultimate in satisfactory performance.

Fuel-oil storage tanks are an important part of the system. Their capacity largely depends on the amount of oil to be burned and the methods of delivery. The general practice is to have the fuel-oil storage tank at least 1½ times the capacity of the largest delivery vehicle likely to be used. If Number 6 oil, the heaviest of commercial residual oils is used, it must be delivered hot enough so that it can be pumped. Thus, when this grade of oil is delivered by railway tank car, provision must be made to heat the oil in the car. This is generally done by connecting a steam line to coils within the tank car.

New applications constantly being discovered open broader fields for automatic oil burners using residual fuel oils. Industrial acceptance of such new uses promises to be rapid due to the reliable and dependable performance of heavy-fuel oil burners in many large buildings over a long period of years. Recent improvements in control and operating features have made installations so trouble-free that relatively unskilled personnel can take care of the equipment after a brief period of instruction. Hence there is every reason to believe that the demand for heavy-fuel oil burners will continue to tax manufacturers' production facilities for some time to come.



Typical flow pattern of heavy-oil storage and feed system indicates convenience of handling without manual labor. Oil takes less storage space than solid fuel

⊕ ⊕ ⊕

PISTON-RING OILING

Studied Under Operating Conditions In Glass Engine

BEHAVIOR of the oil film on the piston of an internal-combustion engine, representing new technical knowledge expected to be directly helpful in designing and constructing motor vehicle powerplants, was described at a recent meeting of the Society of Automotive Engineers.

Methods and results from two photographic studies of what happens inside the cylinder of an internal combustion engine were reported as providing engineers at long last with exact knowledge of the performance of piston, rings, and oil film during the full cycle of induction, compression, explosion, and exhausting.

Visual studies, using glass cylinders, camera, and both scattered and fluorescent lighting, were described by M. C. Shaw and T. J. Nussdorfer, of the National Advisory Committee for Aeronautics, as revealing that piston skirt lubrication is hydrodynamic for at least part of the stroke and that the amount of lubrication is a function of the relative angular positions of the piston rings and the lateral motion of the piston. It was said that piston rings were observed to rotate as rapidly as one revolution per minute at engine speeds of 1000 revolutions per minute. The oil film on the faces of piston rings was estimated to be only .0001 inch thick, perhaps less.

SYNTHETIC FUELS AND OILS

Tested for Military Use, Made from Natural Gas

AN EXTENSIVE line of synthetic fuels and lubricants were recently given full-scale tests by both the Army and Navy. The new synthetics were used to fuel and lubricate landing craft, amphibious tanks, and experimental gas turbine and turbo-jet engines.

The tests were carried out as a part of plans just announced by the Navy for a long-range study of synthetic fuels to be made jointly by the Navy and the oil industry. According to Dr. W. E. Kuhn of The Texas Company, synthetic gasoline is made by an improvement on the Fischer-Tropsch process. Synthetic gasoline of high-octane rating, high-cetane Diesel fuel, and jet fuels can be produced by burning methane — the principal element in natural gas — in an atmosphere of pure oxygen. From this, two gases, carbon monoxide and hydrogen, are obtained which are the building blocks for the synthetic products.

The synthetic grease demonstrates a wider range of operating temperatures than any lubricant previously available. It therefore appears suited for aircraft use in that it will operate satisfactorily between a subzero temperature of minus 65 degrees, Fahrenheit, and a high temperature of 250 degrees, Fahrenheit. This grease is made from 20 percent soap and a special synthetic oil.

New Vitamin C For Old

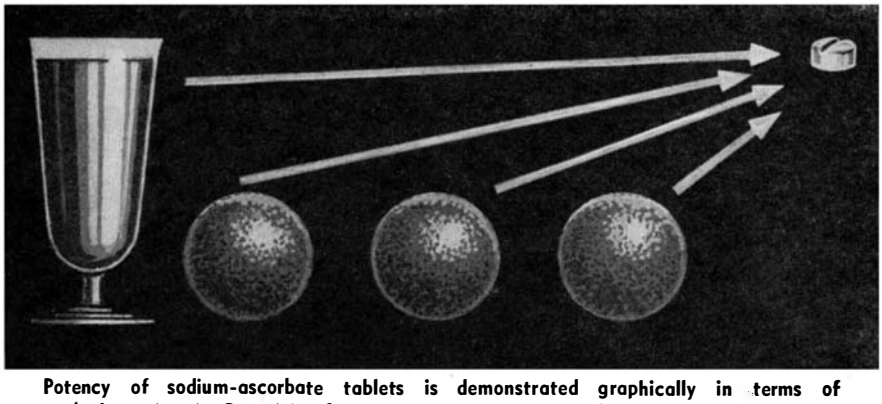
In This Best-Fed Nation in the World, One-Third to One-Half of the Population Lacks Vitamin C. This Vital Food Element—Essential for Vigor and Efficiency—Is Now Available in a New Synthetic Form that Eliminates Undesirable Reactions Common to the Older Ascorbic Acid

By BARCLAY MOON NEWMAN
Author of "Must We Grow Old?"

• LOOKING AHEAD •
Future generations unplagued by tooth and gum deterioration . . . Vitamin therapy by industry, cost to be offset by better worker health, greater output . . . Possible reduction in premature senility in a population now growing older . . . Less unintentional and unrecognized malnutrition from food-handling and preserving methods that destroy vitamins.

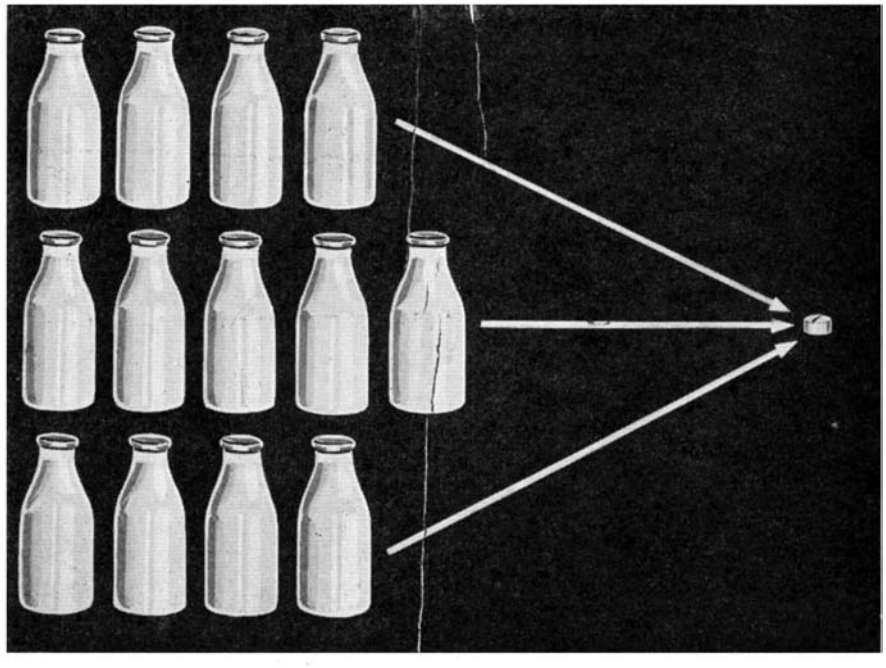
POOLING their ambition and technical genius, the industrial chemist and the medical researcher have succeeded in performing a remarkable feat—at the same time a feat promising improved health, more vigor, and possibly more years not only to industrial employees but also to other millions of people the world over. The feat is remarkable because industry has turned into reality an ideal of the medical world: to bring to mankind a synthetic chemical—a new form of vitamin C—that improves upon Nature's original design for this vitamin eaten by man for untold years.

The discovery of the new vitamin by Dr. Simon L. Ruskin, a distinguished medical scientist, and its mass production by the chemists of the Van Patten Pharmaceutical Company, are timely. Recent surveys sponsored by the United States Public Health Service, the Rockefeller Foundation, and the Milbank Memorial Foundation have disclosed that chronic deficiency of vitamin C is surprisingly common in the United States—more common and more serious than in the instance of other food factors. Results of the deficiency include gingivitis (gum inflammation), early loss of teeth, subnormal vigor, and probably also acceleration of the processes of aging. To treat chronic deficiency, large doses of "C" must be given over a period of many months. The old "C"—known to chemists as ascorbic acid—is definitely an acid. Hence, in quantity, it often causes an undesirable if not decidedly injurious acid shift in the human body, swinging the system too far from the normal, slightly alkaline side. It also irritates the delicate membranes of the gastro-intestinal tract. And many people are allergic to both natural and synthetic ascorbic acid.



Potency of sodium-ascorbate tablets is demonstrated graphically in terms of equivalent vitamin-C activity from other sources. On this basis, one tablet matches three large oranges—about eight ounces of juice—or 13 quarts of milk

THEORY TO REALITY — As early as 1933, immediately after the discovery of the chemical nature of ascorbic acid, Ruskin began to experiment with new combinations of the acid and *metals*. He thus pioneered into a novel world of therapy—chemotherapy with the metallic salts of ascorbic acid. After years of investigation, Ruskin was able to determine that tablets of sodium ascorbate—ascorbic acid neutralized by union with sodium metal—have the same physiological



and therapeutic activity as the old "C" but do not have the same undesirable side-effects. A new "C"—far better than the "C" of the past—was thenceforth available to mankind—theoretically. There were many technical obstacles between theoretical discovery and practical application. The dream of the theorist had to be transmuted into practical reality by the art of the industrial scientist.

Here it was necessary to work out the problems of practical production methods. The technicians developed successful manufacturing processes based on the formation of the neutral salt, sodium ascorbate, by combining ascorbic acid and sodium under anhydrous conditions. Acid and base yield salt and water, according to the elementary textbooks. Why not simply neutralize ascorbic acid with sodium-containing base in water solution, then evaporate to dryness, to obtain the dry powder mass of sodium ascorbate crystals? Ascorbic acid is a very sensitive chemical: in brief, it is too unstable to be dealt with in this way and the salt-forming reaction must be conducted in water-free methyl alcohol. A series of relatively complex operations must be carried out before the new vitamin C precipitates as a pure, white crystalline mass. Sodium-ascorbate tablets are produced from these crystals by standard precision tablet-making machines.

Each tablet is scored to permit ready adjustment of dosage—especially advantageous when supplementing the diets of babies and small children. Unlike acid "C," the tablets have a pleasant malty flavor and can be chewed like candy—a practical feature in the cases of individuals who have difficulty in swallowing any kind of tablet or pill.

SAFER AND MORE POTENT — Because of its unusual value in chemotherapy of "C" deficiency and in relation to public health, the new vitamin has been given speedy official recognition: it has been incorporated in the new edition of the Pharmacopeia of the United States. By now, sodium-ascorbate tablets are known to most doctors and dentists. Chemically neutral, they cause no shift in the human chemical system, do not unbalance it toward the acid side. They are less irritating to the gastro-intestinal membranes than is ascorbic acid, hence can be safely given in the large doses now generally prescribed for reversing the changes wrought by prolonged "moderate" deficiency.

Doses as high as 1000 to 2000 milligrams per day are administered in many cases—more vitamin C than could be obtained from dozens of oranges per day, or scores of tomatoes, or 100 quarts of milk.

Technician weighs finished tablets carefully on accurate chemical balance. Each sodium-ascorbate tablet contains 120 milligrams. This is equivalent to 100 milligrams of vitamin-C activity

Natural vitamin C is readily destroyed by oxidation—a half hour in the sun on the doorstep, and a bottle of milk has lost its vitamin-C content. Expose orange juice to air—in or out of the refrigerator—and soon most of the "C" has been oxidized by the oxygen of the air. "C" disappears during storage, canning, and cooking of vegetables and fruits; it gradually disappears from the cans on the grocer's shelf as well as the vegetables on the fruit stand. Normal eating of the old "C" in food results in much of it being oxidized in the digestive tract, the intestinal flora participating in this destruction of the indispensable food factor. Sodium ascorbate, however, is far more stable, and may be kept indefinitely in the form of tablets—if in a cool, dark place.

NECESSARY TO HEALTH — Because of the rapid oxidation of the old "C" in foods and beverages, many persons do not obtain all the vitamin they think they are getting. And how many increase their intakes when they take strenuous exercise, or have colds, or suffer from other ills? Increased activity and disease, even such a mild disease as the common cold, markedly increase the vitamin C requirement. And different individuals differ widely in their needs for "C"—old or new. For these reasons, as surveys have shown, between one third and one half the population suffers from mild "C"-deficiency. Probably most persons intermittently permit their levels of "C" to sink below the optimum.

Industrial workers by the thousands have been found to suffer from effects of sub-optimal intakes of the vitamin. In many cases, such deficiency leads to gum inflammation and actual loss of teeth at an early age—because of pathological changes in the supporting structures of the teeth. Also, "C" deficiency predisposes to pyorrhea—a definite although recently established fact. Other results of lack of "C" are of great importance to industrial workers. Accidents do occur, and when the body has very low stores of "C," wounds heal slowly or fail to heal—until the vital food factor is provided in sufficient quantity. Further, as recent investigations at Columbia University's College of Physicians and Surgeons indicate, the "C"-deficient body does not have the same capacity to resist and counteract the effects of shock—as in accidents—as does the human system with a normal level of the vitamin in the tissues.

Other studies have indicated—though not established—that the duration of the common cold is briefer in those with normal levels of "C." Theory would lead us to expect such discoveries. The need for the vitamin is greatly increased by infection and fever, and resistance to certain types of infection—particularly of the gums and supporting structures of the teeth—is definitely lower than normal in cases of vitamin-C deficiency. Some authorities believe that resistance to *any and every* type of infection is reduced by lack of "C."

AFFECTS LIFE SPAN — More fascinating still are the results of investigations to determine the effects of so-called "mild" chronic vitamin-C deficiency on vigor and length of life. A recent report by Dr. Harry Dayne Kruse, of the Milbank Memorial Foundation, and associates, after years of study of the effects of prolonged "moderate" lack of the vitamin indicates that slow changes resulting from "C" deficiency add up

to rapid aging. They state: "In the past, these chronic alterations have been called senile changes with the implication that senility caused them. But time is simply a dimension over which chronic changes progress. The tissue changes in the chronic form of deficiency disease are of a kind that progresses slowly and insidiously and recedes just as slowly." These investigators add a point which clarifies the great significance of the new "C": "Potent therapy will produce maximum blood levels and entirely restore bodily saturation (with the vitamin) in several weeks but will completely repair the slightest chronic tissue lesion only after many months." Potent therapy means high dosage—and daily administration for many months. Thousands of industrial workers and much of the general population need such therapy—to save teeth, to gain vigor, and add years. There are risks associated with therapy employing the old "C." The industrial chemist, co-operating with the medical scientist, now makes available the new, safer "C"—sodium ascorbate tablets.

⊕ ⊕ ⊕

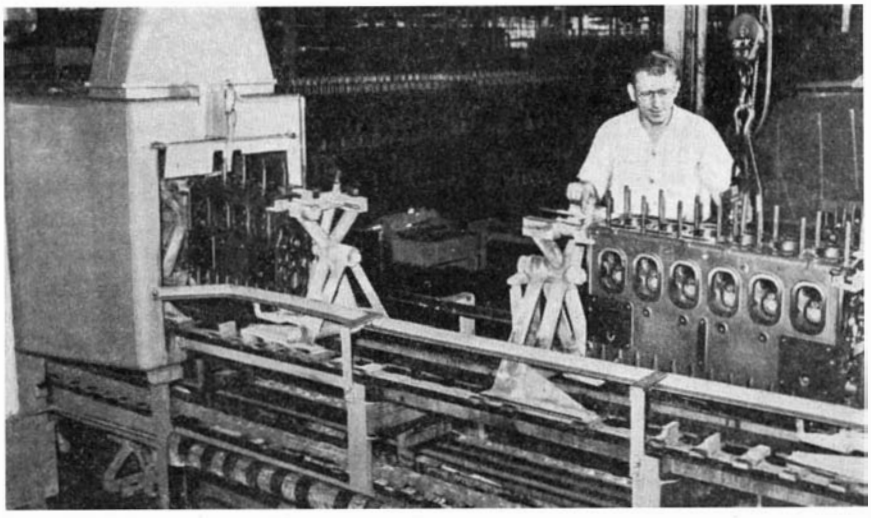
PARTS WASHER

Insures Thoroughly Clean Units for Diesel Assembly

THE CARE and precision which goes into the manufacture of Diesel engines requires a continuous lookout for foreign substances which might easily ruin the close tolerances necessary for best performance. At the Detroit Diesel Engine Division of General Motors Corporation, for example, vacuum cleaners are used continuously to remove the dust and dirt that develop in the ordinary process of manufacture. But even this is not enough to have the engine parts absolutely clean for assembly, and further investigation of the problem proved necessary.

First, the places in the plant where the dust was heaviest were located. This was done by placing foot-square pans in different areas, leaving them 48 hours, and then collecting and weighing the accumulated dust. Trouble areas were located near milling and boring machines, and huge fans now operate the "vacuum cleaners" which draw away the fine particles, keeping them out of the air, and letting the heavier chips fall to the base of machines.

With much of the dust thus eliminated, it was possible to devote full attention to more thorough washing. Previously it had been the practice to "dunk" parts in a water-and-solvent bath—a manually controlled electric hoist would do the "dunking" in an open vat—and then blow the parts dry with manually directed streams of compressed air.



Diesel engine blocks are rocked in cradles as they are cleaned

Although this process loosened much of the dirt, the pieces being washed weren't turned so that the dirt would spill out. This was particularly true in the case of engine heads and blocks, which have recesses and channels where dirt could hide unnoticed. Also, it was easy to miss a spot in the drying process, and rust would form where moisture remained.

To correct this condition three automatic-washing machines, one for heads, another for blocks, and the third for smaller parts were installed.

In the head washer, the cylinder heads move in on a roller conveyor, are locked into place on an endless chain, and go through three stages of washing. The first stage consists of thoroughly bathing the cylinder heads in a solution to dissolve oil or grease. The solution is projected at the cylinder head from a revolving cylindrical rotor containing a slot lengthwise from which the cleaning mixture is thrown by centrifugal force. The second stage consists of passing the head through the same type of washing action, but a clear, hot water which contains a small amount of inhibitor to prevent rust is substituted for the solution used to dissolve grease. This produces a head that is free of dirt and the heat from the preceding operations plus an air blow-off at the end of the washer produces a clean, dry cylinder head.

During the process the heads revolve—32 times in all—so that cleaning solution, the rinse, and the air reach all nooks and crannies. The blocks go through the same process on conveyor cradles, but instead of turning, they are inclined from side to side. Smaller parts are washed on conveyor hooks, the parts being placed and slanted so as to come into full contact with the water and air.

STEEL ON FARMS

May be Made Economical For Building Construction

RESEARCH in the construction of steel frame farm buildings by welding, conducted on a long-time basis by the University of Wisconsin through a grant by Carnegie-Illinois Steel Corporation, and broadened by engineers of the steel producer itself, points toward low-cost barns, silos, and cribs, as well as dairy, poultry, and other buildings, which may be quickly erected from materials that should be comparatively plentiful in the post-war period.

For several years Carnegie-Illinois has sponsored research to determine the functional requirements of dairy farm buildings, and to make steel a practical and inexpensive building material for farm use. One of the results of the studies is a new "Site-Welded System of Construction" that makes steel farm buildings competitive with those built of other materials and at the same time opens a broad new avenue of jobs for trained welders and a market for welding equipment.

No attempt is being made to limit the use of materials for this field of construction strictly to steel. Other materials are used where they can be employed more economically and to functional advantage. In fact, the structures being designed by Carnegie-Illinois combine economically several building materials—lumber, asphalt, asbestos, cement, and others—assembled on a basic steel structure.

In the construction of many one-story farm buildings having clear

spans from 24 to 40 feet, only nine—and possibly as few as five—sizes of steel members, primarily standard angles, channels, light columns and plates, are needed for framework. If a combination of steel and other materials is used, an even smaller number of steel sections may be required.

The small number of steel members demanded by this type of construction makes it practical for building material dealers, warehouses, builders, and welding shops to carry adequate steel stocks to serve the farm trade. The research engineers believe local builders can use steel economically because it will be readily available from local dealers in standard sizes which may be cut to desired length and quickly, easily, and permanently welded on the job into a great variety of strong structures.

DDT USE

Not Recommended Over Freshly Whitewashed Areas

FRESH whitewash is likely to be sufficiently alkaline to decompose DDT. Hence DDT should not be mixed with whitewash or applied over freshly whitewashed surfaces.

It may, however, be applied over old whitewash which has largely lost its alkalinity. Any decomposition of the DDT under these conditions will be very slow, and its efficiency can be maintained by applications at shorter intervals, if needed.

INDUSTRIAL REFRIGERATION

Undergoing Continuous Growth As New Applications Evolve

RECENTLY developed products in mechanical refrigeration now are lowering thermometers over a range of more than 230 degrees, Fahrenheit, and are performing as many as 200 domestic, commercial, and industrial services, according to current information from this field. Expanded by engineering progress durthe war and since, refrigeration's job today is said to begin in cooling air to 80 degrees above zero for summer air conditioning, while the lower end of the scale is not yet in sight.

Various industrial and laboratory operations now require mechanically produced refrigeration down to minus 150 degrees, Fahrenheit, thus accounting for the 230-degree range. Among such operations are "cold treating" of metals, cold testing of products and materials, and many research processes.

Between the two extremes, refrigeration now is provided at nearly all temperature levels, with the temperatures themselves controlled within narrow limits to keep drinking water cool, for example, at a constant 50 degrees, Fahrenheit; to keep frozen foods "fresh" at zero; or to dry penicillin properly at minus 70 degrees, Fahrenheit. Other commonly used temperature levels are 72 to 80 degrees, Fahrenheit, for air conditioning; 36 degrees, Fahrenheit, for the preservation of food in the refrigerator, and minus 10 to minus 35 degrees, Fahrenheit, for the fast freezing of foods.

Uses of sub-zero refrigeration in industry have multiplied rapidly, and some of them are becoming standard factory practices. In some industries, it is reported, "cold treating" of metals has become, in effect, a continuation of the heat treating process with resultant greater ductility and longer life. Temperatures down to minus 120 degrees, Fahrenheit, are employed, with the lower limit usually between minus 80 and minus 120 degrees.

Construction of cold chambers, all-weather laboratories, and stratosphere test units, most of them used in airplane development, has been a leading factor in the extension of sub-zero applications of mechanical refrigeration. In addition to improvements in refrigerating equipment itself, advances in insulation have aided the industry in developing

more efficient products ranging from household refrigerators to cold-storage warehouses and large-scale air-conditioning projects.

PURE AIR IN RAIL CARS

Obtained by Activated-Carbon Filtration Unit

INCREASED passenger comfort resulting from a new method of maintaining uniform air "quality," or purity, is promised for railroad cars now being built. By constantly circulating the car air through activated carbon, odors are said to be eliminated.

Odors in railroad cars come from a variety of sources — from smoking, food and drink, and occasionally from the passengers themselves. Heretofore, the railroads were powerless to remedy such odors; this was chiefly due to the lack of space for adequate air-conditioning apparatus. Also involved is the element of weight, an important consideration since cars must carry their air-conditioning plants "on their backs" — each car having its own separate equipment. Hence, the capacity is lacking to treat the outdoor air that must be drawn in if odors are to be kept down or "diluted" and to maintain proper car temperatures at the same time.

In the cars now being built, fresh ventilation air will be obtained from the air within the car itself without requiring additional heating and cooling machinery. The carbon-filtered air increases by two and one-half times the former supply of ventilation air. Air that is recovered — purified — through activated carbon is said to be often cleaner and fresher than outdoor air.

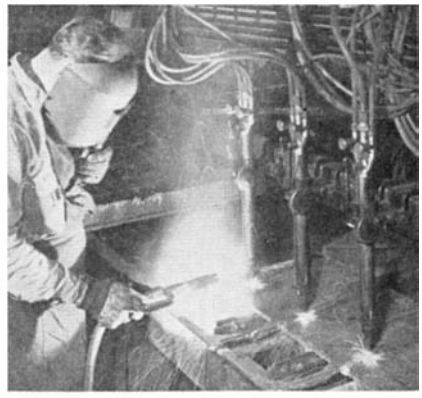
Granular, activated carbon, the term for carbon that has been specially treated to remove extraneous matter, has a powerful attraction for gases and vapors — odors. When these gases strike the carbon surfaces they condense and cling to them until the carbon reaches a state of saturation, usually when the weight of the condensed gases is about 20 percent that of the carbon. This process is known technically as "adsorption." When the carbon becomes saturated it is re-activated or freed of its stored-up impurities so that it can again be used. Activated carbon is a powerful adsorbent agent because of its porosity which provides a vast surface area—it has been estimated that in the type of activated carbon used in air conditioning one cubic inch has a surface area of approximately five acres.

Carbon air purification has been used successfully in large industrial plants where conditioned air is recovered and re-used, a considerable factor in conserving materials, fuel, and energy.

FLAME-CUTTING DISTORTION

Minimized by Arc Weld Follow-Up

AN INTERESTING method of preventing distortion during a multiple-torch cutting operation employs both arc and flame. After the torches



Courtesy Air Reduction Sales Company

Arc-weld "tacks" hold flame-cut plate

have made the cuts in the outer edge of the steel plate, the welder follows along, making arc tack welds at the point of entry, thereby restoring the steel to one continuous strip and precluding the possibility of "walking" or "lifting."

PHASE MICROSCOPY

Makes Transparent Subjects Visible without Staining

TRANSFORMING an ordinary light microscope into an instrument that extends the range of human vision far beyond the limits of present microscopes, new equipment has been developed which permits the observation and study of many living cells, tissues, micro-organisms, and industrial materials so transparent that heretofore little or no detail could be seen in them. This advance in the use of the microscope is called phase microscopy and the converted instrument a phase microscope, according to the American Optical Company.

The new microscope equipment consists of light-controlling diffraction plates which, when placed in an objective lens system, makes detail visible within a specimen by increasing, reducing, or reversing contrast in the image formed by the microscope. One of the features of the phase microscope is that it makes possible an accurate study of transparent living organisms. Formerly, to make them visible it was usually necessary to stain them with dyes, a procedure that kills most organisms. As a result, much of the information gained in the past with the microscope was limited to the study of dead rather than living material.

The phase microscope will be useful in the study of plant and animal life, parasites, emulsions, replicas of metal and other surfaces, glass and plastics transparent surfaces, minerals, crystals, synthetic fibers, and other materials. In the field of industry, innumerable applications are possible; for example, crystals other-

The new phase microscope (right) is equipped with a light-controlling diffraction plate (upper left). Mold fragments (small white objects, lower left), invisible with ordinary microscope, are made visible through the application of phase microscopy

wise barely visible can be seen. In reverse order, regions within certain substances can be made invisible, facilitating the discovery of impurities.

Equipment required to transform a standard light microscope into a phase microscope consists of a diaphragm for controlling light concentrated on the specimen and one of the new diffraction plates placed in the objective lens system. An auxiliary telescope used in place of the microscope eyepiece is helpful while centering the equipment.

Investigations indicate that different types of diffraction plates are preferable for various kinds of investigations. Operation of the diffraction plates is based on the fact that although many materials are so transparent that nothing can be seen with regular microscope equipment, their internal structures usually do have differences in optical path which alter the phase of any light passing through them. The material and size of the parts of the specimen produce the optical path differences. In phase microscopy the specimen is first illuminated by a hollow cone of light and a diffraction plate inserted within the microscope objective. Depending on the kind of diffraction plate, any regions within the specimen of different optical path can be made bright on a dark background, or dark on a light background. The invisible phase differences of the light are converted into illumination differences to which the eye is sensitive.

INDUSTRIAL X-RAY

Will Penetrate 10-Inch Steel Pressure-Vessel Walls

INSTALLATION of a large X-ray machine—2,000,000 volts—for the purpose of examining welds in pressure vessels, will bring to 12 the number of X-ray machines used for this purpose by the Babcock and Wilcox Company, manufacturers of steam generating equipment. A special building will house the new machine and it will be erected adjacent to the location of the present 1,000,000-volt X-ray unit. The building has been designed to protect personnel from radiation and to make possible examination of the largest size drums made by the company.

Although the apparatus, which was purchased from the General Electric X-Ray Corporation, is capable of operating at any voltage from 1,000,000 to 2,000,000, it will be used principally at the higher voltages to take pictures of heavy welds, four inches thick and over. As compared to the 1,000,000-volt X-ray, the new unit will produce much clearer pictures in that thickness, and will reduce by half the average time required to take radiographs. It can be used successfully on steel walls 10 inches thick. The specially designed building will be 35 feet wide, 31 feet high, and 81 feet in length. Double walls consisting of 42 inches of sand solidly packed between quarter-inch steel plates will prevent radiation from the unit. The building is planned to provide all possible safeguards to protect not only technicians within the building, but anyone in the immediate area.

An overhead, floor-operated crane will support the X-ray unit and move it around within the building. The X-ray machine is 5 feet in diameter, 12½ feet in length, and weighs 6000 pounds.

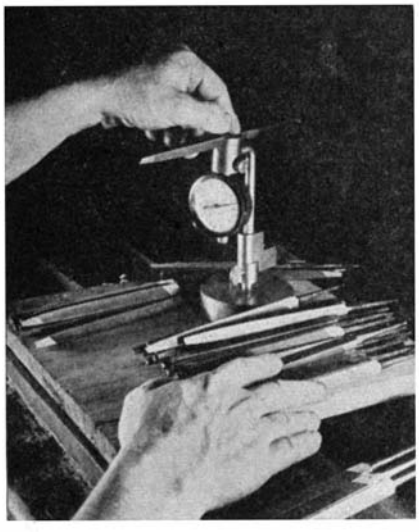
The building will accommodate drums up to 13 feet in diameter and 75 feet in length, which are the dimensions of the largest vessel likely to be shipped by rail. Vessels that weigh up to 150 tons can be tested. This probably represents the maximum weight of pressure vessels that the firm might be called upon to make and test. Two cars with drum turners will bring the drums into the building. One car and one drum turner will be motorized to facilitate handling.

New Products and Processes

DIAL GAGE

Integral Part of File Inspection Unit

FOR precise inspection of Nicholson Files, a dial indicator gage which checks the width of the file to ensure uniformity of this dimension has been designed. The operator, who may be inexperienced, is able to see on the



Accurate checking of file dimensions

indicator dial whether the width of the file is within tolerance or not and, if outside tolerances, by how much.

The Federal Dial Indicating Gage used is a standard unit built into the indicator set-up as an integral part.

LIQUID SOAP

Doubled in Quantity By Addition of Extender

A METHOD of extending liquid scrub soaps by 100 percent without increasing fat consumption cuts soap content of the finished product to 9 or 10 percent.

The new formulation not only gives results equivalent to those obtained from standard liquid soaps from the standpoint of detergency, but in addition it adds wetting power, improves rinsability, and is highly effective in hard water.

Although any given formulation frequently must be adjusted slightly to accommodate the particular type of fatty acid base employed by the soap manufacturer, the developer, Rohm and Haas Company, recommends a basic formula containing .4 percent methyl cellulose, 44.5 percent water, 0.1 percent Tamol NNO, 5 percent Triton X-300, and 50 percent liquid potash soap (18-20 percent soap). The formulation gives a clear solution with better viscosity than that of standard scrub soaps. It has been tested with 20 percent corn-oil soap, 20 percent coconut-oil soap, and standard soaps made with tall and linseed-oil fatty acids. In every case reported the formula did not reduce the foam and gave good results from the standpoint of detergency.

EXPANSIVE BIT

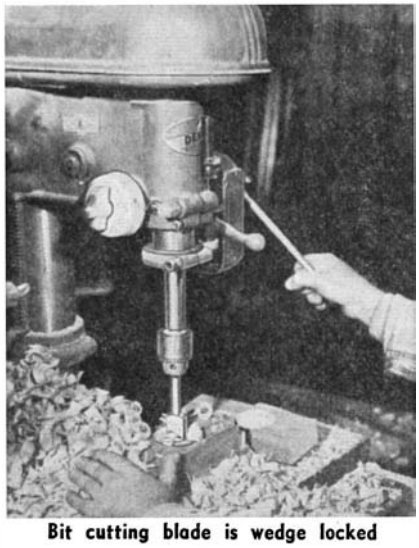
Fits Power-Tool Drives; All Parts Replaceable

FOR USE in an electric drill or drill press, to bore holes 1½ to 3½ inches in wood, a new heavy-duty expansive bit with ½-inch straight shank is said to embody a new principle in wood-boring tools.

The efficient performance of the tool, called the Bruno Heavy Duty Expansive Bit, is reported to be due to its sturdy construction. The center lip, which cuts away the core at the center of the hole, extends back to form a clamp which firmly holds the adjustable blade at the diameter set. The clamp is locked tight by means of a screw. Once locked in the positive wedge-lock V-groove, the cutter remains securely in place.

Also, a diamond-shaped screwpoint gives longer life by lessening the chance of breakage and the lead-screw is threaded finer than is usual for this type of tool. This latter feature helps pull the bit through the wood, requiring only light pressure to cut quickly and cleanly. The threads are ground to correspond to the capacity of the tool.

The heavy-duty expansive bits are equipped with two cutting blades—one long and one short—to cover the range of the tool and a graduated scale on the blade aids in adjustment. In addition, the fixed cutter, or center lip, cuts away the material at the center around the screw point. The clamping center-lip, being removable, makes possible the easy replacement of all parts. With the shorter cutter, the diameter range is from 1½ to 2-7/16 inches, while that of the long cutter is from 2½ to 3½ inches.



Bit cutting blade is wedge locked

FORMING BRAKE

Features Precision, High Output, and Versatility

MAJOR features now being incorporated in a new model forming-brake include a special material-clamping action which makes possible extremely sharp bends, a double-edge vertical folding plate allowing close reverse bends to be formed, and roller bearings to increase speed and ease of operation. For precision duplication of parts, a quickly adjusted material gage and accurate angular degree stops are also provided.

The tool, called the Di-Acro Brake Number 4, has a material capacity of 16 gage sheet steel and a maximum forming width of 24 inches. It is described as a well constructed unit weighing 285 pounds and incorporating a machine-tool iron base casting to assure continued accuracy. The brake will rapidly and accurately duplicate complicated parts in many ductile materials, such as copper, bronze, stainless steel, aluminum, bi-metals, sensitized materials, varnished cambrics, and dielectrics.

Clamping action holds material

The original contact surfaces of the Di-Acro Brake can be quickly changed on the job, thereby increasing the working range of the unit to cover the forming of special parts. This feature is said to make possible the forming of shapes and outlines which are often impractical or impossible to duplicate with regular production dies. Also, small parts which are normally produced by large hand or power operated brakes can be formed to advantage on this unit with greater precision and higher production.

WATER-REPELLENT FILM

Eliminates Effects of Humidity on Fluorescent Lamps, Tubes

A NEW material that forms an invisible and permanent "rain coat" over fluorescent lamps and, when used with

metal adjacent to the lamp such as a reflector, makes it practically insensitive to high humidity, is described as the best material yet found to form a continuous insulating film over glass.

The insulating material, called Dri-Film, is applied easily and lamps can be maintained with only customary cleaning. Tests have shown that the lamps, when so coated, not only start faster but also operate satisfactorily even under 100 percent relative humidity.

The water-repellent materials comprise a series of General Electric products made in the course of its developments in the silicone field and were first used for the treatment of ceramic insulators for radio and other communication equipment. The insulators, as in the case of fluorescent lamps, would lose effectiveness when exposed to high humidity.

The company advises that Dri-Film is now being used in an increasing number of applications. One of the most recent was for hearing-aids in which it is used to treat vacuum tubes.

ARC WELDING HEAD

Accommodates Small Electrodes, Speeds Operation

IMPROVEMENTS of the welding head, designed to simplify production installation set-ups and increase speed of operation, are now available for the Lincolnweld hidden-arc process of automatic, metallic-shielded, arc welding. The new, improved head is designated as the LAF-2.

To further expand its use on sheet metal work, the head has been designed to accommodate 3/32-inch electrodes. Equipped with the same lower wire contact jaws as the previous head designated as LAF-1 which accommodates electrode wire ranging from ⅛-inch to 7/32-inch, the new unit also has an extra, movable, tapered contact jaw which can be quickly interchanged if 3/32-inch wire is desired.

The controls have been modified to simplify arc starting. All that is required to start the arc is to turn a single control switch to the "Down Weld" position. This causes the electrode to feed down until the end touches the work piece. Here, short-circuiting the wire to the plate automatically causes the wire feed motor to stop. The flux valve is then turned on and the arc started by means of a push button. The arc is extinguished and the electrode is withdrawn by moving the operating switch from "Down Weld" to the "Up" position.

The Lincolnweld process is designed for use with direct current, utilizing a bare metallic electrode which is fed through a granular flux deposited on the joint to be welded. Sufficient flux is applied to completely cover the arc and the molten metal; the unfused flux is then reclaimed for further use. Successful usages are reported in welding all types of joints including plug, butt, lap, edge, fillet, and corner.

The standard head is changed from butt to fillet welding in a few minutes. In making fillet welds the lower wire guide and flux tube are changed from straight to curved, thus permitting the head and wire reel to be left in its normal position. The wire is fed in at 40 degrees from horizontal which gives the maximum effective throat for horizontal fillet welds.

INKS FOR RUBBER

Penetrate Surface; Plastics, Enamels, Also Marked

COMPOUNDED for the purpose of trade-marking and imprinting rubber—both natural and synthetic—and plastics as well as for marking enamel and lacquer insulations on wire and cable, several new inks are available in liquid or paste form. Separate inks are used for each material and the ink for rubber marking can be furnished in a variety of standard colors.

The liquid-form inks are designated as Acro Inks, while the paste-form inks are known as Acromark Inks. Liquid inks are applied by hand or machine, in standard liquid-type ink fountains, and are furnished in various drying characteristics to suit the application. The paste-form inks also are applied by hand, or by mechanical means in standard ink feeds and are said to be as easy to handle and control as regular printers' ink.

In the marking of rubber, these inks are described as permanently penetrating the surface of the rubber and dry-

ing in a flexible state to eliminate cracking off or other later deterioration.

The inks developed for marking plastics and enamels are also claimed to combine with the surface of the material and actually become part of it.

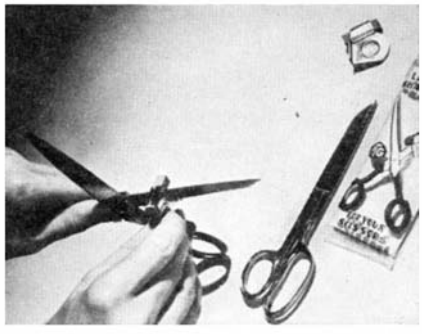
It is noted by the Acromark Company that the success in developing these inks lies in penetration rather than a simple coating, because in most instances a mark must remain a part of the material for the surface life of the product.

SCISSORS SHARPENER

Assures Keen Edges at Proper Angles

MADE in a single stamped and nickel-plated unit, a new scissors sharpener grips a Carborundum stone at an exact manufacturer's angle for producing a keen cutting edge on dull shears and for maintaining the sharpness of new scissors.

In use, one scissors blade is held in the left hand and the flat angle guide of the sharpener is placed against the blade. This brings the cutting stone



A Carborundum stone does the job

down on top of the blade and in position for sharpening. A few two-way strokes are said to be all that is necessary to re-edge a dulled pair of scissors.

The quarter-inch square by one inch long Carborundum stone may be moved forward or backward in the holder and may be turned to any of its four surfaces so that sharpening operations will not wear grooves in the cutting surface of the stone. The device is distributed by South East Merchandise Company.

ALUMINUM PAINT

Retains Qualities in Ready-Mixed Storage

A STABILIZER used in the manufacture of a ready-mixed aluminum paint is reported to give package stability and prevent the paint from darkening in the can even after opening. Also, the paint indicates less tendency to tarnish after application.

Called Chromatone, and intended for indoor or outdoor application on a wide variety of materials—metal, wood, glass, and other hard surfaces—the new paint formula is said to have high protective qualities. Featuring both rust and heat resistance, successful use on heaters, radiators, tanks, plumbing, and so on is described for the paint by the manufacturer, The Alumatone Corporation.

Good drying and lasting qualities, and a higher percentage of leafing properties which improves hide and adds luster are also claimed. The paint sets in 20 minutes, dries in two to four hours, and may be applied by brush or spray.

NYLON ROPE

Resists Deterioration, has Elasticity, Strength

OVER 29,000,000 feet of nylon filament is contained in 100 feet of ½ inch-diameter nylon yacht rope. This impressively large figure indicates the ultra-fineness of a filament of nylon.

Nylon yacht rope is said to possess many distinct advantages, including higher tensile strength, greater elasticity (which makes it valuable in an anchor line for easier riding and safer tension), resistance to rot and marine decay, and ease of handling. Dry or wet, nylon, it is reported, does not get stiff or hard, or jam in blocks. Also, it can be stored even when wet and will not deteriorate in storage lockers. Longer wear and greater beauty are other advantages.

According to Plymouth Cordage Company, nylon ropes are also being used by ranches and rodeos as lariats. On mule spinners in textile mills, it has been found that nylon drive ropes reduce machine shut-downs.

ROTARY PLANER

Cuts Wood, Metal, Plastics Without Tearing

QUICKLY fitted to any drill press, a new Safe-T-Plane, will plane, rout, panel, bead, or rabbet to any depth in wood working materials. Positive cutting action of the high-speed steel,

Above: View of the cutter of the new rotary planer. Right: The planer in use in a standard power drill press

shear-type blade is said to eliminate scraping or tearing in hard, medium, or soft woods, including balsa, irrespective of grain position. A special cutter is available for making square-shouldered cuts, another for work in non-ferrous metals and plastics. A single cutting blade, "one-spot" blade adjustment, the addition of a protective hand and eye guard, and light weight are features of the tool. The bell guard directs flying chips downward. Only one blade setting is necessary and no separate adjustment of multiple cutters is required.

SHORT-RUN PARTS

For Machinery, Made Economically of Plastics

LESS expensive than machined metal and more durable and dimensionally stable than wood, moldings of Laminac resin and fiberglas cloth have been used as label hoppers on packaging machinery. These hoppers have been a problem in precision labelling machinery, because of the complexity of shapes and sizes which must be handled by them quickly and accurately.

The problem was solved by molding hoppers from a low-pressure resin laminate, called Glastic, to produce small runs economically. The reinforced pastics parts have proved to be quite satisfactory, as far as strength, wearability, and appearance are concerned. The technique appears suited to use on printing and other production machinery where special parts are required in relatively small quantities.

ELECTRICAL TACHOMETER

Mounts Generator on Machine and Meter in Remote Spot

FOR PERMANENT installation where a "pick-up-unit" or generator must be mounted permanently on a machine, and the meter mounted on a panel far removed from the generator position, a new electrical tachometer employs a generator consisting of a small, permanent Alnico magnet motor mounted on precision-sealed ball bearings and capable of continuous operation at any speed within the limits of the meter.

The meter or indicating instrument is a rectifier type, including a sturdy D'Arsonval movement. It is capable of withstanding a momentary overload up to four times the maximum speed indication without damage.

For installation up to 200 feet the unit may be connected with two-conductor No. 18 insulated wire. For longer distances, it is recommended that the manufacturer, Ideal Indus-

tries, Inc., be consulted for proper size of conductor.

The meters are rectangular in shape and available in either three- or seven-inch sizes. Both are available in three scale sizes—0-1250, 0-2500, and 0-5000 revolutions per minute.

RAYON FABRICS

Fade Less with Anti-Fume Chemical

FASTER colors on acetate-rayon fabrics are made possible through development of Anti-Fume DE Paste, a new atmospheric gas-fading inhibitor. Certain dyes which previously faded when exposed to atmospheric gas fumes are given better fastness by the use of small quantities of this chemical material.

The Du Pont product is substantively absorbed by the fabric, and its protective effect persists after repeated washings and dry cleanings. It may be used with numerous popular shades on acetate rayon. This material is applied during the dyeing operation, and requires no additional equipment.

STAR TIME

Told by New Watch for Astronomical Use

A SIDEREAL time watch, featuring an accurate 8-day movement and a 24-hour dial with a sweep-second hand, is now available at a lower cost than the usual

Astronomer's aid

astronomical watches. The Waltham sidereal time watch, when used with proper astronomical charts, tells at what instant celestial bodies are crossing the meridian. It is expected that the watch, said to be mathematically accurate, will be helpful to both amateur and professional astronomers.

PLASTICS-GLASS SHEETS

Form Durable and Decorative Lamp Shades

UNUSUALLY attractive lamp shades with the appearance of antique parchment are now being made with a new kind of Fiberglas-plastics combination. Said to be highly practical as a decorative lamp shade material, the glass-plastics combination is impervious to heat and moisture and does not warp, wrinkle, or sag. Cleaning with soap and warm water is entirely possible. In fabrication,

the material can be sewed, pleated, or glued.

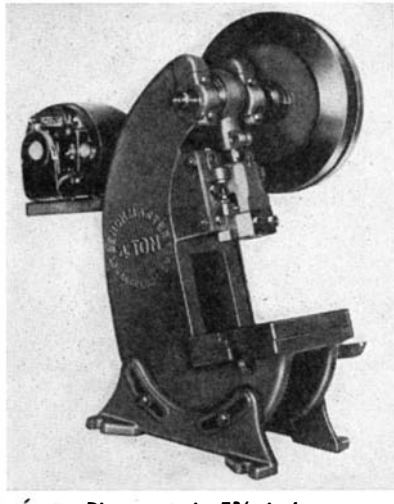
In addition to the antique-parchment type, the laminated sheet is also made in types resembling copper and gold—all with textures of decorative interest. These are adaptable to various light transmission requirements, ranging from translucent to opaque, and are equally pleasing to the eye with or without a light behind.

The basic sheeting, produced by Polyplastex, is also being adapted to use for decorative screens, wall panelling, and table mats, as well as display and packaging materials.

BENCH PRESS

Capable of Production Speeds on Variety of Jobs

UNUSUALLY compact, a four-ton bench punch press, designed to approximate the performance of larger presses, weighs only 215 pounds and operates at a speed of 285 revolutions per minute with a standard-speed electric motor. Features include a precision-ground shaft that is keyed by means of a press



Die space is 5¾ inches

fit to a large eccentric; over-size bronze bushings; and frames cast in one piece from semi-steel, heat-treated and heavily reinforced at stress points. A further feature of this press is an open back that makes it possible for work to be inserted from the front as well as from the sides.

When the ram is in up-position, a 5¾-inch die space is available. The six by eight-inch bolster plate has a thickness of one inch and has a two inch hole in its center.

The builder, Benchmaster Manufacturing Company, points out that although it was specifically designed as a punch press, this machine is also adapted to do stamping, marking, punching, crimping, riveting, and other high-speed production operations.

SILVER ALLOYS

Provide Low-Cost Joints In Two Temperature Ranges

TWO BRAZING alloys featuring lower silver content and called Easy-Flo 45 and Easy-Flo 35 have recently been made available. The first-named alloy contains 45 percent silver, plus copper, zinc, and cadmium. One of its features is a low melting range—1120 to 1145 degrees, Fahrenheit. The joints produced between ferrous, nonferrous, and dissimilar metals are said to be strong, ductile, and leak-tight. The manufacturers, Handy and Harman, state that it offers the full advantages of alloys with a higher silver content but due to less silver in its composition provides an economy to help offset the recent increase in the price of silver.

The 35 percent alloy has quite different characteristics, a wider melting range—1115 to 1295 degrees, Fahrenheit—and is free flowing at an exceptionally low temperature for an alloy containing 35 percent silver. It is intended for the economical production of joints between ferrous or nonferrous metals which are high in strength and ductility and is appropriate to use in places where its higher working temperature is not objectionable.

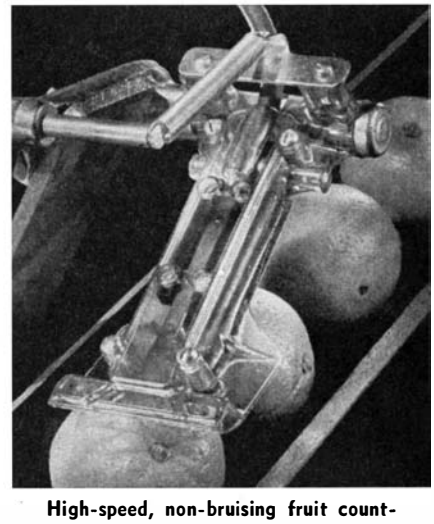
Editorial purpose of Scientific American is to provide its readers with thought-provoking feature articles and shorter items on all phases of industrial technology. In every case the material is drawn directly from industry itself. The Editor will be glad to refer interested readers to original sources and, when available, to additional literature giving further details of a more specialized nature.

FRUIT COUNTER

Gains Accuracy with Non-Bruising Plastics Paddle

ELECTRICALLY-OPERATED citrus counters used in the highly organized citrus fruit industry are now equipped with "paddles" molded of transparent, tough Tenite plastics. The paddle is that part of the counter which the fruit touches as it travels down a moving belt. Electrical apparatus contained within the paddle records the number of pieces of fruit counted by the paddle.

Light weight and toughness are the two principal characteristics required of the material used in the paddle—the paddle not only must not bruise the



High-speed, non-bruising fruit counter uses light-weight plastics paddles

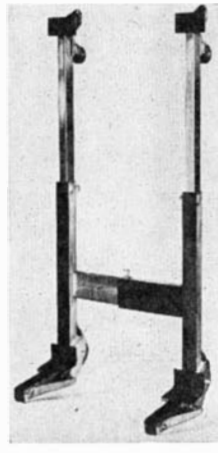
fruit which passes under it, but also it must not bounce after being struck by the fast-traveling fruit. This insures accurate counting and recording. The 2½-ounce Tenite paddle is reported to have stood up well under continual use.

Screw holes are drilled in the plastics so that the two parts of the paddle —housing and cover—may be fastened together. Electrical parts are tapped in during final assembly.

LOAD MOVER

Weighs 27 Pounds, Adjusts to Article Carried

CONSTRUCTED entirely of magnesium, a new light-weight two-wheel truck weighs 27 pounds as compared with its steel predecessor's 58 pounds. One of its features is the fact that it is adjustable in length from 41 to 58 inches, and in width from 19 to 29 inches, making it practical for handling stoves,



Magnesium parts reduce weight

refrigerators, and other items of varied size. Also, stairway hand holds are provided which fold under and snap out of the way when the mover is being used as a two-wheel truck and which are extended for use as hand grips when loads are carried up or down stairways.

The truck is equipped with rubber-cushioned main roller wheels. Two smaller wheels built into the main supporting members permit pivoting of the truck on landings and facilitate moving articles into recesses.

Made by Keen Manufacturing Corporation, the load movers were developed in co-operation with The Dow Chemical Company.

BATTERY WATER

Rarely Needed with Extra-Capacity Case

A NEW automotive battery, which is said to have three times as great a water reserve as conventional batteries yet fits standard auto cradles, has recently been placed on the market. Built with a specially molded hard-rubber container one-quarter inch higher than ordinary units, the battery, called Sta-Ful, achieves its extra water capacity by increased interior space.

The extra space was obtained by

lowering inside bridges at the bottom so the plates, increased in number from 15 to 17, are located at a lower level in the battery, thus giving extra headroom over the separators at the top. This in turn allows more room for water which, in addition, now has so far to fall before evaporation has exposed the plates that the Electric Auto-Lite Company estimates in normal use the Sta-Ful needs water only three times a year.

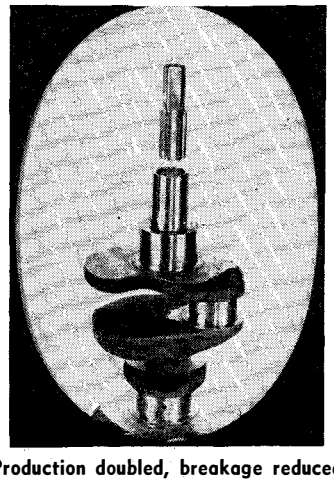
Further, it is claimed that the extra water results in milder average strength for battery acids which tend to eat away plates more quickly when concentrated.

TAP BREAKAGE

Reduced on Tough Forgings by Specially Ground Tool

SPECIAL steel crankshaft forgings, when heat treated for high strength, tend to develop a crystaline structure that resists cutting. Conventional taps used on the forgings shear frequently at the tooth roots in addition to dulling rapidly and requiring reconditioning which impairs production schedules.

Now, a specially designed, ground tap is reported by Detroit Tap and Tool Company to distribute the cut-



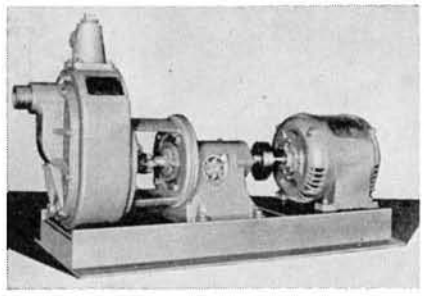
Production doubled, breakage reduced

ting load over a 3-½ thread chamfer on each of six straight flutes. Also, eccentric relief of the chamfered section is minimized to provide maximum support of the cutting edges and maintain full concentricity of the thread. By these means, it is said, reduction in threading rejects have resulted and production has been more than doubled. Further, tool costs were materially reduced by the production of an average of 700 pieces between grinds. Tap breakage is claimed to be entirely eliminated.

INDUSTRIAL PUMPS

Combine Automatic Prime and Centrifugal Action

ELECTRICAL and belt-driven self-priming centrifugal pumps, in sizes to handle 50 to 4000 gallons per minute, will be made available on an expanded production basis. As explained by their manufacturer, Marlow Pumps, an unusual diffuser design allows the pumps



Special design makes a new line of centrifugal pumps self-priming and able to handle a variety of liquids

to prime and re-prime automatically without recirculation or the use of auxiliary mechanical devices. As in regular centrifugals, the impeller alone moves the liquid; thus they combine the efficiency of centrifugal pumping with dependable, automatic action.

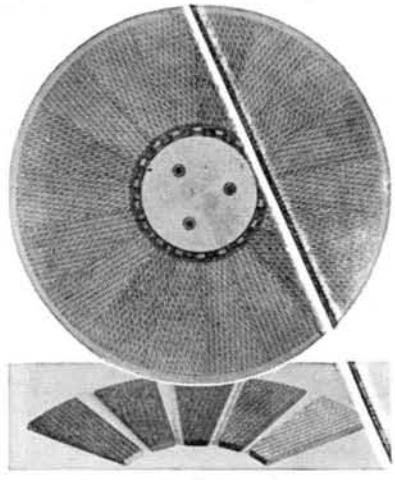
The pumps are made with 1½ to 10-inch fittings, and will operate on heads 10 to 150 feet. They handle clear, gritty, warm, or volatile liquids.

DISK FILE

Removes Metal as Clean Chips, Creates Little Heat

DESIGNED to facilitate the facing of rough castings, and removing of unwanted projections, such as flash or draft, gates, risers, and so on, a new disk file is produced for use on light alloys, die castings, and plastics. It consists of double-cut segments of solid Kennametal, dovetail-wedged into a 12-inch diameter steel body which can be supported and driven by any suitable means. The teeth are formed and positioned so that the material is sheared off in clean-cut chips.

The file body may be attached directly to a rotating member of the



Shearing action gives dustless filing

driving machine, by socket head cap screws, if the machine has a suitable supporting flange and centering stud. If such means are not available, a flanged adaptor may be made.

Advantages claimed for the disk file include increased production rate, better working conditions since material is cut off in curled chips rather than rubbed off as dust, and less heat created in workpiece.

The Editors Recommend

PROCEDURES IN EXPERIMENTAL PHYSICS — *By John Strong, Ph.D.* A wealth of useful data of a practical kind for the constructor, experimenter, and skilled craftsman. **$7.10**

HIGH FREQUENCY INDUCTION HEATING — *By Frank W. Curtis.* Answers many questions concerning induction heating and its utility in industrial processes. Thoroughly practical in scope. **$3.10**

TOOL MAKING — *By C. M. Cole.* Instructions for making and using all kinds, from personal tools to arbor presses, lathes, planers, etc., in different metals. **$3.60**

POTTERY PRODUCTION PROCESSES — *Edited by J. J. Svec.* For amateur and professional alike, this compact volume gives specific instructions. Particular atention is called to troubles most likely to develop. **$2.10**

YOUR HAIR AND ITS CARE — *By Oscar L. Levin, M.D., and Howard T. Behrman, M.D.* Scientific facts about hair—how to save and beautify it, treat infections, and so on. Real facts—not a "cure-for-baldness" screed. **$2.10**

EXPERIMENTAL SPECTROSCOPY — *By Ralph A. Sawyer.* Covers theory and types of spectroscopes and spectrographs, mounting and use of gratings, determination of wavelengths, infra-red spectroscopy, spectrochemical analysis, and so on. Somewhat elementary but requires knowledge of physics and some physical optics. **$5.10**

ATOMIC ENERGY FOR MILITARY PURPOSES— A General Account of its Development Under the Auspices of the United States Government, 1940-1945. The famous Smythe report, telling in relatively non-technical language of the developments in nuclear physics that lead to the manufacture of the atomic bomb. **Paper cover, $1.35; cloth, $2.10**

PLASTICS — *By J. H. Dubois.* Third edition, again revised and enlarged, with two four-color plates. This is an important book on the whole general subject of plastics, plus much brand new material on synthetic rubber, manufacturing processes, and plastics moldings. **$4.10**

REVISED LAPIDARY HANDBOOK — *By J. Harry Howard.* Practical instructions in gemstone cutting and polishing, for both beginner and the advanced hobbyist. **$3.10**

EXPERIMENTAL ELECTRONICS — *By Ralph H. Muller, R. L. Carman, and M. E. Droz.* A solid book of eminently practical information on the characteristics and non-communication applications of electron tubes. The text describes experiments and presents results. For students, radio engineers, communications experts, and the serious general reader. **$5.10**

THE MEANING OF RELATIVITY — *By Albert Einstein.* Second edition with added chapter describing advances since publication of first edition some 25 years ago. Requires knowledge of advanced mathematics and physics; not a popular exposition. **$2.10**

TECHNIQUES OF GLASS MANIPULATION IN SCIENTIFIC RESEARCH — *By Julius D. Heldman, Ph.D.* Text covers properties of glass, glass-working equipment, basic operations, seals (including metal-to-glass), and exercises aimed at perfecting technique. **$3.70**

A PRACTICAL COURSE IN HOROLOGY — *By Harold C. Kelly.* Definite, outright, practical instructions on watch making, repairs, and adjustment. **$2.85**

Best Sellers In Science

SLIDE RULE SIMPLIFIED — *By C. O. Harris.* How to use a slide rule, without any of the mystification that often surrounds this important tool of the engineer. Excellent illustrations make everything clear. **$3.60** including a slide rule; for book alone, **$2.60**

HOW TO SOLVE IT — *By G. Polya.* The text deals with the general method of solving problems. It will be of value to teachers but will also find wide use by those who have to solve problems requiring scientific reasoning. **$2.60**

MACHINERY'S HANDBOOK — *13th Edition.* "Bible of the mechanical industry." 1911 pages of latest standards, data, and information required daily in shop and drafting room. **$6.10**

BUILDING INSULATION — *By Paul D. Close.* When, how, and where to use thermal and sound insulation. Fundamentals as well as practical aspects, with many typical examples and their solutions. **$4.60**

ATOMIC ARTILLERY AND THE ATOMIC BOMB — *By John Kellock Robertson.* Standard best seller for years, describing electrons, protons, positrons, photons, cosmic rays and the manufacture of artificial radioactivity—now with a chapter added on the bomb and the difficulties of its production. **$2.60**

PRINCIPLES OF PHYSICS, VOL. III — OPTICS — *By Francis Weston Sears.* One of the most modern works on physical optics available today. At college level, it covers the subject with emphasis on physical principles rather than practical applications. **$5.10**

ELECTRONIC PHYSICS — *By Hector, Lein and Sconton.* A simplified text for those who desire to acquire a sound basis for following the advance of applied electronics. **$3.85**

TESTING PRECIOUS METALS —*By C. M. Hoke.* This guide for those who buy and sell precious metals describes testing methods and gives important facts that such people should know. **$2.10**

FUNDAMENTALS OF OPTICAL ENGINEERING — *By Donald H. Jacobs.* This new work starts out at the very beginning, is mainly non-mathematical, and is probably the best suited of all existing books as an introduction to optical design. Author is a physicist at Bureau of Standards. **$5.60**

WITH THE WATCHMAKER AT THE BENCH — *By Donald DeCarle.* Simple, practical, straightforward instructions on the repair of timepieces, with direct implications to the manufacture and repair of delicate instruments of all kinds. **$3.10**

THE PROLONGATION OF LIFE — *By Dr. Alexander A. Bogomolets.* Competent evaluation of present knowledge of the mysteries of human aging, including full discussion of ACS—anti-reticular cytotoxic serum. **$1.60**

FEATURES OF THE MOON — *By J. E. Spurr.* New volume that includes all of the former "The Imbrium Plain Region of the Moon," plus an extended study of the whole Moon. 453 large pages, 14 Mt. Wilson photographs, 95 drawings. **$5.10**

(The above prices are postpaid in the United States. Add, on foreign orders, 25¢ for postage on each book, except as noted.)

(All prices subject to change without notice.)

For Sale by: **November, 1946**

SCIENTIFIC AMERICAN, 24 West 40th Street, New York 18, N.Y.

I enclose $..... for which please forward at once the following books:

.....

.....

Name .....

Address .....

Write us for information on books on any subject. We can supply any book in print.

CURRENT BULLETIN BRIEFS

Conducted by K. M. CANAVAN

(The Editor will appreciate it if you will mention Scientific American when writing for any of the publications listed below.)

GUIDE BOOK FOR INDUSTRIAL DESIGNERS. Written to suggest applications of rubber and synthetic products to industrial designers, this 12-page booklet presents pertinent information on Koroseal, Vibro-Insulators, Torsilastic, rubber-lined equipment, and other products. *The B. F. Goodrich Company, Public Relations Department, Akron, Ohio.—Gratis.*

A SELECTIVE SUBJECT INDEX FOR 1945, prepared by Willard Kelso Dennis, Librarian, Beech Aircraft Corporation. In 386 pages are covered an enormous range of aeronautical literature. The index will be a great help to anyone wishing to secure information on aviation matters—librarian, student, writer, aviation man, or business man. All important aeronautical periodicals have been indexed; the headings are comprehensive and well arranged. The index is being continued in monthly form for the current year. *Beech Aircraft Corporation, Wichita 1, Kansas.—$5.00 for 1945 Index.*

AIR FOAM is a 20-page booklet based on the use of this newer mechanical method of fire fighting—without chemical reaction. Information is presented on what air foam is, how it is applied, and its advantages. *Pyrene Manufacturing Company, 560 Belmont Avenue, Newark 8, New Jersey.—Gratis.*

REPLACEABLE-FACE HAMMER is a bulletin describing a split-jaw tool which permits speedy replacement of faces. It is designed for use in construction, repair, and metal-working operations involving surfaces that must not be marred. Information and prices are listed for the replaceable Basa faces which are reported not to shrink, expand, chip, or disintegrate. Request Bulletin BE-12. *Greene, Tweed, and Company, Bronx Boulevard and 238th Street, New York 66, New York.—Gratis.*

X-RAY AS A FOUNDRY CONTROL TOOL. In this four-page reprint information is given on: how X-rays are produced, equipment costs, small casting production, fluoroscopy, personnel, and operational costs. Request Bulletin Number R1023. *North American Philips Company, Inc., 100 East 42nd Street, New York 17, New York.—Gratis.*

FOUR STEPS IN PLASTICS PRODUCTION presents and illustrates Printloid's unusual operation. All four steps—forming, printing and die cutting, machining, design and assembly—are offered by one company which guarantees uniformity of production control and eliminates the necessity of farm-

out work to different houses. This log contains listings of major types lastics available, with trade names, acteristics, and typical applications. *tloid, Inc., 95 Mercer Street, New k 12, New York.—Gratis.*

UMATIC TOOLS. This catalog lists a mplete line of pneumatic tools, in- ing 14 new tools developed during war. Capacity and specification es are presented in easily under- d form. Request Catalog Number n your business letterhead. *Keller Company, Grand Haven, Michi-*

EN HAZARDS ON YOUR ROOF, an il- strated folder, deals with repair- and water-proofing of worn, leaky ; and also the economical way to re life to cracked or dried-out roof aces. *Stonehard Company, 403 n Broad Street, Philadelphia 8, sylvania.—Gratis.*

STIC FACTS NUMBER 1A. Supple- enting Fact Sheet Number 1 (this nn, July 1946), this sheet covers of the established uses of silicone er. Six Silastic stocks, now avail- in commercial quantities, are nmended for uses where conven- l rubbers deteriorate rapidly be- e of heat or weathering. *Dow Corn- Corporation, Midland, Michigan.—*

UBE EVAPORATORS is a 25-page bul- n containing information on the us types of evaporators and their ls of design. An explanation of the tion of evaporators and of benefits ned by their use is of special in- t to plant engineers and execu- Request Bulletin 364. *The Gris- Russell Company, 285 Madison ue, New York 17, New York.— is.*

ON UNIVERSAL TESTER is a 16-page strated brochure describing this ment and including a complete f tables showing factoring of speci- tests for many materials. *W. C. n and Company, Inc., 5410 West ison Street, Chicago 44, Illinois.— is.*

PLY — A NEW TECHNIQUE IN FLAT ND MOULDED PLYWOOD MANUFAC- In 34 illustrated pages this book- utlines a new process for the more omical manufacture of flat, simple ed, and complex molded plywood. ographs show some articles being commercially by this process and utline of the advantages claimed he new material is given. *Casein pany of America, 350 Madison ue, New York 17, New York. — s.*

MMENDED PRACTICES FOR AUTOMO- E FLASH-BUTT WELDING is a 22- booklet containing sections on notive-type steels, flash-welding ment, design considerations, tool- welding technique, and inspection. *ican Welding Society, 33 West Street, New York 18, New York.— nts.*

Our Book Corner

THE BOOK DEPARTMENT of Scientific American is conducted, with the co operation of the Editors, to make available for you a comprehensive book service. Each month the Editors select and review in these columns new books in a wide range of scientific and technical fields. In addition, they are ready at all times to advise you regarding the best available books on any subject. You are invited to use this service freely. Tell our Book Department what kind of books you want, and you will be furnished with the names of available books, including prices. When inquiring about books, please be specific, remember that we can be of the greatest help only when you tell us just what you are looking for. Books listed in these columns may be ordered from our Book Department. Add 25 cents per book for mailing outside U. S. All remittances are to be made in U. S. funds. Prices given are subject to change without notice.

TO MAKE CERTAIN that books ordered by or for men in the Army, located in the United States, or men in the Navy, Marines, or Coast Guard, located anywhere, will be delivered, insurance fees should be sent with orders, as follows: To $5 in value, 3¢ additional; from $5 to $25, 10¢; from $25 to $50, 15¢.

Because of increased production costs of books, publishers' retail prices today are subject to constant change. It may be necessary, therefore, for our Book Department to advise book purchasers of increased costs, even when orders sent are based on current quotations.

The Editor

THE ABSOLUTE WEAPON: ATOMIC POWER AND WORLD ORDER

Edited by Bernard Brodie

SHALL the whole subject of atomic power be guided by the "tell-all" or by the "do-nothing" schools of thought? This book, prepared by members of the Yale Institute of International Studies, shows the dangers of following either of these schools and attempts to serve as a guide to rational planning and wise statesmanship as a means of meeting the greatest challenge in man's history. Emphasis throughout is not upon technicalities but on the political aspects of the latest force unleashed by science. (214 pages, 6 by 8 inches, unillustrated.)—$2.10 postpaid.—*A.P.P.*

INSIDE THE VACUUM TUBE

By John F. Rider

AVOWED purpose of this book is "to present a solid, understandable concept of the theory and operation of the basic type of tubes as a foundation upon which can be built a more advanced knowledge of tubes in general." This purpose is admirably forwarded by unusual illustrations prepared by Baxter Rowe. They amplify the solid text in a manner which makes for easier reading and more thorough comprehension. A series of two-color anaglyphs (viewing spectacles are included with each book) provide stereoscopic views of certain vacuum tube phenomena. (407 pages, 6 by 9 inches, lavishly illustrated.)—$4.60 postpaid.—*A.P.P.*

ELEMENTARY APPLIED AERODYNAMICS

By Paul E. Hemke

IN A sense, the title of this book belies its contents. Athough the material written upon is elementary from the standpoint of an advanced aerodynamicist, the method of coverage is predicated upon the student being well founded in pre-engineering mathematics, physics, and mechanics. The book is intended to comprise about the right amount of material for an average college term, and treatment is predominately mathematical. The examples, problems, questions, and solutions are essentially common to the college-text style and, as it must be, the subject matter is based on air properties, fluid and gas flow, airfoil behaviors, and general aerodynamic forces. Some discussion of compressibility effects, as well as a section on rotary-wing craft is provided. (231 pages, 6¼ by 9¼ inches, numerous line cuts, graphs, visible-flow tunnel pictures, and tables.)—$3.35 postpaid.—*E.F.L.*

WHITMAN-PECK PHYSICS

By Walter G. Whitman and A. P. Peck

CHARACTERISTIC of many high-school students is the attitude of "taking" a course as though it were a sort of vaccination to have over, done with and forgotten. Frequently such outlooks stem from inadequate correlation by teacher and text of the subject matter and the student's daily life. Hence it is refreshing to review a physics text into which that rare thing, a breath of life, has been drawn by authors cognizant of the fact that things-academic and things-of-the-world are inseparable. Teaching aids include chapter summaries, review exercises, problems, and exercises for clear thinking. Student aids include unusual and modern pictures, chapter-end sidelights, an informal style of writing, and balanced discussions calculated to hold the attention of both boys and girls. Subject

matter meets college-entrance requirements and includes all standard physics material plus additional subjects—aviation, electronics, photography, and automobiles—to allow a flexible and interesting school year. An unusually well handled series of drawings and halftones, nearly 700 in all, give the book a dynamic and thoroughly understandable quality. (629 pages, 6½ by 9 inches, index, four-color frontispiece.) —$3.10 postpaid.—*E.F.L.*

SMALL BOATS FOR SMALL BUDGETS

By Jerrold Oakley

LANDLUBBERS thinking of taking up boating will find this most elementary book orients them with regard to types of construction, manually propelled boats, motorboats, sailboats, how and where to build a boat, check points on buying, care and painting, seamanship, learning to sail. Others may find it too elementary though few will be likely already to know quite everything in it. Accent on landlubbers, total tyros, who want to learn. (146 pages 5 by 7 inches, 28 illustrations.)—$2.60 postpaid.)—*A.G.I.*

ORGANIC REAGENTS FOR ORGANIC ANALYSIS

By the Staff of Hopkins and Williams Research Laboratory

THE USUAL method by which the organic chemist identifies an unknown substance is to form one or more derivatives from it and then to determine the properties of the derivative (melting point, particularly). Having the properties of the original compound and of its derivative of a known type, identification usually follows simply. This book is definitely a chemist's work book. It provides the basis for such analyses by giving in convenient form the reactions characteristic of the several important classes of organic compounds, the reagents used for producing them and finally a table of melting points of the derivatives. Much information is collected in a small space for ready reference. (175 pages, 5½ by 9 inches, unillustrated.)—$3.85 postpaid. —*D.H.K.*

AIRPORT PLANNING

By Charles Froesch and Walther Prokosch

THIS ANALYSIS of airport planning and design problems is probably as comprehensive and well done as anything that has been written on the subject. It is an excellently handled piece of work. The airport, as discussed here, is recognized as a vital factor in the integration of a given community and its environs with the economic units of the nation and the world. Detailed treatment of present and future aircraft and their requirements, traffic control, building design, field management, and so on, is interwoven with fundamental airport factors of size, type, layout, and governmental regulations. Illustrations, tables, and explanatory matter are exceedingly well selected, and presented in the correct place for best use. A bibliography at the end of each section, and footnotes where necessary, provide a satisfying evidence of scholarly investigation before writing. The book is one well worth a place on the desk of any municipal or other official concerned with aviation or the ramifications of aviation in his area. Competent use of the material available should go far to prevent blunders in planning or operating an air-transport facility. (250 pages, 9 by 11½ inches, a multiplicity of tabular and illustrational material, glossary, index.)—$7.10 postpaid.—*E.F.L.*

ELECTRIC MOTOR REPAIR

By Robert Rosenberg

INTENSELY practical is this unusual book on motor repair and rewinding. It is so prepared that it can be used by men with little background of electrical knowledge as well as by those who are more advanced yet need specific instructions for certain phases of repair work. The book is divided into two parts, each individually spiral bound but held together by a single cover. One-half contains the text and the other the illustrations. Thus the illustration part of the book can be left open at a certain point for reference, while the text is followed through several pages. This convenience feature will be doubly appreciated when the book is used at the bench. (Text, 308 pages; illustrations, 243 pages; 7 by 9 inches.)—$5.10 postpaid.—*A.P.P.*

SCIENCE IN A CHANGING WORLD

By Cabis, Getchell, and Kadesch

HERE the physical sciences are presented in a style that steers closely enough to the high-school physics text to be accurate but far enough away from that same text to be interesting. Intent is clearly that of offering the intelligent citizen who occasionally feels somewhat overwhelmed with the mad rush of present science a bit of solid footing with a thin sugar coating. On this basis, the book is both well timed and well written. Little is left out and, in addition to its basic purpose, the publication is a handy one for quick general reference around the office or home. Thoroughly revised over the 1940 edition. (622 pages, 6¼ by 9¼ inches, 329 drawings and illustrations.) —$5.10 postpaid.—*E.F.L.*

A PRIMER FOR STAR GAZERS

By Henry M. Neely

EXCELLENT white-on-black constellation charts with the old Greek animals and lucid, simple instructions for finding the stars characterize this attractive book. It is not aimed at the average amateur astronomer but at that friend of his, or his flighty aunt or uncle who "just goes all to pieces" for fear astronomy is going to be technical or mathematical. It purposely avoids everything remotely technical, is frankly adult kindergarten stuff, and tries

to teach only where the stars and constellations are, not astronomy, though here and there it slips in a little instruction of the wide-eyed wonder but authentic kind. It would be a good medium through which to sneak up on that frightened friend and "get him used to the dark" without scaring him off. That, in fact, is the author's asserted main aim. (334 pages, 5½ by 8½ inches, 96 charts, 14 photographs.)—$3.85 postpaid.—*A.G.I.*

SIMPLIFIED PUNCH AND DIEMAKING

By James Walker and and Carl C. Taylor

STEP BY STEP the reader is lead through the design, construction, and operation of dies and punches. The result is a comprehensive reference book for tool engineers as well as for those who are just getting started in the art of punch and diemaking. Emphasis is on what-to-do and how-to-do-it, from the simplest to the most complex dies. Much information is included on the newer materials and methods. (235 pages, 6 by 9 inches, over 250 photographs, drawings, and diagrams.)—$5.10 postpaid.—*A.P.P.*

THE ALKALINE-EARTH AND HEAVY-METAL SOAPS

By Stanley B. Elliott

THE METALLIC soaps have long been extremely valuable in industry but no comprehensive discussion of their manufacture and highly diverse applications has heretofore been published. This volume provides an excellent survey of both phases of the subject and suggests many stimulating thoughts that will undoubtedly lead to new and important applications in other fields. In addition to the running discussion of metallic soaps which forms the body of the book, the author has included six appendices totalling nearly a hundred pages of tabular and quoted material. The book constitutes a rich mine of information on its subject matter, useful alike to the manufacturer and to the user of compounds of this broad type. This is No. 103 of the series of American Chemical Society Monographs. (342 pages, 6 by 9 inches, illustrated.)—$7.60 postpaid.—*D.H.K.*

AUTOMOBILE MAINTENANCE

Prepared by a Staff of Experts Under the Supervision of Ray F. Kuns and Tom C. Plumridge

WITH EMPHASIS on maintenance service, as contrasted with repair service, this book encompasses a mass of valuable information for the use of automobile service men. The text deals first with service station operation, then with motor analysis (with attention to special testing equipment), then covers trucks and electrical equipment in general. Following this, for the major portion of the book, are wiring diagrams and data sheets for automobiles from 1933 to 1942 models. (735 pages, 6 by 8½ inches, lavishly illustrated, glossary and index.)—$4.85 postpaid.—*A.P.P.*

Telescoptics

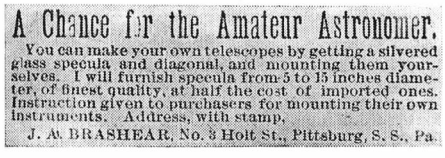
A Monthly Department for the Amateur Telescope Maker

Conducted by ALBERT G. INGALLS

Editor of the Scientific American books "Amateur Telescope Making" and "Amateur Telescope Making—Advanced"

ROSE TOOLS having petals which *are tapered,* in contradistinction to tools similarly used for local correction of optical surfaces but which are simply channeled in the normal manner, turn out to have been the invention of the famous "Uncle John" Brashear. Mirror makers have used such tools for years but their origin has been lost sight of. Porter, in "A.T.M.," 64, describes such a tool.

The rediscovery of the rose tool's origin happened thus: G. Dallas Hanna, a San Francisco advanced amateur, mentioned having come across "an interesting paper" in Volume 33 (1884) of the *Proceedings* of the American Association for the Advancement of Science, and when this paper was looked up it was found to contain evidence that Brashear invented that



A Chance for the Amateur Astronomer.

You can make your own telescopes by getting a silvered glass specula and diagonal, and mounting them yourselves. I will furnish specula from 5 to 15 inches diameter, of finest quality, at half the cost of imported ones. Instruction given to purchasers for mounting their own instruments. Address, with stamp,

J. A. BRASHEAR, No. 3 Holt St., Pittsburg, S. S., Pa.

Crossroads on a famous career

type of tool. Background is supplied by Brashear's "Autobiography."

In 1872 Brashear, then a steel mill worker in Pittsburgh, started a 5″ objective lens as an amateur, broke the crown lens while polishing it, started again and finished the telescope. In 1877 he started a 12″ *f*/10 mirror, finished it but cracked it while silvering, but made another. (At that time he found "Burton's Method" of silvering the backs of looking glasses described in Scientific American, modified it, and this was the genesis of the Brashear Method of fame.) In 1880, while still laboring in the steel mill, he inserted in Scientific American, October 30, the tiny advertisement here reproduced. "Alas for me!" he writes, "Hundreds of inquiries came to me from that advertisement;" such a market vacuum in telescopes existed at that time in this country.

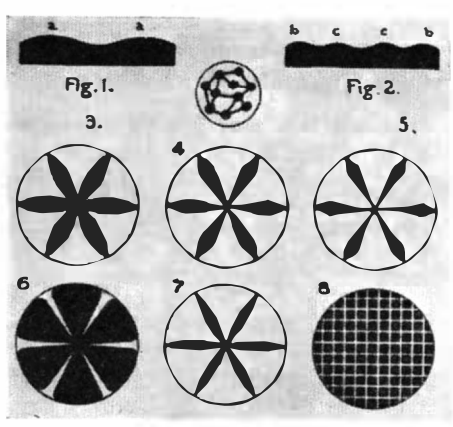
By Christmas Brashear had shipped three mirrors but, working daytimes in the steel mills, spare time on optics, he underwent a breakdown. The Pittsburgh philanthropist William Thaw saw him, liked the cut of his jib, gave him an equipped new shop, paid off his home mortgage, and told him to do optics whole time.

By 1884 Brashear "had invented and successfully used for several years a method of correcting the local errors in optical surfaces which proved to be very efficient" ("Autobiography") and which "has been used by many of the best opticians of the world. . ." He was invited to read a paper before the scientists of the nation and did so in 1884, its title being "The Production of Optical Surfaces." This paper is not merely a historical curiosity; it lucidly presents instructions of as great practical application in 1946 as in 1884. The paper:

IT is the purpose of this paper to describe briefly a new method of producing accurate optical surfaces, both plane and curved. The hand and machine methods of past and present workers in this line of research should not be forgotten, especially Foucault's method of local correction and Dr. Draper's excellent modification thereof.

In order that the new method may be more clearly understood, attention is called to the serious difficulties met with in producing regular surfaces with the ordinary forms and methods of using local polishers. It is quite well known that the tendency of all local retouching is to leave on the surface of the abraded material what may be aptly called residual errors. This may be readily understood by the following illustration.

Suppose in the sectional view, Figure 1, we wish to work down the high zone, *a,* in an over-corrected surface. A local polisher is worked over the high zone, either by hand or machine, of a size corresponding with the breadth of the zone and usually circular in outline. The result of this local abrasion is seen in Figure 2 in which the zone, *a,* Figure 1, is seen to be broken down, but generally the residual zones, *b* and *c,* are left incompletely abraded by the edge of the local polisher, which must afterwards be abraded by a larger polisher, which may or may not introduce new periodic or systematic errors. Dr. Draper seems to have overcome this tendency in a great measure by the use of the machine described in his monograph. After many experiments and much careful study of these zonal errors, I endeavored to eliminate them with a machine constructed so as



Rose tools, their forms and their uses

to give an intricate motion to the polisher, a motion that would scarcely return into itself in many thousands of strokes. Notwithstanding the fact that this machine produced a number of excellent curves, it could not be depended upon, for in spite of the intricate interlacing of the polisher, zonal errors would creep in. After six years of labor I reluctantly gave up the pursuit in this direction. From the fact that occasionally good results were produced by the machine, I was led to a careful study of the forms of polishers, and after three years of experimental work, I have been led to this conclusion: that, given a properly shaped polisher, surfaces of the highest excellence may be produced; either by hand or machine work, and that the simple rotary and reciprocal motions are all that are necessary to be given to the polishing tool.

I will now give as briefly as possible the leading features of the method which I have found so sure and certain in its results, by which not only zonal errors are overcome, but by which any desired curve may be given to the optical surface under treatment. As it is necessary in all optical work to get the highest attainable polish, the first polishers are made in the ordinary form, *i. e.,* with square or circular facets equally distributed over the surface of the tool, as shown in Figure 8. This is done to expedite the polishing. When the polish is brought up to the best (the best polish is no doubt the *finest scratching* we are able to do) the glass is allowed to come to a normal temperature, and is then studied by the admirable methods devised by M. Foucault for curved, and by Steinheil and Dr. C. S. Hastings for flat surfaces. Very seldom are the surfaces found free from defect. In order to clearly understand the method which I use for the correction of errors in producing a *regular* curve, let us take the former case of Figure 1, where the Foucault test shows a decided overcorrection or hyperboloid of revolution on the concave surface. The zone *a* is to be depressed and at the same time new errors, especially zonal errors, are to be avoided. The iron tool, which is of the same diameter as the surface to be worked, is laid off into six points diametrically opposite with the dividers set to the radius of the tool; as in Figure 3. The tool is now warmed and the pitch is spread over the leaf-like spaces, which are given the proper curve by being pressed down on the (previously wetted) concave surface. The pitch and tool are now cooled quickly by an abundant flow of water. In the shaping of this leaflet lies the whole secret of success. The zone, *a,* Figure 1, needing the greatest amount of abrasion, the leaflet is made widest at that point, but in order that no zonal errors may be introduced, as in Figure 2, it is gently tapered in each direction, the amount of taper being somewhat governed by the amount of lateral stroke given to the polisher, as well as the amount of departure of the zone from the normal curve. After the proper shape is given to the correcting or figuring tool, the pitch is again

slightly warmed, pressed on the wetted surface, laid aside for an hour or so, and the work of correcting or figuring is then begun. When the polisher has worked long enough to transfer its own peculiarities to the surface under treatment, the glass is allowed to come to a normal temperature and again tested. If any change in the shape of the leaflets is needed, an inspection of the surface will indicate the character of the change required.

Cooper Key many years ago graduated the square facets of his polisher. Elliptical, ring and other forms of polishers have been tried from time to time with varying success, and I have myself tried many forms, but with none have I had such uniform success as with the form which I have just described. It has all the advantages of a local polisher without its defects, and as these leaflets can be so readily shaped, and so easily manipulated, we have a ready means of giving any desired form to the optical surface we are manipulating. Figures 4, 5 and 6 show the various forms of these polishers which are designed to correct different forms of errors. Figure 7 shows a polishing or figuring tool which will give fine results, when time is not an element in the work. Such a polisher would break down almost any form of irregular surface, and give a regular curve, the kind of curve—oblate spheroid, spherical, elliptical, paraboloid or hyperboloid, depending on the length of lateral motion given to the polisher; indeed almost any idiosyncrasy which a curve may present can be successfully treated with a slight modification of this form of polisher.

Flat surfaces may also be treated by modifications of the same general form of tool, and overworking the edge zone, so difficult to avoid in hand polishing, can be readily and easily overcome.

It is beyond the limits of this paper to discuss the various difficulties which the practical optician has to deal with besides those noted; but I would mention one thing that seems to be an insurmountable barrier to the production of an ideal optical surface, in the lack of homogeneousness in material. It is a fact well known to everyone who has to deal with minute measurements that no two pieces of glass, speculum metal or other optical material made by artificial means are ever absolutely homogeneous when they come into the hands of the optician; hence every piece of material must have its special study, and in many cases idiosyncrasies present themselves which say "Thus far shalt thou come, but no farther."

If, in this brief paper, I have said anything that will add to the interest of this study, intimately associated with the names of Newton, Herschel, Ross, Lassell, Foucault, Nasmyth, Dr. Draper any many eminent opticians of to-day, I shall feel more than repaid for my work.

END of Brashear's paper. In it, he mentions the Draper modification of Foucault's method of local correction. This was described in Draper's paper "On the Construction of a Silvered Glass Telescope," 1864, in Volume 14 of the "Smithsonian Contributions to Knowledge." That paper was reprinted in the Smithsonian Contributions in 1905, Volume 34, as well as in Scientific American Supplement, July 29, August 5, 12, 1905. There Draper described his machine, the one shown in "A.T.M." 165, as a simplification of Lord Rosse's and Lord Rosse described that machine in 1840 in the *Philosophical Transactions* of the Royal Society of London.

There are a number of these old classical papers pertaining to telescoptics. For example, Lassell on "Polishing the Specula of Reflecting Telescopes," *Philosophical Transactions* 1875; Ritchey on the "Two-foot Reflecting Telescopes of the Yerkes Observatory," in *The Astrophysical Journal*, 1901; and Ritchey "On the Modern Reflecting Telescope, and the Making and Testing of Optical Surfaces," from the "Smithsonian Contributions to Knowledge," 1905—all of which are out of print and to the average reader out of reach. Much of their content is obsolete and they are also too long to reprint in the present place. Some of them and others may, however, be reprinted in a sequel to "A.T.M." and "A.T.M.A." which has been planned, as sources of scattered pointers. It is difficult to estimate in advance how readers would regard these things. On the one hand, if you had the originals of these classics by your side would you read them? But if you had been asked to pay the added cost of including them in a book partly of original contributions, as in "A.T.M.A.," at about two cents a thousand words, would you then be critical? Please apply the same test to the inclusion of selected reprints—those of potential usefulness to telescope makers—from two decades of the present department and cast your vote.

Theoretically, all this matter may be looked up in large libraries but the difference between that and having the same things within the covers of a single volume, one's own, permanently available at home to pick up, dip into and throw down at any time, without strings attached, is almost absolute.

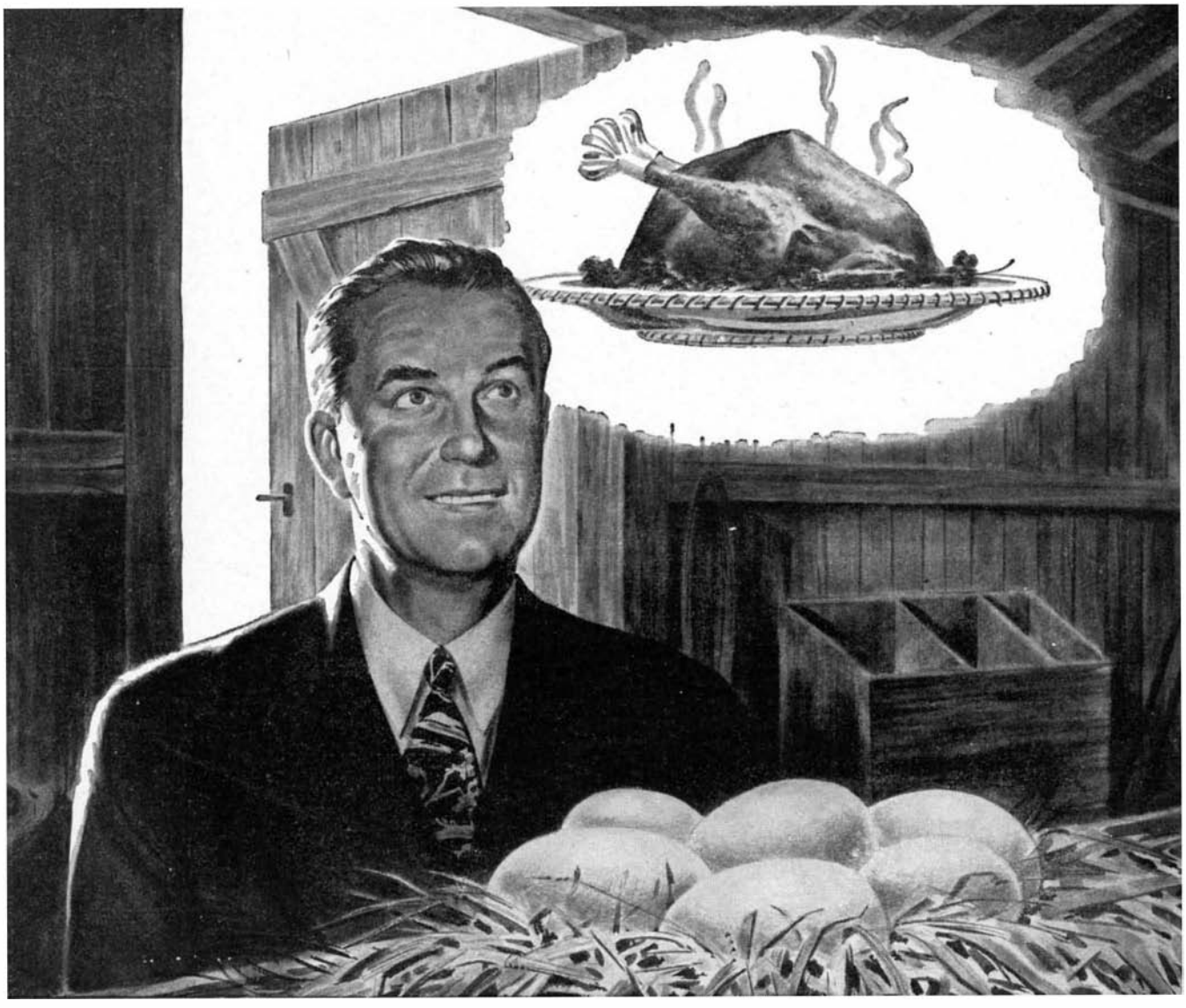
Your advice about this book is solicited and, as usual in human affairs, will be followed if it is liked.

CONTINUING last month's outburst of light verse, there now comes a contribution which presents a somewhat different and perhaps alarming after-complication of a severe case of addiction to telescoptics. Jack Haviland ("A.T.M.A." chapter on designing and making refractors) has entitled his effusion "The Telescope."

When the shades of night have fallen
But the seeing's very bad
Other views may oft be had.
Sometimes a celestial maid
Has forgot to draw the shade.
Thus, from studies astronomical
One can turn to anatomical.

Albert H. Johns, Larchmont, N. Y., speaks feelingly in light verse:

The kitchen floor knee deep in pitch—
To make a lap 'e'd 'ad an itch.
"I'll build a telescope," 'e said.
(When young, 'e'd fallen on 'is 'ead.)



Sometimes you can break a good rule!

It's usually a wise rule not to plan a chicken dinner before the eggs are hatched.

But not always!

If the "chicken dinner" represents your future, and the "eggs" are financial nest eggs—go ahead and plan!

Especially if your *nest eggs* are U. S. Bonds—all the War Bonds you have bought—all the Savings Bonds you *are buying*. For your government *guarantees* that these will hatch out in just 10 years.

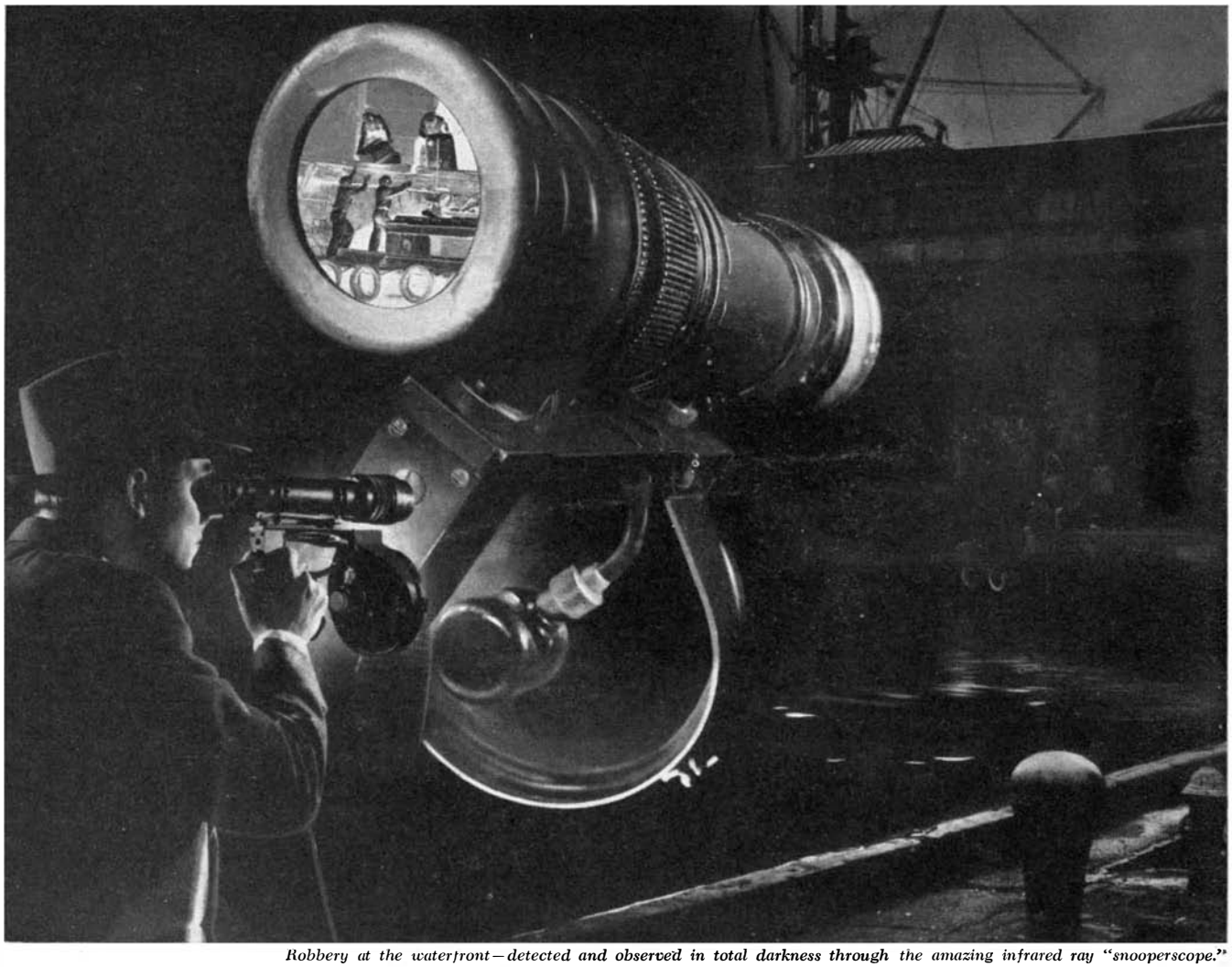
Millions of Americans have found them the safest, surest way to save money . . . and they've proved that buying Bonds on the Payroll Savings Plan is the easiest way to pile up dollars that anyone ever thought of.

So keep on buying Savings Bonds. Buy them at banks, post offices, or on the Payroll Plan. You'll be building real financial security for yourself, your family, and your business.

Best of all, you *can* count your chickens before they're hatched . . . plan exactly the kind of future you want, *and get it!*

SAVE THE EASY WAY... BUY YOUR BONDS THROUGH PAYROLL SAVINGS

Contributed by this magazine in co-operation with the Magazine Publishers of America as a public service.



Robbery at the waterfront—detected and observed in total darkness through the amazing infrared ray "snooperscope."

"Snooperscope"--sees at night with invisible light!

Crime detection is one of the many uses for this uncanny telescope that can distinguish objects more than a quarter of a mile away in a complete blackout.

The sniperscope and snooperscope are two wartime developments of RCA Laboratories in co-operation with the U. S. Army which are now being converted to civilian, industrial and police uses.

These instruments were made possible through a tiny image tube less than two inches in diameter and less than five inches long. Adapted to various military equipment, these telescopes provided the Army with some of its best night-fighting devices. A helmet-mounted binocular employing these image tubes enabled scout cars to speed over roads at 40 to 50 miles an hour without lights.

The same engineering skill that produced the snooperscope is reflected in every RCA and RCA Victor product—whether it is a Victrola* radio-phonograph, made exclusively by RCA Victor, or a television receiver, or a radio tube. If it's an RCA, it is one of the finest instruments of its kind science has achieved.

Radio Corporation of America, RCA Building, Radio City, New York 20. Listen to The RCA Victor Show, Sundays, 2:00 P. M., Eastern Standard Time, over NBC Network.

The "Sniperscope." Here our infrared telescope is mounted on a carbine. The combination was aptly called a "sniperscope" for it enabled a soldier in total darkness to hit a target the size of a man at 75 yards. Thirty per cent of the Japanese casualties during the first three weeks of the Okinawa campaign were attributed by the Army to this amazing sniperscope.

RCA **RADIO CORPORATION of AMERICA**

*Victrola T. M. Reg. U. S. Pat. Off.