

MARCH 1947 7.352/47

CHEMICAL & METALLURGICAL ENGINEERING

information Service (1997



This issue features: roundup of current developments in atomic energy program, weatherproof insulation for unhoused plants, technology of oxygen production in article and flow-sheet, design of low-pressure tanks, vinyl resins as consumers of C₂H₂ and C₂H₄, elimination of linseed oil fumes, casein bristles.

Cover picture: "Cold bax" in liquid oxygen plant houses all of coldest parts of production unit.

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Volume 54

Number 3

MARCH 1947

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and heavy-duty service.

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BUCKET ELEVATORS

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Compact Crusher

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STEAM CONDITIONS: For any fuel and method of firing, design pressures may vary from approximately 160 to 1000 psi with steam temperatures up to 900 F, or more.

SPACE AVAILABLE: Because of its standardized compactness and flexibility of proportions, VU often solves the problem of limited space.

FIRST COST: First costs reflect economies in engineering, manufacturing and erection made possible by VU standardization.

EFFICIENCY: Efficiency ranges from 80% to 88%, depending on fuel, method of firing and use of heat-recovery equipment.

OPERATING ECONOMY: Low maintenance cost and high availability are a matter of record in hundreds of installations.



WILFLEY is the highly efficient pump that delivers continuous 'round the clock performance for months on end WITHOUT ATTENTION... Famous for dependability, WILFLEY pumps embody many exclusive features developed through years of pioneering and research in the field. Heavy pumping parts of rubber, alloy iron, alloy steel whatever material best suits your particular problem. Individual engineering on every application. Buy WILFLEY for high efficiency and cost saving performance. Write or wire for details.



A. R. WILFLEY & SONS, Inc. DENVER, COLORADO, U. S. A. NEW YORK OFFICE: 1775 Broadway, New York City



New Multi-Purpose Resin Sets Up Clearing House For Organic Compounds Is Now Readily Available

Information concerning the thousands of organic chemicals synthesized each year will soon be readily available at a central clearing house, an official government publication announced recently. The clearing house is now being set up to record all new organic substances, keep a systematic file of their most important properties, and point the way to further research on their potentialities. A special coding system is being developed by a committee of 14 outstanding scientists in the field of chemistry, biology, and medicine in order to catalog adequately the physical, chemical, and biological properties of the numerous compounds to be listed.

Here's how the central clearing house will work for a manufacturer: Faced with the need for developing a specific fungicidal agent to protect delicate electronic equipment from deterioration in the tropics, the manufacturer submits specifications to the central clearing house. By means of the special coding system, information is rapidly obtained on compounds having the required characteristics. This information is then sent to the manufacturer, who is then ready to begin his developmental work.

Radioactive Phosphorus May Lower Fertilizer Costs

Radioactive phosphorus is being utilized for research on the fundamental principle of phosphate fixation and release by soils, it was revealed recently. Plants fed with fertilizer phosphate are often low in their use of this particular food, and it is hoped that this new tool, made possible by atomic research, will supply the answer to the low rate of recovery. Once equipped with the answer much higher rate of phosphate recovery may lie ahead, with consequent improvement in fertilizer efficiency and lower costs to the user.

New Petrolatum Test for Ductility Is Established

A new test, said to afford users of petrolatum for the first time with a means of determining the ductility of a petrolatum sample, was announced recently. The new ductility test is said to represent a radical departure from the hit-or-miss methods commonly employed in judging this property. The test is reported to give ductility a numerical value which will enable users to select a product suitable for a particular use.

Cuts Bodying Time of Oils

The bodying time of tung, crude oiticica, and similar vegetable drying oils is substantially decreased by treatment with infrared radiations, according to the claims made in a patent issued recently. In order to obtain the required degree of body in the decreased time, the oil is said to be exposed to radiations of prescribed intensity.

NG

Aroplaz 1299 Used for Architectural-Type and Industrial Finishes - Also in Exterior Finishes When Extended with Additional Oil

A new resin, designed for use in architectural-type finishes, air-dry or lowbake industrial coatings and for exterior finishes when extended with additional oil, is now readily available from U.S. Industrial Chemicals, Inc. The



Aroplaz 1299, the now-available U.S.I. phthalic-free resin, is particularly useful in architectural-type coatings . . . in whites or colors - and the colors stand up!

THE MONTH IN COSMETICS

Perfumed synthetic sponges are being produced in France . . . An alcoholic tincture of soap is an essential ingredient of a pleasant-smelling antiseptic telephone spray . . . Exclusive rights to the Scotch method of "cold" permanent waves is obtained by an American firm . . . A review of solid perfumes is published . . A study of the properties and chemical structure of lactones is made . . . New-type filters, containing resin-impregnated cellulose elements which are said to remove particles as small as one micron from liquids with viscosities up to 600 S.S.U., are placed on the market . . . The use of ultra-violet lamps is cutting spoilage losses in the industry . . . A government report indi-cates that foreign markets absorb about 10 per cent of cosmetic production Two catalytic methods of preparing paracymenes are patented . . . Cosmetic sales reach all-time high . . . Methods for the determination of the softening point of lipsticks are analyzed.

Mothproofing in Europe

A review of the recent advances in the mothproofing of woolen materials in Europe is contained in a booklet published recently. Material in the booklet is a compilation of reports, documents, and interviews made by the "Textile Team" and the "Chemical Team" of the U. S. Army's Technical Service Forces. re-icing with this new material.

resin is Aroplaz 1299 solution (75 per cent solids in mineral spirits), an oxidizing resin of medium-to-long oil length - hard resin modified, phthalic-free.

Films of Aroplaz 1299 air-dry well overnight, or they can be baked in one hour at 250 degrees F. to glossy, durable finishes. Aroplaz 1299 is suitable for use in most whites, as well as in all tints and colors. It supplies good resistance to water, abrasion, and alkali, making it highly washable. Flexibility and adhesion of films are also good.

Supplied in Concentrated Solution

Aroplaz 1299 is produced in concentrated solution to permit reduction with a wide choice of solvents. Its viscosity is so adjusted that when reduced with mineral spirits or VMP naphtha to 50-53 per cent solids, a normal enamel vehicle viscosity of D-F (Gardner Holdt) will be obtained.

Finishes produced with Aroplaz 1299 which have been reduced with mineral spirits, or similar slow evaporating solvents possess excellent brushing properties. Those containing VMP naphtha as the reducing medium can be adjusted to give excellent spray coatings. The enamel-type finishes particularly are

(Continued on next page)

Alcohol Extraction of Soybean Oil Is a Success

The extraction of oil from soybeans by a continuous alcohol extraction process has proved so successful on a pilot-plant scale that a full-sized plant for applying this process has already been designed, the U.S. government announced recently. Industrial application is expected to lead to lower cost of oil extraction, greater safety in operation, higher quality of oil, and a more palatable soybean meal suitable for making soybean flour or for use in various food products, the announcement stated. In this process, the alcohol is recovered for reuse by chilling rather than by the more familiar method of distilling the alcoholic solution of oil.

Makes Long-Lasting Ice

A new type of ice, which is said to last 37 to 40 per cent longer than ordinary ice, has been placed on the market. The extended freeze-life is obtained by means of a chemical treatment which does not change the freezing point. In a test, several cars of carrots which formerly needed re-icing in transit, needed no March

U.S.I. CHEMICAL NEWS

Patents Two New

+

Grease Removers

Two new grease-removing compositions patented recently contain butanol and ethanol as essential ingredients. One, which is said to remove carbon deposits as well as grease from metal, plastic, or earthenware parts. contains sodium dichromate and vegetable oils in addition to the alcohols. This mixture may be used cold and without agitation, the inventor claims. The other composition is claimed to remove oil. grease. and metal oxide from metallic surfaces and to deposit a metallic phosphate coating. In addition to ethanol and butanol, this composition is described as containing phosphoric acid and a petroleum solvent.

Aroplaz 1299

Now Available

(Continued from page one)

good in leveling properties. Aroplaz 1299 enamels possess a high, sharp gloss which is retained well on long, interior exposure,

For industrial coatings, Aroplaz 1299 is often modified by adding cold cuts of high melting point resins or short oleo resinous

SPECIFICATIONS - AROPLAZ	1299
Solution (75% Solids in M.S.) Acid Number (solvent free	Z-Z 1
basis):	8-12
Color (Gardner Stds. 1933):	8-12
Weight per gallon at 25°C:	7.85-7.95
Oil Content (solvent free basis):	65%
Phthalic anhydride content:	None
Solubility: Complete in petroleum and hydrocarbons; insoluble in e hol. Compatible with many o and alkyds.	d coal-tar ethyl alco- ills, resins

varnishes. For exterior coatings the addition of moderate quantities of bodied oils is recommended.



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Plastics Bibliography

A comprehensive bibliography entitled. "Plastics." comprising over 300 titles dealing with German- and American-developed processes and products, is now available. The bibliography, which covers every phase of the plastics industry from raw materials to uses for finished products, is classified as to contents, such as manufacture, properties. tests, coatings, cementing, protective coatings, fungus resistance. molding. laminating. plasticizers, and uses.

FREE RIBOFLAVIN BOOKLET

"The Use of Riboflavin in Manufactured Feeds" - an authoritative booklet. written from the viewpoint of the feed dealer, for the feed dealer is now available. Feed manufacturers interested in arranging for copies for their dealers should write to U. S. Industrial Chemicals, Inc., Special Products Department CN. 60 E. 42nd St., New York 17, N. Y.

New Vitamin B₁ Assay

A new method for the determination of vitamin B, consists in oxidizing the thiamine to thiochrome, which is assayed fluorometrically or by titration of the reduction product.

TECHNICAL DEVELOPMENTS

Further information on these items may be obtained by writing to U.S.I.

A new paint-mixing machine, designed to fit into any 22-inch square of floor space, is said to in-troduce a new mixing principle to insure uni-form pre-mixing of base colors. (No. 168) US1 said to in

USI New luminous tubing, described as comprising a tough, semi-transparent, moisture- and acid-resistant plastic, uniformly coated with a radio-active material which is said to be clearly and continuously visible at a considerable distance in complete darkness, has been marketed. (No. 169)

(No. 169) USI For surfaces difficult to coat, a new resin de-rived from petroleum is offered to the paint and varnish industry. It is said to have excellent qualities of adhesion, flexibility, and wetting courses (No. 169) (No. 170)

To bond synthetic rubber, a new cement is now available. It is recommended by the manufac-turer for bonding Buna-N synthetic rubbers and vinyl films or sheet stocks to rigid surfaces such as steel, aluminum, glass, wood or concrete. (No. 171)

New-type stainless steel laboratory filters, claimed to have higher flow rate for any given pore size than any other type of filter, can be heated and cooled without danger of cracking the manufacturer states. (No. 172) USI

To remove synthetic enamel and other coatings a new stipper, described as a viscous liquid which can be applied by brush or spray as well as dipping, has been announced. It is said to have no harmful action on metals, plastic, or wroad wood. (No. 173)

USI A flaw detector for thin materials can continu-ously detect and count holes, weak spots, and conducting paths in materials such as paper sheat rubber, sheet mica, varnished cloth, plas-tic materials, and enamel films on wire, the manufacturer states. (No. 174) To resist temperatures up to 1200°F a new

To resist temperatures up to 1200°F., a new non-volatile ceramic-type coating, said to resist rust and acid as well, has been marketed. (No. 175)

(No. 175) USI A self-destroying label, said to remove the dan-ger of anyone removing a label from a genuine product and placing if on substitute merchan-dise, may be applied to metal, plastic, wood, varnish, glass, or cellophane, and will adhere permanently despite heat, cold or humidity, the maker claims. (No. 176) (No. 176) maker claims.

A new-type wall covering said to be composed of one-inch jewel cut squares of plywood bonded to a fabric backing, can be applied to both flat and curved surfaces with invisible seams, ac-cording to the manufacturer. (No. 177)

To destroy soot, a new liquid, designed for use on all types of oil and kerosene burners, is said to be harmless to metals or refractory brickwork. (No. 178)

U.S. NOUSTRIAL CHEMICALS, INC. 60 EAST 42ND ST., NEW YORK 17, N. Y. (U.S.I.) ALCOHOLS ACETIC ESTERS INTERMEDIATES FEED CONCENTRATES Amyl Alcohol Butanol (Normal Butyl Alcohol) Fusel Oil—Refined Amyl Acetate Butyl Acetate Acetoacetaniide Acetoacet-ortho-anisidide Acetoacet-ortho-chloraniide Riboflavin Concentrates *Vacatone 40 *Curbay B-G *Curbay Special Liquid ACETONE Acetoacet-ortho-toluidide Acetoacet-para-chloranilide Ethanol (Ethyl Alcohol) OXALIC ESTERS Chemically Pure RESINS Specially Denatured-all regular and anhydrous formulas Completely Denatured-all regular and anhydrous formulas Pure-190 proof, C.P. 96% Dibutyl Oxalate Diethyl Oxalate Alpha-acetylbutyrolactone 5-Chloro-2-pentanane 5-Diethylamino-2-pentanane PHTHALIC ESTERS Congo Guma-raw, fused & esterified *Araplaz—alkyds and allied material *Arofene—pure phenolics Diamyl Phthalate Dibutyl Phthalate Diethyl Phthalate Ethyl Acetoacetate Ethyl Benzoylacetate *Arochem-modified types Natural Resins-all standard grades

*Solox proprietary Solven

*ANSOLS

Ansol PR

OTHER ESTERS

'Diatol Diethyl Carbonate

Ethyl Chloroformate Ethyl Formate

Ethyl Alpha-Oxalpropionate Ethyl Sodium Oxalacetate ETHERS

Ethyl Elher Absolute-A.C.S.

- OTHER PRODUCTS

Ethylene Urethan Ethylene Glycol Urethan Nitrocellulose Solutions dl-Methionine

Printed in U.S.A

You can interchange this pump's CORROSION RESISTANCE to fit the corrosive

DURIRON



a high-silicon iron, containing approximately 14.5% silicon. Handles almost any commercial corrosive. Practically unaffected

by sulfuric, nitric and acetic acid at any strength or temperature. Ask for bulletins 11 and 810.

DURICHLOR

a high-silicon iron similar to Duriron but with much greater resistance to hydrochloric acid and its compounds, especially at higher tem-

peratures and concentrations. Ask for bulletins 50 and 810.

DURIMET

a high nickel high chromium molybdenum copper—silicon low carbon stainless steel. Some of the corrosives it successfully han-

dles include sulfuric and sulfurous acid, oleum, caustic and bleach solutions. Ask for bulletins 110-2 and 811.

CHLORIMET

#2—nickel base, high molybdenum alloy; #3—nickel base, high molybdenum, high chromium alloy. Both of these are high strength, ma-

chinable alloys. Chlorimet #2 handles hydrochloric acid in all concentrations and temperatures. It is excellent for hot sulfuric acid under reducing conditions and for wet hydrogen chloride gas. Chlorimet #3 handles most acids under oxidizing conditions, various salt solutions, also hot sulfuric in concentrations of less than 35%. Ask for bulletins 111 and 811.

OTHER ALLOYS

Durco D-10, Monel, Inconel, Pure Nickel, Ni-Resist and Nickel Cast Iron.

Without changing the operating characteristics or disturbing the motor, bearings or alignment, you can give your Durcopump the ability to handle an entirely new group of corrosives.

Model 40 Durcopumps are available in capacities up to 2000 GPM and for heads as high as 230 feet.

28-GM

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SPECTACULAR SAVINGS MADE IN MATERIALS HANDLING COSTS

With these magic Trucks and dependable EXIDE POWER

Increased production, faster materials handling and greatly reduced handling costs are some of the important economies brought to industry by the Electric Battery Hand Truck. It can be handled by one man with amazing ease...guided through narrow aisles, around sharp turns and up and down grades, always under absolute control. And when batteries are Exide-Ironclads, you are assured of dependable, safe, low-cost performance.

Exide-Ironclad Batteries have the *high power ability* required for frequent "stop and go" service...

the *high maintained voltage* that repeated lifting and hauling demands...and the *high capacity* that assures steady, day-long performance with full shift availability. You can always count on Exides for dependability, long-life and ease of maintenance.

Write us for a FREE copy of Exide-Ironclad Topics which contains "Case Studies" of materials handling problems. It tells how to cut handling costs up to 50%...covers latest developments in handling materials from receiving to shipping.

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NO CONTACT MAINTENANCE— I just install 'em and forget 'em!

-ACID

Bulletin 709, Size 1, solenoid starter with enclosure for hazardous gas locations (shown with cover removed). The double break, silver alloy contacts on Allen-Bradley solenoid starters never need to be cleaned, filed, or dressed. Oxides that may form on these contacts are good electrical conductors. What's more, there are no pins, pivots, bearings to gum up and cause trouble. You can see the advantage of using this type of starter mounted in enclosures that have covers tightly bolted down—the type so commonly used in the process industries. Allen-Bradley starters are easy to install. The white interior reflects light and illuminates the starter in dark locations. They have numerous knockouts and plenty of room for wiring. Write, Allen-Bradley Co., 1337 S. First Street, Milwaukee, Wisconsin.

Bulletin 712 combination starter with water-tight enclosure. Combines a solenoid starter and disconnect switch in one cabinet. Takes less space than separate units, cuts wiring costs, and gives a neater appearance. It's the sign of an up-to-date installation.

ALLEN - BRADLEY SOLENOID MOTOR CONTROL

These examples of American Flexible Metal Hose and Tubing, in small diameters, suggest the variety of assemblies available in factory-engineered and factory-assembled units.

UT RUGGED TOO!

WHEREVER a flexible conveyor is required, for gases, liquids or solids, under a wide range of temperatures and pressures, there's a type and size of American Flexible Metal Hose or Tubing for the purpose.

American Seamless Flexible Metal Tubing is as leakproof as the seamless bronze tube from which it is made, and flexible as garden hose. Its wire braided cover adds the strength needed for high pressure services. Standard sizes from $\frac{1}{8}$ " to 4" I.D.

American Metal Hose, manufactured from

strip in four spirally wound types, is available in bronze, brass, aluminum, steel or any other workable metal. It is extensively used for carrying steam, water, oils, tar, asphalt, air, dust—and dozens of other agents under high and low pressures and for vacuum work. Sizes from $\frac{1}{2}$ " to 12" I.D.

Both types of "American" products can be fabricated completely with fittings and connections according to your specifications. Publication SS-50, giving complete information, will be sent on request.

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • General Offices: Waterbury 88, Conn. Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

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ALOXIE MARK POROUS UNDERDRAIN System Eliminates

MUD BALLS • DEAD SPOTS • GRADED GRAVEL DISTURBANCE TS

AVEL NCE



HIGH MAINTENANCE COSTS • • • • • • • •

All troubles caused by graded gravel disappear on installing the ALOXITE aluminum oxide porous plate underdrain system in rapid sand filters. Dispensing with graded gravel, displacement is no longer a problem. Mud balls are eliminated. Backwashing is uniform over the entire bed. Less wash water is required to maintain clean filter media. Longer filter runs are frequently obtained.

Added to these benefits is lower filtering and backwashing operating heads. They result from smaller pressure loss through the underdrain system and reduced filter heights.

More complete data are provided in Engineering Bulletin No. 2. For a copy, write Department D-37, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

Underdrain Plates



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TRADE MARK

Through many decades, Baker Platinum Laboratory Ware has well earned its reputation as the highest quality obtainable. Among the design changes we introduced are our reinforced rim crucibles and dishes, the Baker Low Form Crucible and our platinum-rhodium alloy, now widely used for laboratory ware. Our long experience in the refining and

working of the platinum metals, gold, and silver justify our claim that anything that can be made from them can be produced by us most economically. Some of our regular products are: platinum gauze for ammonia oxidation, platinum mass catalysts, platinum pure and alloyed in all forms, contact points, platinum-rhodium wire for thermocouples, platinum black, sponge, salts and solutions and Platinum Clad (platinum bonded to a base metal body) in sheet wire and tubing. We can make anything for you that can be made of precious metal. Send for our book: Data Concerning Plati-

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Many months of use in major industries and fire fighting services have confirmed CHEMOX' wartime performance verdict . . . the simplest, lightest—only 13½ lbs., easiest-to-use oxygen breathing apparatus ever developed, and the only apparatus generating its own oxygen for breathing in a replaceable chemical canister.

The U. S. Bureau of Mines-approved Chemox Apparatus belongs in your plant safety picture! Chemox gives complete respiratory protection in atmospheres containing toxic gases, oxygen deficiency, or both—for forty-five minutes at hard work. See it for yourself in a readily-arranged demonstration, and meanwhile, write for Bulletin BM-14!

MINE SAFETY APPLIANCES COMPANY Braddock, Thomas and Meade Sts. Pittsburgh 8, Pa.

Braddock, Thomas and Meade Sts. Pittsburgh 8, Pa. District Representatives in Principal Cities In Canada: MINE SAFETY APPLIANCES COMPANY OF CANADA LIMITED The Chemox Apparatus consists of an All-Vision facepiece with extra-large contoured lenses—exhalation and inhalation breathing tubes connecting to the Chemox canister—a tough, sturdy breathing bag made of heavy Neoprene—and comfortable harness designed for maximum wearing ease.

The complete assembly is simple to put on, quickly adjusted, and easy to



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FOR YOUR INFOR



The formation in Seattle of a Western Division, provides Monsanto with a larger industrial unit to face continually expanding operations on the Pacific Coast. The new division consists of four plants devoted to the manufacture of plywood glues, paint and wood preservatives. One plant is situated at Los Angeles, while targer plant sites are located at Seattle, where a \$2,000,000, 3-year construction program is scheduled. The initial unit in the new construction will be devoted primarily to the manufacture of soybean glues and wood preservatives.



World's Largest Producer of Plywood Adhesives

Original Monsanto facilities for manufacturing raw materials, in combination with the merged Laucks properties on the Pacific Coast, now establish Monsanto as the largest producer of plywood adhesives in the world.



New Pilot Plant for Plastics Research

Construction of a new pilot plant designed for experimenting with production methods for new products has been announced by Monsanto's Springfield office. This added unit will more than double present facilities.

Company officials also stated that the color laboratory will be tripled in size to handle increased requirements due to expanded production of all types of plastics materials. New injection molding equipment will be installed to facilitate sample molding runs.



WHO CAN USE MIXED ISOMERIC TERPHENYLS WR CHOICE O ASTIGIZER

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Note

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Mixed Isomeric Terphenyls have been used as constituents in marine coating materials and as components in special high-temperature lubricants. Since other commercial uses can undoubtedly be found, the following physical, chemical and electrical properties are included to assist you in developing new applications:

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Oews of Monsanto Chemicals and Plastics or the Process Industries..... March, 1947

SIMPLIFY ERPHIL CHOICE OF STICIZERS

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You will find a preliminary basis for the selection of Monsanto Plasticizers in the cross-reference table included here. Obviously this is only indicative of possible applications — Monsanto's 60-page book "Plasticizers and Resins" contains extensive information on moisture resistance, flexibility, adhesion, hardness, softening effects, permanence, fire retardence, film strength, brilliance, gloss, and other desirable properties contributed by Monsanto Plasticizers. Send for your copy. Also contact Monsanto for specific information concerning your present or prospective needs. Write:

MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Mo.

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SKYLAC Flame-Resistant Fabric Finish

Monsanto's Merrimac Division at Boston has begun volume production of Skylac — a flame-resistant fabric finish for both exterior and interior surfaces of aircraft. Skylac was initially developed for the armed forces.

This improved flnish affords an additional safeguard since its burning rate is about one-fourth that of conventional flnishes. It ignites more slowly and, unless heat is applied from without, the flame tends to snuff out. It has the same tauting effect as present flnishes but can be applied with far less effort. Skylac also contains a fungicide which protects fabric from deterioration due to mildew.

Another Plastics Sales Office

To further extend its service to molders, Monsanto Plastics Division recently located a sales office in Cincinnati, with Edward T. McBride as Branch Manager.

Expanded Production of Wood Flour

Monsanto's Plastics Division has just announced plans for construction of a new plant for the production of wood flour, key ingredient of phenolic-type plastics sold under the trade name Resinox. Among other things, these added facilities will permit an exacting control over product quality.

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MONSANTO CHEMICAL COMPANY, 1700 South Second St., St. Louis 4, Missouri... District Offices: New York, Chicago, Boston, Detroit, Cleveland, Cincinnati, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle. In Canada, Monsanto Ltd., Montreal, Toronto, Yancauver. *Beg. U.S. Pal. Off,





Precision assembly and the high, uniform rolling pressure, employed to reduce and bond the components, give positive control over the uniformity of cladding thickness. There's no guesswork about it!

Lukens Stainless-Clad Steels are usually furnished in 10% or 20% clad, but percentages from 5% to 50% can be produced.

Any standard specification stainless, including types 410, 430, 304, 316, 347 and others, can be supplied in plates from 3/16" to over 3" thick, or up to 162" wide; also in formed heads in all styles and sizes to over 18' in diameter.

Beginning with Nickel-Clad Steel 17 years ago, Lukens now manufactures a complete line of clad steels produced by the same process. Each of these clad steels offers the corrosion resistance and product protection of the solid metal at substantial savings in cost.



Hot rolling Lukens Stainless-Clad Steel on the 206" Mill, world's largest plate mill. In this operation, the stainless steel and the backing plate are permanently and uniformly bonded.

Additional information on Lukens Stainless-Clad Steels is offered in the new Bulletin 338; on Lukens Nickel-Clad, Inconel-Clad and Monel-Clad Steels in Bulletin 255. Copies of these Bulletins will be sent on request.

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LUKENS STEEL COMPANY World's Largest Plate Mill 370 Lukens Building * Coatesville, Pa. Cable Address: Lukens Little That' Yarw dustry are e. special In serr woully c. providi keepinj Yarwa valve0 part) t

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Yarway

SMALL TRAP

Little? Sure. But what a giant's job they do:

That's how men judge Yarway Impulse Steam Traps.

Yarways are well suited for trap service throughout industry. The small size itself is an important feature. They are easy to install, fit in anywhere, require no special supports.

In service they *drink* condensate, discharging *continuously* on heavy loads, at short *intervals* on light loads providing maximum heat in the shortest time, and keeping equipment at top efficiency.

Yarways are suitable for all pressures without change of valve or seat. Simplicity of construction (only one moving part) minimizes maintenance. Also, initial cost is low.

Try some Yarways today-standardize on them tomorrow. See your nearest Supply House or write for Yarway Bulletin T-1739.

YARNALL-WARING COMPANY 137 Mermaid Avenue, Philadelphia 18, Pa.

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VED WAY IMPILISE STEAM TRAP

OVER 500,000 ALREADY PURCHASED

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How INDUSTRY

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From a Continuing

One of the most important events in processing history occurred in the summer of 1907!

Oliver Hopper Dewaterer . . . 2. Oliver Precoat Filter . . .
 Oliver Topfeed Filter . . . 7. Oliver - Campbell Cane Mud

We shall be glad to send you our General Bulletin No. 214 which describes briefly these variations in the Oliver Continuous Filter.

6

Chas BENEFITED

Wi Policy of Progressive Development...

f the rtant cressing rred in f 1907. That summer saw the first practical application of continuous automatic vacuum filtration in this country, the equipment being the first Oliver Continuous Vacuum Filter, designed and installed to wash cyanide residues. The success of this filter marked a turning point in the history of processing because it gradually brought about completely changed filtration and clarification practices throughout industry.

Without deviating from the fundamental principles of that pioneering filter, Oliver United engineers have brought out many variations of the Oliver Filter to take care of the special problems brought to their attention by other divisions of the processing industry. For example, special "Olivers" have been developed for the processing of salt, starch, wood pulp, synthetic rubber, cane sugar, beet sugar, petroleum, phosphate rock and other chemicals. Each Oliver differs from the others in its operating features.

Industry has benefited greatly from this continuing policy of progressive development. It has made possible the economical handling of many intermediate and end products. It has enabled some plants to simplify their processing.

There seems to be no end to the different filtration and clarification problems brought to our attention. Usually, the solution is found in some one of the numerous existing Olivers -or, if necessary, in one of our several pressure filters. But there is no letup in our program of research and development. This is one of the best ways, we believe, to continue to serve industry.

^{ber Precoat Ry}liver Precoat Filter (enclosed vacuum) . . . 4. Oliver Precoat Filter (pressure) . . . 5. Oliver Chemical Type Filter . . . ^Campbell Car . . . 8. Oliver Rubber Protected Filter . . . 9. Oliver Synrub Filter . . . 10. Oliver Panel Filter . . . 11. Oliver Ringvalve Filter





JUST THE SAME!

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED BEATS TOUGH CORROSION CONDITION

This 554-foot chimney was built* in 1936 for International Nickel of Canada to handle gases from copper reverberatories and converters. Now, after ten tough years, the smoke goes up this chimney just the same as the day the stack was built!

TEN YEARS WITHOUT REPAIR

The gases contain SO_2 with moisture content slightly above atmospheric humidity. Despite this corrosive condition, up to the present time no repairs have been made to this stack, and no evidence of deterioration has been noticed.

HERE'S WHY:

The entire lining of this stack was built with acid-proof brick laid in Penchlor Acid-Proof Cement.** In addition the top fifty feet of this stack was further protected by using Penchlor Acid-Proof Cement for pointing the outside surface joints. Penchlor Acid-Proof Cement is a superior sodium silicate cement that is quick-setting and selfhardening. Its outstanding record of satisfactory service has been proved in chemical plants, steel mills, paper and pulp mills, oil refineries and smelting plants.

SEND FOR CASE REPORT

If you have a corrosion problem, you'll be interested in further details about this Penchlor installation, as well as an illustrated brochure on Penchlor. Write for Case Report Number 67-3. F

Special Chemicals Division **PENNSYLVANIA SALT MANUFACTURING COMPANY** 1000 Widener Building, Philadelphia 7, Pa.

NEW YORK . CHICAGO . ST. LOUIS . PITTSBURGH . CINCINNATI . WYANDOTTE . TACOMA . PORTLAND, ORE.



*Built by Custadis Canadian Chimney Company, Limited, Montreal **Penchlar Acid-Proof Cement was furnished by our Canadian Associates ~ G. F. Sterne & Sons, Ltd., Brantford, Ontario

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Find out how

STOP

PERHAPS you haven't thought of turbine oil as part of the turbine installation problem at this stage of your planning. But there is one oil that differs so much from other turbine oils that its use affects your plans all the way back to the drafting board. This oil-Nonpareil Turbine Oil-brings real economy in auxiliary equipment, in plant space, and in total investment.

TURBINE OIL

Nonpareil Turbine Oil is guaranteed for the life of your turbine. That's not merely a way of saying "Nonpareil is a long-lasting oil." It means that Nonpareil should be considered as part of your turbine investment just as much as the auxiliary equipment which goes with the turbine. Here's why:

1. Less space is required for a turbine and its auxiliary equipment when Nonpareil is used. One fill of oil is all that is needed for each turbine. No space is needed for extra can save money . even before it starts operating

storage tanks or batch treating and settling tanks.

THAT TUDE INSTALL

THAT TURBINE !

2. Less equipment is needed, such as pipes, fittings, pumps and tanks usually required where oil must be treated.

3. Lower operating and maintenance costs because there is less equipment to maintain.

Take time now to consider the benefits offered by Nonpareil Turbine Oil which are covered by written guarantee-that it eliminates turbine oil maintenance, and deposits caused by oil deterioration. Test it in one or more of your present units. You'll be convinced it's the oil you want to match the new, efficient generating equipment you install.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for a Lubrication Engineer to help you make the test.

SERVICE

STANDARD STANDARD OIL COMPANY (INDIANA)

Where open gears need water-resistant lubrication

use.

THE SIMPLE TEST described here shows how Calumet Viscous Lubricants reduce lubricant consumption and protect open gears against wear, even though subjected to the direct washing action of water.

Calumet Viscous Lubricants give these advantages because they are compounded from selected soaps and oils of proper viscosities and contain a special additive which makes them adhere closely to metal. They do not require heating before application, and all but the heaviest grades can be sprayed. These application features offer direct savings in time and grease.

A Standard Oil Lubrication Engineer will help you select the grade you need for low cost open gear lubrication.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.





Test equipment for comparing water resistance of greases. Mete conventional type soda soap grease. Right strip—a Calume **Viscous Lubricant**

CALUMET

Viscous Lubricants

The instrument dips the strips into beakers containing water at 80°F, at the rate of 30 times per minute for 20 hours.





SERVICE

The same test strips after the 20-hour test. The strip containing conventional type soda scap grease is practically bare. The strip holding Calumet Viscous Lubricant is still completely covered

STANDARD OIL COMPANY (INDIANA) STANDARD

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TIMKEN CARBON STEEL TUBING Generally for service not exceeding 900°F, where corrosion and oxidation resistance are not important.

TIMKEN CARBON-MO STEEL TUBING For temperatures up to 1000°F. Improved creep strength makes it safer than carbon steel.

TIMKEN DM STEEL TUBING For service up to 1150°F. This steel offers outstanding creep strength.

TIMKEN 2% CR ½% MO STEEL TUBING For service up to 1150°F. Intermediate corrosion resistance plus good creep strength, fair oxidation resistance.

TIMKEN SICROMO 2 STEEL TUBING For service up to 1200°F. where better scale resistance is required than can be obtained with 2% Cr. 15% Mo. Steel.

TIMKEN 24% CR-1.0% MO STEEL TUBING For service up to 1150°F. Has greater resistance to creep than 2% Cr. 16% Mo. Steel. At least one of these was made for you! TIMKEN SICROMO 3 STEEL TUBING For service up to 1200°F. Has excellent oxidation resistance and good corrosion resistance.

TIMKEN 4-6% CR MO STEEL TUBING For service up to 1200°F. Superior corrosion resistance. Less oxidation resistance than Sicromo 3.

TIMKEN SICROMO 5 S STEEL TUBING For oxidation resistance to 1500°F. Good creep strength and corrosion resistance to 1300°F.

TIMKEN SICROMO 7 STEEL TUBING For applications requiring better corrosion resistance than can be obtained with 5% Chromium type ateels.

TIMKEN SICROMO 9 M STEEL

TUBING This steel possesses the maxi-

mum corrosion resistance of any of the steels below the stainless group.

Let us help you choose the steel that will best solve your high temperature tubing problems

TIMKEN 18-8 STEEL TUBING Shows the best combination of creep strength, oil corrosion resistance and oxidation resistance up to 1500°F.

WHATEVER your toughest tubing problem may be -heat, pressure, corrosion, or oxidation -- chances are you'll find the answer in one of the Timken high temperature steels listed above.

For each of these fine alloy steels was developed to meet specific requirements in transferring liquids and gases at temperatures from 900° to 1500° F. They are the result of 17 years of research on the properties of metals at high temperatures. Your assurance of uniform quality is our completely controlled production, step by step, from melting the steel to finishing the tubing.

For the right solution to your toughest tubing problem why not consult our Technical Staff? Also write for Technical Bulletin No. 20, "A Guide For Users of High Temperature Steels". Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

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THE DORRCO CLARIFLOCCULATOR

IN the Processing Picture for

ENGINEERING

WHEREVER Flocculation and Sediin the processing picture, the Dorrco Clariflocculator is worth careful consideration. A two-in-one unit, it provides mechanical flocculation with or without chemicals in a central compartment, and sedimentation of the flocculated solids and clarification of the solution in an annular, mechanically cleaned outer zone.

FOR WATER PURIFICATION it will remove turbidity, color or hardness to give you a specification water to fit your most exacting process requirements.

RESEARCH

FOR BRINE PURIFICATION it will deliver an effluent suitable for rapid sand filtration by reducing turbidity and removing both soluble and insoluble impurities.

FOR WASTE TREATMENT it will handle your disposal problem by removing suspended solids — and in some cases may even effect a recovery of valuable constituents for reuse.

Why the Dorrco Clariflocculator over other types of flocculation and sedimentation equipment? First, because of maximum utilization of tank volume-due to central subsurface feeding, peripheral collection of overflow

ASTE TREATMENT and controlled agitation during floc

PURIFICATION

PURIFICATION

and controlled agitation during noc formation. Second, because Dorrco Clariflocculator installed and operating costs are less than for any other combination of separate units producing the same results.

• Why not let a Dorr engineer study your problem with you and give you the benefit of our experience on Clariflocculator performance in the Process Industries?



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GET BOTH SIDES OF THE STORY ON NGAC STAINLESS-CLAD STEEL

• There's nothing one-sided about IngAclad-the Stainless-Clad Steel that provides 100% protection on the exposed or contact side-at about half the material cost of solid stainless.

One side of the IngAclad story is its 20% cladding of solid stainless steel for complete protection against rust, corrosion, abrasion, erosion.

The other side is IngAclad's 80% backing of mild steel -which makes it easier to fabricate than solid stainlessand cuts both material and fabricating cost.

That's the IngAclad story-both sides-in a nutshell. Remember it-for any application where stainless steel is needed only on the contact side. Further details on request-no obligation.

INGERSOLL Steel Division **Borg-Warner Corporation**

310 South Michigan Avenue • Chicago 4, Illinois Plants: Chicago, Illinois • New Castle, Indiana • Kalamazoo, Michigan



20% 5241



EVER SINCE: Allis Chalmers pumps have been setting records for efficiency!

IN BOSTON and other large cities, for example, Allis-Chalmers sewerage pumps have set world records for economy. The same unsurpassed engineering talent and experience that produced these pumps have developed and perfected the pumps you require today: Pumps to handle water, gasoline, abrasive liquids or semi-solids — pumps to handle great volumes or high pressures — pumps of every capacity from 10 gpm to 635,000 gpm! And, Allis-Chalmers also makes the motors to drive them — supplies complete, integrally designed pumping units, and assumes undivided responsibility for their performance. For more details, call your nearest A-C office or write for Bulletin 6059-C. ALLIS-CHALMERS, MILWAUKEE 1, WIS.







SYNTHETIC RUBBER

LUBRICANTS

HIGH OCTANE GASOLINE

Consistently uniform high purity is one reason why processors like to use Hooker Aluminum Chloride, Anhydrous. They know that here is one catalyst that will not "gum up" the works because of unknown impurities or changes in analysis from one shipment to another. Where smooth operations depend upon uniform purity of the Aluminum Chloride, you can depend on Hooker.

In Hooker Aluminum Chloride, too, you have a choice of three sizes from which you can select the one which will give you the best results.

Fine Grindan unscreened material practically all passing 20 mesh. Coarse Grind unscreened, 1 mesh and finer containing 25 to 35% finer than 20 mesh.

Coarse Screened . . same as above screened to remove 20 mesh and finer.

Hooker Aluminum Chloride is being used as a catalyst in many Friedel-Crafts syntheses, polymerization, isomerization and halogenation. Practically free from iron (0.05% max.) it is especially desirable in the preparation of derivatives for use in the manufacture of high octane gasoline, lubricants, synthetic rubber, dyes, varnishes and pharmaceuticals.

Additional physical and chemical data on this important chemical are contained in Technical Data Sheet 714, sent when requested on your letterhead. Hooker's Technical Staff is also available for consultation and help on the application of Aluminum Chloride and the other Hooker chemicals to your purposes.

SPECIFICATIONS

Hooker Aluminum Chloride, Anhydrous AlCl₃ Gray, crystalline solid in three sizes.

ANALYSIS 0.05% max. Iron Non-sublimables in air at 950° C. 1.5 % max.

From the salt of the earth



5 FORTY-SEVENTH ST., NIAGARA FALLS, N.Y. New York, N.Y. Wilmington, Calif. Tacoma, Wash.

Caustic Soda

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Sodium Sulfhydrate

ONE OF THE FIRST

Built by De Laval in 1902

MIXED FLOW PUMP

Modern De Laval centrifugal pumps represent the culmination of more than 45 years of continual improvement and perfection. This long period of concentration upon the problems of centrifugal pump design and application places at the user's command a complete line of modern, high quality pumps and a vast store of knowledge concerning pump application problems.

SINGLE STAGE, DOUBLE SUCTION PUMP



FOUR STAGE, OPPOSED IMPELLER PUMP

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CLOGLESS PUMP

TRENTON 2, NEW JERSEY

100% Joint Efficiency - the result of RESEARCH

TECHNICAL BULLETINS

Ask to have your name added to the list of engineers receiving "The Gasket"—a series of technical j bulletins containing original and useful gasket information from the Goetze Research Laboratory. Write on your company letterhead giving your position. The single objective of Goetze laboratory research is to provide gaskets that give 100 per cent joint efficiency not only under ordinary conditions, but also unusual conditions of temperature, pressure, corrosion or any other factor.

The results of this research have been the development of the only complete line of metal gaskets — a line that makes it possible for Goetze to supply the right gasket for your particular applications.

And this research has proved something else: Most gasket troubles aren't necessary. Let a Goetze representative help you review your gasket usage. The chances are that the troubles you take for granted can be eliminated.

We invite your inquiries. What are your problems?

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Alcobol from Maine Potatoes

. . . with the aid of **CB&I** Equipment







• Clark Distilleries, Ltd., affiliate of E. H. Clarke, importer and distillers' representative of Boston, are making alcohol from potatoes at their Caribou, Me., distillery. The Clarke plant processes 1,000,000 lbs. of the local potato crop per 24-hr. day, producing 10,000 gals. of 190-proof alcohol. The views on this page show some of the steel plate structures we fabricated in one of our plants and erected at this distillery. The above view shows a 12-ft. diam. malt storage bin. The photo at the upper left shows a close-up of two 60,000-gal. tanks which are used to store alcohol and the other photo shows the tops of some of the five 42,000-gal. fermenters we furnished.

You may not be in the distilling business but most chemical and process plants use steel plate structures in their manufacturing processes. Our facilities for designing, fabricating and erecting this kind of equipment are complete in every detail. We build vessels according to code requirements or to your own specifications-stress-relieving and x-raying when required. Pressure storage tanks for storing liquids or gases, bins, flat-bottom storage tanks, refinery towers and elevated water storage tanks are but a few of our products. When you need steel plate work of any kind write our nearest office for quotations.



Chicago 4. Cleveland 15..... 1503 LaFayette Bldg. Detroit 26 Plants in BIRMINGHAM, CHICAGO, and GREENVILLE, PENNA.

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402 Abreu Bldg. Houston 1. 5603 Clinton Dr. 1405 Wm. Fox Bidg. Los Angeles 14. 1222-22 Battery St. Bldg. San Francisco II. In Canada-HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.

Something new under the SUN trade-mark! SUNWAX

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COWLES DISSOLVER

Two to twenty times faster than conventional mixers, the scientifically designed impeller of the Cowles Dissolver turns at a high rate of speed. It sets up components of laminar flow, resulting in interface shear between multiple surfaces of molecular thickness, each moving at a rate different from its neighbors. The high velocity gradients of these laminae subject every particle of the materials being treated to molecular tensions and scrubbing, greatly accelerating the dissolving or dispersing action, holding undissolved residues to low levels and producing more homogenous mixtures. High viscosities improve the dissolving and dispersing action.

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Sound design and rugged structure . . . plus finely machined materials of high physical properties . . . all assure maximum life with minimum maintenance requirements. A high degree of static and dynamic balance has been achieved in the rotating parts, eliminating noise, vibration, splash and dead spots. Turbulence and aeration are thus held at low levels, though controlled aeration on he had it desired can be had if desired.



the high-speed machine with molecular-scrubbing action

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In two models-with built-in tanks in capacities of 100 gallons, 250 gallons and 500 gallons, or for use in tanks brought to the machine. Motor speed and horsepower adjusted to the need. Explosion-proof motors on special order. Write for descriptive folder, or ask for a technical representative to call.

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Type Operation	Material	Cowles Dissolver	Standard Mixer
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Synthetic resin dissolving	Vinylite	1 Hr.	6 Hrs.
N/C solution	Nitrocellulose	12 Min.	90 Min.
Tinting	Enamel	5 Min.	30 Min.
Pigment dispersion	Heavy enamel	6 Min.	150 Min.
Coating suspension	H. T. Clay	1 Hr.	0 Hrs

Cayuga, N. Y. Associate: Alexander Fleck, Ltd., Ottawa, Ont.



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IN DESIGN, materials and construction, nothing has been overlooked to make Sier-Bath Screw Pumps the most efficient units of their type. Made in an up-to-date precision gear shop, equipped with the most modern machinery, these pumps always perform up to the high standards required by users. They are used for pumping the most viscous of liquids—acetates, asphalts, brines, Bunker C fuel oil, cellulosics, greases, molasses, syrups, etc.

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Only 2 Moving Parts

Sier-Bath Screw Pumps are made both in horizontal and vertical models. They are less affected by head than other displacement pumps. Angle of inclination at which they operate is unimportant. They run without vibration or pulsation. Needle bearings are standard equipment. Send for descriptive booklet.

Wertical Model. This unit handles Bunker C Fuel Oil. Rated at 350 g.p.m. 50 p.s.l., 10" vacuum 20 H.P. 1150 r.p.m. motor drive. Built for Y tankers A.S.F.



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DISCHARGE The DeLaval Industrial Separator is used wherever the problem is one of continuously separating two liquids of different specific gravities which are not soluble in each other, with a simultaneous removal of a small quantity of solids. This type of machine is usually used when the sediment content is under 0.5 per cent, as in the purification of different types of oil.

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The De Laval Multiple Clarifier is used for removing solid impurities from a liquid. Solids are retained in the bowl which, owing to its double-chambered construction, has large sediment-holding space together with constant high efficiency. The Clarifier is best adapted to use when the sediment content does not ex* ceed 1 per cent by volume.

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Years ago Alexander Graham Bell dreamed of "a machine that should render visible to the eyes of the deaf, the vibrations of the air that affect our ears as sound." He never realized that dream, but his researches led to the invention of the telephone.

Today Bell Telephone Laboratories have turned the dream into a fact – translating the spoken word into readable pictures.

By this new invention of the Laboratories, the talker speaks into a microphone. Vibrations of the voice are unraveled through electronic circuits, and then are reassembled as luminous patterns which travel across a screen. Each syllable of sound has a distinctive shape and intensity.



Science unravels speech

Visible speech is still in its infancy, and is not yet available to the public. But educators of the deaf are now evaluating it. Indications are that the deaf can learn to read the patterns and, by comparing the patterns their own voices make with the patterns of correct speech, can improve their diction.

Patterns of visible speech also provide a means for analyzing and recording sound in the study of phonetics and of languages. Eventually, visible speech may make possible visual telephony for the deaf.

This is but one of many contributions by Bell Telephone Laboratories to the understanding and control of sound.



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These Outstanding Ladish Features Increase Piping Efficiency and Assure Greater Reliability



UNIFORM GRAIN STRUCTURE—The finer, more uniformly compact metal structure of Ladish Seamless Welding Fittings substantially increases their dynamic strength and toughness... while rigid control of melting processes gives added protection against brittleness at low temperatures and provides increased resistance to distortion at high temperatures. The dense, homogeneous grain structure also provides measurably greater resistance to corrosion and erosion.

HEAT CODE IDENTIFICATION—The heat code symbol, a permanent identification on Ladish Seamless Welding Fittings, is your assurance of complete metallurgical integrity and responsibility. Through this exclusive feature, Ladish's customers can obtain upon request, certified metallurgical reports giving complete chemical composition and physical properties of the particular steel from which any Ladish Fitting is made.

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REDUCED PRESSURE LOSS—Easy sweeping curves, smooth inner surfaces, true circularity, and full effective radii reduce friction and pressure losses to a minimum.

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Sarco Controls are not expensive—they pay for themselves in the amount of fuel saved. There's a complete line for every purpose and steam traps of every type. Why not get the advantage of the Sarco Representative's experience in process operations now? SARCO TEMPERATURE CONTROL

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From treating the hulls of mighty ships to providing superior catalysts in the manufacture of intermediates for today's finer synthetic fabrics . . . V-C Phosphoric Acid plays an important part, gaining increasing acceptance with new users of H_3PO_4 . Whether your problem is that of obtaining an easier pH control in a dye bath . . . or of phosphatizing for rust-prevention or improving paint adhesion . . . V-C high-purity Phosphoric Acid can serve you effectively, more economically. Virginia-Carolina Chemical Corporation looks forward to the opportunity of serving you. S. S. America, flagship of the U. S. Lines, leaving Newport News Shipbuilding and Drydock Company's yard Nov. 9, 1946. V-C Phosphoric Acid was used in the treatment of her hull preparatory to her recent conversion there from wartime gray to peacetime "dress."

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THERE'S NO GUESSWORK **ABOUT CONTEMPLATED** PRODUCTS . . . WHEN BUFLOVAK MAKES EARLY TESTS FOR YOU!



BUFLOVAK EQUIPMENT DIVISION OF BLAW-KNOX CO. 1551 FILLMORE AVE. BUFFALO 11, N. Y.



With a Banbury Mixer you can automatically produce batch after batch of uniformly mixed stock with clocklike consistency by following a simple, prearranged routine.

Once the proper sequence and timing of mixing operations for your particular plastic has been determined, the Banbury itself tells your operator what to do and when to do it. The result is standardized, uniform quality and higher production at lower cost.

HERE'S HOW ALL THIS COMES ABOUT-

THE TIMING DEVICE – A telechron-motor-operated timing instrument is mounted in full view of the operator. On the removable paper dials detailed information can be written, giving the operator complete mixing instructions for each stock. Graduated by minutes, the dial tells how long to allow for each operation, when to add ingredients and when to discharge the batch. The device automatically signals the operator as each stage of the operating cycle is completed by flashing one of a series of lamps on the instrument.



TEMPERATURE CONTROL-The sides, rotors and discharge door of the Banbury are cored for circulation of cooling water or steam. Valves for regulating the various circuits are arranged to put accurate control of batch temperature at the operator's finger-tips. An electrically actuated potentiometer pyrometer with its thermocouple in direct contact with the batch indicates and records the temperature on a chart, continuously. When

Typical WELLS W tor instal ern powe is provid supply a make-up what this raw wate

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Of the eight standard sizes of Banbury mixers, the one most generally used for plastics is the size 3A, illustrated above, having a capacity of 100 x specific gravity of the stock. For complete information send for Bulletin No. 180. FB-350

FARREL-BIRMINGHAM COMPANY, Inc. ANSONIA, CONN.

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Farrel-Birmingham

When you have difficult HEAT BALANCE and WATER SUPPLY PROBLEMS

is a dependable source for

MODERN WATER EVAPORATORS

Shop view of a large makeup water evaporator far a Gulf Coast oil refinery. The evaporator shell is 100" diameter and the condenser mounted above evaporator is 48" diameter. Separate preheater and controls are not shown.

Typical STRUTHERS WELLS Water Evaporator installed in a modern power plant, where it provides a reliable supply of really pure make-up, no matter what the variations in raw water supply.

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STRUTHERS WELLS CORP. PROCESS EQUIPMENT DIVISION WARREN, PENNA. PLANTS AT WARREN, PENNA.

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In modern high-pressure power plants, pure make-up water is essential, regardless of the raw water source available.

With years of experience in all types of evaporation problems, and having successfully handled many types of water, STRUTHERS WELLS can supply an evaporator to fit into any heat balance and water supply problem. Provisions for thermal descaling and for assurance of highest vapor purity are included without any complicated construction.

Also available for power plant service are closed Feedwater Heaters, featuring the "Boltless Head" high pressure closure; blowdown exchangers, oil coolers, and other similar items of heat transfer equipment.

Bulletins descriptive of power plant equipment are available on request.

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Four Type XPV steam-driven and one XRE electric-driven compressors generating Air Power...total free-air capacity nearly 13,000 cfm. Steam exhausting at 30 psi is used for heating applications in the factory and boiler house. (Photo, courtesy of Albert Kahn, Associated Architects Generating

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Illustration number 1 shows a Century 75 horsepower general purpose drip proof motor driving a coal pulverizer in a large industrial plant. The drip proof construction protects against falling objects or dripping liquids.

Number 2 shows a 1 horsepower Century open rated general purpose motor driving a milling machine in a tool room where extreme accuracy must be maintained. Protection isn't needed here because the motor is mounted on top of the machine—and in clean surroundings.

Number 3 shows a 11/2 horsepower Century totally enclosed motor driving a blower on a gas heated oven for paint drying.

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which accounts for the rapid drying and uniformity of the finished product. After 67 minutes of drying time, the nitroguanadine is discharged from the dryer at the rate of 1,880 pounds per hour (C.D.W.†), with a uniform moisture content of 0.25% (B.D.W.B.). By means of preforming the material and then drying it in the continuous conveyor dryer, it is possible for the manufacturer to secure a maximum output and still maintain uniformity.

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S THE American way of life – progress by private initiative – going to get a fair chance to demonstrate its superiority over all the challenging varieties of collectivism?

That's the real question before Congress as it confronts the long labor of remodeling the federal tax structure. What Congress does about taxes will come pretty close to making or breaking the U.S.A.

Today the tax colossus that sprawls across the national economy is unguided by any central nervous system. Its crushing weight comes down first here, then there, as the giant wobbles around, unguided by any central purpose except to grab as much as it can.

The central purpose of a tax system is simple. It should raise the necessary revenue without placing unnecessary fetters on enterprise.

As recently as 1929 federal taxes took only one dollar out of every twenty of national income. A loose-jointed and inconsistent tax structure was a nuisance then. But it wasn't serious.

Today the federal tax burden is the dominant element in the nation's economy.

Even if Congress succeeds in cutting \$6 billions out of President Truman's \$37.5 billion budget, federal taxes still will take about one dollar out of every five of the national income. And few Congressmen are hopeful enough to think that they can get the tax load below \$25 billion for any year that is in sight.

Drastic Budget Cuts Required

Indeed, to get the tax load down to \$25 billion, Congress will have to stop treating expenditures, like those for military purposes and veterans, as politically sacrosanct. Congress must scrutinize every item in the budget. Economy must go along with tax cutting or we shall end in bankruptcy.

Suppose that expenditures are slashed to the bone. Our taxes *still* will be so heavy that the *way* they are loaded on the nation's back will make a big difference in how well the nation gets along. That's something which the postwar boom has tended to obscure. It will become much clearer as this boom wears off. Then a remodeling of the federal tax system to remove its manifold obstructions to private enterprise will be of transcendent and obvious importance to everybody.

Tax Experts Agree

The remodeling will require political courage plus tax wisdom. Congress must supply its own political

courage. But it can lean on tax experts for tax wisdom. Fortunately, tax experts now agree on the necessary reforms — especially on those that will remove obstructions to business. How well the tax experts agree is shown in the charts on the next page, summarizing answers to a questionnaire on possible federal tax reforms. The questions were asked by the Department of Economics of the McGraw-Hill Publishing Company. The answers came from a broad cross-section of tax experts, including the authors of a considerable crop of books on postwar federal taxes and what to do about them.

The experts agree (see the charts) that double taxation of corporate dividends should stop.

They agree that the tax rate on corporate income (now 38 percent) should be reduced as rapidly as possible to the initial rate on individual income (now 20 percent).

And they agree overwhelmingly that it is desirable to let net losses be subtracted from net profits over a 5-to-6-year period in computing business income for tax purposes.

All three changes would stimulate corporate initiative and hence make jobs. Averaging business incomes would make new ventures attractive even though these ventures *might* result in early losses. Reduction of the corporate income tax would have the same effect. So, too, would the elimination of that highly discriminatory provision whereby corporate dividends are taxed first as corporate profits, and again when received as income by individuals.

Penalties on Incentives

Beyond these changes, there must be an end to tax penalties on *individual* initiative. Consider the enterprising business man whose income fluctuates markedly from year to year. Because of his enterprise he may pay, on the same income, twice as much federal income tax as the man who plays it safe for a steady income. That's because he can't average his personal income over several years for tax purposes. He can count on heavy taxation of his good-year profits with no chance for offsetting against them his bad-year losses. It is a case of heads you lose, tails the tax collector wins. Eightysix percent of the experts agree that an incomeaveraging allowance for individuals is desirable.

Three-quarters of them also agree that tax rates at the top end of the individual income scale (now running up almost to 90 percent) should come down. In my judgment, the total tax should not amount to more than 50 percent to encourage business men to venture for high stakes.

Advocating tax relief for men in the higher income brackets - and particularly for management men-has been considered political suicide for more than a decade. Some members of Congress still hold that view. A Democratic Congressman from Michigan told an Illinois colleague who advocated cutting upper bracket taxes, "If you put that idea forward at home, you won't come back."

The Congressman has an even better chance of not going back if our economy bogs down. One of the best ways to bog it down is to keep the taxes that destroy business incentives and block enterprise-for example, the confiscatory rates which

drive the people in the high brackets away from risktaking.

To give the American system of individual enterprise a fair chance was clearly the mandate of November's election. To give it that chance, enterprising business men must have a chance to make large rewards - as well as the always-present chance to lose their shirts. Under present tax rates, they don't get a break.

Prevailing federal taxation throttles bold business enterprise in other ways. It fails, for example, to encourage research and rapid industrial modernization. It tends to siphon investment away from private enterprise, driving it into tax exempt state and local securities. (The experts agree almost to a man that such

Because we can not avoid enormous federal expenses in the years immediately ahead, all badly needed reforms of the type to which this article is confined obviously can't be made at once. Also there are other tax reforms bearing on consumption which obviously should be weighted in an over-all program of tax revision.

But this is equally obvious: We should have a general design for tax revision which would line up all the necessary steps. Then we could get ahead with tax reductions as rapidly - and as sensibly as revenue requirements and political courage would permit. Tax cutting may come piece-meal, but tax planning must not.



design we might discover that some decidedly beneficial improvements in the federal tax structure can be made at relatively slight cost. But today there's no way to be sure. No one in Washington with access to the information has even undertaken to make the neces-

Through such a

Instead, federal tax revision continues to be a hitand-run businessand a short-run political business. Take, for example. the proposal of a 20 percent tax reduction across the boards. There are virtues in such a proposal. But how they stack up beside many other extremely urgent needs for tax reform remains a mystery.

Congress must dispel such mysteries. Only in that

tax exemption must be eliminated.) The list of obstacles could be amplified.

Hit-and-Run Revision Disastrous

Most of the reforms needed to prevent the federal tax system from smothering enterprise would lower federal revenues, at least temporarily. Elimination of the double taxation of corporate dividends might lop off \$800 million. Dropping the corporate income tax from 38 percent to 20 percent might cut away as much as \$4 billion.

way will it do the job of converting our present jerry-built tax structure into a moderately safe abode for the American system of private initiative, sparked by adequate incentives.

Mues H. W. haw.

President McGraw-Hill Publishing Company, Inc.

THIS IS THE 56TH OF A SERIES

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4 & 5 Bristol pH Recorder-Controller for automatic pH measurement and control in chemical treatment insures optimum conditions for coagulation . . . results in good flocculation and excellent preparation for sedimentation and filtering. For recarbonation, continuous pH measurement effectively maintains and controls addition of CO₂... prevents carbonate scale deposition in filters and supply mains. • Bristol Liquid Level Gauges measure and record levels in sedimentation and flocculating basins and in clear well, giving continuous indication of conditions . . . provides over-all picture of water flow through plant. Gauge illustrated is pressuretype.



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WATCHING WASHINGTON

R. S. McBride, EDITORIAL CONSULTANT J. V. Highlower, WASHINGTON CORRESPONDENT

Delay in establishment of Atomic Energy Commission has halted plans for new technical programs... Further study of German technology by private investigators to be stopped in American and British zones of occupation in Germany ... Petroleum industry cooperates with Office of Technical Services in analyzing German documentary data ... Export licenses now permit larger movement of equipment and replacement parts where needed to restore foreign industry ... New bills introduced to provide for a census of manufactures in 1948 and every five years thereafter

Atomic Controversy

DISPUTE over the suitability of David E. Lilienthal for chairman of the Atomic Energy Commission has delayed for at least a month almost all technical plans for new projects. The Commission explained frankly its desire not to embark on new research or engineering until after the personnel of the Commission has been fixed by Senate confirmation. Among the more important projects delayed is the proposed new health research laboratory suggested for joint operation by Public Health Service and National Bureau of Standards.

Standards Atomic Plans

LAST year Congress appropriated funds with which the National Bureau of Standards expected to build a new betatron. The project was delayed because, by the time bids were taken, cost of construction had risen to a point preventing completion of the equipment and its housing within the funds available. Plans now contemplate erection of two betatrons which will permit research on measurements and standards into the range of 50 to 100 million volts. The first application of this equipment when completed probably will be standardization of x-ray equipment and measurements to guide the medical profession.

Also contemplated is the possibility of a joint atomic energy laboratory to be operated by U. S. Public Health Service and the Bureau. Atomic Energy Commission has been requested to provide funds, and it appears that the Commission looks with favor on

the idea for early consideration. The proposal is that the new laboratory will be built on the grounds of the National Institute of Health, Bethesda, Md., a suburb of Washington located about five miles from the main grounds of the Bureau.

The most costly single item in the new \$20,000,000 laboratory would be an experimental uranium pile. It is likely that this pile alone would cost in excess of \$3,000,000. It and the other facilities would be utilized primarily to develop accurate methods of measurement and control. The Public Health Service is interested because pile operation should provide radioactive products of many types which could be utilized as tracer materials and for other purposes in medical and biologic research.

Blackout for German Work

AMERICAN and British occupation authorities in Germany are closing the doors to further inquiry into German technology by private industrial investigators. This development was a jolting surprise to the Commerce Department's Office of Technical Services, which has sponsored American investigations in the British-American zones. OTS knew nothing of plans for an early cut-off date before February 6, when the State Department asked the agency whether a March 31 deadline would be satisfactory. In a rush call to its branch in Germany, OTS was informed that British concerns, like American companies with respresentatives in Germany, considered that a sweep-out without prior notice is unfair and costly.

At once, OTS asked the State Department to arrange that American private industry investigators and the OTS staff at present in Germany be permitted to remain there until June 30, on the understanding that no more investigators be dispatched after March 31. It was estimated that if the proposed cut-off date were imposed, the microfilming work on well over 100,-000 documents in Germany could not be finished, and that about 200 planned survey reports could not be written. It was considered that if the work could be continued until June 30, most of this undertaking could be finished.

Why the Rush?

HERETOFORE, the wind-up of the American work in Germany had been planned for December 31. At present, about 50 investigators from industry and other private groups are there, and approximately 90 others are in various stages of "processing" preparatory to going. Also, OTS has its own staff of 150 government men still working in Germany, screening and microfilming documents and handling the preparation of reports.

It is a conservative estimate that about 2.5 million pages of documents still await microfilming.

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There is considerable speculation as to reasons leading to the rush to cut off at an early date the survey of German technology. Both the American and British governments want to eliminate as rapidly as possible all real or fancied impediments in the way of restoration of permitted German industrial and scientific activity. It has been claimed that the presence of foreign investigators has in some instances delayed and confused managerial and production work.

An Unfinished Task

A BIG question facing the Office of Technical Services, a matter in which some branches of industry are deeply interested, particularly the smaller companies, is whether the mountainous collection of individual reports and scat-



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tered, still untranslated documentary data covering Germany's technology will ever be competently analyzed and brought together. OTS officials in Washington recognize the need for a critical study of this material. They know there is much chaff, uncertainties and blank spots amid the reports now available. Millions of pages of documents still awaiting translation and study may help eliminate certain defects in information gathered by examinations of German plants and company officials.

If the round-up task is to be performed at all, it appears so far that the job would have to be done at government cost. Both the Manufacturing Chemists Association and the American Chemical Society favor such work in the chemicals field, but say the government should foot the bill. OTS has gone to various industrial groups about the matter but without much encouragement for the idea that such groups should defray all or part of the costs of the work in their own lines of interest.

Oil Industry Does Job

IN THE field of German developments in synthetic liquid fuels and lubricants, the petroleum industry, cooperating with the Bureau of Mines, is participating in the kind of industrygovernment teamwork which the Office of Technical Services would like to see extended to other industries. Microfilms of German documents are being analyzed by civilian petroleum specialists and Bureau of Mines engineers, many of these two groups being the same men who studied synthetic liquid fuels and lubricants in Germany. Reports prepared by these examiners are microfilmed and are made available to the oil industry and the Bureau of Mines. Three comprehensive reels containing individual study reports and translations carried on a large number of basic reels have been prepared, and two others are being prepared.

OTS Special Listings

BECAUSE of a barrage of requests for information covering chemical and other specific industries, the Office of Technical Services has begun to prepare a series of special bibliographies covering all reports dealing with particular fields. These issues will identify the numbers of the reports, titles, prices of photostats or microfilms, and include short summaries of subject matter in a few cases. They will cover both foreign and American information.

Ready last month was a summary of

data on plastics. In preparation were bibliographies covering caustic soda and chlorine and acetylene chemistry. Decision, up to a few weeks ago, was that these summaries may be had without cost to companies requesting them. Just how many such compilations will be made depends on the volume of material reaching OTS and the extent of inquiries for information.

Export Licenses Expanded

MACHINERY and other commodities certified by the Office of International Trade, Department of Commerce, as essential to certain foreign projects, may now be exported without being charged against commercial export allocations. The list of projects under the new rule covers new plants for the production of lumber, tin, lead, zinc, copper, hard fibers, edible vegetable oils, petroleum, sugar and rubber.

The effect of the new regulation, OIT officials say, is to speed production, in foreign countries, of commodities necessary in this country. The new rule applies also to maintenance and replacement materials, whether or not for projects making the products specified under the regulation.

During the war, special project licenses were used to move materials, as a group, to foreign countries in the Allied Nations category. When V-J Day came, such licenses were largely dropped, on the supposition that foreign needs could be met under the general commercial export quota system covering individual items. It has been found this supposition was wrong with respect to certain foreign products needed in the United States.

Science Board at Work

THOSE connected with the work of the President's Scientific Research Board, set up last October to review the nature and scope of federal and non-governmental scientific research and development, say the Board's final report should be ready by June 30. Before that time there may be interim reports on some phases of the investigation.

Information on scientists outside the government is being secured for the Board's Subcommittee on Scientific Personnel by the following societies: American Chemical Society; American Institute of Physics; American Mathematical Society; American Geological Society; and American Psychological Society. Questionnaires have been sent out by most of these groups. The ACS forms had been returned last month.

Dr. M. H. Trytten, director of the

Office of Scientific Personnel of the National Research Council, has made available the recent records of that agency. The Board's Subcommittee is expected to have in about two months the facts on its survey of government research, covering the distribution of technologists and research workers, their numbers, salaries, types of projects, costs of projects and governmental work being done by government and outside government by contract.

Another Try for Census

THE Administration shares the hopes of industry that Congress will be in a more receptive mood than it was last spring to permit the census of manufactures and business to go ahead. President Truman has asked \$5 million for the job on manufactures and \$10 million for that on business. Private organizations strongly support both projects. What is worrying proponents of the work is the size of the bill. Big also, say executives, market research specialists and engineers, is the need for up-to-date benchmark statistics. Their view is that forecasts still extrapolated from the old 1939 reports are becoming more risky as the years go by.

Bills introduced in the House last month by Harold Hagen (R., Minn.) and in the Senate by Albert Hawkes (R., N. J.) are identical, and resemble the general census program submitted by the Census Bureau last year. The bills provide that censuses of manufactures, mineral industries "and other businesses, including distribution trades and service establishments," are to be undertaken in 1948 and every five years thereafter. Sponsors of the legislation say that it would furnish some marketing data by mid-1948, when the "seller's market" will be largely in the past. Except in agriculture, where a full census was made in 1945, there has been no comprehensive information available since Pearl Harbor.

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Pollution Bills Back

BACK again in Congress are stream pollution bills. The four bills which had been introduced by the middle of February would establish controls in the U. S. Public Health Service and vest broad authority in the Surgeon General. Scope of the Surgeon General's powers would include preparation of programs in which other government agencies, state health offices and other groups would participate; encouragement of uniform state legislation and interstate agreements; proposal of solutions for pollution prob-

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lems; and initiation of legal action where necessary.

The bills authorize government funds up to \$1.5 million per year for loans or grants to states to study pollution; and up to \$100 million annually for loans or grants to states or cities, and for loans to private industry, for construction of treating equipment. The government's participation would be held to one-third of reasonable cost as determined by the Surgeon General. Loans to industry would be approved by that official and state health authorities.

Texas Eastern Gets Lines

OFFICIALS of the Texas Eastern Transmission Corp. were confident, last month, of being able to surmount the hurdles still facing the new company in its plans to use the Big Inch and Little Big Inch pipelines for natural gas transmission. Texas Eastern's high bid of \$143,127,000 for the carriers was quickly snapped up by War Assets. After notification of the award, company officials were optimistic as to their prospects of securing approval from the Federal Power Commission and the Justice Department for taking over the two pipelines.

Texas Eastern was expecting to take over the temporary, partial-capacity operation of the facilities after their lease by Tennessee Gas and Transmission Co. expires April 30. Also, the company was expecting approval for its plan of ultimately sending 425 million feet of gas per day through the lines for use on the Eastern Seaboard.

It is not expected that capacity operation of the lines can be achieved this year. A Federal Power Commission official has predicted that hearings in connection with application for a permanent certificate will occupy several months, and says the application will be contested "on many fronts." Capacity operation will not be possible until compressor stations are built and gathering facilities and equipment for distribution of the gas are installed.

Plans for "Inch" Lines

PLANS of the Texas Eastern Transmission Corp. call for the marketing of natural gas in the East, primarily the Seaboard vicinity. Company officials say their plans for distributing the gas include sales to several classes of consumers in the following order of preference:

(1) To the public through companies distributing manufactured gas; largely by substituting the gas for oil at present used for reforming and en-

riching. (2) To such natural gas companies in the Appalachian areas as wish to bolster their declining local supplies of natural gas. (3) To petroleum refineries seeking gas to replace fuel oil. (4) Other large loads of such nature that they could be quickly and conveniently interrupted if the government needed to recapture the lines.

For its gas supply, Texas Eastern has been negotiating with the United Gas Pipe Line Co., which has extensive connections in Texas and Louisiana. United Gas could supply a "substantial" portion of the gas put through the lines. Texas Eastern probably would move a considerable volume of "flare", or waste, gas at present being burned for lack of profitable use.

Officers of the company are: George R. Brown, Houston, chairman of the board; E. Holley Poe, New York, president; Charles I. Francis, Houston, vice president and general counsel; H. J. Frensley, Houston, secretary-treasurer. Brown is a Houston industrialist with numerous connections. Poe, former head of the natural gas section of the American Gas Association, has long been active in the gas industry. Francis is a member of the Houston law firm of Vinson, Elkins, Weems and Francis.

Markets for Gas Assured

FLOATING around Washington is a strong belief that Texas Eastern Transmission Corp. hopes sometime in the future to install an additional pipeline to parallel the Big Inch and Little Big Inch carriers to move southwestern natural gas to the East. Many of the bidders are known to have had such plans in mind. Texas Eastern is understood to have commitments for all the 425 million feet of gas per day it can move through the present two lines, and that earlier surveys indicated there is a waiting market for several times this volume.

In Washington, a War Assets official says he believes the operators of the two lines might have to spend as much as \$40 million in installing compressor stations, feeder lines and other equipment needed to convert the lines to capacity operation in natural gas, providing protection of existing liquid petroleum facilities, etc.

Where Are Caustic Cells?

HIGH officials of the Chemical Corps, War Department, said last month they didn't know the whereabouts of specimens of German electrolytic caustic-chlorine cells which were supposed to have been shipped to Edgewood Arsenal, many months ago.

for display and testing. A Chemical Corps officer who was recently in Germany, was informed there that the cells had been shipped in June 1946. On his return to the United States, he was informed that the equipment had never arrived. He said in February that an inquiry would be filed immediately.

These cells, because of their ability to produce caustic of high concentration and purity, have interested the American industry. Government authorities wishing to have them shipped to the United States say the longdelayed consignment consisted of examples of the German 7-meter and 14meter horizontal cells and the new vertical, 24,000-amp. cell.

A Standards Shift Barred

SECRETARY of Commerce Harriman has scotched the efforts that were nade in Mr. Wallace's regime to uproot the Divisions of Simplified Practice and Trade Standards from the Bureau of Standards and move these two groups bodily into the Office of Domestic Commerce. Last month, Harriman, fully aware of the opposition of business to the change, decided the two agencies can function best where they are.

When industrial, distributor and buyer-groups learned of the contemplated change last year, they made strong representations to Congress and the Department of Commerce, opposing it. These groups said they were satisfied with the work done at the Bureau of Standards by the two divisions and were far from being convinced the projected change would work out well. Men in the divisions, also, have opposed the change, believing that if they were removed from close contacts with other sections of the Bureau there would be loss of time in their contacts with those groups.

Engineers, Chemists Needed

PRESENT openings for engineers and chemists preponderate in requests filed by industry with the U. S. Employment Service National Clearing House for scientific, professional, technical and other workers. This was learned from USES officials when the Service, last month, issued the first listing of job openings in these categories since the National Clearing House and the National Roster of Scientific and Specialized Personnel were merged and field operations transferred to the local state employment service offices.

The listing has been filed with the 1,800 state local offices, and will be revised eight to ten times a year. Lack of

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Disinfectants Produced from Phenol Derivatives

Phenol derivatives are now being used in the manufacture of many disinfectants. These phenol products, produced by Dow, are known as Dowicides. They are noted for their high germ-killing powers which are largely retained in the presence of organic matter. Other important properties: excellent compatibility with cresols, pine oils, and soaps, and effectiveness under alkaline conditions. These qualities indicate the wide adaptability of Dowicides to the manufacture of bactericides and fungicides.

Propylene Glycol Used as Shortening Extender

The food industry is making increasing use of low-cost Dow propylene glycol because of its unusual properties



as a solvent, humectant, preservative, and wetting agent. Through the wetting action of this highly purified material it has been found pos-

sible to extend the effectiveness of shortening in producing baked goods. Propylene Glycol aids in the dispersion of the shortening throughout the batch with a consequent saving of critical shortening not otherwise possible.



funds has, so far, made impossible the listing of all openings. The first "indicative" list includes 189 job descriptions, 157 of which are for private organizations and 32 for the government, although there are 3,000 positions open.

open. Washington specialists connected with the work say one of the largest chemical corporations in this country has filed a standing request to interview all job applicants in its field. These specialists have undertaken a campaign to acquaint industry with the fact that there is now a clearing house for placing men and women of high technological and professional qualifications.

Army Backs Up

ARMY plans for extensive nitrogen exports have been modified so that after May 1 there can actually be substantial transfer of ammonium nitrates to benefit both American agriculture and foreign users outside Army occupation areas. The Army was allowed to make this "voluntary" decision. But it is clear in Washington that the grilling given by the House Committee on Agriculture was the real cause. That Committee shortly after the Army announced its plan also released its findings. The following recommendations were included (briefly summarized): That the War Department imme-

diately return 110,000 tons of ammonium nitrate which it borrowed. That the Army exports for occupied areas be strictly limited to fertilizer made in Army sponsored plants. That government export commitments to other districts be reviewed and reduced wherever possible for the benefit of American farmers. That conversion of tank cars from petroleum service to ammonia plant service be speeded. That Canadian imports be speeded. And that all agencies "cooperate earnestly and intelligently in a program of timed distribution so that fertilizer will be available in specific areas for the planting and dressing of major crops at the time it will do the most good."

Inter-Mountain Fertilizer

A NEW plan to put the government into business in potash and phosphates has been formulated as a substitute for the plan of a year ago. Instead of having the government build the plants, which would later be transferred to farmers' co-operative, the new plant puts the co-ops into business from the start. This program is being sponsored by American Farm Bureau Federation with the cordial support of Interior Department officials and executives of Tennessee Valley Authority. Undoubtedly it will be opposed by other farm organizations.

Tax Escape

An important factor in the Inter-Mountain fertilizer program is the plan to make agricultural cooperatives the owners of federally financed developments. That insures tax exemption under the present income tax laws. This escape from tax responsibility also gives one of the strongest arguments of the critics who claim that it is unfair of the government to eliminate this large element of cost when it enters into an industry as a competitor of the private investor. However, there appears to be no likelihood that present tax benefits given by law to co-ops will be curtailed by Congress this year, or next either for that matter.

To Break Monopoly

Most aggressive effort in monopoly control by guided sale of surplus property has resulted in establishing two large competitors in the aluminum industry for the prewar "monopoly" of the Aluminum Co. of America. War Assets Administration brags that it has successfully established two competitive firms, Reynolds Metals Co. and Permanente Metals Corp. (Kaiser).

To accomplish this result 28 wartime plants have been sold, but only 18 for continued use in the aluminum industry. One of these, an extrusion plant at Cressona, Pa., has gone to Alcoa. The present industry is now rated for alumina: Alcoa, 43.7 percent, Reynolds, 35.9 percent, and Permanente, 20.4 percent; and for primary aluminum 54.0 percent, 29.2 percent, and 16.8 percent, respectively.

Underground Survey Active

DESPITE currently short funds and Congressional talk about further tightening, the Army-Navy Munitions Board and other military agencies are pushing hard to get the engineering and economic facts about putting strategic industries underground. What other countries, notably Germany, Japan and Sweden, have done in this line in recent years is being carefully reviewed, but more information is needed and is being sought.

The Corps of Engineers is examining caves and abandoned mines and quarries and is expected soon to make a report to ANMB. There is belief among investigators of caves that, as manufacturing sites in the Atomic Age, such natural cavities are too rugged and irregular, and are too far from transportation and raw materials, to offer much help. Mines and quarries, though having better prospects than caves, have their own drawbacks. There is opinion in the War Department that hillside excavations, particularly in soft rock, may be the best answer—if the statesmen finally fail.

Processing Salmon Wastes

CHEMICAL engineering treatment of wastes from Alaskan salmon fisheries may, if successful, result in a profitable use of the material, which is estimated to be discarded in Alaska at an annual rate of around 110 million pounds. Plans are under way for utilizing such refuse for the manufacture of diet accessories, pharmaceuticals and other products. Project engineers in the Industrial Research and Development Division of the Office of Technical Services, Department of Commerce. expected a few weeks ago the signing of a \$45,000 IRDD contract with the Alaskan Fisheries Experimental Commission for a laboratory and pilot plant investigation.

The Commission, an Alaskan government-administered agency established in 1937, expects to receive some aid in the work from the laboratory at Ketchikan maintained by the Commission and the Interior Department's Fish and Wild Life Service.

Minor News Glimpses

Tax exemption for new industries established in Puerto Rico is promised by the governor of that territory. This will be accomplished under a law 27 years old in order to give more inducement for establishing new or branch enterprises on the island.

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Beer seizure by Food and Drug Administration has resulted in destruction in more than 50 carloads of brew which contained small quantities of monochloracetic acid. Any food or beverage containing that chemical is poisonous according to the interpretations of F & DA.

Penicillin inspection indicates a very satisfactory quality of production of that pharmaceutical. Pre-distribution tests are required by Food and Drug, which reports that about 4.000 lots were inspected with less than 2 percent found unsatisfactory in any particular. Output during the fiscal year 1946 was 2.1 trillion units, and is still growing. the An these are and are to a raw mass these and quaprospects arawback of a prospects

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Petroleum Chemists Use Speedomax "G" In Infra-Red Spectroscopy

In the Esso Laboratories of the Standard Oil Development Company, the infra-red spectrometric equipment shown above solves many routine and research analysis problems. A frequent application is the determination of petroleum constituents which are almost impossible to separate by usual chemical methods, but which have characteristic infrared absorption spectra from which they can be identified and measured quantitatively.

The recording instrument used with this equipment is a Speedomax Type G, one of L&N's high-speed recorders. It follows the rapid changes in spectrometer output quickly and accurately; faithfully reproduces on its wide strip-chart each of the complex details of the unknown's spectrum. Its speed and sensitivity are more than adequate to keep pace with the rest of the spectrometric equipment.

Speedomax "G" is well suited for spectrometry applications. Its carefully designed input filter is highly effective in reducing pick-up, without sacrifice of the recording speed which is of prime importance in spectrometric work.

An L&N engineer will be glad to discuss how this recorder can be applied. Or, if you'd like more details about the instrument itself, write for Catalog ND46(1).



At top: Infra-red spectrometric equipment at Standard Oil Development Co. Speedomax Type G, in upper right panel, records the output of the Perkin-Elmer spectrometer in the center of the photograph. Pre-amplifier mounted directly

Enlarged view of chart shows detailed record of infra-red spectrum drawn by Speedomax.

under the Speedomax uses an L&N Type HS

Galvanometer.

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MARCH 1947

SIDNEY D. KIRKPATRICK, Editor

Too Much and Too Soon?

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M OST of us, in principle at least, find it difficult to believe that as a nation we could ever spend too much on scientific research. Chemical engineers have never subscribed to the theory of a moratorium on research in order for the rest of the procession to catch up with scientific progress. But now through the munificence of Congress and the U.S. Treasury, we are faced with a situation that threatens to kill off the long-time contributions that research can make to the national economy. It is barely possible that less governmental research spending right now can mean more and better research a few years from now. And the converse might be equally true, namely that too much federal money for research right now can seriously damage our prospects for future scientific advance.

Consider first the supply of technical manpower. ipment is a Speed Research personnel with adequate training and sound experience is exceedingly scarce. We must do somerately; faithful, thing about it so we plan to plow money into our letails of the unitar educational institutions, not for basic teaching of the younger generations but mostly in the form of research contracts intended to carry out certain investigations and at the same time promote post-graduate training in research methods. Thus there is a tendency to divert professors from undergraduate teaching into the carrying out or supervision of governmental research projects. The desired result is that this process will give us research leaders and supervisors sooner than would otherwise be the case. But in the meantime the colleges will have neglected their much more important responsibility for better training of undergraduates in every division of science and engineering.

> Our greatest deficit over the next ten years will be in the supply of young technologists-men with bachelor's diplomas that are backed up with more thorough and adequate training than they now represent. Reluc

tantly, some of us have come to the conclusion that research will be better served over a ten-year period if it is not allowed to encroach too far on undergraduate training during at least the first half of that period.

We have talked with dozens of research directors who tell us that the government is seriously competing with industry for research personnel. The Army and Navy are not only attracting older men-including teachers-but are earmarking the most promising youngsters and signing them up for long-time careers in governmental research. If this policy is carried to extreme, industry will have to be satisfied with the leftovers in the colleges or wait until the better men can be hired away from the civil-service jobs for which they have obligated themselves. All of this raises a grave question as to how efficiently federal funds are being used in the necessary and justifiable support of our educational program.

Finally, as engineers and employers, we must also face the fact that the government's projected annual outlay of one and a half billions can greatly endanger the cause of research if those funds are wasted on illadvised projects. Present indications are that much less than half of that huge sum can be spent efficiently. If that is the case, the money is being worse than wasted for it will soon bring research into such disrepute that economy-minded legislators will be quick to cut off support and perhaps to shelve the whole program of a National Science Foundation.

These are serious problems from the standpoint of industry and even more serious for the general public. Now is the time to face them squarely and to work with our congressional leaders and the policy-making heads of the Armed Services to make certain that illadvised spending does not endanger the long-time future of research.

INDUSTRY'S STAKE IN ATOMIC ENERGY

ROBERT COLBORN Washington News Bureau For the McGraw-Hill Atomic Energy Committee

HOW ATOMIC ENERGY IS BEING DEVELOPED FOR COMMERCIAL APPLICATIONS AND THE EFFECT OF SUCH PROGRESS ON INDUSTRY

B VER since Hiroshima, speculation has been rife on the implications of atomic energy on human society. Although many people are still inclined to act as though it were a private problem of statesmen, soldiers and physicists, alert engineers and businessmen are beginning to realize that atomic energy will have far reaching effects throughout industry. Research in atomic energy is fast widening and its results must be considered in any long range industrial planning. It should, therefore, be well to know the direction of this research and how it is being carried out.

Power Generation

Commercial production of electric power from atomic engines is thought by many to be only about five years away. Experimental production of power on a substantial scale will be under way within a couple of years at at least three places—Oak Ridge, Schenectady, and Chicago. This is much sooner than was being predicted a few months ago and reflects promising results of preliminary investigations.

Power piles will be designed to operate at temperatures similar to those of a modern high-pressure steam plant. Fluids such as molten bismuth, sodiumpotassium alloys or others which can reach high temperatures without creating high pressures, will first be heated in the pile and then used to generate high pressure steam. New piles of the Clinton laboratory at Oak Ridge and the Knolls laboratory at Schenectady are specifically designed for power production. The Argonne laboratory's new pile at Chicago, though intended for general experimentation, will run at high temperature and will incorporate a heat exchanger.

Cost will not be an obstacle to the use of atom-fueled electricity. The figure of 8 mills per kwh. which has been estimated is some 30 percent higher than costs of coal-generated power in areas where coal is plentiful But it would make atomic power economical in any area where coal costs more than about \$10 a ton.

A complicating factor in costs is the question of byproducts. An operating pile always produces valuable radioactive materials or may perhaps be used for experimental, metallurgical, or chemical purposes other than power production. Pricing of atomic power is likely to involve some of the complications encountered in distributing the costs of a multi-purpose hydroelectric project.

Supply of atomic fuel does not appear to be any obstacle either. Uranium and thorium, the two known fuels, are rather plentiful. Known world resources of good ore are said to be sufficient to meet the world's total power needs for something like twenty years, and exploration for uranium has been intensive for only a few years. Extraction from low grade sources—granite, shales, seawater—has hardly been studied at all.

The peculiar characteristics of atomic power sources are perhaps more significant than cost factors in assessing the industrial effects of commercialized atomic energy. As of now it appears that:

1. Atomic energy may be most readily and economically used in large installations. Plant and operation costs for small plants are out of proportion to the useful energy produced.

2. Technically, the power output of any atomic device is extremely flexible, can vary easily from a few watts to the level of an atomic bomb. Output of a power plant is limited only by the capacity of the heat transfer system to absorb the power.

3. Economically, an atomic power plant would resemble a hydro plant in needing a high load factor. Once the plant was fueled up, cost of fuel replenishment would be a minor factor. Fixed capital charges, which continue no matter what the output, would be the large element in cost.

However, labor cost is a larger factor than in conventional plants. Much of

Commercial implications of atomic energy have been somewhat obscured by political considerations regarding its control and development. While Chemical Engineering has frequently reported the progress in this field since August 1945, Mr. Colborn has now brought together and summarized the important facts to help engineers and industrialists evaluate their stake in atomic energy. the labo mond" e somewhat A. Mon plant is 1 o penden opo fuel input the line the lin

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the labor would be in the "ash removal" chemical plant and could vary somewhat with the power output.

4. Most novel and perhaps most significant feature of an atomic power plant is that it is completely independent of transportation. Because its fuel input is measured in pounds rather than tons, it can be put wherever power is needed. Not only does this simplify problems of electricity transmission, but it can have a profound effect on the geography of all the heavy power-consuming industries. It might become economic, for instance, to make aluminum near the bauxite fields rather than transport bauxite to a power supply.

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Isotopes

Of wide significance is the manufacture of elements not found at all in nature-the so-called "radioactive isotopes." These are elements with the same chemical properties as the natural r only a few year elements but possessing the additional ow grade source property of emitting radiation, much water-has had as radium does. Radioactive forms of nearly every element can be manufactured in quantity in an atomic pile. er sources are pele

The research and medical value of radio-isotopes has been well publicized, leffects of country but their potential usefulness in many s. As down industrial processes is not as widely realized. Two types of use are promisenergy may ing-as radiation sources and as tracers. conomically use: Production of radio-isotopes is still

Plant and openin so small as to limit their use to laboraats are out of " tories, but they'll be available to indusenergy produced try also within a year or two. Any wide ally, the power of power piles would make radiovice is extrement isotopes an available industrial tool.

Developed in a country which, more mic bomb. Out than any other, stresses private enteris limited out prise as the key feature of its economy, e heat transfer this new and far-reaching technology was immediately and almost unanically, an atom mously seen as a thing which had to be semble a hudm socialized. There was no serious disload factor. I pute in Congress last year as to giving ed up, cost di the government complete control over ould be a min the new industry; the May-Johnson harges, which and McMahon bills both did that. The the output, a fight was over the secondary question of what branch of the government or cost is a larger should exercise the control.

More, the idea is being taken seriously that introduction of such a fundamental new factor into the world's economy is a matter for the organized efforts of the entire human race. The U. S. government is officially sponsoring a proposal to create an entirely novel form of political instrument for international socialization of the atom.

It's hardly surprising therefore, that confirmation of the membership of the Atomic Energy Commission set off a senatorial battle rather more bitter than

that over the basic legislation. The confirmation question gave Congress and industry a second look at the problem after appreciation of the sweeping nature of the issues had become clearer.

The Socialized Industry

By the terms of the McMahon Atomic Energy Act, every phase of atomic activity is under complete government control. Key activity is the manufacture of fissionable material. This is a complete government monopoly. It is illegal for a private person to own any fissionable material or any equipment capable of producing it. Only exception is that equipment capable of producing negligible quantities may be used for research purposes, subject to a government license. All patents in this field are wiped out. No patent can be granted on any dis-covery usable solely in production of fissionable material and any such patents previously existing have been canceled. Moreover, all patents are nullified as far as production of fissionable materials is concerned; any patented article or process may be used without regard to the patent. Anyone who makes a discovery in this area is required to bring it to the commission.

Private ownership of uranium, thorium, or high-quality ores of these materials is still legal, but all dealings in them, once they leave the ground, are subject to a license from the commission. AEC may requisition or condemn such materials or any land containing deposits of them.

Private ownership and operation of devices using atomic energy is also legal -but only if the commission grants a license for them. It's entirely up to the commission whether it will grant a license; no standards are set except the public welfare and security and the maintenance of free competition.

The commission itself may also finance or carry on development of methods to utilize atomic energy. The law says nothing as to how the commission shall handle the applications it develops, except that any power produced may be used by the commission itself, turned over to other government agencies, or sold to public or private utilities under contracts providing for reasonable resale rates.

Either through ownership or through its licensing powers, the Atomic Energy Commission has complete control over the rate and the manner of introduction of nuclear technology



Original University of Chicago pile now at the Argonne National Laboratory

LENGINEE CHEMICAL ENGINEERING • MARCH 1947 •

into industry. And the law leaves the commission almost unlimited discretion. Congress did not intend this situation to be permanent. It's a temporary arrangement until the problems in-volved become clearer. For all its powers, therefore, there is a tentative aspect to every decision of the commission. Essentially it's an interim body, carrying on until the situation has settled down enough to permit long-range decisions. Inevitably, however, the present AEC will be setting patterns, creating vested interests, that can't help influencing the Congress when the time comes for another review of the situation.

The atom is going to be a political issue, and an important one, for a long time to come—taking its place alongside such economic-political questions as public power, taxes, labor relations. The international negotiations on the atom now making their sluggish way through the UN introduce another big element of uncertainty.

Pattern for Operations

Eventually, the AEC will have to deal with a long string of economic and social questions—timing the commercialization of atomic processes, working out procedures, setting priorities, easing the impact on competitive industries, establishing prices. These are still several years away.

The commission is actively seeking answers to a lot of immediate questions. It needs a patent policy based on the novel and still uninterpreted provisions of the McMahon Act; a consulting group of patent experts is working on this now. The commission has a group of leading accountants trying to work out a decentralized financial system for it which will minimize red tape; objective is a large measure of autonomy for individual units within the limits of an annual budget.

On one major point, commission policy is fairly well established. AEC will continue the Manhattan District policy of operating all its plants and laboratories by contract, rather than as purely governmental agencies. When AEC took over, about 50,000 of the atom workers were on contractors' payrolls and only about 5,000 were drawing government paychecks. This proportion is scheduled to decrease if anything.

In some cases the contractual relationship is pretty nominal. The contracting firm may have been especially organized for the job. Or the contractor's connection with the work may hardly extend farther than putting its name on a document and appointing a staff satisfactory to AEC. Here, the



Radioactive isotopes are separated in this unit at the Clinton Laboratories

practical effect may be pretty close to that of a quasi-public corporation. In other cases, of course, the contractors are very much in the picture and are exercising a large voice in policy.

Terms of AEC contracts are still treated as secret. It is known, however, that they are on a non-profit basis cost-plus-nothing or plus a fee of \$1. Cost in these contracts, however, is interpreted rather more broadly than in the standard fee contract so as to protect the contractor against any possibility of out-of-pocket loss.

There's some question how long the non-profit arrangements can be maintained. Many businessmen doubt that the commission can get the wide industrial participation it wants unless it provides for some return to its contractors.

The issue is sharpened by the precautions AEC is taking in an effort to prevent giving its contractors too much of an inside track on ultimate commercialization of atomic energy. Chief among these is the device of an advisory or consulting board for each contractor, representing a range of interested outside firms and assigned definite rights under the contract.

This idea was first developed by the university people who've been working out schemes for administration of research, but it's being inserted by AEC into its contracts with industrial firms. Thus the contract covering General Electric Co.'s operation of the Knolls laboratory not only specifies that members of the advisory committee must be given complete access to this work but also requires G. E. to appoint to its laboratory staff people nominated by the advisory firms up to a maximum of 15 percent of personnel.

As a result, there's a feeling among

some firms that under the present set-up they would be as well off represented on advisory committees as they'd be with all the headaches of actual management. how re dled, I

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Some time in the 1950's the Atomic Energy Commission may turn out to be one of the most powerful economic planning agencies in the federal government. For the present, AEC is a long way from that. It is a research agency, expanding our knowledge of the underlying principles of nuclear energy and learning the technics of applying it.

The commission's research work now centers at four laboratories inherited from the Manhattan District. Three additional laboratories are under construction, and the commission has contracts for specific research projects with more than a dozen universities and research agencies.

The four functioning laboratories are: (1) Clinton Laboratory at Oak Ridge, operated by the Monsanto Chemical Co.; (2) Argonne National Laboratory at Chicago, operated by the University of Chicago; (3) Berkeley Radiation Laboratory operated by the University of California; (4) Los Alamos Laboratory in New Mexico, also operated by the University of California. New laboratories in the works are the Brookhaven National Laboratory being built at Patchogue, Long Island, which will be operated by a group of eastern universities; the Knolls Laboratory at Schenectady, to be operated by General Electric; the Dayton Engineer Works near Miamis burg, Ohio, to be operated by Monsanto.

This assortment of facilities represents the remnants of the bomb project which AEC takes over. There are still



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Synchrotron nearing completion for the Navy at General Electric's laboratories

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r functioning labor linton Laboratory rated by the Ma o.; (2) Argonne N t Chicago, operate f Chicago; (3)] of California; (+ pratory in New !! by the University khaven National ult at Patchogue will be operated stern universitie tory at Schenech y General Electri er Works near J be operated by

ent of facilities ts of the bombp over. There an

firms that under a lot of decisions to be made as to her would be well eventually be handled. But the way policy is shaping on advisory one up suggests that the final pattern will with all the head include these elements:

Pattern for Research

1. The Los Alamos laboratory as a agencies in the lime center for actual weapon development. For the present, Although this is a pretty definitely govfrom that. It is a ernmental job, it will probably conanding our loos time to be operated, at least nomi-dring principles in ally, by the University of California, d learning the two in accord with the AEC administrative policy of avoiding the straight civil ommission's researd service type of set-up.

2. Three or more laboratories operm the Manhattal ated by industrial firms and assigned pretty specific objectives. Thus the General Electric laboratory at the or specific research Knolls is to concentrate almost exclusively on generation of usable power from atomic piles. Monsanto's Clinton laboratory will probably emphasize the chemical problems of pile operation and the production of isotopes. Work to be done at the Dayton works has not been revealed.

Associated with each of these industrial labs there will be an advisory or consulting group of other industrial firms, who will thus be enabled to keep in touch with what is being done and to make what contribution they can.

3. Most of the more fundamental research will center around a group of "regional" or "national" labs. Much of the outside contract research will eventually be handled through them, and they will be intended to guide and finance the bulk of university nuclear research. Argonne and Brookhaven are the two such units approved so far. Another will very likely be formed on the West Coast around the present Berkeley lab. Later there may be a southern lab and one in the northwest.

Central theme at the Argonne lab in Chicago is the design of atomic piles -at a somewhat more fundamental level than the engineering approach involved in the power production program. Immediately engrossing problem is to work out the features and characteristics of piles which run hot, at temperatures in the neighborhood of the 900-deg. level of modern steam plants.

But including and stretching beyond this job are a whole range of problems to be investigated: Relative merits of different moderators such as graphite, heavy water, beryllium. Characteristics of piles using uranium with various degrees of enrichment in U-235 or plutonium. The metallurgy of uranium itself, so little studied before the war that not even the melting point of metallic uranium was known with any precision. Mechanical, chemical and nuclear characteristics of structural pile materials under the conditions of an atomic fire will be studied.

Early indications are that the Brookhaven National Laboratory will focus on basic nuclear research. It will work on such things as the nature of the different sub-atomic particles; the properties of the mysterious "binding force" that holds them together in the atomic nucleus and whose release is the source of the energies of the atom.

If and when a national laboratory is set up on the West Coast it will probably inherit from the Berkeley Radiation Laboratory its interest in the design and construction of particle-accelerators ("atom smashers"). These rank with the atomic pile as principal tools of nuclear research.

Although each of the national laboratories seems destined to evolve or be assigned its own field of concentration, each of them also serves a second function—as a regional center for the nuclear research carried on in all the neighboring universities and research institutions.

In the first place each laboratory will be a pool of equipment for the universities. Negotiations are now in progress between AEC and the military services to insure that in future most major government-owned equipment will be centralized at the labs, where it will be available to a broad group.

In general government financing of university atom studies will channel through the regional labs. AEC will not simply farm out to the universities work it wants done; it will also help finance almost any worthwhile research in the field.

The Regional Role

At each of the labs there will be at least three different levels of work under way: First will be the research carried on by the permanent laboratory staff. This is where the field of concentration of the particular laboratory will have most influence. Second will be so-called "sponsored" programs of research. These will normally originate when someone on a university staff brings in a line of work he'd like to undertake-and the work seems to fit rather definitely into the AEC program

Still a third will be when one of the universities might bring in a job of research which involves the principles or the equipment of nuclear physics but has no very clear connection with AEC work. Then, if the project looks sound from the scholarly point of view, the lab might make it a "participating" project.

This whole system, still in an early and somewhat tentative stage, has been drawn in terms of university problems. Little thought has yet been given to the possibility of use of the regional laboratories by industrial researchers.

Although the national laboratories have both a national and a regional role, it's their regional function that has dictated their administrative arrangements. Within very broad limits, the labs will be run, their policies and programs will be determined, by

the neighboring universities. Legalistically, this can take several forms. Brookhaven is to be run by a specially-formed corporation - Associated Universities, Inc .--- organized by nine eastern universities. Because the midwestern state universities lack legal authority to organize corporations, the requirements based on 1,000 lb. of vinyl chloride polymer are approximately 450 lb. of acetylene and 640 lb. of hydrogen chloride. The latter is most suitably produced by the direct reaction of hydrogen and chlorine.

The most convenient and economical process for the production of vinyl chloride involves the chlorination of ethylene to produce the dihalogen substituted ethane. This is followed by dehydrohalogenating with alcoholic potash. The raw material requirements based on 1,000 lb. of vinyl chloride polymer are approximately 470 lb. of ethylene and 1,200 lb. of chlorine.

Variety of Vinyls

Vinyl Chloride-Vinyl Acetate Co-Polymer Resins—The two monomers may be co-polymerized to form an extremely versatile group of resins. The commercial co-polymer resins contain 80 to 95 percent of vinyl chloride. These co-polymers have various fields of uses depending on the vinyl acetate content; however, the resins containing higher percentages of vinyl chloride predominate.

Vinylidene Chloride Polymers— Vinylidene chloride monomer (1,1dichloroethylene) is conveniently prepared by the reaction of 1,1,2-trichloroethane with aqueous alkali. The vinylidene chloride monomer is then polymerized to form resins.

Commercial vinylidene chloride polymers usually contain small quantities of additional monomers; for consumption estimates however, a basis of pure polymer is assumed. Consumption requirements for 1,000 lb. of polyvinylidene chloride resin would include approximately 375 lb. of ethylene and 1,760 lb. of chlorine.

Polyvinyl Alcohol—This compound is obtained commercially by saponification or alcoholysis of polyvinyl acetate. The alcoholysis reaction is generally alkali catalyzed and is an ester interchange.

Commercial polyvinyl alcohols are produced in varying stages of hydrolysis and for the purposes of estimating consumption requirements a 90 percent hydrolyzed product is assumed. This type of alcohol polymer represents an average grade and indicates that 90 percent of the ester linkages have been replaced. The production of 1,000 lb. of 90 percent hydrolyzed polyvinyl alcohol would require approximately 1,800 lb. of polyvinyl acetate and 790 lb. of methanol. This type of polymer involves the use of polyvinyl acetate as an intermediate raw material.

Polyvinyl Acetals-Polyvinyl acetal resins are a generic group of materials

including the condensation products of polyvinyl alcohols and simple alde-These reactions are acid hydes. catalyzed and essentially involve the reaction between two alcoholic hydroxyls and the oxygen of an aldehyde. The reactions, as carried out commercially, may either be sequential or simultaneous depending upon whether or not polyvinyl alcohol is isolated from the primary reactions. The methods of producing these aldehyde The resins indicate another example of the use of polyvinyl acetate as a resinous intermediate.

A wide range of commercial acetal products are produced depending on the type of aldehyde used, degree of alcoholysis and degree of condensation. In 1944 the production of these materials was stated to be approximately 15,000,000 lb. and their largest outlet was in the manufacture of safety glass and for the coating of fabrics.

The resin from the polyvinyl alcohol prepared by essentially complete hydrolysis of polyvinyl acetate of medium viscosity with a subsequent condensation with normal butyraldehye is the polyvinyl acetal of largest commercial importance and production. This is the type used as the interlayer for safety glass. The commercial butyral resins contain less than 3 percent vinyl acetate and between 65 and 75 percent of the hydroxyl groups acetalized.

On the basis of a polyvinyl butyral resin with an average of 70 percent aldehyde replacement of the hydroxyl groups and a neglible vinyl acetate content the production of 1,000 lb. of this polymer type would require the approximate consumption of 650 lb. of polyvinyl acetate, 465 lb. of methanol, and 400 lb. of butyraldehyde. If the entire production were assumed to be polyvinyl butyral the total consumption requirements, on the basis of a 15,000,000 lb. annual production would be approximately 9,600,000 lb. of polyvinyl acetate, 7,000,000 lb. of methanol and 6,000,-000 lb. of butyraldehyde.

A reasonable estimate for the production of polyvinyl alcohol polymers in 1944 would be 3,000,000 lb. Here again it must be borne in mind that the various resins being made commercially range in degree of hydrolysis from 43 to 98.5 percent. It is felt, however, that in view of the relatively greater importance of the almost completely hydrolyzed alcohol resins the basing of unit consumption requirements on a 90 percent hydrolyzed resin is valid.

By far the largest individual monomer production was that of vinyl chloride and this resulted in a correspondingly large production of polyvinyl chloride and polyvinyl chloride acetate co-polymer resins. The production of vinyl chloride was assumed to be in the neighborhood of 70 to 75 million pounds which would lead to total resin production of approxmately 85 million pounds of polymer and acetate co-polymer. The total production of vinyl acetate monomer for all purposes was approximately 50 million pounds for 1944.

On the basis of estimated total production and the unit chemical requirements the total chemical demands of the vinyl resins are summarized below. The unit figures were based on average yields and consumption data and suit able conversion factors were then calculated. The conversion of unit requirements to approximate total requirements was made on the basis of estimated total individual resin production.

Chemical Requirements

A summary of the chemical requirements for vinyl resins in millions of pounds is as follows: Acetylene and ethylene, on acetylene basis and includes factor for acetic acid production, 70; HCl and Cl_2 , 49; aldehydes, 5½-6; methanol, 7.

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The above figures will show the magnitude of the chemical market that has been created by the vinyl resins. The approximate consumption require ments as shown by the above totals do not include miscellaneous raw materials which are used at various points in production. In addition, no estimates have been made for compounding ingredients used in processing the vinyl resins. This latter group, while extremely difficult to break down into component totals represents a considerable chemical market. Plasticizer requirements alone for the vinyl resins will approximate 50 million pounds based on 1944 resin production. Other necessary formulating agents such as pigments, heat and light stabilizers, fillers, lubricating compounds, waxes and miscellaneous requirements will account for possible another 20 to 30 million pounds.

Production figures for the vinyl resins for 1945 and 1946 were recently made available. These figures, based on statistics compiled by the Bureau of Census, present an interesting picture of the relative position of the vinyl resins in our present economy. The vinyl resin production for 1945 was 122,000,000 lb. and for 1946 was 145,000,000 lb.

In attempting to estimate 1947 vinyl resin production certain factors must be considered. Disregarding the somewhat confused and unbalanced and polyvinyl mer resins. yl chloride was neighborhood ounds which in production d million pounds a te co-polymer. a of vinyl acetate a upposes was approximition wounds for 1944. e basis of estimated ne total chemical der resins are summits t figures were based of id consumption data iversion factors were The conversion nents to approximit nts was made on the ed total individual a

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Raw material flowsheet for vinyl resin production

state of the present market situation, 1947 will be the first normal production year since before the war. With the return to peacetime production the state of regular civilian markets will determine the quantity of resin produced. Estimates for 1947, based on expansion plans announced by the industry, indicate a vinyl resin production in excess of 200,000,000 lb. Exactly how much the production will exceed 200,000,000 lb. will depend almost entirely on the plasticizer situation. At the present time this is the primary bottleneck and the outlook for the future does not appear too promising. The seriousness of the situation becomes quite apparent when it is considered that 30-40 percent of plasticizer is required for every pound of vinyl compound processed. In 1946, approximately 50,000,000 lb. of plasticizer were used for the 145,000,-000 lb. of resin produced. With an appreciable increase in resin produc-tion contemplated for 1947 there should also be an increase in plasticizer production. Estimates for 1947 plasticizer production indicate approximately 70,000,000 lb. will be produced. Of this total 20-25 million pounds will be absorbed in the production of cellulose acetate plastics. The re-mainder, available for vinyl resin compounding, hardly seems adequate. It is therefore quite apparent that strong consideration of the plasticizer picture is necessary.

Plasticizers

The primary raw material for the better grade ester-type plasticizer is phthalic anhydride. Phthalic anhydride is esterified to the various phthalate plasticizers. The possibility of any substantial increases in phthalic anhydride production for 1947 are very unlikely. The contemplated production of phthalic anhydride from petroleum sources does not appear to be able to reach projected capacity in 1947 and normal suppliers have not indicated any appreciable expansion plans.

In addition to phthalic anhydride other shortages are besetting the suppliers of plasticizers. Dioctyl phthalate, the most widely used vinyl plasticizer with a normal production of approximately 30,000,000 lb. per year is being affected by shortages in octyl alcohol (ethylhexyl alcohol) in addition to phthalic anhydride. The production of tricresyl phosphate, another widely used plasticizer, is affected by a shortage of cresylic acid.

Plasticizers based on fats and oils sources do not help the picture any. Various castor oil derivatives such as the sebacates are in an unfavorable price position and their use is thereby limited. Other fatty acid type plasticizers are generally of the secondary type and have limited applications to a greater or lesser extent. Plasticizers based on petroleum derivatives, while quite interesting from a cost standpoint, have severe limitations as to their use. The general shortage of first rate plasticizers is of considerable importance in spite of the relative availability of other plasticizing materials. In order to compound the vinyl resins properly, suitable ingredients must be used. With proper plasticizers unavailable, there is a tendency toward indiscriminate use of substitutes, with a consequent detrimental effect on the finished plastic.

An interesting adjunct to the analysis of the chemical requirements of the vinyl polymers is the effect of present research and developmental trends on the future raw materials picture. The vinyl resins as a whole have been firmly established as important industrial materials and the market they have created will be a permanent one notwithstanding individual material changes. In this respect it would appear that the future increases in resin production will be, for the most part, in the vinyl chloride and chloride copolymer class. This is based on their relative price position and cost potential. In addition they are the most versatile of the group as a whole and will therefore find the greatest use. The vinyl acetals are in an unfavorable position regarding their cost and as a consequence will be relegated to specialized uses with polyvinyl butyral maintaining its position primarily because of its outlet in the safety glass field where it stands supreme. The possession of unique and superior properties will also result in the increase of production of the vinylidene chloride polymers. Their greatest outlet undoubtedly will lie in the field of oriented filaments.

Acetylene

With reference to the vinyl group as a whole, the raw material question however merits quite a bit of attention. It has been shown that all of the vinyl resins may be considered to be derivatives of either vinyl chloride or vinyl acetate. As such we can then go back one more step and consider acetylene and ethylene as the source of these monomers. With the present acetylene based almost entirely on calcium carbide the choice of either acetylene or ethylene would appear, at present, equivalent to choosing either coal or petroleum as the primary raw material. The production of calcium carbide is strongly influenced by locational and power factors and in a similar manner ethylene is also subject to these influences. The present tendency toward the stronger consideration of acetylene as an organic raw material has placed no little emphasis on the possibilities of making cheaper acetylene from petroleum or byproduct gases.

Acetylene is a potentially large scale petroleum derivative and its manufacture from byproduct gases has been considered for many years. One of the strong factors that has placed the raw material possibilities of acetylene in the recent limelight has been the wartime achievements of the German chemical industry. The motivating factor for the German emphasis on acetylene chemistry was their lack of petroleum and natural gas. Although this situation does not exist in the United States it nevertheless poses a problem of considerable interest.

For many years the desiderata of research programs has been the develop-(Continued on page 120)





mal fabricators' tolerances in both the diameter and the length are usually permitted. Exact maximum and minimum tolerances allowable should be specified by the customer.

Specifications

Welded Steel Tanks—Use of the ASME Code for Unfired Pressure Vessels is recommended for the specification of material, fabrication and inspection requirements for welded steel tanks as illustrated in Fig. 1.

Riveted Steel Tanks—Use of the API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases is recommended for the specification of material, fabrication and testing of riveted steel tanks fabricated in accordance with Fig. 3. Exceptions to the aforementioned codes may be made when relatively low working pressures are encountered.

Head and Shell Thicknesses-The head thicknesses and the shell thicknesses indicated on Figs. 1 and 3 are suitable for most above-ground serviccs when installed under the regulations of the National Board of Fire Underwriters, a representative state code (Commonwealth of Pennsylvania), and the ASME and the API-ASMÉ codes. This is a general statement and is not intended to preclude more thorough investigation when severe service conditions and regulations are encountered. Conversely, under service conditions and regulations of sub-average severity, it is logical to assume that a nominal reduction in head and shell thicknesses may be made. The savings in weight by such reductions may assume proportions of importance on large orders. Greater plate thicknesses should be specified for tanks designed for corrosive service. Underground storage tanks should, as a rule, have plate thicknesses of not less than ¹/₄-in.

Standard Heads—Designs as outlined on Figs. 1 and 3 are based on the use of the so-called "standard flanged and dished heads." This is not a definite specification since the several mills producing such heads have varying dimensions for the lengths of the straight flanges, and the knuckle and crown radii. However, this general specification usually permits the ready availability from existing stocks. For a reasonable degree of uniformity, it is suggested that the following specifications be employed:

"(No. reqd.)—_in. outside diameter by _in. thick standard flanged and dished heads having straight flanges of not less than $1\frac{1}{2}$ -inches, knuckle radius of not less than three times the head thickness, and inside crown radius equal to the nominal diameter of the heads."

Nozzles And Connections

The number, size, type and locations of nozzles are variables which must be decided upon only after careful consideration of all the factors involved. Codes and regulations are important factors, as, for example, in certain restricted locations and under certain other special conditions, liquids having flashpoints below a given temperature may not be drawn from storage by gravity, but must instead be drawn by suction from the top of the tank. Inclusion of manholes is usually mandatory. Tapped connections into manholes and branch connections at nozzles between tank and shut-off valves frequently are prohibited. Code requirements may also affect types of gaging devices, vent sizes, and the use of flame arrestors and safety devices.

Factors affecting liquid flow rates must be considered in determining nozzle size. These include liquid viscosity and whether the tank is to be filled and emptied by gravity or by use of pumps. Nozzle Location and Design—Location of nozzles is considerably influenced by the type and location of tank supports, and shell seams. The number, size, and the location of nozzles shown on Figs. 1 and 3 will be found suitable for average conditions. The sizes are proportioned to the tank capacity. Locations permit the use of concrete saddle supports as shown on Fig. 5. Possible interference between nozzles and shell seams should always be checked.

Use of lapped-type flanges and lapped joint stub ends for welding, as indicated on Figs. 2 and 4, is recommended because of their high strength, their neatness, and the ease with which they may be aligned before welding. The ability to turn the flanges freely after the nozzles are installed, and the fact that the flanges have American 150-lb. (or 125-lb.) standard drilling are decided advantages.

Fig. 2 shows a typical nozzle detail using the lapped flanges and stub ends for welded tanks. Fig. 4 shows typical nozzle details using lapped flanges and stub ends for riveted tanks. Where shops are equipped for the fabrication of riveted tanks, but are not equipped for welding, it is possible to have the stub end welded to the riveting flange in another shop. Otherwise, the two typical details may be entirely optional, either on the part of the customer or the fabricator.

As a rule, the use of couplings and other screwed-type fittings for tank connections should be discouraged since damage to threads resulting from making and breaking connections, as well as from corrosion, frequently necessitate costly replacements. There are, however, numerous types of tank nozzle fittings, both screwed and flanged, for welding or riveting, and of the prefabricated or shop built-up types. In certain cases some of these

(Continued on page 120)

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CASEIN FOR BRUSH BRISTLES

EDITORIAL STAFF

USE OF SYNTHETIC BRISTLES FOR BRUSHES IS FURTHERED BY DEVELOPMENT OF PROCESS FOR MAKING CASEIN BRISTLES

OR GENERATIONS brushes have been made from badger, hog, horse and other animal hairs. More recently there has been a trend toward supplementing these with synthetic bristles, due in part to the difficulties of securing these natural hairs in wartime, and to the recent important developments in synthetic fibers; already nylon and one or two other filaments have been adopted for use in regular lines of paint brushes. And now comes announcement of the successful production of bristles from casein. At Salisbury, Md., the Rubberset Co., of Newark, N. J., is making the new bristles and experimenting with their use in paint brushes. While the present facilities are turning out a fair size output the process is still in a state of development. It is possible that other proteins may be substituted for the present raw material if any should be found to result in superior bristles.

Characteristics

Present casein bristles are round and have a black color comparable to that of horsehair or hog bristles. Like any synthetic fibers, they can be produced in any length desired and in any diameter. The casein bristles are particularly adaptable to the construction of paint brushes since they are resistant to oils and organic solvents. While casein bristles are untapered they have good paint-carrying capacity, make smooth films, and have satisfactory wear resistance. They have been found to be stable in air under ordinary conditions and have been kept for several years without deterioration.

Synthetic resins have not only formed a new industry, but in addition are branching out into many established industries where they are taking the position long held by other materials. It was only a short step from the field of fibers to bristles. Nylon got a start several years ago in tooth brushes and today is probably used in nine out of every ten. Now comes the successful production of casein bristles that are particularly adaptable to the construction of paint brushes. No doubt other resins will find their way into the field of bristles for here is an industry that has long been bandicapped by having to depend on Russia, China and other distant sources of raw materials.

The process in use at Salisbury consists of mixing casein and a dilute solution of hydrochloric acid, extruding into air while hot, and then stretching and hardening with para benzoquinone.

Bags of casein (containing 8 percent water) are emptied into mixers where a dilute solution of hydrochloric acid is slowly added while the mixer is running. The strength of the acid solution is subject to change depending on the pH of the lot of casein being used. It adjusts the pH of the crumb to the desired point of 4.65. The water swells the casein and is absorbed forming crumbs. The crumbs are mixed after the solution is added, then allowed to stand for aging. They are then dumped into a granulator equipped with 12-mesh screens. Granulated casein, containing at this point the proper percent water, is put into galvanized barrels and covered. It is now ready for extrusion.

The screw-type extrusion machine consists of a hopper equipped with stirrer, a jacketed pipe about 6 ft. in length through which passes a screw, and the spinnerette. Casein enters the hopper and slowly feeds down into the screw. The barrel of the extruder is equipped with hot and cold zones. When the casein reaches the end of the screw it is forced through the spinnerette by the ejector screw under controlled pressure. The spinnerettes have 40 holes. The holes in some spinnerettes are of 0.006 in. diameter; in others, they are as large as 0.010 in. The 40 filaments on leaving the spinnerette form a tow and pass through an anti-stick bath tank. The solution is fed continuously into the vessel by gravity from a tank above.

From this point the tow goes to the stretching tank, a long shallow vessel under a hood. While in the tank the tow passes over and under stretching rollers. The last submerges the filaments in the bath. The





Screw-type extrusion machine on far end holds the spinnerette. Filaments form a tow which passes through anti-stick bath and stretching tank in foreground

Stretched tow is taken through eye of oscillating guide arm and wrapped around one of two take-off drums on rack at end of machine



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stretched tow is taken through the eye of the oscillating guide arm and wrapped around one of the two take-off drums on the rack at the end of the machine. Tanning Bath

Skeins of continuous filaments from 20 reels on rack are

formed into a larger tow and pass to tanning bath

The bath is a water solution of quinone held at a constant temperature. It is circulated continuously from a sump tank where it is strained into another tank equipped with heating coils which hold the temperature constant. A float valve controls the level of the solution in the sump, opening a water valve when necessary. The quinone tanning bath increases the durability of the fibers and darkens the color. Fibers are stretched in the quinone bath in order to obtain the greatest strength consistent with maximum flexibility. Stretching also increases the wet strength and slightly decreases water absorption.

Full reels are stored temporarily in

a cabinet and as needed are removed and placed on the semi-circular rack holding 20. Skeins of continuous filaments from the 20 reels are formed into a larger tow and pass to the tanning bath.

The tanning machine is 20 ft. long, and is composed of an upper and a lower shallow tank of solution. The tow passes back and forth through the upper tank and then through the lower. Pulleys are graduated in size so as to bring about further stretching of the filaments. This machine is made of stainless steel and above it is a hood to carry away the obnoxious fumes. The tanning solution is similar to that used in the earlier para benzoquinone bath and like it is kept at a constant temperature and in constant circulation.

On leaving the tanning machine the tow of what has become brown filaments passes through a lubricating bath, which gives the filaments a glossy coating, and then between rolls in order to remove excess coating before passing into the dryer.

After passing through tanning bath tow goes to dryer

which is heated by steam and electricity

The dryer is 12 ft. high and temperature is held constant by a combination of steam and electricity. A fan circulates the air in the dryer, and means have been provided for carrying off the vapors. A tow of filaments passes from bottom to top of the dryer numerous times. When drying is completed it is wound onto large fiber reels until between 13 and 14 lb. have accumulated. The heat of the dryer converts the brown color of the casein filaments to a black. The fliaments are removed, cut into short lengths and stored, ready for making into brushes of many types.

Materials of Construction

Practically the entire equipment including the spinnerettes is made of stainless steel which is required to resist attack from the combination of chemicals handled during processing.

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FUME SCRUBBER Effective on Linseed Oil Kettles

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ELIMINATING FUMES FROM THE HEAT- OR AIR-BODYING OF LINSEED OIL IS A TOUGH PROBLEM. A PEASE-ANTHONY SCRUBBER LICKED IT

F elimination of the fumes from the heat treatment of oils and varnishes^{1, 2} has received the periodic attention of manufacturers of these products. It has been the object of numerous patents and devices,³⁻²⁰ some "home made" and others designed by companies specializing in dust and fume removal systems.

The linseed oil fume problem has persisted until the present time, probably because there has not been any adequate equipment generally known for entirely satisfactory elimination. Consequently, in many instances, manufacturers and their neighbors have had to be content with whatever improvement has been attainable.

The Problem

A microscopic examination of the visible fume from the "heat bodying" of linseed oil indicates that it consists of oily liquid droplets suspended in the air stream and that approximately 95 percent of them, by weight, consist of liquid droplets 5 to 25 microns (averaging 10 microns) in di-

ameter, and the remainder, droplets of one micron in diameter and smaller. Fume from the "heat-" or "air-bodying" of linseed oil contains acrolein which is so extremely irritating that its presence can readily be detected by the human nose, which, incidently, served in this investigation as a test of its presence or absence. One fortieth part of acrolein per million parts of air will cause irritation and induce slight necrosis." It irritates the mucous membranes of the eves, nose and throat, and has a nauseating effect. Because of the sensitivity of the eyes and nose to acrolein, even the diffusion of the fume by means of a 75 ft. stack has been found insufficient at times to reduce the concentration to a non-irritating degree. This condition is particularly aggravated on dull, windless days when the heavy character of the fume allows it to drop down from the stack top.

Thus, it is obvious that some form of fume elimination equipment should be used and that available equipment should be investigated for ways and means to improve its effectiveness and efficiency.

Fumes given off during the "heat-" or "air-bodying" of linseed oil are unusually irritating and unusually difficult to eliminate. For many years, attempts at control have met with only indifferent success. Recently the National Lead Co. put a Pease-Anthony scrubber on the job and got excellent results. The detailed account of their experiences indicates that other difficult fumes may be controlled by similar means, Means for the complete elimination of all types of fumes were beyond the scope of this investigation. However, as the elimination of linseed oil fume is one of the most difficult fume problems, it is possible that other fumes can be controlled or eliminated by the same or similar means.

Survey of Methods

Two methods, burning and scrubbing, were seen as possibilities for handling the problem.

The first, that of burning the fume,²² would insure 100 percent elimination. The fume laden air is usually blown into the firebox of a steam boiler, kettle or other equipment not requiring close regulation of the air supply or of combustion, but in the present instance no such means were available. As far as could be learned, the burning of the fume in specially designed incinerators was still in the experimental stage. In the installation then being studied, it was esti-mated that 1,000 lb. of fume laden air would contain only 1 to 5 lb. of oil fume. Because of the large excess of air that must be heated to the ignition temperature (above 500 deg. C^{1}) of the oil fume content, the operation was considered uneconomical and further consideration of this method for linseed oil fume elimination was then abandoned. However, where the quantity of air mixed with the fume can be considerably reduced without effect on the oil treatment, it is possible, though improbable, that further investigation will show that the fume can be burned economically during the period of copious fume CR Kettles

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generation. This is based on the assumption that the fume has no value as a byproduct.

Second method, that of scrubbing the fume laden air with water, is well known and is most generally used. However, the completeness of the fume removal has evidently not been entirely satisfactory, probably for the following reasons: (1) Improper design for handling this type of fume, (2) poor efficiency in the utilization of the water, and (3) limitations due to the cost of equipment and water.

Nevertheless, as it seemed to be the more economical under the circumstances, it was decided to investigate some form of fume scrubber using water and attempt to increase its effectiveness and efficiency without exceeding a reasonable cost for water and power.

There are various ways of utilizing the water for fume removal, such as: (1) For cooling surface condensers through which the fumes are passed, (2) in countercurrent absorption towers packed with various types of packing materials, and (3) for impacting the fume particles by water jets or sprays.

The first is very inefficient because the fume particles are dispersed in large volumes of air and the air interferes with the fume particles getting into contact with the cold surface of the condenser. The second, which is most commonly used, tends to be inefficient because the very fine particles of fume pass through the interstices of the usual type of wetted packing without contacting it to a sufficient extent. There is also a strong possibility of channeling which reduces the effectiveness of the packing. Because of the gummy character of the cool congealed fume, it resists washing out and, in time, cements the packing into a solid mass. The third method, believed to be the most efficient, was the one selected at the time for further consideration, utilizing water sprays of various designs.

Several designs of the water spray type scrubber were studied. Because of the scientific explanation of its functional operation given in the literature, attention was particularly attracted to the Pease-Anthony type of scrubber. Further study¹⁵⁻¹⁷ and inquiries indicated that this scrubber, if it could be adapted to the handling of linseed oil fume, would operate effectively and efficiently.

As explained in the literature,^{25, 18} the scrubber causes the fume to rotate rapidly in a cylindrical chamber, forms a suitable spray or fog of fine liquid particles in the region of the axis of

the cylinder, and causes these particles to traverse the fume radially until thrown out against the wall of the chamber by the centrifugal force of the rotating mass of fume. The rotation is produced by introducing the fume tangentially near the bottom of the chamber, as shown schematically in Fig. 1. The radial motion of the water particles across the fume stream causes them to collide with the fume particles and carry them to the walls from which they are washed and discharged from the scrubber.

After some preliminary tests of other equipment, it was decided to concentrate upon the Pease-Anthony scrubber because it seemed to have the

Below — Complete installation for eliminating fume from linseed oil kettles. A, heat-bodied fume duct; B, airbodied fume duct; C, tangential inlet; D, Pease-Anthony scrubber adapted from old fume washer already in place; E, exhaust for scrubbed gas; F, blower; G, stack. Right—Close-up of tangential

inlet to scrubber

greatest possibility of achieving practically complete elimination.

Pilot Unit

At the start of the investigation, an experimental unit with a rated maximum capacity of 600 cfm. was obtained and set up near a 1,000 gal. kettle in which linseed oil was being heat bodied at about 580 deg. F. Varying volumes (200 to about 450 cfm.) of the estimated 2,400 cfm. of fume then being produced by this kettle were withdrawn from the fume hood through a 4-in. flexible metal hose and blown into the tangential inlet of the experimental scrubber.





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Fig. 1—Pease-Anthony scrubber

Later, in the plant sized scrubber, the fumes were exhausted through the scrubber.

The pilot scrubber consisted of a cylindrical shell of 17-in. dia. and 52 in. height with a tangential inlet at the bottom and a centrally located outlet at the top. It was made in two detachable sections for ease in getting at the spray nozzles, which are screwed into the centrally located, vertical, 14-in. header pipe. Using eight or more nozzles, 8.5 to 12 gpm. of water or oil solvents were sprayed into the scrubber at pressures between 60 and

Fig. 2—Arrangement of equipment used for the elimination of fumes from the heat treatment of linseed oil



120 psi. The volume of the fume being scrubbed was controlled by a blast gate on the blower and a swinging damper in the tangential inlet of the scrubber.

While kerosene and Gulf Oil No. 896 were tried out as spray mediams, most of the tests were run with city water, as it was readily available in quantity not requiring recirculation. It was found that all the spray mediums, when recirculated, seemed to become saturated with the irritating acrolein vapor in a short time. Other advantages in the use of water were its relative cheapness, absence of fire hazard, solubility of the acrolein in water (40 gm. per 100 c. c. water), and the ease of disposal of the fouled Recirculation of the spray water. medium was also found to be undesirable because certain insoluble gummy constituents of the fume tended to pass through the water strainer and plug up the orifices of the spray nozzles. Although numerous solvents were tried, none was found in which all the constituents of the fume were completely soluble. Moreover, such a solvent would probably be too expensive even if it were to be stripped and recirculated. The use of water soluble reagents and wetting agents was found impractical.

The minute droplets of water apparently accomplish their purpose by impact with the fume particles or, in the case of acrolein vapor, by solution. It is quite evident that the greater the pressure on the spray nozzles, the finer is the atomization of the water, with more of the smaller droplets and fewer of the larger drops. In the atomization of the water, it is important that practically all the spray droplets be smaller than about 100-200 times the diameter of the smallest fume particles to be removed in order to overcome the tendency of small particles to streamline around large droplets. Efficiency of fume removal appeared to be increased by longer time of scrubbing, by finer atomization of the liquid, by higher liquid-to-gas ratios, and with some slight increase by the use of higher spin velocities.

It was planned that each volume of fume laden air was to be swept with spray about four times in order to attain a calculated efficiency of about 98 percent fume removal.

Final tests with the experimental scrubber indicated that it would scrub about 325 cfm. of fume laden air satisfactorily, using 8.5 gpm. of water at 120 psi. It was estimated that the entering velocity of fumes through the tangential inlet, dampered down to an opening 1 in. wide by 3 in. deep, was about 15,600 ft. per min. which, after picking up and spinning 8.5 gpm., gave a resulting velocity of fume and water spray of about 4,000 ft. per min. At this velocity the centrifugal force exerted on the particles would be approximately 200 times gravity. The vertical component of the velocity in the 17-in.. scrubber of the 325 cfm. of fume laden air passing through it is calculated to be (325)/(1.57 sq. ft.), or 207 ft. per min.

From these data, calculations were made to determine the dimensions of a scrubber needed to further study, in another plant, the elimination of all the fumes from two 1,000-gal. kettles heat-bodying linseed oil and from two 1,200-gal. and one 1,000-gal. kettle air-bodying linseed oil, arranged as illustrated in Fig. 2.

Full Scale

From observations and tests, it was realized that the more the actual fume droplets were dispersed by large volumes of air, the more difficult would be the elimination of the fume. Later, success was achieved in reducing the initial quantity of air sucked in with the fume without interfering with customary kettle operations. However, at the time, it was estimated that a total of about 2,000 cfm. of all fumes would have to be handled by the scrubber. From the vertical component of the fume velocity (207 ft. per min.) in the 17-in. experimental scrubber when handling 325 cfm., it was estimated that a scrubber of approximately 4-ft. dia. would be required for 2,000 cfm. However, as an old countercurrent fume washer, 6-ft. dia. by 14 ft. 4 in. high, was already available in place at the site, and new equipment being difficult to ob-tain, it was decided to adapt this washer to the Pease-Anthony design even though the effect of the larger dimensions could not be predicted. A tangential rectangular inlet was fabricated and welded into the side of the scrubber. The air and heat-bodied fumes were brought into this inlet by 12-in. ducts welded into the larger ducts that formerly conducted the fumes to the stack or to the old fume washer. The photographs show the complete installation.

Fumes entered the scrubbing chamber at high velocity through the narrowed opening of the tangential inlet, the swinging gate type damper regulating the width of the opening to produce the required velocity to "spin out" the water spray and prevent entrainment. On account of the type
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and condition of the exhauster available for use, it was not possible to increase its speed sufficiently to build up the centrifugal force of the swirling fumes in the 6-ft.-dia. scrubber to the same extent as had been possible in the experimental scrubber. As the inlet area was decreased to build up velocity, the throughput of fumes decreased because of the greater re-sistance to the flow. Thus, with the exhauster running at 1,380 rpm. and handling 2,000 cfm., the greatest velocity attainable was 9,870 ft. per min. which, after picking up 25.5 gpm. of water spray and accelerating it, gave a resulting velocity of 4,084 ft. per min. and a centrifugal force of only about 48 times gravity as compared with 200 times gravity in the experimental scrubber. However, there was no observable entrainment of water spray in the air leaving the scrubber because of the ample time for the centrifugal forces to act, afforded by both the low (about 71 ft. per min) vertical component of the fume velocity in the scrubber and by the ample height (8 ft. 4 in.) of the spin-out zone between the "core-buster" disk

and the top of the scrubber. For the plant sized installation provision was made to supply about 25 to 30 gpm. of water spray from 32 nozzles at 150 psi., and for most of the scrubbing operations this proved more than sufficient. Time and other conditions did not permit determination of the minimum amount of water needed for the various types, quantities and densities of the fumes. The main effort was turned toward the practically complete elimination of the fumes and, in that, success was achieved. This may have been due in considerable measure to the reduction of excess air in the fume as well as to reduction of the originally estimated 2,000-cfm. throughput. That such is the case is indicated by the following data when 840 cfm. of fume

ATOMIC ENERGY (Continued from page 100)

for extraction of plutonium and is now the center for manufacture of radioactive isotopes.

Newest project at Clinton is the construction of a high temperature pile for power generation-the first such project to be announced. There's never been any public definition of the division of effort between Clinton and the Knolls on power generation. As a matter of fact there's plenty of

laden air was handled using the same amount of water as would be used for 2,000 cfm. Also, the decreased capacity, by lowering the vertical component of the fume velocity, increases the time during which the fumes are in the scrubbing zone.

Ferformance

The following data are indicative of the results obtained when scrubbing all the dense fumes from two 1,000gal. kettles heat-bodying 2,000 gal. of linseed oil at 580 deg. F.

Well water used, gpm	25	
Pressure on spray nozzles, psi	155	
Exhauster suction, in., w.g	11.15	
Exhauster discharge pressure, in., w.g	0.12	
Linseed oil temp., deg. F	580	
Fume temp. scrubber inlet, deg. F	165	
Suction on 12-in. pipe to scrubber, in., w.g.	0.25	
Calculated vol. gases discharged, cfm	840	
Odor of scrubbed gases discharged Non-irritating		
Temp. scrubbed gases, deg. F., dry bulb.	73	
wet bulb	72	

While unscrubbed oil fumes appear white and quite dense, the appearance of the scrubbed gases of this test, discharging from the stack, was so faint that they barely could be detected when viewed against the black background of a nearby stack. This was sufficient indication that elimination was satisfactorily complete. At the same time, by smelling the discharged gases, it was evident that the exceedingly irritating acrolein had also been satisfactorily eliminated. In the air-bodying of linseed oil at temperatures of 150 to 260 deg. F., the fume seems to be mostly acrolein vapor with a slight amount of oily spray entrained during the violent aeration. Because of the considerably larger volume of the irritating acrolein, this air-bodied fume is far worse than fumes from the heat-bodying treat-ment as judged by experience with very low concentrations of the two types of fumes. No difficulty was ex-

room for parallel activity without duplication. The researchers are anxious to try out dozens of different types of pile.

But perhaps it can be assumed that Monsanto's background will be especially valuable in dealing with the chemical problems of uranium and plutonium circulation through the pile and extraction of fission products.

At any rate, it's along those lines that Monsanto foresees an eventually profitable role for itself in the atom business. It's convinced that there will have to be room eventually for proprietary rights in nuclear discoveries.

perienced by the scrubber in eliminating acrolein fumes from the regular air-bodying treatment of linseed oil.

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And though Monsanto may never operate commercial piles, there's always the possibility of a commerce in ideas similar to the substantial business the company now does in licensing chemical processes.

Again, there's the whole littleexplored field of application of radiation to chemistry, which it should pay a chemical concern to be in on. In the pharmaceutical field, in which Monsanto is closely connected, there'll be work to do in synthesizing complex compounds containing radioactive elements for medical tracer or therapeutic use.

INSULATING UNHOUSED PLANTS

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NEW TECHNIQUES AND MATERIALS, PARTICULARLY BLANKET TYPE MINERAL WOOL, PROMOTE THE TREND TOWARD OUTDOOR PLANTS

THE so-called "outside" plant—in which most, if not all, processing operations are unhoused, without walls and roofs for weather protection -are being found increasingly economical. Indeed, the evolution is sufficiently clear and general to be called a trend. Such equipment as lime kilns, coke ovens, blast furnaces, and refinery stills have long been out under the sky, but now we find acid plants, certain units for synthetic fiber and rubber production, power generating plants, wind tunnels, and numerous other chemical and mechanical engineering operations taking to the open air. Nor is the trend confined solely to winterless southern climates, where, of course, the development involves even wider ranges of production. Today's processing equipment can take wind, ice, rain, dust and sunshine, all in its stride.

Two other trends have made possible the trend toward outside plants. First, process control is becoming increasingly automatic, so that men need not roam all over the plant site, but can remain principally in small nervecenter structures housing only the controls and the instruments which now replace manual manipulations "at the scene of the crime." Second, processing cycles are becoming continuous and sequential, in contrast to one-stepat-a-time methods, and batch handling. Thus, the halts and starts, the pile-ups and storages, the chargings and unloadings are vanishing characteristics of production.

And, of course, the basic purpose behind the outside plant is economic. In 1941 it was calculated that the cost of operation and maintenance of an outside plant was between 7 and 15 percent less than for a conventionally housed plant. The savings in construction costs are obvious and considerable. And in this day of tight materials supply and high building

Insulation of unboused plants is more complicated than indoor insulation for the reason that it has to be weatherproof as well as thermally efficient. Thanks largely to improved techniques and materials for such insulation, there is a growing trend toward outside installations. Outdoor plants have gained ground particularly in distillation industries, but they appear to be spreading to other fields and to regions of rigorous climate. Our purpose here is to review the economic conditions which motivate this trend and the techniques which permit it. costs, the benefits of unhoused manufacturing are even greater. Still further values accrue from easier dissipation of corrosive or noxious fumes and greater freedom in placing production units in proper space relationship.

But open-air manufacturing is not all beer and skittles. Fluctuating ambient temperatures, physical ravages of expanding ice, impact of wind-borne solids, the deteriorating influence of sunlight, and the corrosive action of air and moisture all impose new problems in equipment design, installation and maintenance.

Special Insulation Techniques

Equipment designed for outdoor exposure, and the use of metals, materials and finishes of weather-resisting types (stainless steel, plastic coatings, impregnated woods, and such) are significant factors in the equation. But our attention here is focused on insulation technique because, it will be noted, the predominant percentage of those processing operations which have moved outdoors are those in which heat losses, heat balances, heat gains, and temperature maintenance within close limits are "musts."

The two most important factors in outdoor insulation, in addition to the basic considerations of cost, ease of application and thermal conductivity, are mechanical strength and reaction to moisture. Powdered forms are difficult to install, costly to maintain, and subject to loss by shifting and leakage with vibration and time. Block materials made from powder-compacts are



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hts of unbound only as lasting as their binders and impact strengths. Organic materials om esserdant may rot or undergo undesirable chemical change. Recently, much attention has been given to materials produced from blown or spun fibers of inorganic silicates, generically known as mineral wool.

These materials are not friable, heavy, organic, or difficult to install and maintain. And their thermal con-ductivities ("k" factors from 0.19 to 0.33 Btu. in. per sq. ft., hr., deg. F.) are quite superior for insulating pur-poses. Further, they are supplied in a wide variety of forms—rigid block, pliable felt, blanket-sandwiches between metal lath or poultry netting, loose wadding, granulated fill, and trowelling cements. Molded forms are made for use with certain sizes of piping and common types of fittings. Service temperatures up to 1,200 deg. F. and down to -20 deg. F. are common.

In addition, helpful and thoroughgoing standards have been drawn up by the National Bureau of Standards to insure compliance with minimum quality requirements and to instruct users in the proper installation techniques for different conditions. These standards, CS-117-44 and CS-105-43, are available from the U.S. Government Printing Office and should be studied by all users and appliers of insulation for industrial purposes. The former covers the insulation of heated surfaces, the latter, cold surfaces.

The important consideration of preventing moisture from getting into the insulation has been solved by applying

the insulation over surfaces hotmopped with asphaltic compounds, and by incasing insulation layers in non-porous membranes of impregnated canvas, special felts, or weather resisting paints. External surfaces are often rendered structurally strong and hard by troweling mineral wool cements over expanded metal lath, or by incasing the whole job in sheet metal--crimped, riveted or seam welded in place.

Danger of moisture condensation inside the insulation is two-fold: corrosion and the filling of dead-air spaces with water or ice of high thermal conductivity. Vapor barriers which prevent moisture from diffusing into the insulating matrix are the cure. Where it is impossible to use vapor barriers as a complete envelope around the insulation, it is generally desirable to use the barrier on the warmer side of the insulation, especially in cold storage work. Thus, any tendency toward condensation is at a surface which is not sealed, and the moisture has means of getting out before change of state of into water or ice.

Steam Line

Perhaps more concrete help in planning insulation for outside plants will be gained from records of actual experience than from academic generalities. Herewith are reviewed a few case histories which point up the type of attention modern insulation deserves.

A steel mill in Cleveland needed more steam for blast furnace and rolling mill use, but could not obtain new boilers. Excess steam generating capacity existed 3,300 ft. away, but the steam could not be piped underground at any reasonable cost because of intervening railroad lines and highways. Accordingly, the 14-in. line was suspended from appropriate spans of one of Cleveland's bridges across the Cuyahoga River. Two inches of blanket-type mineral wool was applied in two layers. It was cemented in place with hot-mopped asphalt plastic and weather-sealed with two layers of 75-lb. roofing felt. Each layer of felt was steel-strapped on 12-in. centers, alternate layers being strapped at points staggered with respect to one

Methods of applying insulation to cold lines. A, method of sealing off pipe insulation; B, how to insulate pipe According to CS-105-43, National Bureau of Standards





Refrigerated liquid butane storage tank covered with one inch of board type mineral wool. Insulation cut refrigeration power by 85 percent



Oil mixing tank after fire and explosion. Its blanket type insulation came through unhurt and was used to insulate the new replacement tank

another, thereby providing support for the insulation every six inches. The outside surface was brushed with two coats of cold-resistant roofing compound.

The efficiency of the job was demonstrated when the firm was forced to enlarge the capacity of the pressurereducing station at the delivery end. An anticipated temperature drop of 70-90 deg. F. actually proved to be only 10-15 deg. F. The steam in the line was delivered at 550 deg. F. and 235 psi. Provision of 100 deg. superheat was initially intended to exceed anticipated line loss, but even in the most severe weather the actual measured drop has never exceeded 15 deg. F. The installation has now been in service four years and has required almost no maintenance. It has never been necessary to buy the new boilers which were considered so essential four years ago.

Butane Storage

At a Pennsylvania oil refinery, liquid butane was to be stored at 45-50 deg. F. and 20-25 psi. in seven large spheroids, each of 85-ft. dia. By the use of 1 in. of insulating board it was possible to provide a 100 percent safety factor with steel plate only 1/2 in. thick. In this case annealed steel wires were butt-welded at regular intervals over the tank surface. The pliable insulating panels were hand-pressed to fit the spherical contour so that the wires pierced them, and the wires were twisted into poultry netting which held the insulating panels in place. The outer surface was finished with a layer of troweled mineral wool cement. Two layers of hot-mopped asphalt provided a final protective coat.

This combination of a good insulation job with a small refrigeration system not only minimized the steel thickness, through control of pressure, but also required less than 15 percent of the power needed to control an uninsulated tank. Furthermore, the insulation acts as a thermal safety cushion in the event of failure of power or compressors, providing a 48hr. lag in pressure buildup in the hottest expectable weather.

More Cases in Point

Oil refineries, in general, are a maze of exposed hot pipelines and vessels. In few other operations do little details of insulating technique make so much difference in cost and efficiency. In one Kentucky refinery fractional distillation units, desalting tanks, surge and storage vessels, cookers, oxidizers, line

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At this refinery, the type of insulation (mineral wool) and its form (blankets with metal lath backing) are standardized, but many methods of sealing and external finishing are employed. In the case of the road oil

Upper right-Insulated, 14-in. high pressure steam line. Lower right-Paint baking and drying ovens moved to roof to save floor space, protected with 6-in. blanket insulation. Below-Crude oil desalting tank in refinery covered with blanket insulation, insulating cement and hot asphalt

mixing tank and certain other blending tanks, the outer shells are of 20 gage corrugated or flat sheet metal. Seams are double lapped and riveted. Insulation on desalting tanks is covered with cement troweled over the expanded metal lath backing of the blanket and weather sealed by two layers of hot asphalt. Pipelines are wrapped with canvas and painted with weatherproof cement. On certain complex fractionation equipment, where as much as 4-in. of blanket insulation are used, cement is used for the finish, then heavy felt or canvas is hotmopped into position with asphalt mastic. Final coats of weather-resistant paints are then applied.

In every case ""through-metal" is carefully avoided. Where ribs or other structural members are required to carry insulation or its sheathing, these are spaced away from the surface to be insulated by means of welded ears or cross ribs at as few points as possible. Often a good insulation job can be spoiled by overlooking heat leakage through supporting metal members.

In still another case, a Tennessee manufacturer, some 10,000 sq. ft. of plant space was saved by moving two 15-yr. old finishing ovens to the roof. Despite the age and hard service of the ovens, the insulation was found to be intact and was reused when the rebuilding job was done on the roof top.

Plain Geometry

Finally, let us note an ingenious technique used when extremely complicated fabricated structures are involved. Sometimes it is simpler to incase the entire complicated structure in a cube or other inclosure of light construction and simple geometry, and then insulate only the outer housing. The dead air space between the complicated structure and its simple envelope can only improve the insulation job, provided the inclosure is complete so as to seal off the air space against chimney effect.

The day is coming when chemical processes will be even more automatic and will involve even fewer operating personnel. As this occurs, the unhoused plant will become even more common and the importance of evolving insulation techniques such as here discussed will be even greater.



CHEMICAL ENGINEERING • MARCH 1947 •

DEAD MEN Do Tell Tales

CROSBY FIELD Colonel, Ordnance Department, Reserves, USA

CORPSES, STUDIED AS MISSILES, OFTEN HELP MATERIALLY TO DETERMINE THE CAUSE OF ACCIDENTAL EXPLOSIONS

THE PRESENT case has to do with a cottage-like building in the suburbs of a mid-western city. One thing distinguished this structure; it was wholly enclosed within massive concrete barricades and access could be had only through a labyrinth passage. The structure itself was made mostly of brick and had a composition roof.

This building was used to house a "pre-dry" operation for detonators. All totalled, there were one-half million caliber .30 primers and one-third million caliber .50 primers, equivalent to about 130 lb. of sensitive high explosives in it when suddenly something went wrong. An explosion occurred leaving the mass of wreckage (shown in the illustration) which the investigators found on arrival, and two dead operators.

After Explosion

As for the equipment in the building, rack Nos. 1 and 3 had been secured to the floor; Nos. 2 and 4 had been on casters. Movable rack No. 4 was found in the approximate location A and did not show signs of an explosion initiated within its confines. It was rather as though it had been pushed into that position by an explosion external to itself. Although the tubes were twisted there were several trays partially in contact with the rack and one tray had its wooden sides still intact; all of the primers had burned but apparently few, if any, had actually detonated. Fixed rack No. 1 was found in approximate location B, the southwesterly part of this rack showed some breakage as though explosion had occurred within its confines but the northeasterly portion was comparatively intact. Movable rack No. 2 was found exploded in pieces largely hidden by debris and

This third in the series of investigations by Colonel Field of causes of accidental explosions was selected primarily to illustrate the importance of the corpses. These should be examined most carefully just as any other missile or fragment is studied. A corpse has one peculiarity of great importance. It is soft and will absorb and retain small fragments of other missiles blown into it. Furthermore, such corpses are usually the remains of people who were very near the initiation of the explosion and who might have been involved in some way in the operation in the conduct of which the explosion occurred. A study of the detailed cause of death shows how close they had been to the actual explosion. A knowledge of the operations and the operators combined with this information may tell at just which point the explosion initiated.

These corpses of Mr. A, left, and Mr. B, right, gave the investigator much valuable information on the cause of the explosion. They are remains of people involved in some way in the operation in the conduct of which the explosion occurred



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within the area C, D, E, and F. Fixed rack No. 3 had been well distributed by the explosion but an appreciable amount twisted and torn was found in its approximate original location. The major lateral force was in a southwesterly direction as shown by the marks on the southwesterly barricade made by the flying missiles, leaving the other barricades relatively unscathed.

Center of the explosion insofar as could be ascertained by inspection was at the point marked G, approximately 2 ft. from the southwesterly end of rack No. 3 and about on the longitudinal center line thereof. The body of Mr. B was found at about location H, and Mr. A was found on top of the debris in location K.

Corpses

Information regarding the location of the .30 and .50 caliber primers in the bodies was obtained with the assistance of a surgeon. Due to the condition of the bodies when inspected in the undertaker's establishment some 16 hours after the explosion, and after they had been well processed toward final condition for burial, a considerable amount of information probably obtainable at the time of the original autopsy was not available at the time of this latter inspection. It is not believed, however, that anything which might have been found would have interfered with these conclusions. The testimony of the guards originally interviewed was that there was one explosion, but subsequent interrogation of the guards on duty in the tunnel connecting the dry buildings brought the fact that there was a report somewhat like that of a shot gun just prior to the main explosion and which preceded it by a very small fraction of a second.

The supervisor stated that about three minutes elapsed between the time he left the building and the time he heard the explosion. This timing of three minutes is substantiated by the fact that the night supervisor walked slowly from this building into another Upon arrival investigator found site as shown here. Building was wholly enclosed within massive concrete barricades

location and estimated the interval by the time it normally takes him to walk that distance.

A check on the loading indicates that a buggy would normally be loaded in less than three minutes so that there was probably one fully loaded buggy or almost fully loaded buggy in the room at that time.

How It Happened

It would appear from the foregoing that a buggy had been loaded with .30 caliber primers from the northwesterly end on rack No. 1 and that at the moment of the explosion the buggy was standing in the position shown at L with the easterly side of the buggy completely filled with .30 caliber primers, and with Mr. A. standing in the position marked M facing northwesterly and standing substantially upright. Mr. B. was probably standing in the position marked R, but in a stooping posture so that his chin was within a few inches of the top of the buggy. He was apparently taking a tray of .50 caliber primers from either the lower portion of the southwesterly portion of rack No. 1 or northwesterly portion of rack No. 2 and was in the act of turning at the moment when he either dropped the tray of primers or wedged a primer; or by A's changing slightly

Center of explosion was at point marked G, 2 ft. from southwesterly end of rack No. 3. Building contained 130 lb. of high explosives



the position of the buggy, he (A) forced B to perform either of the above acts which resulted in the initial detonation of the buggy. This was heard by the guard and said by him to be a report similar to the discharge of a shot gun. This caused A to rise in the air and started B through his trajectory and, within a brief fraction of a second, this explosion was communicated to racks 2 and 3, causing the main detonation, in turn demolishing the building.

In further substantiation of this conception of the scene the following facts are illustrated in the sketches: that no 50 caliber primer pieces were taken out of A's body excepting the one in his chin; that all the other primer wounds were .30 caliber; that practically no .30 caliber primer pieces were taken out of B's body but many .50 caliber were found there; that A's hands although burned, were not shredded, whereas B's hands were badly burned with thirddegree burns, shredded, and the third right hand finger was practically disarticulated. These, together with the other matters obvious from a study of the sketches, plus the fact that both had an extremely large number of plywood splinters imbedded in the anterior surface while the posterior sur-

STORAGE TANK DESIGN (Continued from page 107)

types may prove more advantageous than the lapped flanges and stub ends.

Manholes—The 18-in. diameter manhole will be found suitable for the complete range of tank sizes. Manhole designs shown on Fig. 2 (welded type) and Fig. 4 (riveted type) are substantially in accordance with the ASME and the API-ASME codes. Manholes properly fabricated from these designs will safely withstand the established maximum working pressure of 15 psi. (Special attention is directed to the requirement of full-face gaskets in order to preclude excessive static stresses in component manhole parts).

manhole parts). Gage Columns—The gage column is undoubtedly among the more practical closed types of liquid level devices. Accessible shut-off valves should be installed in the pipe column immediately adjacent to the gage column connections which are indicated on Figs. 1 and 3. As a rule, ball-check gage cocks should be specified to assure immediate automatic closure in the event of broken gage glass. All glass for gages should be of the heat-re-

face showed absolutely no marks whatsoever exceptin a burn on A's posterior below the buttocks, all contribute to the conception of the scene as described above.

Note particularly that only plywood present was that from the sides and covers of the buggies.

What Is It That Kills

A person has to be very close indeed to an explosion to be killed solely by the heat or the pressure effects of the blast itself. This is easy to believe when it is realized that the human body has a 50-50 chance of living if subjected to an instantaneous explosive blast pressure of 400 lb. per sq.in. On the other hand ear drums are fractured at only about 7 lb. per sq.in. and it takes only about 1 lb. per sq.in. to hurl a person about.

As would be expected from these data, most killings in a high order explosion of an appreciable mass of explosives are due to either the body being thrown with violence against a stationary object such as a post, a boulder, a hard roadway or by receiving a fatal wound from a high-velocity fragment. One exception to the foregoing is frequently found in low order

sistant type. Suitable structural guards should be provided to minimize the possibility of glass breakage. Guards should be entirely independent of either the gage cocks or the glass.

Certain safety codes and insurance codes prohibit the use of glass gaging devices for especially hazardous liquids. Under such conditions the use of more special types of liquid level indicators or signaling devices should be investigated. A simple test well is usually suitable for non-volatile, non-flammable liquids stored at atmospheric pressure.

Skimmer Connections—Due to the possible accumulation of scale and other foreign matter in the bottom of the tank, it is usually desirable to project the suction or drain connection above the bottom a distance of approximately 10 percent of the tank diameter as indicated on Figs. 1 and 3.

The final drain indicated in Figs. 1 and 3 may be independently piped to a recovery system or to other point of discharge, or it may be combined with the normal drain as a common suction line to a pump, the discharge of which may be branched to different locations as required. Shut-off valves should be installed immediately adjacent to the tank nozzles in any arrangement. explosions. In these cases death may occur from serious burns. The absence of burns from high order explosions is remarkable. When it is appreciated however, that a high order explosion occurs in a very small fraction of a second and that the temperature directly within the explosion is of the magnitude of 5,000 deg. F. or higher, the reason for the absence of burns is apparent. If the person is within the zone of the actual explosion itself the body is completely vaporized so that there is no trace whatsoever remaining. That this is a fact is attested by the prevalence in high order explosions of missing people of whom no trace is ever found. If a corpse is found, the person was outside of the actual zone of the explosion and therefore was hurled about by relatively cool air pushing out from the explosion zone.

Little Help From Small Pieces

When the term corpse is used it must be understood to mean any piece of body. As is the case with inanimate objects, the smaller the size of the missile the less informative it is and if there remain only a very few pieces of body and these are very small, little can be learned from them.

VINYL RESIN CHEMICALS (Continued from page 103)

ment of more economical processes for the production of acetylene. Although no cost figures are available for the production of acetylene from petroleum and natural gas, it has been unofficially reported that acetylene produced in large quantities near cheap sources of supply might cost less than 50 percent of its present price. The possible use of electric arc cracking of light hydrocarbons such as methane and ethane has not, as yet, proven to be eco-nomically feasible. Although the potential costs of acetylene would appear to be only a fraction of the present cost through calcium carbide the costs of purification are extremely high. Nevertheless the possibility of solving the purification problem exists and this would serve to place greater emphasis on acetylene as a raw material in organic syntheses.

Any decrease in raw material costs would be reflected in the ultimate cost of the vinyl resins and would make them intensively competitive with other plastic materials, that are utilized solely for cost reasons, and in addition with natural and synthetic rubbers.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR

\$50 CASH PRIZE FOR A GOOD IDEA!

Until further notice the editors of Chemical Engineering will award \$50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e.g., the March winner will be announced in April, and his article published in May. Judges will be the editors of Chemical Engineering. Non-winning articles submitted for this contest will be published if acceptable, in that case being paid for at applicable space rates.

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Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as

FEBRUARY WINNER

A \$50 prize will be issued to

ALFRED H. McKINNEY Chemical Engineer Philadelphia Quartz Co. Philadelphia, Pa.

For an article describing an ingenious air operated, variable pump for feeding solids at a controlled rate, that has been judged the winner of our February contest.

This article will appear in our April issue. Watch for it!

January Contest Prize Winner

ADAPTING A DIFFERENTIAL PRESSURE CONTROLLER TO WIDE-RANGE INTERFACE CONTROL

JOHN G. KIRKPATRICK

Instrument Engineer, Eng'g. and Const. Div. Koppers Co., Pittsburgh, Pa.

N MANY processes where non-misci-The liquids come together it is necessary to control the interface between the two liquids to prevent them from both being drawn off together from the top or bottom of the vessel. If the desired position of the interface is known and there is sufficient gravity difference-with a well defined separation between the liquids-it is comparatively easy to control the interface. A ball float type or a displacement type level controller will perform the control job very satisfactorily. However, if the exact position of the interface is not known; if it might have to be changed due to process change or lack of exact knowledge of the best position; or if the interface is not sharply defined, the short-range level controller is not satisfactory since it would be necessary to provide extra connections on the vessel and shut the process down while the level controller was being moved to a new position. Besides labor costs, the production loss can amount to a considerable figure while changes are being made.

To overcome these difficulties, in-

herent in the standard interface controller, a differential controller flow meter body can be used. To adapt a differential controller to this service it is necessary to purge the leads or pressure connections continually

False head chamber adapts differential controller to interface control



he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are considered.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

and to provide a fixed "false head" on the low-pressure side of the meter body. To illustrate these requirements and show the adaptation of the differential controller the following problem is assumed and the accompanying sketch will clarify the description.

A counterflow oil scrubber with water entering at the top and oil entering at the bottom requires interface control at some point to be determined by results obtained in operation. This scrubber has an effective height of 10 ft. As can be seen it would be inconvenient to use either the ball float or the short-range displacement float since it would have to be moved to a number of new positions during the tests run to determine the best position. A 10-ft. displacement float could possibly be used but it would make a very awkward installation in a violently agitated scrubber. This same agitation would also prevent a sharply defined interface.

To adapt the differential controller an impulse line is run from the highpressure connection to the lower connection of the scrubber and another line is run from the low-pressure side of the meter body to the false head chamber and then to the upper connection on the scrubber. Both of these connections are continuously purged with air or gas from the meter body back to the scrubber, using small rotameters, bubblers, or capillary restrictions to keep a small but continuous

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flow of air or gas in the meter impulse lines. As can be seen in the illustration the high-pressure connection has the liquid head of the scrubber plus the static head impressed upon it. The low-pressure connection has the same static pressure plus the pressure created by the false head chamber. Since both sides of the differential meter body have the same static pressure this pressure will cancel out. Also any liquid head above the upper tap will cancel out.

The false head chamber permits us to employ the full range of the meter so that the meter will read 100 percent when the scrubber is full of water and 0 percent when full of oil. This can be explained as follows. If the specific gravity of the water is 1.0, and of the oil, 0.8, then the full meter range for this gravity difference should be 0.2×120 in. = 24 in. Although a standard meter body could be recalibrated to 24 in., it would be better to use a standard 20-in. meter body and to assume in effect that the interface will be allowed to vary only within a range of 100 in. (since $0.2 \times 100 =$ 20 in.). By adjusting the depth of mercury in the false head pot the full range of the meter can be made equivalent to 100 in. variation in the interface, and this 100 in. range can be placed at any desired point between the taps. Let us assume that it is centered.

What Calculations Show

When the meter reads zero, the head on the lower tap must equal the head of the false head pot. But if the meter is to read zero when the interface is 10 in. above the lower tap, then the head between upper and lower taps will be 10 in. of water plus 110 in. of oil or $10 + (110 \times 0.8) =$ 98 in. water equivalent, which for a zero reading requires a mercury head in the pot of 98/13.6 = 7.22 in. Checking this when the interface is at its upper limit, 10 in. below the upper tap, the head between the upper and lower taps will be 110 in. of water plus 10 in. of oil or $110 + (10 \times 0.8)$ = 118 in. of water equivalent. Since 118 - 98 = 20, the meter will read 20 or 100 percent, as it should. In this way an exact reading of interface can be obtained over the entire range, and since the interface can be read it can be controlled. Even if the interface is not sharply defined this system will give an accurate reading of the average interface.

The remainder of the control set-up is typical, with a standard level controller to draw off the oil from the top of the scrubber, while the interface controller draws off the water

CLAY CHANNELS INCLOSE UNDERGROUND PIPE

An ingenious use of clay channel pipe (half-round pipe) was recently worked out by Birmingham Electric Co., Birmingham, Ala., for completing the inclosure of insulated underground steam mains. The view shows the main during construction. A slab of concrete 4 or 5 in. thick was laid in the bottom of the trench to form a cradle for the insulated steam line and permit it to expand and contract freely. Ordinary hollow tile were laid on top of the slab, either side of the pipe, to support the clay pipe roof. Channel pipe were then laid on the tile to form a tunnel and grouted firmly to it, while the bell and spigot ends of the channels were filled with hot-poured jointing compound for water-tightness.

from the bottom. The reader can easily adapt this method to any separation problem that might come up.

VACUUM DISPENSER FOR DISCHARGING CARBOYS

J. B. WHITTUM Lewiston, N. Y.

POURING corrosive liquids and soltainers is a messy business at best, with the attendant danger and financial loss from spillage. The plastic pumps and various forms of dispensers such as siphons are a partial solution but all have disadvantages.

The method here described will permit dispensing, in fairly precise quantities, liquids which will corrode or dissolve metals or flexible tubing so that metal valves or pinch clamps on flexible tubing cannot be used to control the flow of a siphon, while a plastic pump would soon be dissolved or otherwise rendered useless. A few of the liquids which can be better dis-

Vacuum dispenser unloads liquids unsuitable for flexible tubing or plastic pumps





pensed by this method are nitrobenzene, strong acids, and strong hydrogen peroxide.

Liquid from the carboy is drawn out by a tube through vented stopper S, using a controlled suction applied to the flask or bottle which it is desired to fill. A battery of carboys might be served by one vacuum control with individual dispensers.

The vacuum, preferably from a laboratory aspirator pump, is controlled as follows:

1. Close the small plug cock A shown in the illustration and make sure the $\frac{1}{8}$ -in. needle valve B is open.

2. With vacuum on, crack open the $\frac{1}{6}$ -in. needle valve C. (Valve C can be omitted if an aspirator pump is used.)

3. Close down on needle valve B until a vacuum of 8 to 10 in. Hg is registered on manometer M. (More or less vacuum may be necessary depending on the specific gravity and viscosity of the liquid and the location of dispenser outlet D relative to the liquid level.)

4. Open valve A and place receiver R under the dispenser outlet, pressing the rubber stopper of the outlet firmly down on the mouth of the receiver. Liquid will be drawn into the receiver and flow may be controlled by releasing pressure on the rubber stopper. The vacuum should be such that the liquid will just come over at a good rate without making it necessary to slow the flow by releasing pressure on the rubber stopper. It is important that the end of the dispenser outlet be above the liquid level in the carboy so that the flow will not be continued by siphoning when the rubber stopper is released from the receiver.

The detail sketch shows a crosssection of the dispenser outlet construction, indicating how the con-



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Comparison of rectangular and triangular coordinates for ternary system plot

trolled vacuum is applied to the receiver.

The dip tube must be glass for most corrosive liquids, but if possible it should be of metal to minimize breakage. Its size will depend on the desired delivery rate, with $\frac{2}{3}$ in. diameter a probable maximum.

RECTANGULAR COORDINATES FOR THREE VARIABLES

ALLEN S. SMITH University of Notre Dame Notre Dame, Indiana

W IN HAS NOT been irked with the inflexibility of the coordinates and size of conventional triangular graph paper? Certainly, not anyone who has tried to plot data with precision for a three-component system within the narrow confines of the 20 or 23 cm. equilateral triangle. The triangular diagram affords a convenient graphical representation of properties of ternary mixtures, but interpolation or calculation from the plot leads to uncertainty. Specifically, its use for ternary solubility diagrams is inadequate. Low solubility cannot be shown at all. For extraction calculations, equilibrum tie lines must be interpolated from a separate rectangular plot, and a graphical method applied for the determination of the course of extraction. If the tie lines are located by the lever arm relation, measurements must be made on the chart to obtain a numerical ratio.

Rectangular coordinates have been used for ternary systems by plotting A/(B + W) against B/(B + W) where A, B, and W are the percentages of the three components. This distorts the curves, requires the use of a separate equilibrium diagram, and does not improve the representation of low solubility.

All the advantages, and none of the disadvantages of the triangular chart are retained by plotting two coordinates on rectangular paper identified by A and X. A is the percentage of the component normally represented by the vertical apex of the triangular diagram, and $X = (A + 2W)/\sqrt{3}$ in which W is the percentage of one of the other components. In a plot of A vs. X, W = $(\sqrt{3}X - A)/2$ and B, the third component, = 100 - (A +W) since the sum of the percentages of the components must equal 100. These coordinates, derived from geometric relations, are compared in the

Neutralizing spray protects temporary gas main against corrosion



accompanying figure with the corresponding triangular coordinates.

The normal shape of the ternary curve is retained by this method of plotting. The coordinate scale can be changed at will to enlarge the whole or a section for low solubility. The lever arm relation can be used without measurement to locate tie lines by reading vertical or horizontal coordinates. For example, in the figure, (c - d)/(f - e) = (o - c)/(e - 0)= od/of = weight of W phase \div weight of B phase. A separate plot is unnecessary for tie line interpolation, and one equilibrium measurement suffices to define the entire system of tie lines. All tie lines converge at a point K on the A = 0 ordinate at

$$X = 2\left(\frac{A_2W_1 - A_1W_2}{A_2 - A_1}\right) / \sqrt{3}$$

and any line drawn from this point through the diagram is a tie line. The subscripts in the equation indicate components in equilibrium in two phases. Finally, numerical calculation can replace the graphical method of measuring distances on the triangular diagram for more rapid and accurate determination of the course of an extraction process.

This method can be applied to advantage to plot other properties of ternary mixtures, and is not limited to solubility representation.

CORROSION CONTROL FOR GAS MAINS

WILLIAM H. TELL Corpus Christi, Tex.

SINCE corrosion is a problem of primary importance, allowances are made normally for its occurrence in all permanent systems. However, in temporary or semi-permanent installations this problem does not always warrant a great deal of expense, even though the control of corrosion is desirable.

One method of alleviating corrosion in systems handling corrosive gases is to install a number of internal spray nozzles in the gas mains. Although the efficiency obtained is low, use of sufficient nozzles will permit satisfactory results to be obtained. To remove the liquid mist in the gas a knock-out drum or its equivalent is required—the design dependent on the nature of the corrosive agent and the system involved. Caustic soda solution, boiler blowdown or other similar spray materials will provide satisfactory results.

A typical flow diagram of such an installation is suggested in the accompanying sketch.

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EDITORIAL VIEWPOINTS

Sidney D. Kirkpatrick and Staff

GET THAT EQUIPMENT NOW

FANATICAL favors for housing under the Veterans Preference plan no longer dominate all Washington thinking. Officials are therefore much more openminded when presented with a rational plan to provide enlarged chemical plant capacity. While one must not expect too much from this change, nevertheless even the little improvement now noticeable is most welcome.

Further liberalization may be expected soon. Accordingly, now is a good time to renew requests for authorization of equipment needs long overdue. Now is the time to show that the public suffers when this equipment is not provided for both new and modernization projects.

To make such requests more effective one should emphasize wherever possible that the end uses of the chemicals, or the end uses of the products made from them, are vital for food, for housing, for public health, or for national security. So long as there remains any vestige of governmental control on materials, equipment and construction these four basic arguments are the most potent.

CARTELS vs. STOCKPILES

THIS country is beginning to build up certain stockpiles of strategic and critical minerals. Ultimately the process will require several hundred million dollars of federal funds. Currently the spending is of the order of ten million dollars per year, or a little more, but sound public policy demands even higher speed in stockpile building of some more urgently needed commodities.

Already there is evidence that some of the world cartels controlled by foreign governments are not anxious to sell goods to the United States Government for stockpiling purposes. In at least one case a foreign government has refused to allow an important strategic material to come from Empire territory into the United States. There is good evidence that several other commodities are being similarly withheld.

American dollars are urgently needed abroad if other nations are to buy from us absolutely necessary capital goods, as well as the food and clothing needed to prevent starvation and freezing. It would seem that our State Department might put a little pressure on those wanting American aid by demanding that as return payment for our relief and reconstruction goods we be permitted to buy the essentials we need for stockpile building.

General Marshall thoroughly understands the stockpile problem. It is to be hoped that he will impress on the career diplomats of his department the necessity for reasonable but effective demands along these lines as they negotiate new trade arrangements throughout the world. It may be that these arguments could become one of the most forceful parts of our representation in the international trade and economic discussions shortly to begin in Geneva. A bit of hard realism in trade arrangements must be an essential part of our foreign economic policy. polit and

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IN DEFENSE OF THE SMYTH REPORT

WHEN Bernard Baruch, and later David Lilienthal, labeled the Smyth report as an information "leak" and the "biggest breach of security since the beginning of the atomic bomb project," they really started something. The elder statesman added fuel to the flame by claiming that the Army had been "lambasted" into releasing the report by pressure from American scientists. Now comes back the Bulletin of the Atomic Scientists to speak for many of the top scientific personnel of the project in protesting their innocence. They would put the blame back on the Industry-Army team that wanted to publicize their joint achievements and incidentally to show where two billion dollars of the people's money had been spent in the process. As the circle of conflict closes one cannot help wondering why some one has not been willing to speak in dispassionate defense of what, after all, was a very logical and justifiable procedure.

It was the scientists themselves who first widely proclaimed that there were no atomic secrets that could possibly be withheld from the world for even five or ten years. The biggest secret of all was that the release of atomic energy for military purposes was a fait accompli and certainly the Smyth report was no breach of security in that connection. If it did show that certain processes were tried and did not work, while others appeared to be more successful, it was not revealing information that could not readily have been deduced from other sources. What the Smyth report had to say about engineering and industrial processes could scarcely give comfort to an enemy or aid very materially in the efforts that will inevitably be made to duplicate our facilities in the event that we fail to solve the No. 1 problem of international control.

It seems inconsistent to us that scientists who have most at stake in the battle for freedom of thought and publication should not rise to the defense of the Smyth report. It was prepared by their own leaders and fellow workers for exactly the purpose that it accomplished namely to raise the iron curtain of secrecy from around the minds of men engaged in studying the fundamental laws and properties of the universe. It is disappointing, to be sure, to find such well-informed laymen as Baruch and Lilienthal openly condemning a fundamental policy

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of free science that the McMahon Act has made the law of the land. Perhaps it has to be charged off to the politics of getting congressional approval for personnel and policies to guide the new Atomic Energy Commission. If so, it shows a sorry lack of statesmanship at a time when intra-mural battles must give way to united thinking and action on the World's No. 1 problem.

SYNTHETIC TO THE RESCUE

PRICE cuts on synthetic rubber are being provided by the federal government as an offset for the rise in the cost of natural rubber, which was recently raised in price by 3.25 cents per pound. Thus, it is hoped by Washington that the end products of the rubber industry can continue to be made without increasing costs to the general public.

As the American made synthetic drops more and more below 20 cents and the natural crude rubber is raised more and more above that figure, the competition between the two becomes more interesting and intense. If petroleum butadiene can be made in sufficient quantities at expected low prices this competitive relationship may permanently favor synthetic rubbers. Thus chemical engineering has provided a basis which makes American enterprise almost indifferent to the policies of the British-Dutch rubber cartel for the bulk of our rubber.

As yet neither British nor Dutch plantation rubber is being produced for delivery in large volume under favorable circumstances. Disturbed conditions in Netherland Indies and in British Southeast Asia remain an obstacle to most effective plantation operation. Most of the socalled Singapore rubber is actually bootlegged from small native sources in Java and other insular areas.

That condition cannot be tolerated indefinitely by the two European nations whose future depends on a successful rubber industry. But apparently the United States synthetic rubber industry has at least another year in which to establish itself better with sound technology and good product performance before it must meet vigorous full-quantity competition from abroad. Without further federal subsidy than free rental of government-owned plants, American-made rubber can already compete on a price basis for at least half of the rubber requirements of this country. In another year the situation may be more favorable.

"EVEN SECTIONAL FADS"

"SYNTHETIC yarns will eventually be varied to meet almost any demand—the needs of wearers of all ages, their style preferences, and even sectional fads..." This statement by an outstanding director of nylon sales is a demonstration that chemical engineering can manufacture industrial products to meet almost any demand of the ultimate user. What can be done for nylon stockings is equally well done for other plastic products and for most other products of the synthetic organic chemical industries.

Chemical engineers are approaching an era of much more intense competition than we have known for six or eight years past. This means that the buyer will again dictate many details of orders and deliveries. That is as it should be. It means also that research, development and factory operation must be attuned to the wishes of the ultimate consumer as well as to his fundamental needs. The job of appraising whims as well as substantial requirements will again confront us in many industries.

ISOTOPIC FERTILIZERS

RESEARCH employing radioactive phosphorus as a tracer material is to be financed by the fertilizer industry through a special committee which will work under the leadership of Dr. Ralph W. Cummings at the North Carolina State Agricultural Experiment Station, in Raleigh. Raising of funds to support this investigation has had the active encouragement of the National Fertilizer Association whose president, Maurice H. Lockwood, has emphasized that this is an industry rather than an association project.

Radioactive phosphorus is to be obtained from the Atomic Energy Commission by the U. S. Department of Agriculture. It will be incorporated in certain standard fertilizer mixtures at the laboratories of the Department at Beltsville, Md. The resulting fertilizers will then be employed on pot and plot (field) tests at three stations— Raleigh, Beltsville and Ithaca, N. Y.

The primary study undertakes to determine what becomes of phosphorus in fertilizer when applied to the soil. Recovery of phosphorus in the growing plant represents such a small percentage of the total applied to the soil as to necessitate further investigations regarding the disappearance of the majority of the phosphorus used. Since the radioactive phosphorus can be traced in various parts of the plant, in the run-off water, and in various parts of the soil, it is hoped that this investigation will permit a study answering this very important question. What practical result may then follow is not forecast at all by the agronomists in charge. But it is obviously hoped that the result may be an improved technique of fertilizer use which will give improved efficiency in utilization of the plant food.

GOOD INSURANCE

A STRONG military reserve in civilian clothes will necessarily be part of our national picture for the next few years, no matter how rapidly the United Nations achieve their most desirable goals. To keep this reserve strong, its "skilled labor" must not be permitted to lose its special abilities. A skill which is unused soon disappears.

Granting of military leave for a week or two of intensive training each year, in addition to the usual twoweek vacation, is one problem jointly confronting industry and the armed services. Even the most attractive inducements offered by the Army and Navy to maintain reserve officer status will be considerably offset if a man must forego his regular two-week vacation year after year. While weekends throughout the balance of the year should offer ample opportunity for maintenance of individual skills, it is only by assembled intensive practice, for several days at a time, that teamwork and group activities can be maintained satisfactorily.

It would be difficult to predict the additional personnel load that this will place on the chemical industry as a whole, or to forecast the decreased production of chemicals by reason of an extra military training absence from the job. But it looks like good insurance.



REPORT ON

AIR SEPARATION Principles and Technology

Much of the material on oxygen that has been appearing in recent months has tended to leave the impression that modern oxygen technology started with the work done for NDRC on small low-pressure portable plants for military oxygen. Obviously this is not the case, nor would those who did the work wish to convey that idea. It is true that techniques continued their earlier evolution, and that much work was put into the development of ideas that had previously received little attention. It is also true that some of these ideas will prove extremely useful should large tonnage, lowpurity oxygen come into the picture as now seems quite possible. Nevertheless, there is much more to the story of oxygen technology, as this report will bring out.

TN THE "Chem & Met" Report for January 1947¹ we examined the underlying reasons for the present great increase in interest in the produc-tion of oxygen. It was found that the present-day industry is primarily con-cerned with a 99.5 percent product which is relatively expensive to produce and distribute, but is essential for the usual cutting, welding, and breathing applications. There are, however, distinct possibilities that a tremendously expanded oxygen demand may come about in the oil, steel, chemical, and perhaps the manufactured gas industries^{1, 2} if a lower purity gas of 98 percent oxygen or less can be produced cheaply enough, and if the future demonstrates the soundness of the eco-nomic principles involved. There is already some evidence that low-purity oxygen can be produced at extremely low cost if made continuously in large plants at the point of use. Production, as well as application, is about to be tried out on the requisite scale in both oil and steel industries. The next few years are expected to demonstrate conclusively whether oxygen will or will

not become a large tonnage industrial chemical.

In the January Report it was brought out that, although oxygen can be produced both by electrolysis of water and by various chemical means, such methods are of limited application and need not concern us here. The only methods likely to be practicable for large scale oxygen production are those based on liquefaction and subsequent fractionation of air. Of these there are a great many that are described in the patent literature. However, a comparatively small number have actually been used.

Variations in cycle are introduced in methods of compressing the air, and in purifying and refrigerating it, as well as in the designs of heat exchange, rectification, evaporating and condensing equipment. Top pressures in the various cycles range from as low as $4\frac{1}{2}$ atm. to 200 atm. Some of these variations have been introduced from personal preference, some in the search for a closer approach to theoretical efficiency, and some because of the need for a higher or, again, a lesser degree of separation. Various features of plant design have particular advantages, as well as compensating disadvantages. Some cycles, for example, have inherently higher efficiency than others which may to a large extent be offset by a higher capital cost and carrying charges, increased complexity, higher maintenance and depreciation and sometimes lessened operating flexibility. Thus most designers recognize that compromises between high efficiency and other desirable features are often necessary.

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Air's Constituents

Air consists of an invariable mixture of nitrogen, oxygen, argon, hydrogen, neon, helium, krypton and xenon, with variable concentrations of other constituents including water vapor, carbon dioxide, and hydrocarbon gases such as acetylene. (According to Metzger methane is also found in the kryptonxenon fraction, although it is not known whether this comes from the atmosphere or from compressor lubricant decomposition.) The boiling points at 1 atm., together with volume percentages and the critical temperatures of both the constant and some of the variable constituents of air are recorded in Table I, while Fig. 1 plots the boiling and critical temperatures in degrees Kelvin (Centrigrade degrees above absolute zero).

According to the principles of thermodynamics the separation of a mixture of gases requires a certain theoretical amount of energy input which is independent of the method of separation. Actually, of course, no process approaches this ideal since there are unavoidable losses that constitute irreversible changes in the thermodynamic sense. Such losses arise from friction in the moving parts; fluid friction losses; heat leakage into the system (which necessarily operates at extremely low temperatures); departures from the ideal in compression and expansion; and the impossibility of securing perfect heat exchange. Since at least some temperature difference is necessary to cause heat flow, this means that the exit gases must always be lower in temperature than the entering air and therefore it is never possible to recover all of the refrigerant effect in the outgoing products.

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All air separation processes of the types considered here involve two distinct phases: liquefaction and fractionation. The liquefaction phase is always accomplished by combining compression with refrigeration.

For compression, reciprocating compressors are used for the higher pressure cycles, while for the lower pressure, both centrifugal and axial flow compressors are coming into use with

Fig. 1—Boiling points at 1 atm. and critical temperatures of gases





Fig. 2-Skeleton temperature-entropy diagram for liquid and gaseous air

the larger units. For refrigeration, practically all cycles depend either wholly or in part on the expansion of the com-pressed air itself. In a few, auxiliary refrigeration is used to secure additional cooling effect through the medium of the evaporation of some more easily liquefiable gas such as ammonia or Freon. Less energy is required to produce a given refrigeration effect by evaporating an easily liquefiable gas, than by expanding an unliquefied compressed gas. In practice, the added complication of the cycle resulting from auxiliary refrigeration is sometimes not considered worth while except for relatively large plants, or for those where the energy input must be increased to enable the plant to pro-

duce liquid products. Since the liquefaction and fractionation phases of the process are in fact distinct, it will be convenient initially to consider them separately. With regard to liquefaction, although the names of Carl von Linde and Georges Claude are rightly mentioned among the pioneers, these men were not the first to liquefy gases. Cailletet in France and Pictet in Switzerland both produced liquid oxygen in 1877, while the following decade saw the liquefaction of all the permanent gases except hydrogen. Dewar in England was experimenting with liquid air during the early 1890's and the world-famous lowtemperature laboratory at the University of Leiden, Holland, was estab-

 An excellent diagram in English units, prepared by the M. W. Kellogg Co., was presented in a recent article by Rushton⁵. lished about 1892. The first cycles of Linde and of Claude were developed shortly thereafter (1895 to 1902) but the greatest contribution of these men lay in their recognition of the commercial importance of gas liquefaction and separation, and in their development of practical plants.

Air Liquefaction

To understand how air can be liquefied by self-refrigeration and without the use of an auxiliary refrigerant, it is desirable to employ a diagram of the thermodynamic properties of air. As in the study of steam systems, the temperature-entropy diagram (which is not always the best for calculation purposes) is the most illuminating for the visualizing of cycles, and so is used here. Fig. 2 is a skeleton version of such a diagram* adapted from the

Table I-Properties of Air and Constant Constituents (From Various Sources)

	Volume Percent	Boiling Point, Deg. K.	Critical Tem- perature Deg. K.
Air	100	79	132.3
Nitrogen	78.03	77.19	126.0
Oxygen	20.99	90.04	154.2
Argon	0.94	87.16	156.
Hydrogen	0.011	20.56	33.1
Neon	0.0015	26.7	53.
Helium	0.0005	4.02	5.2
Krypton	0.00011	120.1	210.
Xenon	0.00009	165.9	258.
Carbon dioxide	² 0.03 to 0.07	194.0 ^a	304.1
Water ²	0.01 to 0.02	373.0	647.

¹May be variable; sometimes reported much less. ³Variable constituents. ³Solid carbon dioxide sublimes.

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Fig. 3—Diagram showing the principle of throttling and isentropic expansion

chart of Hausen reproduced by Ruhemann'. It shows the "dome" characteristic of such diagrams which is bounded on its left by the liquid curve, and on its right by the saturated vapor curve, with the critical point between. Points to the left of the dome represent liquid air, while those above and to the right are superheated vapor. Points beneath the dome are "wet," consisting of mixtures of liquid air and saturated vapor, comparable to wet steam. Lines sloping upward to the right are lines of constant pressure, while those sloping downward to the right are constant enthalpy (total heat) lines. Lines of constant quality, not shown on Fig. 2, appear under the dome on Fig. 4.

A portion of Fig. 2 from the superheat region, reproduced in Fig. 3, permits us to examine the two methods whereby air can be cooled by expansion. Air initially at point a is first compressed to b at constant tempera-ture—a practical impossibility, although isothermal compression can be approximated by multi-stage compression with inter-stage cooling. If this air is then allowed to expand through a valve-an operation known as throttling-the expansion involves no change in total heat content, and the condition of the air moves down a line of constant enthalpy. In the process the air becomes colder, which is the well-known Joule-Thomson effect. It was an expansion of this type, used repeatedly in such a way that the refrigeration would be cumulative, that Linde employed in his air liquefiers.

On the other hand, if the expansion from b is accomplished in the cylinder of a reciprocating engine, or by means of a turbine, in either case producing the maximum amount of work of which it is capable, then in theory the expansion is adiabatic and the air condition moves vertically downward to d along a line of constant entropy. Actually, inefficiencies in the engine deflect the line to the right to some such point as d'. In any event, however, the fact that the air has expanded and has also done work means that it has lost more energy than by throttling alone and its final temperature is therefore lower. This method was the one used by Claude to obtain the bulk of the refrigeration in his process. In some of Claude's cycles, the expansion engine was used on the outgoing nitrogen stream, which was in heat exchange relation with the incoming air, but the principle is the same. Expanders operating on a part of the air, with the remainder throttled, are a regular feature of most modern air liquefying and separating installations.

How the cooling and liquefaction are obtained in a number of liquefier cycles can be visualized with the aid of Figs. 3 to 6. The simplest of these, the socalled simple Linde liquefier, is illustrated in Fig. 4. The upper part of this figure shows the temperatureentropy diagram after the system has reached steady-state conditions. The lower portion is a simplified flow sheet of the air liquefying equipment.

Simple Linde Liquefier

The cycle initially starts with air at atmospheric temperature and pressure, at a in Fig. 3. After approximately isothermal compression to some pressure such as 200 atm. the air, still approximately at room temperature, enters and flows through the heat-exchanger. However, there is initally no refrigeration available so that the air expands through a throttle valve to about atmospheric pressure and in so doing is cooled only to the tempera-ture of c in Fig. 3. This temperature being insufficiently low to cause any liquefaction, all the air returns through the heat exchanger to the compressor. In the exchanger it cools the incoming compressed air and is itself thus reheated to about room temperature.

After its first pass, the air continues to recycle, but on each pass it is cooled to a progressively lower point in the heat exchanger after which it expands through the throttle valve down a progressively lower line of constant enthalpy (for example, one of the dotdash lines of Fig. 4) to some point e'. Eventually its expansion line falls beneath the "wet" air dome. When this occurs a small part of the air condenses and the remainder recycles as the refrigerant. But this remaining air is less in quantity than the entering air by the amount condensed, so that eventu-ally a steady state will be attained where no further lowering of the incoming air temperature will be possible in the heat exchanger, and the expansion line cd can move no lower. Now

liquid of condition f can be withdrawn if desired, while uncondensed air of condition e will recycle as refrigerant. New air equal in quantity to that being liquefied now enters the compressor, while the position of point d with respect to the lines of "constant quality" shows the fraction of the total air in circulation—a small fraction in any event—that is being liquefied. the a

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It is a characteristic of all liquefiers that, on starting up warm, a more or less considerable time is spent as shown here in working the system temperature down to the point where air is being liquefied and a steady operating state is reached. However, once this state is reached, it is generally possible in the higher pressure cycles to reduce the pressure.

A somewhat more complex cycle developed by Linde to secure greater cconomy is shown in Fig. 5 which again portrays steady state conditions. Work can be put into the liquefying process only by way of the compressor. Since compressor work is roughly proportional to the log of the compression ratio, this work can be reduced substantially if the compression ratio can be lowered. To reduce the compressor discharge pressure materially would cause serious reduction in the fraction liquefied per pass, but raising the suction pressure means only that slightly more air has to be recycled. In Fig. 5, which shows Linde's so-called highpressure cycle, air enters the first compressor stage at a and is compressed to b, then cooled in the exchanger to c, where it expands at constant enthalpy through valve (1) to d. The bulk of the air, which does not condense, is recycled through the exchanger, reentering the compressor at an intermediate stage f, while the liquid produced is expanded through valve (2) from g to h at substantially atmospheric pressure. This expansion causes a small part to evaporate, which part returns by the path ia through the heatexchanger to the first stage of the compressor. Under typical conditions Ruhemann' finds that the high-pressure cycle requires only about 58 percent as much power per unit of air liquefied as the simple Linde cycle.

A cycle showing the effect of introducing the expansion engine, in addition to the throttle valve, appears in Fig. 6. This is the Claude cycle which, according to Ruhemann, reduces the power consumption per unit of air liquefied to about 35 percent of that required for the simple Linde cycle. As in both Linde cycles already considered, Fig. 6 shows that the Claude cycle compresses the air more or less isothermally from a to b and then cools it at constant pressure along the line teristic of all

ass, but raising neans only the. Fig. 4-Temperature-entropy diagram and be recycled. Linde's so-cale air enters the fi t a and is comm in the exchange ids at constant a (1) to d. Their does not cont igh the endur compressor at a f, while the lin ded through w ubstantially atm xpansion cluse ite, which peti ia through b e first stage of B r typical can Is that the hi res only about) oower per und imple Linde o ng the effect of ision engine a the value, app Claude cycle emann, rede an per and 35 percent veles alread s that the air more b and the along the

It can be b c e. However, about 80 percent of uncondents the air is cooled only to c where it is recycle as in taken off after the first heat exchanger quantity to shown in the flow diagram and is alnters the on lowed to expand to d in an air engine on of point or expander where it does work of s of "constant some sort such as producing electricity ion of the more assisting the main air compressor. pressor by way of two of the three heat exchangers, in which it furnishes the g up Name, bulk of the remgeration of the air is time is speed cooled to e in the second and third exg the system cooled to c the expanded through the point of changers, then expanded through through throttle valve to f where part liquefies and a deale throttle valve to f rest returns as vapor from g H. Hower, through all three heat exchangers. Claude used a high pressure of ab

Claude used a high pressure of about ressure crete 80 atm., compared with 200 atm. for the Linde cycles. He introduced the more compar air to the expander at about 190 deg. nde to the expanded and that still lower own in he power consumption, about 30 percent steady state of that for the simple Linde cycle, reway of them selected by Claude. He used a high or work is me pressure at 200 atm. and introduced log of the on about 60 percent of the air to the exk can be mine pander at room temperature, throttling compression the remaining 40 percent. Heylandt's o reduce them changes in the conditions are shown by sue mited the dotted lines in Fig. 6 and by the eduction in the points b', d' and e'.

flowsheet for simple Linde cycle

Linde cycles of either the simple or high-pressure types may, as previously suggested, be made more efficient than those shown in Figs. 4 and 5 by the addition of auxiliary refrigeration using ammonia, Freon, etc. The effect on these two diagrams is to push the points c farther down the initial cooling line, where the constant enthalpy lines are steeper and the increase in entropy per unit of cooling is less. Entropy increase being a measure of thermodynamic inefficiency, refrigeration therefore improves the performance of the cycle. Furthermore, it is evident that the portion liquefied will be greater. Ruhemann states that the addition of refrigeration to the simple Linde cycle reduces the power requirement to about 52 percent, while its addition to the high-pressure cycle reduces power to about 34 percent of the requirements for the simple cycle.

Still greater liquefying efficiency is possible with the so-called cascade cycle, in which all refrigeration is secured by the expansion of liquids rather than gases which, as previously noted, is a more efficient cold producer than gas expansion. The system is complicated and so is seldom used, although it is capable, according to Ruhemann, of reducing the power consumption to around 20 percent of that

Fig. 5-Temperature-entropy diagram and flowsheet for high-pressure Linde cycle

for the simple Linde cycle. Such a cycle employs a series of interlocking refrigeration cycles with progressively lower boiling refrigerants, each of which can be liquetied by moderate pressure at the temperature of the boiling liquid of the next higher boiling retrigerant. For example, ammonia can be condensed at atmospheric temperature, ethylene in boiling ammonia, and methane in boiling ethylene. Finally, air under moderate pressure will condense in boiling methane. The atmospheric boiling points of these several gases are included in Fig. 1.

Air Separation

Although air is a multi-component mixture, about 99 percent is nitrogen and oxygen, and it will suffice for the present to consider it as a two-component system of 79 percent N_2 and 21 percent O_2 . The fundamentals of its separation by the usual methods of fractionation differ in no way from those encountered in more familiar cases of distillation and rectification in the organic field, except for the problem of obtaining refrigerants cold enough to bring about condensation. In air liquefaction only the components of the air itself can ordinarily be used. If this appears to be a case of

Fig. 6-Temperature-entropy diagram and equipment flowsheet for Claude cycle



lifting one's self by one's own bootstraps, it need only be recalled that the same refrigerant can produce a variety of temperatures, depending on its evaporation pressure and that, for example, nitrogen at a higher pressure can be condensed by boiling oxygen at a lower pressure, despite the fact that at the same pressure oxygen's boiling point is higher.

If a mixture of oxygen and nitrogen in the proportions of air be cooled until condensation begins, oxygen (the higher boiling component) will condense more rapidly at first and the liquid formed will be higher in oxygen and lower in nitrogen than the gas that is condensing. This situation is shown for pressures of 1, 5 and 20 atm. by the equilibrium diagram of Fig. 7 (after Dodge and Dunbar[®]). Just as with the equilibrium diagrams used in ordinary distillation, these charts are drawn so that a vapor mixture at any point on the upper curve is in equilibrium with the liquid mixture on the lower curve which lies on the same horizontal line (same temperature).

On the I atm. diagram, for example, air at 81.4 deg. K., which is just start-ing to condense (point a) is in equilibrium with a liquid mixture of 49 mol percent of oxygen and 51 mol percent of nitrogen at the same temperature (point b). As the air cools further and more of it condenses, the liquid composition becomes progressively poorer in oxygen and the vapor progressively richer in nitrogen, until eventually at point c, where condensation is completed, the liquid composition equals that of the original gas mixture. However, the last bubble of gas to condense has the composition of point d or 93.5 percent N2 which shows that a gas mixture and a liquid mixture in equilibrium must have different compositions.

Furthermore, considering a system depending on condensation, when air passes upward through a vertical tube surrounded by a refrigerant of sufficiently low temperature, condensate will form on and flow down the walls of the tube and there will be continual interaction between the refluxing liquid and the up-flowing gas in such a way that at all points the liquid will contain more oxygen and less nitrogen than the gas. The descending liquid will give up nitrogen and become enriched in oxygen. If the condenser is long enough, almost pure nitrogen gas can be obtained at the top, but it is impossible to obtain a liquid at the bottom that contains more oxygen than is in equilibrium than the incoming gas mixture.

Thus it appears that this method of separation, which is known as de-

phlegmation, cannot be used for the complete separation of air. Rectification on the other hand, which differs from dephlegmation both in providing more nearly ideal conditions for interaction of the liquid and vapor phases, and in providing ample reflux, can in theory, if properly applied, be used for complete separation.

A simple rectifying column is shown in Fig. 8. Compressed air entering through a heat exchanger is cooled to the liquefaction point by gaseous oxygen and nitrogen leaving the system. It is further cooled in passing through a coil submerged in boiling oxygen, then expands through a valve (throttling) and enters the top of the column where it trickles down over plates of any suitable type against a rising current of gas. Approximate equilibrium can thus be obtained on each plate. The liquid becomes progressively enriched in the higher boiling oxygen, while the vapor becomes enriched in the lower boiling nitrogen. With enough plates pure oxygen can, in fact, be collected at the bottom, but with such a column pure nitrogen cannot be obtained since the outgoing nitrogen must be in equilibrium with the incoming liquid air. According to Fig. 7 this corresponds to a nitrogen percentage of 93.5.

Thus, where a dephlegmator produces pure nitrogen and impure oxygen, a simple or so-called "single" column produces pure oxygen and impure nitrogen. The latter fact may not be serious if the nitrogen is to be wasted, except that a considerable loss of oxygen, perhaps as much as 40 percent, occurs with the nitrogen, thus wasting the power that has been expended on it. The situation can be corrected if the liquid air can be introduced into the column at about its midpoint and the upper half of the column provided with liquid nitrogen reflux for removing the gaseous oxygen from the overhead product. A solution to this seemingly difficult problem lies in the use of a "double" column (Fig. 9) developed by Linde in 1910.

How Double Column Works

Assuming that cooling down has been completed, air is admitted through a series of heat exchangers operating against the outgoing gases at some pressure from say 20 to 60 atm. (depending on the cycle), passing through an evaporator coil a in Fig. 9 where it is further cooled by boiling a liquid containing from 35 to 45 percent O_2 . The liquefied air then expands through a valve b to 5 atm. and enters the lower column c on a plate corresponding to its composition (or,



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Fig. 7—Equilibrium diagram for air at pressures of 1, 5 and 20 atm.

an alternative scheme is to admit partially liquefied air directly into the bottom of the column at a lower pressure, without coil a or valve b). In the lower column the air is rectified with liquid nitrogen reflux from d to a pure nitrogen gas and an enriched liquid air. The nitrogen gas passes overhead to a con-denser d cooled with liquid oxygen boiling at about 1 atm., liquid nitrogen refluxing and also collecting in a trough e. The enriched liquid air of 35-45 percent O₂ is withdrawn from the bottom of the lower column and expanded through valve f to 1 atm., entering the upper column g on a tray corresponding to its composition. Meanwhile, pure liquid nitrogen from the trough e is expanded through valve h to 1 atm. and introduced as reflux into the top of the upper column at i. The enriched air feed is then rectified in the upper column against the pure nitrogen reflux, yielding a pure nitrogen gas overhead which is drawn off at j and pure liquid oxygen at the bottom of the upper column. The latter boils around the tubes of condenser d and pure oxygen gas is then withdrawn at k.

If the plant is of a type where sufficient refrigerating effect can be produced without recovering the "cold" that would otherwise be available in the exit gaseous oxygen, liquid oxygen can be withdrawn at k.

The double column described here is the type most widely used in the oxygen industry, although a number of variations are employed. Simple Conternantia Solution So

quilibrium diagram in sures of 1, 5 and 21 m

tive scheme is to in fied air directly into il a or valve b). Inte e air is rectified m flux from d to a pu an enriched liquit s passes overheal to cooled with liquit bout 1 atm., liquidu d also collecting in niched liquid ar a s withdrawn from ower column and a eftolatm., ente n g on a tray on composition. Me itrogen from the b through valve htt ed as reflux inh t column at i. Thea en rectified in th st the pure min a pure nitrogen a drawn off at ja at the bottom The latter boils condenser d zu then withdrawn? is of a type who ating effect can a recovering the herwise be availe s oxygen, liquid a wn at k. column describer st widely used in , although a m e employed. S

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plants, particularly some of the portable designs developed during the war, use single columns for the production of oxygen alone. Claude designs usually substitute a dephlegmator for the lower column, for it will be recalled that a dephlegmator can produce pure nitrogen but not pure oxygen, a characteristic similar to that of the lower portion of a double column.

Complete Plants

At the start, it should be made clear that an air separation plant has the choice of making several different kinds of product, depending on the demands of the market. In the past most plants in the United States have turned out high-purity 99.5 percent O,, some in liquid form, others as oxygen gas. Some have wasted their nitrogen, whereas others have had a market for highpurity nitrogen in either liquid or gaseous form. A good many plants have been equipped for producing argon, while a few have separated the rarer gases including a neon-helium fraction and sometimes a kryptonxenon fraction^a. In Germany the ad-vent of "enriched air" uses and the development of the Linde-Frankl process brought a lower purity oxygen of 98 percent or less O, into the picture. In the opinion of many, the United States is now on the verge of a similar trend toward low-purity oxygen for large-scale combustion and industrial chemical uses.

The designer has a number of other choices to make in addition to the type of output. These include, among others, the method of producing refrigeration, the means for purifying the incoming air of water vapor and carbon

Fig. 8-Single fractionating column

dioxide, and the question of what pressure to employ.

The various refrigeration methods have already been mentioned, including throttling, throttling and expansion in an engine (in various proportions), and throttling with auxiliary refrigeration (with or without expansion). Nothing has been said, however, about the air purification problem. Water vapor and carbon dioxide, both present in variable proportions as shown in Table I, must be removed down to dewpoints as low as the lowest temperature in the process if the equipment is not gradually to become inoperable from plugging with CO₂ and water ice. In spite of purification, many systems do have to be thawed out at more or less frequent intervals and such plants are designed with extra units to permit some to be out of service for thawing at all times. Most present plants rely largely on chemical methods for removing at least the carbon dioxide, while some use chemicals also for water removal. Caustic soda or potash may be used for both, or caustic soda for CO, removal and silica gel for water. However, water is often removed by freezing it out in a heat exchanger which can subsequently be thawed out with incoming air, waste nitrogen, or warm refrigerant gas.

In the Linde-Fränkl process for 98 percent purity oxygen, metal-packed accumulators or regenerators are substituted for the first heat exchangers, not only permitting a somewhat closer temperature approach at the warm end than with exchangers, but also enabling both CO₂ and water vapor to be frozen out, subsequently to be reevaporated by direct contact with the exit gases. A cycle of this general type

Fig. 9-Double fractionating column

Compressed air in 02 out N2 out Column Liquid air Expansion value Coil



is employed in a plant being built by Air Reduction Co. and Koppers Co., for Bethlehem Steel⁴. For uses employing low-purity oxygen it is, of course, of no consequence that this cycle inevitably produces some contamination of the oxygen and thus cannot yield a high purity gas. The process is, therefore, not employed where high purity is necessary.

This limitation of plants using accumulators can be overcome when high purity gas is needed by the use of reversing exchangers of the type first brought to commercial development by Prof. S. C. Collins', between 1937 and 1943. Exchangers of this general type were used in several wartime portable designs^{1, 8}, and have been advocated for large tonnage production, as for example, by Hydrocarbon Research, Inc.^{1, *}, and M. W. Kellogg Co.^{10, 11, 12}. In the triple and quadruple pipe exchangers of this type, both outgoing oxygen and waste nitrogen are at all times in heat exchange relation with the incoming air, causing the freezing out of moisture and CO2. However, the several gases are separated by metal walls as in ordinary exchangers and the reversing feature applies only to the air and waste nitrogen channels so that contamination of the oxygen is impossible. At three-minute intervals the air and nitrogen swap channels and the nitrogen removes the ice accumulation by evaporation.

Other Contaminants

In addition to CO₂ and water as contaminants of the air, other materials occur in lesser amounts. Oxygen plants are situated away from main industrial areas if possible to lessen contamination. Nevertheless, dust must be filtered out; acetylene, if not removed, tends to accumulate in minute quantities in the liquid oxygen reservoir of the column if there are "pockets," resulting in a considerable hazard; and hydrocarbons from the compressor lubricants tend to be carried into the system. Activated carbon filters may be used for hydrocarbon removal and at least one system¹⁰ claims the use of a catalytic oxidizer for converting acetylene and other hydrocarbons to CO₂ and water.

The question of what pressure is most advantageous for an air separating cycle is not simple to answer since it depends on many factors. One of the most important considerations is the size of the plant. The capacity of a plant varies roughly as the cube, whereas heat leakage (which is a surface effect) varies roughly as the square of some linear dimension of the

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Fig. 10-Simple Linde air separation cycle with ammonia refrigeration



Fig. 11-Air Products cycle used for plants of intermediate capacity

plant. Therefore heat leakage is much less, proportionately, in large than in small plants. Since heat leakage makes up a large part of the load in a plant making gaseous products-for the refrigeration available in the liquid intermediates is largely recovered-it follows that once operating equilibrium has been reached, the minimum possible steady-state operating pressure must vary roughly in inverse relation to the plant size. Hence a large plant can use a lower pressure than a small one. On the other hand, unless a plant uses auxiliary refrigeration, its only method of cooling down in starting is through the dissipation of pressure by throttling or adiabatic expansion. The higher the pressure, the quicker cooling down can be achieved and the greater the flexibility of the plant.

In practice, the tendency in plants with reciprocating compressors is to provide for a medium to high starting pressure (60 to 200 atm.) which can be reduced when the steady state is reached by opening the throttle valve until the lowest pressure (15-25 atm.) that will supply the necessary refrigeration has been attained. With motordriven compressors, carrying this to the extreme means underloading the motor during the steady state with consequent low motor efficiency. A compromise between ability to cool down rapidly, and still maintain relatively high motor efficiency after reaching operating equilibrium, is usually chosen.

In addition to plants that start high and run on lower pressure-which must be designed for high pressuresthere are plants abroad and plants projected for the United States that combine extremely high capacity for lowpurity oxygen (up to 2,000 tons per day) with a low top pressure of $4\frac{1}{2}$ to 6 atm. Such low pressures can be handled with centrifugal or axial flow compressors and expanders which, indeed, are necessities for the enormous air tonnages handled. The piping and heat exchangers can be built for low pressures but, on the other hand, must be much larger in cross section than comparable equipment for higher pressure processes. Where there is some saving in compressor cost and a considerable saving in power, heat exchanger and piping costs increase and in some cycles, in fact, heat exchangers tend to cost at least as much as the rest of the plant.

quirement determines cycle pressure, there appears in most cases to be a balance point (depending on plant size) where a minimum over-all production cost can be achieved, not nccessarily at either the lowest usable pressure—and hence the lowest power cost—nor at the lowest possible plant investment. However, need for operating flexibility may overbalance extreme economy in operation. Such questions can be answered only by a thorough analysis in the light of the individual plant's requirements.

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Plant Cycles

Features of the main types of liquefiers and fractionating devices have already been described. Our next step is to consider how these have been integrated into actual cycles, for which purpose we shall employ a series of simplified flowsheets. Fig. 10 (after Ruhemann⁴) gives a flowsheet of a simple Linde cycle with auxiliary refrigeration. Air is compressed in (1) with inter-stage cooling (2) and is scrubbed with NaOH solution (3) after the second stage to remove CO₂. It then passes in series through a pair of alternating heat exchangers (4), the second one in the series being cooled to about -15 deg. C. with the outgoing nitrogen and oxygen. Most of the water is frozen out in the second exchanger. Before blocking occurs the order of the two exchangers is reversed so that the warm air first enters the second exchanger where it melts the ice, after which it is cooled in the first exchanger. The air is then further cooled to about -45 deg. C. and further dehydrated in a second pair of alternating exchangers (5) where cooling is accomplished in one by NH. vapor from a double-expansion refrigeration system, while the other exchanger is being defrosted and purged by warm NH_s vapor direct from compressor (6). The refrigerant vapor from the compressor is first cooled in a condenser (7), then expanded into vessel (8). After a second expansion into vessel (9), the cold vapor passes to the cold heat exchanger, while the vapor from the latter returns to (9) and thence to the compressor. The air, now thoroughly dried, is further cooled against the oxygen and nitrogen gas delivered by the column in exchanger (10). It is liquefied in the evaporator coil in the bottom of the column and then expanded into the lower portion of the column. The operation of this column and of those to be described with Figs. 11, 13, and 14 is exactly the same as the column described with Fig. 9. Plants manufactured by Air Prod-

Except where the compressor re-

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Plant Cycles

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ucts, Inc., which are leased to users in the United States and sold abroad, illustrate the fact that plant design depends to a large extent on size. For example, the three smallest units, for 200-1,200 cu.ft. per hour, all use auxiliary Freon refrigeration for added flexibility, purifying the air in a caustic scrubber, after which it is dehydrated with silica gel or activated alumina. Except for the largest size, a single column is used. The column produces liquid oxygen which is pumped up to cylinder charging pressure by a novel nitrogen-cooled reciprocating pump, and then is vaporized in the single exchanger and sent to high pressure cylinders. An over-all saving of about 10 percent in power is claimed for this system, as compared with the usual method of compressing gaseous oxygen for cylinder charging. An incidental advantage is that the heat exchanger becomes extremely small and simple.

For larger Air Products plants in the intermediate size range, Fig. 11, a 2,000 cu.ft. per hour plant, is typical. Air is filtered (1), compressed (2), cooled (3), and scrubbed with caustic (4). It is then dried in one of two ing heat entry activated alumina or silica gel cylinone in the ma ders (5). An electric heater (6) supbout -15 deg. (plies warm air for reactivation. The trogen and my air is then cooled against the outgoing oxygen and nitrogen streams in ger. Before blodge the two main exchangers (7) which the two endures operate in parallel. Part of the air is at the war at taken off midway through the exchangcond exchange a ers and put through the reciprocating after which it expansion engine (8). The other part hanger. The air of the air, after further heat exchange, d to about -hi expands from operating pressure of ehydrated in a small about 750 psi. to column pressure and g exchangers enters, along with the air from exomplished in our pander, directly into the bottom of the double expanses lower portion of the column (9), which otherwise operates as in Fig. 9. The liquid oxygen is sub-cooled against nitrogen (10) and discharged by a nitrogen-cooled pump (11) at cylinder filling pressure. The liquid is vaporized in exchanger (7) and delivered to the cylinder-filling rack.

In the pictured flowsheet on pages 136 to 139 of this issue, we portray a modern plant for liquid oxygen, operating on the Heylandt cycle. As previously mentioned, this cycle differs somewhat from both Linde and Claude cycles to give a particularly efficient over-all result.

Rare Gas Separation

The cycle shown in Fig. 12 employs features originated by Claude and is similar to cycles favored by the Air Reduction Co. In addition the diagram shows extra equipment for the purpose of producing argon and a neon-

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helium fraction. Such features are often added to separating plants of other types. In comparison with other flowsheets shown here, therefore, the most novel feature is the use of a $1\frac{1}{2}$ column fractionator, rather than the usual double column. Just as in Fig. 10, Fig. 12 shows air compressed in (1), cooled in (2), and scrubbed with caustic in (3). Water is removed by freezing out in the alternating exchangers (4) while part of the air (up to 80 percent in some of Claude's cycles) passes to an expansion engine (5), while the remainder is further cooled in another exchanger (6) called the liquefier. This air is then expanded into an outer annular chamber in the bottom of the dephlegmator (7), where it meets the air from the expander. Vapor rising through the outer tubes becomes enriched in nitrogen when cooled by boiling oxygen outside the tubes. The inner tubes condense the nitrogen vapor and deliver liquid nitrogen to the center chamber at the bottom. Oxygen separated and condensed from the enriched liquid air (8) by the column (9) collects around the upper part of the dephlegmator tubes, then overflows into a lower compartment around the outer tubes from which the resulting vapor leaves the column. As in other columns, the reflux for the upper portion is liquid nitrogen (10).

If a column of this type, or one of the more usual double columns, is not equipped to produce argon (which boils between oxygen and nitrogen) then the argon will have to leave with one or both of the products. Furthermore, it tends to accumulate in the upper column and reduce plate efficiency. A crude argon fraction of about 7-12 percent A and very little Ns can be taken from the plate where its concentration is greatest and further concentrated to about 60 percent A and 5 percent N_2 in a separate column (11), equipped with an evaporator coil at the bottom and a condenser at the top⁴. Gaseous nitrogen from the dephlegmator (or lower column N2 condenser) is the heating means. The nitrogen condenses in the coil and then is used to cool and condense argon for reflux at the top of the column. Another refinement shown in Fig. 12 is a concentrator for the neon-helium fraction indicated at (12). These ex-

Fig. 12-Basic Claude cycle with added equipment for rare gas separation









Fig. 14-M. W. Kellogg low-pressure cycle with reversing exchangers

tremely low boiling gases tend to accumulate in the nitrogen condenser and lower its efficiency, which can be avoided by blowing off the condenser occasionally. If a neon-helium concentrate is desired, this can be produced by placing condenser (12) at the top (coldest part) of the column and passing a stream of nitrogen gas containing its small burden of neonhelium through it from the main nitrogen condenser. Most of the nitrogen condenses and a condensate of about 23 percent neon and 7 percent helium* can be obtained. If desired, still further purification can be effected by separating a krypton-xenon fraction from the liquid oxygen. These gases are higher boiling than air, and in extremely minute concentration. However, they can be concentrated by further rectification, although to produce any considerable quantity it is necessary to use special methods whereby the krypton content of a large quantity of low-pressure, unliquefied air is scrubbed out and concentrated by a small amount of liquid air*.

Low Pressure Plants

Cycles so far discussed all operate at moderate to higher pressures. The Linde-Frankl cycle of Fig. 13, developed in Germany in 1928 for the purpose of making low-purity oxygen of 98 percent or less O2 content, uses centrifugal compression at (1), compressing the air to 4½ atm. and purifying in it "cold accumulators" (2) and (3), which have the dual function of transferring heat and simultaneously removing water vapor and CO, from the air. The four accumulators are pressure vessels packed with corrugated sheet aluminum spirals, two of them (2) being cooled by waste nitrogen, the other two (3) by the oxygen product. The entering air passes through a previously cooled pair of accumulators,

where it is cooled and its water and CO₂ condensed and frozen out. Meanwhile, the oxygen and nitrogen are flowing through the other pair, cooling them and evaporating and purging the previously collected water and CO₂ ice. At about 3-min. intervals the accumulators are reversed. The cold air enters directly into the bottom of the double column at (4) and partially liquefied air expands into the upper column. Except for the supplementary air feature and the use of nitrogen in the expander, both to be described, the column is conventional.

To make up part of its refrigeration needs, the process expands its gaseous nitrogen in a centrifugal expander after slight warming against a small incoming supplementary air stream in exchanger (5). About 4 or 5 percent of the total air supply is introduced at 200 atm. from a reciprocating compressor 7). This supplementary air is purified chemically in (8), precooled by NH₃ refrigeration (9), further cooled against waste nitrogen in (10), and against unexpanded nitrogen in (5). It is then expanded into the upper part of the column. Its purpose is to make up for a slight deficiency in the refrigeration available in the outgoing nitrogen and oxygen streams, and to assist in purging the accumulators.

Fig. 14 shows the cycle advocated by M. W. Kellogg Co. 10. 11. 19, which is typical of the reversing exchanger cycles now being put forward by several engineering firms for large scale use. Although this cycle will probably be employed chiefly for large scale low-purity oxygen, its exchangers do not contaminate the oxygen product with air,

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water vapor and CO, as do the Linde-Fränkl accumulators, so that it is capable of producing high-purity oxvgen For low-purity use, it would appear that the cost of the exchangers would be somewhat unfavorable compared with accumulators. The process compresses air centrifugally to 77 psi.ga. in (1), oxidizes hydrocarbons catalytically in (2), and then, by means of automatic reversing valves (3), selects the proper air channels through the exchangers. The exchangers (4), of which a considerable number are required, employ extended surface in a concentric triple-tube construction, Product oxygen, in the central tube, always follows the same path. Waste nitrogen and air in the two outer annuli switch channels periodically so that the nitrogen can evaporate and purge the water and CO₂ left by the air on the previous cycle. The cold purified air leaves the top of the exchangers through automatic check valves (5) and passes through an activated carbon filter (6). Part of the air (the socalled unbalance air) then returns to an extra jacket (7) at the top of the exchangers where it is warmed before flowing by way of exchanger (8) and silica gel dryer (9)-which is provided for starting up-to the expansion turbine (10)¹³. Some of the main air stream is added to the unbalance stream before expansion to adjust its temperature. The unbalance air stream serves the same purpose of permitting complete exchanger purging as the supplementary air in the Linde-Frankl cvcle, but is claimed to require none of the complications of the latter.

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The main air stream enters the evaporator at the bottom of column (11) in the conventional manner. However, the enriched liquid air is filtered, then cooled against waste nitrogen in (12), while the nitrogen reflux is similarly cooled against the waste nitrogen in a second heat exchanger (13).

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Maximum Capacity When Needed Most • Ac-

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Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers – various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. Is pages filled with descriptions and applications.



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Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

If costs keep coming at you from such sources as pictured above due to certain valves on your line ... STOP THEM! Put the entire matter in the "hands" of the CASH STANDARD Streamlined Type 1000 Pressure Reducing Valve ... then you can keep your back turned to the CASH STANDARD "1000" Valves for years, because there will only be benefits coming at you as shown on this page. SUGGES-

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Main buildings of liquid oxygen plant; the lower part houses compressors and expanders, the higher heat exchangers and columns

1 These pumps draw water from a nearby river in interstage cooling of both the air and oxygen compression

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-LIQUID OXYGEN-

Shown here is a flowsheet of the principal operating steps in a typical high purity oxygen plant which uses the Heylandt cycle. (See article, pp. 126-134). Plants employing this cycle are efficient liquid oxygen producers but are able equally well to make gaseous oxygen. The plant shown makes primarily liquid oxygen but also ships gas in standard 244 and 122 cu. ft. high pressure cylinders. Air is taken in through filters on the roof and, after removal of carbon dioxide in caustic scrubbers, is compressed in large four-stage reciprocating com-

pressors. Three compressors are used for each of the production units, while three expanders equipped with power absorbers supply most of the refrigerating effect required for liquefying the air.

After compression the incoming air is dried and part is passed through several heat exchange stages where it is cooled by waste nitrogen gas leaving the system. The remainder of the air is bled off ahead of the exchangers and expanded in reciprocating expansion engines to a fairly low pressure where, as a result of doing work which is absorbed usefully, the air is cooled considerably. The main air stream expands through a valve and the entire air supply, now partly liquefied, then enters the bottom of the double rectifying column. Liquid oxygen collects around the condenser tubes shown part way up the column, while liquid nitrogen accumulates in a trough below this condenser. The liquid nitrogen is used as reflux in the upper part of the column for rectifying the enriched air introduced from the lower part of the column.

The pure liquefied oxygen drawn off from the column is stored in heavily insulated tanks from which some evaporation takes place. This evaporation is collected in low pressure gas holders from which the gas is withdrawn by compressors for charging into standard cylinders. Most of the oxygen, however, is shipped as liquid in heavily insulated box tank cars and tank trucks. If desired gaseous rather than liquid oxygen could be withdrawn from the column, passed through heat exchangers, and handled in the same manner as the present gaseous product.

Accompanying photographs and flowsheet furnished by the Linde Air Products Co.

CHEMICAL ENGINEERING

March, 1947

PAGES 136 TO 139

2 Air intake filters on the roof introduce air into the process by way of the four-stage air compressors



3 Three of these synchronous-motor-driven reciprocating a compressors are provided for each production unit of the plan











B. F. Goodrich Chemical Company has available for sale these organic chemicals



For additional information please write B. F. Goodrich Chemical Company, Department CD-3, Rose Building, Cleveland 15, Ohio.

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MARCH 1947
 CHEMICAL ENGINEERING

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(Right) VALUE PLUS IN BRASS VALVES -Crane gives you a full line to choose from-gates, globes, angles, checks-for all needs. Shown is No. 438 Standard Brass Gate Valve with non-rising stem—a favorite for process lines that must be kept sterile. Rated at 125 lb. steam; 200 lb. cold working pressures. Sizes 1/4 to 3 in. Complete specifications in your Crane Catalog.



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for producing powdered materials up to 95%-99% finer than 5 to 10 microns

Superfine grinding jobs . . . beyond the range of the ordinary mill . . . are readily handled in this modern Raymond Vertical Mill

If your manufacture includes such operations as pulverizing chemicals, earth colors, talc, kaolin, limestone, graphite, vermiculite and other nonmetallic minerals . . . you can get extremely fine and uniform particle sizes by using the Vertical Mill.

The mill is complete with air separation and utilizes the whizzer principle in classifying the product. It is readily adjustable for fineness control.

> Write for Bulletin No. 5/

Raymond Vertical Mills are made in two sizes: 18" and 35" diameter of grinding chamber to suit different capacity requirements.

Sectional elevation of Vertical Mill il lustrating feeder, grinding element und whizzer clas



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VALVES • FITTINGS PIPE . PLUMBING AND HEATING

FOR EVERY PIPING SYSTEM

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rent, without dry batteries or standard cells. Owing to its use of a resistance thermometer bulb, the length of lead wires does not affect calibration.

5. Evaporative Condenser

FOR SMALL refrigeration systems rated at from 2 to 7 tons capacity, Niagara Blower Co., 405 Lexington Ave., New York 17, N. Y., has introduced a Bantam model of its Aeropass evaporative condenser, designed to maintain minimum practicable head pressures at the compressor through automatic condenser control. This condenser, using the spray water principle, recirculates the water and removes 1,000 B.t.u. for every pound of water evaporated, thus minimizing water consumption as compared with usual condensers. As in the company's larger models, the condenser employs a pre-cooling coil to reduce the gas temperature below the boiling point of water and thus prevents scaling. The unit also has an oil separa-tor between the dry coil and the sprayed coils and employs automatic air recirculation to maintain a balanced wet-bulb condition.

6. Remote-Bulb Thermostat

Low-cost, explosion-proof construction is used in the new type EJO remote-bulb thermostat put on the warket by United Electric Controls Do., 69-71 A St., Boston, Mass. The anit is designed primarily for applications where dangerous dust and fumes are prevalent, all mechanism being located in an approved housing, the cover of which is threaded for easy moval for inspection or maintenance. The thermostat has an external calibrated adjustment with a 120 deg. or 250 deg. F. range in models covering -120 to 600 deg. F.

7. Pipe Leak Clamp

144

SEALING leaks in pipes at pressures of 240 psi. and even higher is claimed to be accomplished successfully with a new stainless steel pipe leak clamp announced by Marman Products Co., 940 West Redondo Blvd., Inglewood, Calif. The clamp consists of a Hycar synthetic rubber pad secured to the pipe by an annealed backing plate held over the leak by stainless steel clamps of the continuous band type. Since the backing plate can be hand formed to the desired pipe contour, one size of clamp will take care of several pipe diameters. Six sizes are available to fit all pipe diameters from 1/2 to 12 in., with large sizes available on request.



Bantam Aeropass evaporative condenser



Explosion-proof thermostat

8. Air Motor

MODEL 1 is the designation of a new explosion-proof air motor for producing up to 1/6 hp. at speeds up to 6,000 r.p.m., recently introduced by Gast Mfg. Co., Benton Harbor, Mich. The motor weighs $2\frac{1}{2}$ lb. and is $2\frac{1}{4}$ in. in diameter. Its operating elements consist of a shaft-mounted rotor carrying four one-piece sliding vanes which are forced outward in the shell, prescuting their surfaces to the incoming air to cause rotation. The motor is said to run at speeds as low as 100 r.p.m. without stalling.

9. Temperature Regulator

For CONTROLLING gas fuel supplied for process heating, the Leslie Co., 64 Delafield Ave., Lyndhurst, N. J., has announced a new self-contained, directoperated temperature regulator available in $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$ in. sizes for standard temperature ranges from 20 to 600 deg. F. at inlet pressures up to 25 psi. max. All trim is bronze, with renewable valve disk and stem assemblies. Various bulb and bulb casing materials are available. A piston-guided bellows supplies the motive power. The valve incorporates an adjustment for the pilot flame.

10. Industrial Thermometer

Use of a separable socket is claimed greatly to facilitate maintenance of the new Senior Midget industrial ther-



Self-contained temperature regula Left-Industrial thermometer



Stainless pipe leak clamp

mometer offered by the Accura Scientific Instrument Co., Philadelphia, Pa. Through this feature, the thermometer need not be returned to the factory for repair since the maintenance man can easily insert a new refill stem in a few minutes, without loss of production time. This thermometer is produced in angle and straight stem types with heavy armor protection to resist corrosion and dit. It employs a flat-bore mercury stipp in a yellow column for easy reading

11. Multi-Head Tachometer

TYPE 40 E is the designation of a new tachometer having five heads and three speed ranges that is being offered by the Metron Instrument Co., 43 Lincoln St., Denver 9, Colo. The in strument uses five permanent mounted tachometer heads at five dit ferent machines, any one of which can indicate on the instrument dial when connected to the instrument by a selector switch. These heads are wired to the central indicating unit by orde nary BX cable or conduit. The several machines may be at remote locations. in fact, even in different buildings The scale of the instrument shows three separate speed ranges, also capable of choice by a rotary selector switch Any range between 1 r.p.m. full scale

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Eliminate Turbulence

Distribute Air Uniformly

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Designed to fit any air duct What's your ventilation or other air-movement job? La-Del Axivane* Fans can do it in less space and with less power-with easy, low-cost installation and quiet, trouble-free operation. • As the only manufacturer of Axivanet Fans, let our engineers check with yours on futures.

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HEMICAL ENGINEERING • MARCH 1947 •

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ILLINOIS WATER TREATMENT CO. 844-3 Cedar St., Rockford, Illinais 7310-B3 Empire State Bldg., New York City





Tachometer for five indicating heads

and 50,000 r.p.m. full scale may be used. Like other instruments recently introduced by this manufacturer, the tachometer operates on a new principle based on alternate charging and discharging of a condenser without generator or magneto and without vacuum tube amplification.

12. Electric Lift Truck

MODELS for lifting and carrying both skid platforms and pallets are available in the new line of Power Jacklifts introduced by Lewis-Shepard Products, Inc., 248 Walnut St., Watertown 72, Mass. These electric-powered hand-guided lift trucks are equipped with electric brakes and designed to permit every operation with the handle vertical as well as in other positions. However, if the handle is released, the electric brake instantaneously stops the truck in its tracks. In the vertical position, or when lowered, the handle has a steering arc of 200 deg. to permit maneuvering in close quarters. All wheels are mounted on ball bearings, totally inclosed and packed in grease. The platform type is available in both wide and narrow models.

13. Needle Valve

CORROSIVE and high-temperature or high-pressure service in connection with gage and metering lines, instrument lines, test lines and the like is

Pallet-type electric hand truck





Heavy duty needle valve

the field of application of a new precision needle valve announced by Kerotest Mfg. Co., Pittsburgh 22, Pa. The valve uses a special union nut construction said to prevent dangerous blowouts during opening or repacking and also to provide an extra deep stuffing box. Positive back-seating a lows the valve to be repacked safely under full line pressure, it is claimed. The valve is said to combine positive shutoff with micrometer throttling action. This is secured through the use of a stem having a ball seat, providing a positive line seal for complete shutoff, below which is a tapered tip for the desired needle action. Fine stem threads facilitate operation and give close control. Hardened, ground and polished stainless steel is used for the stem, ball seat and tip.

14. Diaphragm Valve

WHAT IS claimed to be a totally new design in diaphragm motor valves has been employed by Fischer & Porter Co., Hatboro, Pa., in its new Valvrator line of chemical service diaphragm motor valves. As the accompanying illustration shows, these valves use a dished-bonnet construction with flushseated bodies and through-bolts. No bonnet flanges are included in the body construction, a design feature said to result in compactness with lowest possible weight, simplified clean-out

Chemical service diaphragm valve



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Synthetic resins made with FORMALDEHYDE-HEYDEN serves the plastics manufacturer, whether he is using Casting resins, Laminating resins or resins suitable for injection or compression molding.

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The versatility of Ansul Liquid Sulfur Dioxide in industrial practices is illustrated by the following examples:

ACIDITY	
ANTICHLOR SO ₂ +	ANTICHIOR
ANTI OXIDANT SO2 +	$SO_2 + 2H_2O + Ch_1 + Ch_2$
HYDROSULFITES 250g -	A typical use is is at the H2SU4 + 2HCI
SULFOXYLATES 2502	Sulfur Dioxide is essential to the productry
NEUTRALIZATION 2502	ness and prevents color reading the improves bright-
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In addition Ansul Liquid Sulfur Dioxide is being currently used as a bleaching agent • purifier • preservative • solvent • fumigant • protective atmosphere In magnesium fabrication • refrigerant and in polymerization, etc.



characteristics and the possibility of fabrication in nearly all corrosion resisting materials. Among available body materials are iron, bronze, stainless steel, carbon steel, hard lead Haveg, hard rubber, Monel, nickel, Hastelloy and porcelain. The valve is made only in 150 lb. construction, in sizes from $\frac{1}{2}$ to 1 in. screwed, and from 1 to 3 in. flanged.

15. Single-Lens Goggles

DESIGNED to employ a continuous rubber frame and a single large acctate lens, a new goggle is available from American Optical Co., Southbridge, Mass., intended particularly



Goggle with acetate lens

for protection against chemical and dust hazards. The goggle can be worn in combination with the company's R-1000 respirator. As the accompanying illustration shows, it affords exceptionally wide vision. In addition it is claimed to give good ventilation and long wearing comfort. It may be worn over most types of prescription glasses. The face-fitting frame is molded from non-irritating, acid-resisting synthetic rubber with perforations at top and sides for ample ventilation. The acetate lens is said to conform to high optical specifications and to be capable of easy replacement.

16. Steel Skid

AN ALL-STEEL welded skid platform for use with both electric and hand lift trucks which incorporates several innovations has recently been announced by the Market Forge Co.. Everett, Mass. Built in any desired size for any specified lift truck, the

Welded all-steel skid platform



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Lubricated Values ON YOUR CHEMICAL LINES

Nordstrom valves give your lines perfect control because they embody: (1) Simple, strong and compact design; (2) The tapered plug provides inherent, positive seating; (3) Hydraulic force is applied through lubricant to insure free operation and positive pressure sealing; (4) Pressurized lubricant channels completely surround the ports, insuring positive sealing against internal and external leakage; (5) Simple rotary action provides positive opening and closing, with minimum mechanical action and without seat exposure; (6) A quarter turn opens or closes the valve; (7) Corrosion and erosion are resisted.

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Acetone Alcohols Alkalies Alum Ammonia Amyl Acetate Aniline Oil Innznate of Soda Benzoic Acid Boraz Brines Butadiene

Standard Pattern

Acetic Acid

Butane **Butyl Alcohol** Calcium Chloride Carbolic Acid Carbon Bisulphide Carbon Dioxide Tetrachloride Caustic Soda Cellulose Acetate Cellulose Nitrate

Chromic Acid Citric Acid Corrosive Sublimate Creosote **Cresylic** Acid **Cyanide Solutions** Ethyl Alcohol Ferric Sulphate Ferrous Sulphate Formaldehyde

Formic Acid Furfural Glucose Glycerine Gypsum Helium Hydrochloric Acid Hydrocyanic Acid Hydrofluoric Acid Hydrogen lodine Magnesium

Multiport

Nitric Acld Nitrogen Oleic Acid Oleum Propane Pyrogallic Acid Sodium Silicate Styrene Sulphuric Acid Tannic Acid

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Round Opening



Short Pattern

NORDSTROM VALVE DIVISION

Venturi Pattern

Main Offices: 400 North Lexington Avenue, Pittsburgh 8, Pa., Atlanta, Boston, Chicago

Rockwell Manufacturing Company Houston, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco, Seattle, Tulsa

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TANK of welded steel, lined with rubber and protected with lining of acid-proof brick, joined with Carbo-KOREZ.* This unit, in a by-product coke plant, handles sulphuric acid, several organic acids. and is subject to severe abrasion.

*Carbo-KOREZ is a synthetic resin cement formed by mixing a powder and liquid.

TANK for hydrofluoric acid and various corrosive salts. Also used from time to time, for Alkaline process at 230° F. Built of steel, welded and lined with rubber, protected with carbon brick, joined with Carbo-KOREZ.*

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ATLAS Materials and Atlas Design have been proven in the chemical process equipment shown on this page . . . and the proof lies in long continuous service without "down time".

A complete line of acid- and alkali-proof cements, together with lining materials and coatings, acid- and alkali-proof brick and tile, jointing material for pipe, combined with years of experience, assures you of complete satisfaction.

Let our Engineering Department assist you in the design and specification of your tanks, stacks, drains, sewers, sumps, gutters, manholes, neutralization pits and process equipment. Contact our nearest branch, or write to our Mertztown Office for technical bulletin No., TB-3,

9 3

platform consists of steel deck panels presenting a smooth, even surface for handling sheet materials such as paper rubber and leather, securely welded to Z-bars on the underside. Solid bar steel legs are used, designed to permit storing the platform on end when empty and so permit conservation of valuable floor space. By interlocking the legs, two platforms so stored take scarcely more floor area in a vertical position than one platform. The platforms are said usually to be 15 to 20 percent lighter than corresponding conventional types, yet are claimed to have greater strength for their weight

If desired, platforms can be entirely galvanized or can be produced from stainless steel or aluminum when corrosive conditions are present.

17. Heavy Duty Mill

FOR HEAVY DUTY grinding and pulverizing applications, the Buffalo Hammer Mill Corp., Buffalo 3, N. Y., has added a new model to its line of 16



Model W-30(H) heavy-duty hammer mill

standard types of hammer mills, the new model having an over-all height of 47 in. and a charge opening of 24x30 in. The machine, which may be discharged either by gravity from the bottom, or by conveying pneumatically to a collection system, is of steel-plate welded construction and is provided with a built-in trap for protection against harmful substances that may enter the mill. The mill is said to be suitable for use in abrasive, chemical. ceramic, fertilizer, paper, plastic, re-fractory and other industries where it may be used not only for fine grinding operations, but also for shredding, defiberizing and other types of reduction. For this purpose a complete line of hammers of various thicknesses is available.

18. Recording Rotameter

INSTANTANEOUS response to changes in flow is said to be obtained with a new type of recording rotameter utilizing the Foxboro Co.'s Dynalog

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THROUGHOUT America, in great and small production plants clibs when production plants alike, wherever power turns the wheels of industry-Sterling Slo-Speed (Geared) Motors are leading the way to increased production records. Sterling Slo-Speed (Modern Gear System) Motors give machinery manufacturers and production executives a complete power drive in one soundly engineeredcompact—flexible—ultra efficient unit. Write today for complete information STERLING ELECTRIC MOTORS, INC. . LOS ANGELES CHICAGO Representatives in Principal Cities NEW YORK

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With Beaumont Birch Coal Handling Equipment, one operator controls all coal handling with finger-tip controls, like this—

Coal arrives by rail, is dumped into hopper, raised by bucket elevator and discharged either into bunker for immediate use or down a chute to yard storage. If it goes to storage, the Beaumont Drag Scraper spreads it into safe, compact layers—eliminating air pockets. Use any available space. Tailblocks can be slung between posts and moved by hand—and mechanically moved on I-beam track, by tail-block car, or suspended from an aerial bridle system. The scraper and cable system is operated by one man through remote control. One company, Beaumont Birch, supplies all necessary equipment.

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system of electronic high-frequency transmission, that has been introduced by Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia 22, Pa. The recording system is based on the induction bridge method and is designed to afford continuous balance, together with ample power. The system employs unit construction with four principal assemblies, affording direct linkage without gears. It is claimed to give positive linear motion, long life, and to eliminate overtravel. This transmitter is now available for many standard SK rotameter designs.

19. Cartridge Filter

MADE in ten sizes and three models, expendable cartridge filters with from 1 to 100 sq. ft. of filtering area have been announced by Bowser, Inc.,



Replaceable cartridge filter

Fort Wayne, Ind., for liquids with viscosities up to 600 S.S.U. and temperatures as high as 350 deg. F. The filter element is a replaceable, resinimpregnated, cellulose-base cartridge said to remove particles as small as 1 micron. Cartridges are housed in a casing with pipe connections on opposite sides of the filter shell, for inline piping. All units are equipped with vent and drain valves and bolted covers for ease in inspection, cleaning and replacement.

Petroleum products, alcohol, animal and vegetable oils and a variety of other liquids can be filtered and clarified with this equipment.

20. Vacuum Breakers

Sizes from $\frac{1}{2}$ to 6 in. pipe size are available in two lines of vacuum breakers announced by the Associated Valve & Engineering Co., 1150 West Marquette Rd., Chicago 21, Ill., national distributors. The Mipco Series 300-2 vacuum breaker is built for pressures up to 600 lb. at 750 deg. F. and comes in eight sizes from 1 to 6 in. The Schade No. 1724 vacuum breaker is available in six sizes from $\frac{1}{2}$
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HEAT EXCHANGERS

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For efficient heat transfer between liquids and gases, the Bell & Gossett Company offers soundly designed equipment plus a helpful engineering service . . . competent, experienced and with a long record of successful designing to specific needs. Whether you are planning to modernize present equipment or are experimenting with new ideas for faster production and better quality, there is no obligation involved by a consultation with B & G engineers.

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Your request for information will receive prompt attention.



Hot oil coming from engine test blocks is cooled and strained in this B & G Self-Contained Cooler Unit.



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A very flexible line of direct expansion evaporators, condensers, liquid receivers, combination liquid receivers and subcoolers for refrigeration purposes are now available. Special alloys may be incorporated in the fabrication for those critical heat transfer applications when requested.



Allrefrigeration components manufactured by B & G conform to the ASME Code for Unfired Pressure Vessels.



Replacement costs are materially reduced when WESTON thermometers are adopted because their rugged, all-metal construction eliminates the ordinary causes of thermometer failures.

- Sturdy all-metal construction provides unusual resistance to vibration, shock or mechanical abuse.
- Absence of capillaries, gases, liquids or involved mechanisms, eliminates breakdowns.

Weston All-Metal Industrial Thermometers are available from stock in types, sizes and ranges for most applications, with stem lengths from $2\frac{1}{2}$ " to 48". If your jobber cannot supply you, see your local WESTON representative, or write for Thermometer Bulletin . . . Weston Electrical Instrument Corporation, 590 Frelinghuysen Avenue, Newark 5, New Jersev.

MAX-MIN models also available to indicate bigbest or lowest temperature reached.

Weston Instrum





Mipco vacuum breaker

panying illustration. The second type, for lighter duty, is intended primarily for providing protection to jacketed kettles, closed tanks and similar equipment which might collapse if subjected to sub-atmospheric pressure beyond a predetermined limit.

21. Steam-Water Mixer

PRIMARILY to produce hot water for industrial washrooms, the Sarco Co., 475 Fifth Ave., New York 17, N. Y., has announced a new steam-water mixer which is said to insure automatic, sensitive temperature control with hot water capacities as large as 200 gal. per hour at a temperature rise from 50 to 120 deg. F., using 75 psi. steam. In the accompanying illustration, steam enters at (1), goes through valve (2), while cold water enters at (3), mixes with the steam in injection chamber (4) and produces a hot water mixture which enters the housing at (5). The hot water flows

Steam-water mixer

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to vacuum breaker

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JACKSON & CHURCH CO. SAGINAW, MICHIGAN over thermostat (6) which actuates plunger (7) to close valve (2) and cut off steam at the temperature set at (8).

22. Pressure Extinguisher

CARBON TETRACHLORIDE under carbon dioxide pressure is used as the extinguishing agent in the new Stop-Fire stored-pressure hand extinguisher



Stored-pressure fire extinguisher

now available from Union Stop-Fire Corp., Brooklyn, N. Y. The fact that it is not necessary to pump the extinguisher is claimed to make its use easier and more accurate. The extinguisher has a long range, the bulk of the stream traveling anywhere from 15 to 25 ft. The extinguisher is equipped with a pressure gage indicating fluid pressure at all times.

Equipment Briefs

23. Less over-all weight, but more carbon dioxide content, is reported for the new 5-lb. carbon dioxide extinguisher produced by Walter Kidde & Co., Belleville, N. J. Replacing the old 4-lb. type which weighed 18 lb., the new light-weight 5-lb. type weighs but $15\frac{1}{2}$ lb.

24. HIGH TENSILE strength glass cloth, impregnated on both sides with synthetic rubber, has been used in the construction of a 60x80 in. fire blanket for plants and laboratories that is now being manufactured by United States Rubber Co., Rockefeller Center, New York, N. Y. The blanket is equipped with large brass grommets at the top and a weather-resistant bracket so that it can be hung outdoors or indoors and easily removed or replaced. It is red in color for quick identification. The blanket is distributed by Benson & Associates, Chicago, Ill.

25. HOLDING 3[§] lb. of carbon dioxide, the new Alfco Speedex fire extinguisher of American-LaFrance-Foamite Corp., Elmira, N. Y., has a total weight of less than 12 lb. The unit is suitable



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are designed to meet a wide range of product requirements and plant layouts. Packers are available in a variety of sizes and types, with filling speeds as high as twenty-four 100-lb. bags per minute—with one operator. Nearly 400 commodities—rock products, fertilizers, chemicals, foods, and feeds—are now being packaged in sturdy, low-cost multiwall paper bags. a series of factual or ces of a group of Amicanufacturers with Ma

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CONTRACTOR SANTATION PAYS DOUBLE DIVIDENDS

To the Central Soya Company, Inc., a sanitary package is a vital factor in the sale of its soya flour—one of the many soybean products made in one of the company's three Mid-Western plants.

This company, whose executive offices are in Fort Wayne, Indiana, formerly packed its flour in fabric bags. Recently it adopted a St. Regis Packaging System consisting of four 100-LS bag-filling machines and multiwall paper valve bags. Clean, fresh-looking Multiwalls won immediate approval from customers. They commented that these dust-free containers assured more effective protection against contamination and infestation. Untouched by human hands, Central Soya's flour today enjoys an enviable reputation for cleanliness.

In addition to better sanitary protection, the new system paid an extra dividend in the form of important economies in containers, labor costs, and in unit packaging costs, as shown graphically on the page at the left.

Thus, the company achieved two important objectives – more sanitary packaging and a substantial saving in costs. The savings alone, typical of economies provided by St. Regis systems, explain why manufacturers in many industries have adopted this modern packaging method. Mail the coupon for the complete picture story of this efficient, economical operation.



Clean Multiwalls stack compactly in Central Soya's storeroom.



Multiwalls are filled by this battery of four 100-LS packers, then placed on the floor-level conveyor for movement directly to box-cars or storage room.

PACKAGINGSYSTM ned to meet a to product requirem Iayouts. Paden of in a variety of to with filling seis twenty-four 104 minute-with ore early 400 commu products, femine foods, and federpackaged in sen ultiwall paper be



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for first-aid fire protection and for use on fires in flammable liquids as well as electrical equipment fires.

26. THERMIX CORP., Greenwich, Ct., has announced a new line of Aerotec pressure switches for controlling automatic boilers and industrial processes, under the designation of Series H-700. Various switches in the line are suitable for pressure ranges up to 300 lb. and differentials of from 1 to 80 lb. Ready adjustments are provided outside the cover, with accurately calibrated scales for range.

27. FOR USE where supplied-air respirators are necessary in dusty, objectionable or harmful atmospheres, the Scott Aviation Corp., Lancaster, N. Y., is offering a new "demand" respirator which is said to use only one-third the volume of air required by constant flow airline respirators and which eliminates the steady and irritating flow of air over the wearer's face. It is claimed that this respirator provides natural and effortless inhalation in contrast to the fatigue experienced when filter or cannister type masks are used. The device, which hooks on to a plant airline, can be used with a choice of face masks.

28. WATER VAPOR can be measured in any gas which does not react chemically with the electrolytic film on the tip of the detector unit, or the copper or brass parts of the instrument, by means of a new water vapor indicator announced by American Instrument Co., Silver Spring Md. The instrument measures water vapor content in saturations down to 0.001 mg. per liter or less, making determinations in 2 to 5 minutes as compared to several hours by gravimetric methods. Accuracy, however, is said to be comparable with that of the latter method. The instrument requires only about 0.1 cu. ft. of gas per test, and it is said that check tests indicate an accuracy of better than 10 percent of the amount of water present.

29. ABILITY to adjust its characteristics to the conductivity of a specific substance is incorporated in a new electronic level control for controlling high, low and intermediate levels of liquids and conducting solids, announced by Trimount Instrument Co., 37 West Van Buren St., Chicago 5, Ill. An electrode installed in the tank or other container actuates a magnetic relay when it comes in contact with the conducting substance. The control unit can be used to actuate valves, pumps or signalling devices and the conductance control permits adjustments so that the control will be unaffected by foam or foreign matter.



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101 Process Equipment. The Duriron Co., Inc., Dayton, Chio-General Catalog H is a 20-page booklet giving a general descrip-tion of each type of corrosion-resisting equipment manufactured by this company. Includes information on new alloys and equipment recently developed, as well as a list of processes and various industries in which this equipment adequately handles chemical corrosives. Also describes the production facilities of this company and explains the composition and applications of its important corrosion-resisting alloys.

OVER

Page 159

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103. Evaporators. Swenson Evaporator Co., Div. of Whiting Corp., Harvey, III.---Bulletin E-107. 8-page booklet featuring forced circulation evaporators for applications involving high viscosity, low temperature drop, saling or scaling conditions, or liquors that require expensive materials of construction. Principles of operation are described, and the advantages are outlined. Several typical flowsheets of processes using forced circulation evaporators are included. Processes where this type of evaporator is useful include the evaporation of electrolytic caustic soda, chemical caustic soda, black liquor,

magnesium chloride, distillery slops and other similar materials.

103, Pumps. Ingersoll-Rand Co., Phillipsburg, N. J.—Form 7095. 10-page illustrated booklet describing chemical pumps made of corrosion-resistant alloy. Details of construction are shown in cutaway views. Specifications, performance and capacities are given.

104. Valves. Manning, Maxwell & Moore, Inc., Watertown, Mass.—Bulletin 8500-B is a 12-page bulletin illustrating and describing the Hancock boiler valves made

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by this company. Construction details are shown in cutaway views and dimensions of the various valves are tabulated. Price lists and discounts are included.

105. Materials Handling. The Rapids-Standard Co., Inc., Grand Rapids, Mich.--Catalog No. 31-C5 is a 32-page bookled containing descriptions, photographs, and specifications of this company's line of power belt conveyors. Contains many illustrations of installations. Detailed drawings and close-up photographs show features of construction.

106. Instruments. Leeds and Northrup Co., Philadelphia, Pa.—Catalog ND 46 (1), 16-page catalog describing the Speedomar Type G pyrometers manufactured by this company. The principle of operation is described and a simplified schematic diagram shows the essential parts of this electronically balanced potentiometer instrument. Features which provide minimum maintenance and easy installation are illustrated. Specifications for the different models are given.

107. Vegetable Oil Bedning. The M. W. Kellogg Co., New York, N. Y.-10-page brochure entitled "Prescription for Glycerides" which illustrates and describes the Solexol process for refining of vegetable, animal and marine oils. Information is given on its use in processing and refining of tallow, soy bean oil, sardine body oil, linseed and shark liver oils, and fatty acids, together with information on possible uses of the fractionated products. It includes an analysis of the economic advantages claimed for this new refining method.

108. Crushers. The Williams Patent Crusher and Pulverizer Co., St. Louis, Mo. —Bulletin 623 is a 12-page booklet featuring the crushers, grinders, shredders, pulverizers, granulators, air-separators, milis, and screens manufactured by this company. Various types of equipment are illustrated with photographs, and diagrammatic sketches, which show features of construction, operation, and application.

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109. Electric Motors. The Leland Electric Co., Dayton, Ohio-Section 600. 8-page booklet illustrating and describing general purpose continuous duty explosion-proof motors made by this company. These motors, which are designed for use in explosive atmospheres containing zasoline, petroleum, ethyl and methyl alcohol, acetone and lacquer solvent vapors, are illustrated by photographs. Outstanding features are shown with cut-away views.

110. Chemicals. Los Angeles Chemical Co., Los Angeles, Calif.—64-page pocketsize booklet giving an alphabetical listing of the industrial and agricultural chemicals available from this company. Contains several pages of detailed information on some of the products made by this company and their more important applications.

(Continued on page 284)

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With the addition of propionaldehyde to the group of organic chemicals produced at Bishop, Texas, Celanese now offers industry a family of lower aldehydes which includes formaldehyde and acetaldehyde as well as this hitherto commercially unavailable three-carbon aldehyde. Sample quantities of propionaldehyde are available immediately for experimentation and pilot plant development. As propionaldehyde is incorporated into industrial processes, large scale production will be gauged to demand.

There are advantages in making Celanese your source of supply for organic chemicals. Situated in an area rich in natural gas, the basic material for Celanese chemicals, Celanese offers stability of supply with all its attendant benefits. Our Celanese Technical Staff is prepared to work with you to suggest the opportunities and processing improvements presented by this new group of petroleum chemicals now available from Celanese. Celanese Chemical Corporation, division of Celanese Corporation of America, 180 Madison Avenue, New York 16, N. Y.

ued on page 280

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Celanese* Chemicals

FORMALDEHYDE ACETALDEHYDE PROPIONALDEHYDE ACETIC ACID ACETONE METHANOL n-PROPYL ALCOHOL ORGANIC PHOSPHATES PLASTICIZERS INTERMEDIATES



CHEMICAL ENGINEERING • MARCH 1947 •

The bottle babies that grew up to be tank cars



Familiar sights to many chemists, these bottles contain samples of the three CSC methylamines. Every month, CSC fills requests for hundreds of samples to be tested in scores of practical industrial applications. As commercial users discover new

COMMERCIAL SOLVENTS Corporation 17 East 42nd Street, New York 17, N.Y. ways to profit from CSC quality and dependability, these sample bottles have a habit of growing up into drums and tank cars.

A request for a sample of a fine CSC chemical is frequently the first step in making familiar products better, and new products possible.

NEW PRODUCTS AND MATERIALS

Richard W. Porter, ASSISTANT EDITOR

For your convenience Reader Service Coupons will be found on pp. 159-160

51. Dithioglycol

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EMICAL ENGLY

HAVING the brand name of Thiokol SC-10, commercial dithioglycol is now being manufactured by the Thiokol Corp., Trenton, N. J. This material has a mild odor, is miscible with water and displays the physical and chemical properties of glycols. It is amber in color, with a sulphurous odor instead of the colorless and odorless characteristics of the pure materials. It esterifies readily with acid anhydrides and chlorides. It etherifies readily in acids to give polymeric ethers and reacts with formaldehyde and other aldehydes to give acetals. Thiokol SC-10 is suggested for use in modifying the physical properties of such materials as leather, wool, hair and other proteins since it wets these materials easily. It is suggested for use as a carrying agent in dyeing such materials and also for use as a solvent for sulphur dyestuffs because of its high sulphur content. It has antioxidant properties and should prove useful in giving greater stability to basic dyestuffs and vat dyes.

52. Corrosion Inhibitive Pigment

DEVELOPED by the National Lead Co., Brooklyn, N. Y., a new pigment, barium potassium chromate has good anti-corrosion properties. Known as pigment E, its most important property is that in the presence of water it readily releases the corrosion inhibitive chromate ion. Paint primers formulated with pigment E are claimed to produce coatings which have shown good performance in protecting iron, steel and light metal alloys. Its physical and chemical properties are as follows:

Physical and Chemical Properties of Pigment E

Color	Pale Yellow
Specific gravity	3.65
Bulking value (gal. per lb.)	0.0329
Weight of one solid gal., Ib	30.4
Oil absorption	11.6
Combined water	none
Total chlorides, as Cl. percent,	0.015
Water soluble sulphates, as SO4,	
percent.	0.05
pH (water slurry of pigment)	7.0
Organic colors and lakes	none
Refractive Index	1.9

Paints containing pigment E may be made with vehicles containing resins

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such as the alkyds, phenolics, polymerized terpenes, resins derived from modified rosins, coumarone-indene, natural resins, chlorinated rubber and other vehicles in current use. Although this material has low tinting strength and low hiding power, neither of these properties is important in the formulation of metal paint primers since top coat paints are applied over them. Where hiding power is important, other pigments may be included. This material is available in experimental quantities only.

53. Plastic Fabric

DEVELOPED by the National Research Corp., Boston, Mass., is a new plastic fabric, consisting of a Saran screen filled with a cellulose acetate film. Known as Miramesh, this material is coated on one side with a thin film of aluminum applied by a high vacuum evaporation process. Alumi-num is used because of its stability and resistance to tarnishing and also be-cause of its high reflectivity and brilliance. A protective lacquer is applied over the metal film. The lacquer is clear in the case of the silver finish and gold colored for the gold finish. Other metallic colors are obtainable. Miramesh is best applied where use can be made of its basic properties of high reflectivity and brilliance, good strength from the Saran screen, opacity and semi-rigidness. It can be stitched or cemented. When stitched, it is advisable to use a binding cloth so as to support the threads on both sides of the material. Various types of cement can be used, but the essential property is that the cement shall not contain solvents which will dissolve the cellulose acetate filling of the base material. Miramesh should not be used where sharp and repeated flexure is required. This causes the base acetate filling to break away from the Saran mesh. It is suggested for use as lampshades, movable screens, table mats, strip covering for venetian blinds, decorative radiant heat reflectors, light diffusers and other similar uses.

54. Synthetic Lubricant

To BE marketed under the brand name of Zupan "Hi-Lo" is a synthetic oil lubricant which will not harden, gum or oxidize and is said to be noncorrosive. Manufactured by Yanda Industries, Independence, Ohio, this lubricant has a tough, adhesive body made so that it can be applied directly through high pressure guns or compression cups. It is light tan in color, having a texture similar to that of butter and will not separate even at temperatures above its melting point. It is claimed to be resistant to both high and low temperatures and may be used over a range of -40 deg. C. to a high of +320 deg. C. It is water resistant but is equally applicable under dry conditions.

55. Synthetic Rubber Adhesives

MADE by the U. S. Rubber Co., New York, N. Y., is a new synthetic rubber adhesive for use in conjunction with textile fibers to make plush, velour, suede and velvet surfaces. This adhesive is claimed to have longer life and more flexibility than base coat enamel adhesives now being used and it can be dyed any color to match the textile fibers. Being designated as M-6177, this material is a flocking adhesive which may be sprayed or brushed on wood, metal, glass and other surfaces. It is used with tiny strands of rayon, cotton, or wool known as flock. These strands range from sha to in. in length depending upon the depth of pile desired. Adhesive for use



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Automatic proportioner . . . for two or more liquids . . . with patented, precision volumetric meter control. Records quantity of each ingredient as well as finished product. Eliminates costly batch mixing . . reduces labor, handling costs, storage space and capital investment.

BOWSTR

Bowser Industrial Xacto Meters accurately measure liquids rang-

accurately measure liquids ranging from acids to wood oil. Gray cast iron, brass and branze or stainless steel construction.

OPERATING ECONOMY

Automatic unit for filling contain-

ers in predetermined quantities from one pint to nine quarts. Temperature control and specific gravity adjustment.

These Bowser units have led the way to lower processing costs in many plants by eliminating shortages, streamlining production and guaranteeing uniformity of product.

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in the flocking process is widely used on phonograph turntables, showcases, toys, boxes and other similar articles. It may also be used to make thick pile fabrics.

56. Dibasic Lead Stearate

Now available in sample quantities and in limited amounts suitable for small plant development purposes is a new stabilizer and lubricant developed by the National Lead Co., Brooklyn, N. Y. Known as DS207, it is the dibasic lead salt of stearic acid, a soft, pure white powder with all the apparent lubricity of normal lead stearate, insoluble in water, and in most of the common organic solvents. DS207 has the properties given in the following table:

Properties of DS207

Formula	2PhOPb(CyHsCOO)
Color	White
Molecular weight	1,220
Specific gravity	2.02
Refractive index	1.60
Weight per solid gal., lb.	16.85
Lead content (percent Pb)	51
Melting point	Decomposes above 300
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Solubility.... I E

ing. Insoluble in water, mineral spirits and linseed oil. Five percent soluble in turpentine, soluble in tricresylphosphate and several other

DS207 is suggested for use as a stabilizer for vinyl plastics, as the active ingredient in non-permanent films for the protection of unpainted steel, for leaded greases, and cutting oils. In vinyl plastics, this material is a heat and light stabilizer. It has some degree of solubility in tricresylphosphate and several other plasticizers. It is also soluble in mixtures of either tricresylphosphate or dioctylphthalate and some of the aromatic petroleum type plasticizers. It produces clear amber film when the aromatic petroleum type plasticizer is used to the extent of 50 percent or more. DS207 is claimed to be an effective lubricant for use in vinyl compounds to improve flow characteristics for molding, extruding, etc. Its basic lead content, its low refractive index and its solubility are claimed to make it valuable in this work. Being approximately 5 percent soluble in turpentine, it reacts to form a waxy compound which is in turn soluble in mineral spirits. This solution may be used in the temporary protection of untreated steel. When mixed with lubricating oils, it provides uniform composition greases with good protection against corrosion.

57. Neoprene Shoe Soles

CLAIMED to be more durable than natural crepe rubber is a new type of shoe soling material made from neoprocess is wide turntables, show d other similar used to make to

ic Lead Stearate

ailable in sample of nited amounts with lizer and labor the National Le N. Y. Known as D. usic lead salt of star e white powder with lubricity of nemi nsoluble in water, e common organic o the properties give

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Shoe Soles

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PARCO LUBRIZING

FASTER BREAK-IN - NO SCORING, SCUFFING, SCRATCHING **REDUCES WEAR - SIMPLE, LOW-COST TREATMENT**

On wearing surfaces throughout the power train, Parco Lubrizing does an outstanding job. It's a phosphate coating that spreads its own protective, friction-controlling, nonmetallic crystals over pistons, rings, gears, shafts, pulleys, valves, rocker arms. Being slightly porous, it also takes and holds oil as bare metal cannot do.

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Regardless of either variation in the cooling load or intermittent operation, the new Niagara Liquid Cooler holds the delivered temperature accurately at the required point. It will deliver fresh water at 33°F. constantly without danger of freezing damage and produces lower temperatures accurately in non-freezing chemical liquids and solution.

Capacity range in available models is from 24 to 465 gallons per minute. High capacity and fast chilling are provided in extremely compact space. The cooler is reliable and easy to maintain; all parts are accessible for cleaning; insulation is easily applied; operation is economical of power and refrigeration.

Write for Bulletin No. 100-CM

NIAGARA BLOWER COMPANY Over 30 Years' Experience in Industrial Air Engineering 405 Lexington Ave. NEW YORK 17, N. Y. Field Engineering Offices in Principal Cities



prene which has been developed and tested by the E. I. du Pont de Nemours & Co., Wilmington, Del. The new type of neoprene crepe rubber is highly resistant to oil and heat and does not soften on hot pavements nor become slippery on oily surfaces. It is claimed to have less tendency to spread than natural rubber and has superior wearing qualities. It is not affected by gasoline or kerosene. Neoprene crepe rubber is supplied in a light amber color similar to natural crepe rubber, but it can also be furnished in almost any other color.

58. Latex Foam

MANUFACTURE of latex foam products under the name of Air-Cell has been resumed by the B. F. Goodrich Co., Akron, Ohio. The company discontinued manufacture soon after the war started because of restrictions placed on the use of rubber latex. Slabs of Air-Cell 42x56 in. and in thicknesses of $\frac{1}{2}$, $\frac{3}{4}$, 1 and 1 $\frac{1}{4}$ in., are now being made in soft, medium and firm densities.

59. Insect Toxicant

A CHLORINATED hydrocarbon insect toxicant with the empirical formula C₁₀H₆Cl₈ is now being manufactured by Julius Hyman & Co., Denver, Colo. It is marketed under the brand name of Octa-Klor. Claimed to be more effec-tive than DDT, this material has been tested on a wide range of insects which have been destroyed by direct contact, by ingestion, or from exposure to its vapor. It is mild in action to warmblooded animals and may safely be used for insect control under a wide range of conditions. The refined grade of Octa-Klor is a pale, amber-colored nearly odorless product intended for use in industrial, institutional and household insecticide formulations where non-staining, odorless materials are desired. It has a specific gravity of 1.61 and weighs approximately 13.5 lb. per gal. It is slowly volatile, but when applied at the rate of 100 mg. per sq.ft. in protected locations, a film will remain from one to several months. The agricultural grade is a dark amber colored product equal in toxicity to the refined grade, but not recommended for inside use due to color and odor. It may be formulated as an oil solution, as an aqueous emulsion free of any solvent, as an aqueous emulsion containing solvent, as a wettable powder or as a dust. Octa-Klor is completely soluble in many organic solvents such as aliphatic, aromatic and chlorinated hydrocarbons as well as in most ketones, ethers and esters. It is completely soluble in deodorized kerosene, but is not soluble in water. In the

• MARCH 1947 • CHEMICAL ENGINEERING

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ttery of Gas Reforming Furnaces at Spencer's Centrally Located Pittsburg, Kansas Works ew,



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Works: Pittsburg, Kansas

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This Great New, Central Source of NH₃ and Aqua Ammonia Is Days and Hundreds of Miles Closer

Maintaining an orderly, even rate of production and scheduled delivery of basic materials . . . is vital to assure continuing 1947 profits against higher wages and costs!

The vast new, war-proven Spencer Works is prepared to make direct tank-car shipments, asscheduled. Spencer's central location expedites delivery . . . assures an even, economical rate of production. It is practical to schedule orders well ahead. Write, wire or phone today.





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WRITE for complete specifications on automatic temperature, pressure and flow controls. Three types of electrode chambers and fittings available for pressures up to 150 lbs. Adaptable to all units for low water cutoff service. Low and line voltage types. Double voltage coils, permitting 115 or 230 A.C. connections.

CEDAR FALLS



FACTORY BRANCHES: PHILADELPHIA . ATLANTA . BOSTON . CHICAGO KANSAS CITY . NEW YORK . DALLAS . DENVER . DETROIT . CLEVELAND HOUSTON . SAN FRANCISCO . SEATLE . PITTSBURGH 12-3 DISTRIBUTORS IN PRINCIPAL CITIES

presence of many alkaline reagents, it reacts to form dehydrohalogenated products which are of a low order of toxicity to insects. This new insect killer is claimed to be especially effective in killing cockroaches. Not only does it destroy the adult roaches, but one application will keep on killing young roaches as they hatch from the egg. It is also said to be effective against clothes moths, ants, silver fish bedbugs, flies and mosquitoes. As an agricultural insecticide, it is useful in controlling grasshoppers, lice, ticks, fleas and many species of flies and other insects. Octa-Klor will not be marketed as a ready-to-use insecticide. It will be sold to insecticide manufacturers and formulators who may use it as the basic toxic component in their products for control of various pests. It is available in 650 lb. drums at the following prices, freight allowed: Refined grade, carload lots, \$2 per lb.; agricultural grade in carload lots, \$1.75 per lb. Less carload lots may be purchased at slightly higher prices.

60. Textile Chemicals

RECENT additions to the line of textile chemical products of the Textile Chemical Division of the Dexter Chemical Corp., 819 Edgewater Road, New York, N. Y., include a dyeing assistant and a family of cationic active softeners. Rexan O is a dyeing assistant to promote level dyeing, and is claimed to improve the penetration of the dye bath when used in dyeing of cotton, viscose, acetates and other fibers. It is recommended in the dyeing and stripping of vat dyestuffs and protects the bath from the effects of hard water. Rexan O is a clear viscose liquid readily soluble in cold and warm water. This material is claimed to be more conveniently used than glue and at the same time to prevent accumulation of oxidized vat colors on surface of the dye-bath. When dyeing basic dye-stuffs, the addition of small amounts of this material is claimed to produce more level dyeings. Its retarding action is said to have a tendency to reduce the bronziness and poor rubbing fastness often encountered. One pound of Rexan O per hundred gallons of basic dye liquor is usually sufficient for desired results.

Useful for softening cottons and rayons is a series of cationic active softeners under the brand name of Softol AC, AD, XAC, and XAD. They also are claimed to be satisfactory for softening fabrics which have been finished with cellulose product. The Softol softeners are soluble in water, unaffected by hard water, and are claimed to ex haust on the fabric without difficulty. They are claimed to be compatible with fats, dextrine, gums, etc. nany alkaline p orm dehydrob ich are of a low nsects. This re ned to be especi ig cockroaches oy the adult m tion will keep es as they hatch also said to be nes moths, anti, es and mosquito insecticide, it i grasshoppers, 1 any species of figta-Klor will not be o-use insecticide ecticide manufact s who may use ita onent in their p various pests. Itin drums at the ght allowed: Ref. is, \$2 per lb; a arload lots, SI d lots may be you ther prices.

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additions to the h al products of the Division of Br Corp., 819 Edgene N. Y., incluie: d a family of catin lexan O is a dreint level dyeing, ad the penetration of used in dying i tates and other for led in the da vat dyestuffs al m the effects of h sed than glue mi o prevent accumi When dving is ddition of small a eings, Its retain ve a tendency b is and poor rall acountered. Or per hundred of or is usually softe

softening own es of catonix are e brand name o and XAD. Two stitutetory from are been finish t. The Softelin water, unafies are claimed to be com guins, etc.



MODEL "DA" (portable)—One operator filling and claing, can handle 2 to 4 100-lb. bags a minute...6 to 12 a minute where filled bags are delivered to BAGPAKER conveyor (quickly adjustable formation bag sizes). Starting and stopping of sewing operation is automatic... no tape wasted.

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MODEL "A"-Completely automatic — extremely accurate weights. Successful give away" material, labor and bag costs, thus paying for itself quickly. Machine capable of filling and closing 100-lb. bags at the rate of 15 per minute . . . needs one operator. TAPED CLOSURE IS MOISTURE RESISTANT-SIFT PROOF-INSECT PROOF

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CH

le Regional Meeting la Louisville

for the first time in Ir, the American Instit Engineers held its n t at the Brown Hotel Registration at the 460. The highlight by session was the may 18. The principal Frederick Willkie, vic al director of Joseph od Sons, Inc., who position of Secretary be created in the pi e. He suggested that stablish a National bon. The foundation tree broad functions: the of research done i universibes, private svemment agencies forts. Second, the if research or the dela warch to be performe mered by independent mie the exploration of at issued by the Der nitme. He also su the of the Secretary serve as a cleaning and research and mouly an encyclop an all fields which timelus to directo a worker, and to me of this inf n countries migh e program to

CHEMICAL ENGINEERING NEWS

AIChE Regional Meeting Held at Louisville

MEETING for the first time in Louisville, Ky., the American Institute of Chemical Engineers held its regional meeting at the Brown Hotel in February. Registration at the meeting reached 460. The highlight of the three day session was the banquet on February 18. The principal speaker was H. Frederick Willkie, vice president and director of Joseph E. Seagram and Sons, Inc., who proposed that a position of Secretary of Research be created in the president's cabinet. He suggested that this secretary establish a National Research Foundation. The foundation should have three broad functions: First, the correlation of research done currently through universities, private foundations, government agencies and individual efforts. Second, the performance of research or the delegation of that research to be performed in fields not covered by independent agencies and where the national interests seem to require the exploration of material not presently available. Third, the dissemination of technical materials for universities and research workers on the one hand, and on the other, simplified materials for the average nontechnical person, similar to those documents issued by the Department of Agriculture. He also suggested that the office of the Secretary of Research should serve as a clearing house for current research and should issue periodically an encyclopedia of problems in all fields which are worthy of investigation, which list would serve as a stimulus to directors of graduate work in universities, to individual research workers, and to industry. An exchange of this information with foreign countries might also be feasible.

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The program for this Regional Meeting included four technical sessions of chemical engineering papers presented before the Institute by representatives of Du Pont, the B. F. Goodrich Chemical Co., National Synthetic Rubber Co., the Girdler Corp., Standard Oil of New Jersey, Brown-Forman Distilleries, Joseph E. Seagram and Sons, Inc., Institute of Gas Technology, and Colgate-Palmolive-Peet Co. Papers were also presented on work done at Princeton University, Purdue University and the University of Louisville. A symposium on chemical engineering activities in Louisville and numerous vists to local manufacturing plants impressed the visiting chemical engineers with the diversity of chemical industry to be found there.

Southern Machinery Show Coming in April

THE Industrial South will be the over-all theme of the second Southern Machinery and Metals Exposition to be held in the Atlanta Municipal Auditorium, April 14-17, according to R. S. Lynch, president of the show. The Industrial Forum to be held in conjunction with the exposition will further develop the theme in stressing the ready markets that lie in this section of the country for southern manufacturers as well as for companies in other parts of the country producing equipment, parts, and material vital to the growth of southern industry.

The show will aid southern plants, manufacturing concerns and processing companies which are modernizing their operations or planning expansion programs or new installations. The latest equipment for these installations and the most modern ideas will be presented at the Auditorium.

Corn Products Constructs Corpus Christi Plant

GROUND was broken recently for the new \$10 million Corn Products Refining Co. plant at Corpus Christi, Tex. The plant, whose process was developed after years of research, will manufacture starch and sugar from milo maize.

The new plant will have a grain capacity of 20,000 bu. of milo maize per day, with provision for unlimited expansion when necessary. The flexibility of the design will also allow for the extension of manufacturing operations to include other industrial and food products and packaged products. Processing facilities can also be provided for corn. if neccessary.

The H. K. Ferguson Co. is in charge of the design and construction

program. Completion of the plant is expected in time to utilize the 1948 crop.

Monsanto Constructs New Phosphorus Facilities

CONSTRUCTION of additional elemental phosphorus production facilities at Columbia, Tenn., involving an investment of more than \$2 million was announced recently by Monsanto Chemical Co. The new facilities will result in over 50 percent increase in Monsanto phosphorus production, the company said, and added that building of new, electrically controlled and operated furnaces has been started and is scheduled for completion in 1948.

The Tennessee plant was the first to use large electric furnace units for phosphorus production and was the first to produce elemental phosphorus on a large commercial scale. Because of its work with this plant, which is located in the Tennessee phosphate rock area, Monsanto was presented the Chemical Engineering Achievement Award for 1937.

CGMA Elects New Officers at New York Annual Meeting

MEETING in New York, the Compressed Gas Manufacturers' Association elected Charles G. Andrew, Air Reduction Co., Inc., president at that group's annual meeting. Other officers elected were: L. W. Hench of American Oxygen Service Co., 1st vice president; Edmund Rowland, Henry Bower Chemical Mfg. Co., 2nd vice president; and F. R. Featherston, secretary-treasurer.

Sharples and Continental Oil Form New Company

A NEW COMPANY, Sharples Continental Corp., formed and entirely owned by Sharples Chemicals Inc. and the Continental Oil Co. will function as a manufacturing organization for production of synthetic organic chemicals from petroleum raw materials.

Top executives of the new corporation are Paul Kendall, executive vice president of Sharples Chemicals Inc. and Harold Osborne, vice president



Dixie Non-Clog Hammermill in operation in plant of the Cuban Portland Cement Co. Incorporating distinct time, labor and moneysaving principles, The Dixie Method carries the material right to the hammer points...eliminating need for extra men at feed hopper.

> Down in the bay of Mariel, some 20 miles out of Havana City, the semi-tropical climate accounts for 50 to 70 inches of rainfall per year. For the Cuban Portland Cement Co., this factor ... combined with the soft, wet material generally encountered in quarrying operations... was seriously curtailing production.

> It was not until the installation of a Dixie Non-Clog Hammermill, equipped with the patented Movable Breaker Plate, that delays due to "Choke-Ups" were reduced and a new 'high' in continuous production was established. Since then, this Dixie Hammermill has worked under the worst possible conditions... operating at times for a whole week on raw material which was "nothing but a mass of plastic, sticky, water-sodden mud."

> This is only one of the numerous instances where a Dixie Hammermill has been instrumental in keeping production at a high peak...yet at a low cost.

Let an experienced Dixie engineer show you how the Dixie Hammermill can increase production and profits in your crushing operation.

> Send for new, illustrated bulletin . . . "More Efficient Crushing of Raw Materials"



4172 Goodfellow Avenue St. Louis 20, Mo. Foreign Sales Office: 104 Pearl St., New York, N.Y. of Continental Oil Co. Both men will retain their respective positions with the parent companies.

The first production unit will be located in Baltimore, Md. at the site of a former Continental Oil Co. refinery. This plant will manufacture nonylnaphthalene, an alkylated aryl hydrocarbon which serves as a raw material for the production of a wetting, washing and emulsifying agent of the alkyl-aryl sulfonate type. It will be marketed by Sharples Chemicals Inc. under the tradename "Neolene." Offices will be maintained at Baltimore, Md., Philadelphia, Pa., and Ponca City, Okla.

Chlorine Institute Elects New Officers at N. Y. Meeting

THE Chlorine Institute, Inc., held its annual meeting and directors' meetings in New York recently. The following directors were elected for two years: Thomas Coyle, E. I. du Pont de Nemours & Co.; W. I. Galli-

CONVENTION CALENDAR

- American Society of Metals, western metal congress and exposition, Civic Auditorium, Oakland, Calif., March 22-27.
- National Association of Corrosion Engineers, annual meeting, Palmer House, Chicago, Ill., April 7-10.
- Electrochemical Society, spring congress. Brown Hotel, Louisville, Ky., April 9-12.
- Southern Machinery and Metals Exposition, Municipal Auditorium, Atlanta, Ga., April 14-17.
- American Chemical Society, 111th national meeting, Atlantic City, N. J., April 14-18.
- Chemical Market Research Association, Hotel duPont, Wilmington, Del., April 17.
- American Zinc Intitute, annual meeting, Hotel Statler, St. Louis, Mo., April 28-29.
- Second National Plastics Exposition, Coliseum, Chicago, Ill., May 6-10.
- American Institute of Chemical Engineers. regional meeting, Coronado Hotel, St. Louis, Mo., May 11-13.
- American Society of Mechanical Engineers, oil and gas power 19th national conference, Cleveland, Ohio, May 21-24.
- Pacific Chemical Exposition, Civic Auditorium, San Francisco, Calif., October 21-25.
- Exposition of Chemical Industries, 21st exposition, Grand Central Palace, New York, N. Y., December 1-6.

ONE TANK CAR LOOKS MUCH LIKE ANOTHER...

To the expert who has shipping problems there are great differences in the various types of tank cars designed and built by GENERAL AMERICAN. Special linings, special alloys, special insulation, heating coils . . . different this or different that—there are all kinds of tank cars built for the specific purposes they have to serve.

We at GENERAL AMERICAN think we know a good deal about this business. We have been at it a great many years—and today, operate more than 37,000 tank cars. That gives us the practical working experience we offer to help solve your problems.

Just call our nearest office.

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Branch offices: Buffalo • Cleveland • Dallas • Hauston • Los Angeles New Orleans • New York • Pittsburgh • St. Lauis • San Francisco Seattle • Tulsa • Washington

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1919



Check with KNIGHT for Corrosion-Proof Chemical Equipment

For 37 years Maurice A. Knight has made acid-proof equipment for nearly every conceivable chemical process. Because of this experience, tough corrosion problems come to us.

Knight-Ware laboratory sinks, valves, pipe and other acid-proof pieces are widely used in chemical process industries. So, too, are absorbers, scrubbers and other functional units of Pyroflex Construction. Berl Saddles, the modern efficient tower packing, are an exclusive Knight product.

MAURICE A. KNIGHT 103 KELLY AVE., AKRON 9, OHIO

Berl Saddles Tower Packing



her, Pittsburgh Plate Glass Co.; W. W. Haley, Southern Alkali Corp.; L. Neuberg, Westvaco Chlorine Products Corp.; E. E. Routh, Mathieson Alkali Works, and B. P. Steele, Pennsylvania Salt Mfg. Co. At a directors' meeting following

At a directors' meeting following the annual meeting, these officers were elected for the year 1947: S. W. Jacobs, president; E. C. Speiden, vice president and R. T. Baldwin, secretary and treasurer.

Italian Chemical Executive Visiting United States

DR. LUIGI MORANDI, eminent electrochemical engineer and president of the Montecatini group of chemical and mining companies of Italy is now visiting various industrial areas of the United States, looking forward to the renewal of technical and business relations with American companies. He reports that the Italian chemical industry is currently handicapped most by the coal industry, but is also in desperate need of coal-tar intermediates and textile chemicals. Industry as a whole in Italy is operating at only about 40 to 50 percent of prewar capacity, but during the past year Montecatini reached a production index of 70 percent of 1938. He anticipates complete recovery within a year provided sufficient raw materials become available.

California Makes Survey of West Coast Soda Ash

AT THE close of 1946, the monthly Pacific Coast consumption of soda ash was approximately 3,500 tons more than western production, according to a recent survey made by C. R. King of the California Division of Mines, San Francisco. The present potential West Coast market was estimated at about 40,000 tons of soda ash and 17,000 tons of salt cake, of which about 20,000 tons of soda ash and 10,000 tons of salt cake are being supplied by present productive capacity and imports. The balance is represented by projected new consuming plants either under construction or planned for the near future. The growth of heavy industry on the West Coast will result in a steady increase in the demand for soda ash and salt cake, it was stated.

Present United States production of soda ash was reported as about 15 percent short of essential requirements, representing a deficit of some 56,000 tons monthly. New plants and proposed plant expansions in the United States will increase the available soda ash supply by the end of le Electro-Vapor Syste 11 eficiency at reduc 2009, is explosion-pro 2019e,

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CONTROLLED HEAT without flame !

The Blaw-Knox Electro-Vapor System supplies heat, closely controlled, through the entire temperature range of 100 to 700 degrees Fahrenheit. It combines the advantages of electric and Dowtherm heating.

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The Electro-Vapor System operates with full efficiency at reduced loads, saves space, is explosion-proof, is simple in principle.

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IMPLEMENTS THE PROCESS INDUSTRIES

SEALED Against FUMES

For handling concentrated Sulphuric and other acids, difficult to seal by stuffing box packing...TABER Vertical Pumps is a logical answer.

Since liquid is not in contact with the Taber stuffing box there is no leakage.

Taber Vertical Pumps are sturdily constructed for mounting in processing or storage tank, and to operate in a vessel sealed against fumes or gases.

PLEASE WRITE ON YOUR LETTERHEAD FOR CONCISE TABER Bulletin V-837

TABER PUMP CO.ESTABLISHED
1859294 ELM STREETBUFFALO 3, N. Y.



Improved Type!

Rugged construction. Crushes material to finished size. Blades spaced to your specifications. Capacity from 3 to 15 tons. Roller bearing mounted shaft. Robinson Processing Equipment designed by engineers whose reputation is founded upon doing things right. Literature available. Inquiries invited.

ROBINSON MANUFACTURING CO. Plant: Muncy, Pa. SALES REPRESENTATIVE MERCER-ROBINSON COMPANY, INC. 30 CHURCH ST., NEW YORK 7, N. Y. 1948 by an additional 25,500 tons monthly, it was estimated, with 22,000 tons of this increase represented by western natural sources. Without taking into account any increase in present demand, this would leave a prospective monthly deficit of some 24, 000 tons under present national requirements. The total national increase in productive capacity now under way or planned for the future was estimated at close to 40,000 tons monthly; this increase will not be fully realized until 1949 or later.

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An increase in productive capacity of present plants operating on the saline lakes of California cannot be expected to augment present production by more than about 25,000 tons monthly of soda ash and 10,000 tons of salt cake without exceeding the economic rate of brine withdrawal, according to present data, it was stated.

New Firm Now Producing Perlite in California

AFTER almost two years of development work, the National Perlite Co. of Campbell, Calif., is now beginning commercial production of expanded perlite, a volcanic rock of rhyolitic composition containing 2-4 percent water that has attracted unusual attention because of its peculiar ability to expand 15-18 fold upon proper heating. The present plant of Na-tional Perlite Co. consists of one building with one experimental converter. However, the firm plans on five additional converters at Campbell within the next six months, stated Joseph Fournier, president. The firm owns four deposits of perlite and is negotiating for additional deposits in California, Nevada, New Mexico and Arizona.

Because of the unique properties of the white, powdery "popped" perlite, the product is expected to find a market in the process industries.

Western Firm Expands Its Industrial Finishes

DESIGNED exclusively for production of specialized industrial finishes, construction of a \$1,000,000 factory addition at the W. P. Fuller & Co. South San Francisco plant is now under way. Part of a general \$5,000,-000 expansion, the new factory will produce a large line of baking enamels, metal finishes, container and tinplate coatings, special materials for leather goods, foil coatings and finishes for the western aircraft and automotive industries. Costing approximately \$500,000, the three-story building is expected to be finished next autumn: equipment is expected to add another

Other products m by Shell Chemi Acetone, Methyl Methyl Isobutyl R Isobutyl Carbii Butyl Alcohol.



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REACTIONS:

Free of extraneous olefins ... and containing tertiary double

for immediate shipment in drum or tank car quantities

bonds only . . . this controlled-quality intermediate is available

ALKYLATION: Both isomers yield identical alkylation products

HYDROGENATION, CHLORINATION, BROMINATION

ADDITION OF HCl, HBr, HI-H2SO4-HNO3-HOCl, HOBr-O₃-N₂O₃-NO₂-NOCl-S₂Cl₂-SCl₂-H₂O₂, etc.

FOR CONSIDERATION IN THE MANUFACTURE OF:

Other products manufactured by Shell Chemical include: Acetone, Methyl Ethyl Ketone, Methyl Isobutyl Ketone, Methyl Isobutyl Carbinol, Tertiary Butyl Alcohol, Allyl Alcohol.

SPECIFICATIONS

100°-103° C

Less than .004 %

Water white

Sweet

by weight (as H2SO4)

Synthetic detergents

Phenolic resins

Oil-soluble varnishes

Textile finishing agents

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A request on your business letterhead will bring quotations and a sample if desired.

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THE PERFECT PAIR for Wet Grinding

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CURRENT CLASSIFIERS

"Made for each other" by Hardinge designers the Hardinge Counter-Current Classifiers, operating in closed circuit with Hardinge Conical Ball Mills, make an unbeatable combination.

The Conical Mill's unexcelled ball-segregating action—the Classifier's one moving part—provide the combination that will produce the maximum mesh tons per horsepower in your plant.

And . . . maintenance in the Classifier is practically nil.



YORK, PENNSYLVANIA — 240 Arch St. • Main Office and Works NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6 SAN FRANCISCO 5—94 Natoma St. • 200 Bay St.—TORONTO 1 \$500,000 to the cost, including facilities for a new industrial finishes research laboratory. Remainder of the \$5,000,000 expansion program will consist of further construction at the firm's Los Angeles and Portland manufacturing plants, as well as additions and improvements to the company warehouses, branch offices and retail stores.

In cooperation with R. N. Nason & Co., San Francisco, acquired by Fuller in 1928, a new industrial finishes department will be added to the Fuller Co. To be known as the Fuller-Nason Industrial division, it will provide facilities for research and development and production in the field of specialized industrial paints. Except for this new industrial division, Nason & Co. will continue as in the past to operate separately.

Commercial Solvents Plant to Produce New Insecticide

AN INSECTICIDE plant to produce a new product, benzene hexachloride, is scheduled for completion this spring by Commercial Solvents Corp. at Terre Haute, Ind. The plant, which is now under construction, will cost \$500,000. Benzene hexachloride gives promise of destroying the cotton bollweevil, cotton aphid, and other sucking insect pests of cotton at the same time, according to tests conducted by the U.S. Department of Agriculture. A three-way acting agent, it is a powerful contact, stomach and fumigant insecticide. Frequently, it is found, this chemical destroys not only the adult insect but its eggs as well.

National Plastics Exposition Coming to Chicago

PLANS were outlined recently for the National Plastics Exposition, sponsored by the Society of the Plastics Industry, Inc., to be held May 6 to 10 at the Coliseum, Chicago, Ill. The Chicago show will be the second National Exposition sponsored by the Society, the first having been held last April in New York, at Grand Central Palace. Admission will be by registration without charge to any cus-tomer of the industry whether he be a manufacturer, distributor or retailer. Expected to attend are material manufacturers, molders, fabricators, suppliers, extruders and laminators, engineers, scientists, technicians, and others identified with the industry. Representatives of retail stores, mail order houses, the automotive, refrigerator, electrical and other industries will be in attendance. The annual National Convention of the Society

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STAINLESS Steel Tubing gives Highest Heat Resistance

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Baw makes ANY type you need

High strength combined with long life under continuous or intermittent attacks by hot gases and fluids are advantages of stainless tubing that pay off for you in terms of trouble-free operation, few shutdowns, lower maintenance costs. The same properties that give stainless tubing its high heat resistance give it other valuable advantages for high temperature services—stubborn resistance to corrosion, scaling, creep, oxidation, and abrasion. From the wide range of B&W Croloy Stainless Steel Tubes you can get the tube having the property best suited for any specific set of service conditions—the best economic balance between initial cost and operational efficiency. For Stainless Croloys embrace the widest choice of grades and analyses available from a single source—in both SEAMLESS and WELDED types.

Call on Croloy when tough tubing jobs call for stainless.



Water-Tube Boilers, for Stationary Power Plants, for Marine Service • Water-Cooled Furnaces • Superheaters • Economizers • Air Heaters • Pulverized-Coal Equipment • Chain-Grate Stokers • Oil, Gas and Multifuel Burners • Refractories • Process Equipment.



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It's easy ... any time ... for inspection or maintenance. Just two clamp screws to open and the diaphragm casing is off. Just open the door in the yoke and the spring adjustment and stuffing box are exposed.

For other equally important new features of the revolutionary new K & M KONTROL MOTOR, check this list:

- Pressed steel Diaphragm Casing . . . lighter . . . tougher.
- Rigid Welded Steel Tubular Yoke,
- Duo-seal molded diaphragm provides high travel, uniform loading.
- Long calibrated Steel spring . . . fully enclosed.
- Enclosed ball bearing spring adjusting screw.
- Streamlined Flow Valve Body for high capacity...unrestricted flow area.
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will be held concurrently with the Exposition. Technical conferences are scheduled for the Stevens Hotel.

Oklahoma Chemical Engineers Meet at Bartlesville

AT THE first 1947 dinner meeting of the Oklahoma section of the American Institute of Chemical Engineers, the following officers were elected: Chairman, Howard L. Malakoff; vice chairman, Virgil Scarth; and secretarytreasurer, Fred H. Poettmann. H. R. Legatski, Lawrence K. Cecil and Harrison L. Haye were elected to the executive committee.

ACCL Organizes New Western Division

LAST month the members of the American Council of Commercial Laboratories with home offices in the western states met at the office of Herbert Imrie, president of Abbot A. Hanks, Inc., San Francisco, for an organization meeting of a Western Division. It was unanimously agreed that this division should consist of what is recognized geographically as the 11 Western States, as well as the territories of Alaska and the Hawaiian Islands. Officers elected follow: Roger W. Truesdail, president; Herbert Imrie, vice president; and E. O. Slater, secretary-treasurer.

ASME Hearings Planned for Boiler Code Revisions

THE Boiler Code Committee of the American Society of Mechanical Engineers has made arrangements to hold two public hearings in the Southwest on the proposed revision of section VIII of the ASME Boiler Construction Code. The first of these hearings will be held in Houston, Tex., at the Rice Hotel, on May 1 and 2. The second hearing will be held in Los Angeles, Calif., at the Bilt-more Hotel on May 7. The purpose of these hearings is to give all those interested in the Code, such as pressure vessel manufacturers, users, and state enforcement authorities, an oppor-tunity to express verbally their comments on the proposed revision.

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Latin American Engineers Offered Fellowships

THREE \$1,000 fellowship awards are being offered Latin American students who can qualify for graduate work at Carnegie Institute of Technology for the academic year 1947-48, it has been announced by Dr. Webster N. Jones, director of Tech's college of engineer-

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up to 90% **MORE WEAR**

with ROE-FLAT the New, High-Tonnage Wire Screen

Yes, incredible as it seems, you get up to 90% longer wire screen life with Roebling's new Roe-Flat-and at no sacrifice in volume of screening production. The secret lies in Roe-Flat's unique crimp, with its absolutely flat wearing surface. It brings to your screening job the combined advantages of both maximum open area and heavier wire diameters.

GET MORE WITH ROE-FLAT

More metallic wearing surface ... 75% more than ordinary crimps! Roe-Flat has no raised intersections to wear out first... wear is distributed uniformly over nearly all the wire surface.

More screening production ... because Roe-Flat's parallel wires on the same plane mean less blinding.

Manufacturers of Wire Rope and Strand • Fittings • Slings • Suspension Bridges and Cables • Aircord, Aircord Terminals and Air Controls • Aerial Wire Rope Systems • Electrical Wire and Cable • Ski Lifts • Hard, Annealed or Tempered High and Low Carbon Fine and Specialty Wire, Flat Wire, Cold Rolled Strip and Cold Rolled Spring Steel • Screen, Hardware and Industrial Wire Cloth • Lawn Mowers More accurate screening ... and less re-screening needed, because of the accurate-sized openings in Roe-Flat.

More resistance to abrasion, wear and fatigue . . . the result of using improved quality steel in Roe-Flat.

A Roebling Field Engineer will gladly show you the savings possible with Roe-Flat ... both on your average screen costs and on your over-all processing operation. Call him at our nearest branch office.

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A CENTURY OF CONFIDENCE





The New AMERICAN "ACS" Offers a Great Advance in Heavy Duty Crushing .



American ACS features sturdy sectional con-struction, dust-tight machined joints. All crush-ing parts of extra heavy manganese steel.

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ing and science. Announcement of the fellowships immediately followed news of the forming of the Matthes Foundation. The three fellowships, to be open to outstanding graduates in South and Central America and Mexico will be offered at Carnegie Tech only in civil, electrical, mechanical, chemical or metallurgical engineering, or in physics, chemistry or mathematics.

New Laboratory Established For Geiger Counters

A NEW laboratory to test Geiger-Müller counters and associated electronic equipment has been established in the radioactivity section of the National Bureau of Standards. The laboratory will test performance qualities, utility, and construction of counters now being manufactured. It will aid purchasers by assisting them in formulating of specifications; and manufacturers by accumulating test data and by determining the type of counters necessary to various fields of scientific research. No attempt will be made at present to set up standard specifications because of lack of uniform types and design of counters.

The Geiger-Müller counter has now become a critical piece of equipment in the fields of science dealing with radioactive matter and isotopes, (physics, biology, chemistry, medicine) and also has important industrial uses. It has been in commercial production less than a year.

Methyl Grignard Reagent Now Commercialized

WHAT is probably the first commercial production of Grignard reagents in this country has recently been announced by Arapahoe Chemicals, Inc., Boulder, Colo., a new firm which has just completed construction of a plant in Boulder for the commercial and semi-commercial production of a series of Grignard reagents and of special organic chemi-cals resulting from the Grignard re-action. Methyl Grignard reagent, first of the firm's series of products, is now available commercially as a two-molar solution of methyl magnesium bromide in ethyl ether in quantities from 500 g. of solution to drum lots.

Georgia U. May Accept Herty Laboratory

A **RESOLUTION** has been adopted by the Savannah City Council calling for the consolidation of the Hunter Field branch of the University of Georgia with Herty Laboratory to form a col-

DUCAL

The high capacity of American ACS Crushers impart efficiency and eco-nomy to any size crushing job in onestep, or closed-circuit operation. Handles all hardnesses of friable and fibrous materials. The type of hammer provided and the number of hammer rows is a custom-built feature which fits the ACS

to your own particular operation. Capac-

4.4% passing 21/2" screen retained on 11/2" screen,

• 16.5% passing 1/2" screen retained on 1/4" screen.

• 13.2% passing 1/4" screen retained on 1/8" screen.

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General Chemical Research Presents





Generol Chemical Company – America's pioneer with the Contact Process for manufacture of high strength sulfuric acid and oleum-makes another major contribution to Basic Chemicals for American Industry with SULFAN . . . Anhydride of Sulfuric Acid.

By perfecting new methods of stabilizing Sulfur Trioxide, General Chemical Research takes an invaluable chemical tool off the shelf of laboratory curiosities and brings it to the Process Industries as a chemical of commerce for use in a host of ways.

General Chemical offers SULFAN in three chemically equivalent forms:

Sulfan 'A' Partially Stabilized, melting at approx. 35°C;

Sulfan 'B' Completely Stabilized, melting at approx. 17°C; and

Sulfon 'C' Unstabilized.

Experimental samples and further technical information are available on request from General Chemical Company, Research and Development Division, 40 Rector Street, New York 6, N. Y.

Some Potential Uses

 For fortification of spent oleum, making possible a ready supply of any strength oleum.
In benzenoid sulfonations for elimination of mixed sulfonates: meta- only or ortho- and para- derivatives only are formed.

3. For di- and poly-sulfonations of aryl compounds.

4. For direct sulfonation of aliphatics.

5. For sulfonations in the presence of a solvent, thus eliminating the removal of H_2SO_4 necessary when oleum is the agent.

6. For formation of addition compounds with amines, valuable in organic synthesis.

Sulfuric Anhydride exists in three chemically equivalent physical modifications as indicated by data below. General Chemical's stabilized product is almost entirely Gamma-Form and its partially stabilized product is largely Beta-Form.

PROPERTY	GAMMA-FORM	BETA-FORM	ALPHA-FORM
Description	Ice-Like	Asbestos-Like	Asbestos-Like
Equilibrium			
Melting Point (°C):	16.8	32.5	62.3
Density (20°C)	1.9255		
Sp. Ht. (cals/gm) (20°C)	0.77		
Ht. of Fusion (cals/mol)	1,800	2,900	6,200
Ht. of Sublimation (cals/mol)	11,900	13,000	16,300
Ht. of Dilution (cals/mol)	40,340		
Vapor Pressure (mm.)			
0°C	45	32	5.8
25	433	344	73
50	950	950	650
75	3,000	3,000	3,000

GENERAL CHEMICAL COMPANY 40 RECTOR STREET, NEW YORK 6, N. Y.

Sales and Technical Service Offices in principal cities from coast to coast

*Trade Mark, General Chemical Company

lege featuring instructions in pulp and paper engineering. The proposal has been sent to the board of regents of the University System of Georgia.

Efforts are being made to make Savannah the center of the pulp and paper industry. The laboratory, sponsored by the city, was named for the late Dr. Charles H. Herty, whose pioneer work in the pulp and paper field attracted scores of mills to the South.

Procter & Gamble Set Up **Purdue Fellowship**

FIRST of a series of fellowships in chemical engineering postgraduate study has been set up by the Procter & Gamble Co. at Purdue University for the calendar year 1947. The fellowship carries a stipend of \$2,500 a year. The company plans to establish additional fellowships in the near future at other chemical engineering institutions.

Du Pont Announces Fellowship Program for This Year

THE E. I. du Pont de Nemours Co. is awarding 75 post-graduate and postdoctoral fellowships to 46 universities for the 1947-48 academic year. All awards given in the preceding year's program have been continued and one new one has been added, a postgraduate fellowship in chemistry at Oregon State College. Each postgraduate fellowship provides \$1,200 for a single person or \$1,800 for a married person, together with a grant of \$1,000 to the university. Each postdoctoral fellowship carries an award of \$3,000 with a grant of \$1,500 to the university. As in the past the selection of nominees for the awards and choice of problems on which they are to work is left to the universities. The individual is under no obligation with respect to employment after he completes his work under the fellowship.

New Developments in Chemical Industry Discussed in N.Y.

SPEAKING before the Society for the Advancement of Management, a panel of speakers recently discussed various new products available as a result of wartime and postwar re-search and development. W. J. Connelly, Bakelite Corp., spoke on plastics advances in recent years. A. K. Seeman, Linde Air Products, explained the development of pure aluminum oxide crystals for use as synthetic sapphires with industrial applications. Robert Burns, Celanese Corp. of America, talked on the immoge, the pr Tes, is fast a industry. praciples (ien develope a being dis min's files

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Lever locking ring drum No. 55188 Lever locking ring pail No. 514X Swivel-spost por-pail No. 584R Band seal pail No. 564 Lug covered pail No. 584

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As in the BETTER UNDER "UNIT PROCESSES," TOO FILE

is under no et complement in exchange, the principle of Permutit's Demineralizwork under the ing Process, is fast becoming a new "unit process" for

chemical industry. Scores of practical uses for ion expmentsin la change principles outside the field of water treatment have been developed during the last ten years and many more are being discovered every week. efore the Socie

In Permutit's files are laboratory reports of the successen ment - ful application of ion exchange in the removal of harmand pair with tons from foodstuffs . . . in the manufacture of vita-lopment with min extracts . . . sugar syrups . . . alkaloid recovery . . . ful ions from foodstuffs . . . in the manufacture of vita-Com, soles even in a reduction of the calcium content of milk.

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If you have always considered ion exchange only in terms of water treatment, it's time to revise your thinking. You will find Permutit's booklet, "Ion Exchangers for Industrial Processes," both illuminating and helpful. Product of more than 30 years' experience, it may suggest ways in which you can use this new "unit process." Write for free copy to The Permutit Company, Dept.CM3,330 West 42nd Street, New York 18, N.Y., or Permutit Co. of Canada, Ltd., Montreal.



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ING HEADQUARTERS



PROTECTION

Certain manufacturing processes created through wartime exigency present countless problems from the standpoint of safety during the peacetime years ahead.

One such process is the manufacture of synthetic rubber as is produced at the Goodyear operated Rubber Reserve Plant at Akron, Ohio. Farsighted company engineers realized the need of absolute security against fire damage for their butadiene storage and handling facilities, and they got it. "Automatic" FIRE-FOG was the answer, for these test proved systems were designed and developed particularly for the control of fires originating in highly flammable liquids and solids. The protection of each operation at this plant was of necessity engineered in a most exacting manner thus assuring the utmost in safety at a minimum of cost.

Isn't now the time to determine whether your fire hazard protection is adequate? An "Automatic" Sprinkler engineer will cheerfully furnish complete information about an "Automatic" FIRE-FOG installationwhere it should be used, why it protects, how it operates. Write today.



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"Automatic" Sprinkler designs, manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories provement of rayon and other synthetic fibers including nylon, Saran, Vinyon and casein. K. W. Given, General Electric Co., demonstrated silicones in various forms.

Continental Can Acquires New Subsidiary

LAST MONTH the Continental Can Co., acquired the net assets of the Hummel-Ross Fiber Corp., Hopewell, Va., manufacturers of fourdrinier and cylinder kraft sulphate paper and liner board. The mill will be used to supply raw materials for fiber drum and barrel manufacture in the Van Wert, Ohio and Reading, Pa., plants of the Container Co., one of Continental's principal subsidiarles.

Ten Fellowships Set Up By U. S. Rubber Co.

U. S. RUBBER Co. has established graduate fellowships in chemistry at 10 leading universities, Herbert E. Smith, president, announced recently. The universities which have accepted the fellowships are: California Insti-tute of Technology, Cornell University, Harvard University, Massachusetts Institute of Technology, North western University, University of California, University of California at Los Angeles, University of Chicago, University of Minnesota, and University of Wisconsin. The fellowships will be available for the academic year starting July 1, 1947. Under the terms suggested by the rubber company, the fellow will receive \$1,200 per year if single, or \$1,800 per year if married. The university will receive \$1,000 to cover tuition and other costs. The fellow will be selected by the universities in accordance with their established practices and will not be restricted in the choice of position after the expiration of their fellowship.

Expand Engineering Program At Rochester University

EXPANSION of the University of Rochester's Division of Engineering program has been carried forward another step with the approval by the University's trustees of three new administrative appointments as follows: John H. Belknap, division chairman, as chairman of the department of electrical engineering; Howard G. Gardner, chairman of the department of chemical engineering; Horace W. Leet, chairman of the department of mechanical engineering.

The Division of Engineering was created in 1945 as an expansion of the former Department of Engineer-

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Coupled with the Foxboro Electronic *Dynalog Recorder... Continuously measures rate of fluid flow... And records the readings... PRECISELY.

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Our analysis, tests and subsequent report to you will be based on experience and data gained from over 20 years in making over 43,000 tests on all kinds of materials. This report will provide a thoroughly sound basis on which you can plan your production. By taking this step you can know in advance exactly what results and performance you can expect from your pulverizing operations. Know what particle size-what uniformity-what output you can expect—how much power will be required—what your operating procedure will be.

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ing and has much of the freedom of action usually associated with a separate school. Enrollment in engineer. ing courses at the University of Rochester totals more than 400, nearly double the prewar number. To provide more room and equipment for the greatly increased number of students in engineering, an addition to the engineering building will be constructed. Work on the project will begin this spring.

Pfaudler Establishes New **Engineering Fellowships**

THE Pfaudler Co., Rochester, N. Y., has provided a Pfaudler Fellowship in chemical engineering at the University of Rochester. The recipient of the fellowship, who will receive a \$1,200 award, in addition to a scholarship, will be a student working in the Graduate School for the master's degree. Research in agitation and mixing, which the fellowship is designed to promote, will be the subject of the thesis for the degree. For the current year, the fellowship with has been awarded to Vernon A Breitenbach.

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Plant Expansion Increases Western Salt Output

To supply the increased demand for salt by Pacific Coast chemical andless plants, the Leslie Salt Co. has initiated an expansion program on San Francisco Bay. At the firm's Newark, Calif., refinery a program is under way to provide a new building and tionies (equipment to process crude salt. Purpose of this move is primarily to modernize and replace the present refinery facilities. To cost approxi-2101 mately \$850,000 and to be completed = Au the s by mid-summer, this expansion will be devoted chiefly to the screening, grading and packaging of crude salt for the chemical and other industries.

Chemical Plant Management Course Now Offered

A PRACTICAL course in the management of chemical plants will be offered during the spring term to graduate students in chemical engineering and well-qualified men from industry with equivalent college training, Dr. R. E. Kirk, dean of the Graduate School of the Polytechnic Institute of Brooklyn, announced recently. One of the few schools throughout the county to include such a course in its curriculum, the Institute is offering the pioneering course as part of its program to better fit its graduates for better places in industry and for advancement in man-
ach of the associated NCIDENTS FROM SMITHway PRESSURE VESSEL RESEARCH

PROJECT No. 2,306 .00015 of sulfur

determines weld cracking in high tensile steels

Designs for a special SMITHway structure called for the welding of SAE 4340 high tensile alloy the design reel to another high tensile alloy steel, in sections up awadd b six inches thick. Welding time was estimated at 50 ours.

Studies showed that this 50-hour welding time could pansion home reduced to nine hours if the submerged-arc method Salt Outor f welding could be employed.

Tests showed, however, that submerged-arc welds Path (an heavy sections of these steels were subject to severe Lede Shi (acking, regardless of wide variations in welding panson pro-chniques.

An integrated research project for several A. O. inite a net mith laboratories determined that residual sulfur in to process mainute amounts in the welding wire was the critical is more a pactor.

With sulfur at or above .040%, cracking was unmin. To With sulfur at or above .040%, cracking was unme, the state of the sulfur content dropped to .030%, me, the stacking was measurably reduced; and at or below child be 125% of sulfur, cracking ceased. Thus, a variation of protect is little as .015% of sulfur made all the difference be-



Macrograph of heavy weld section showing sulfur cracks in weld metal.

tween consistent cracking and dependable freedom from cracking.

The cure was simple. By close control of that critical .015% of sulfur, the production rate of an important project was speeded at the same time that its unit cost was materially reduced.



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THIS PUMP HAD TO GO THROUGH A 10-INCH HOLE



A large chemical manufacturing concern wished to handle a process solution from tanks with an opening only 10 inches in diameter. The inside-mounted, submerged VERTICAL LAWRENCE CENTRIFUGAL here illustrated was the answer. A number of these units were supplied, each delivering 10 GPM against a 30-ft. head; and they have proved to be both dependable and economical in their performance . . . LAWRENCE engineers are accustomed to meeting special problems such as this—with 85 years of pump building to guide them. And this experience embraces practically every "pumpable" fluid and semi-fluid. That experience is at your service.

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agement. Robert S. Aries, consulting agement. Robert S. Aries, consulting and engineer and director of the Northeastern Wood Utilization Council, will direct the graduate course, known as Chemical Engineering Administration, assisted by a group of specialists from industrial firms.

CPA Approves New Plant Plant in Toledo

THE E. I. du Pont de Nemours & Co. new plant in Toledo for the manufacture of paints and similar products has been approved by the Civilian Production Administration district office. The approval covered construction of the building, which will cost \$481 thousand. Additional work will be done to eliminate odors in the vicinity due to the plants operation.

READERS' VIEWS and COMMENTS

Corrections

To the Editor:

Sir: Enclosed is a list of some errors which appear in the two articles on equipment costs by Happel, Aries and Borns published in the October and December issues of Chemical Engineering. A few are serious in nature and deserve published correction.

W. J. BORNS

Paulsboro, N. J.

Corrections and Additions

The following errors appear in the article "Estimating Chemical Engineering Equipment Costs" by Happel, Aries and Borns, which was published in the October 1946 issue of Chemical Engineering.

cal Engineering. On page 102 in the table of "Pump indime Costs" the efficiency of "Centrifugal, heavy duty, over 250 deg. F., 1-5 hp." was reported 10-20 percent. The correct range is 10-60 percent.

In the same table there was shown and the item, "Centrifugals, heavy duty, high clearance." This should read "Centrifugals, heavy duty, high head."

Also in the "Pump Costs" table, the adde efficiency of "Centrifugals, heavy duty, high head, 10-30 horsepower" was given as 20-27 percent. The correct range is 20-70 percent.

The efficiencies reported in the "Pump Costs" table for small pumps (under 1 hp.) are the efficiencies obtained in most installations. The same pumps can be operated at efficiencies as high as 20-25 percent.

In the second article of this series,

Central flow-line boards for the control of modern industrial processes are easy to design with CROUSE-HINDS complete line

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of panel mounting *CONDULET equipment for hazardous locations

Crouse-Hinds panel mounting pilot lights and switches provide visual indication of process stages and instant control of processing or manufacturing equipment. The illustrations show front and back views of a flow-line control board in a starch plant where combustible dust creates a Class II (National Electrical Code) hazardous location.

CONDULETS are made only by CROUSE-HINDS

The pilot lights and switches are dust-tight and explosionproof and are designed for both Class I and Class II hazardous locations. A similar control board for use where flammable gases or vapors create a Class I hazardous location would only require substitution of explosionproof junction Condulets and the addition of explosion-proof sealing Condulets, as indicated.

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Write for additional information.

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CHEMICAL ENGINEERING • MARCH 1947 •

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1. Easy to dismantle. Impeller shaft sleeve can be renewed without disturbing the suction and discharge piping.

2. The Morris Type R has no internal bolts or studs. No troublesome internal joints or fits.

3. Stuffing box subjected only to low suction pressure.

4. Suction chamber designed for extremely low velocity. It is in a separate casting, and not built integral with bearing frame.

5. Shell interchangeable for either right or left hand rotation. Suction and discharge nozzle can be rotated around axis of pump to almost any position desired.

6. Unlimited performance on suction side. Operates equally well under vacuum or positive head. Used as booster pump, it can be connected directly into line. Eliminates need for extra suction hopper.

7. With the clamping effect of the bolts on the discs, the shell is not subject to high stress. Consequently, shell can be made of a large variety of materials, including those of high abrasive resistance, though not necessarily of high strength, such as glass or porcelain.

8. Hydraulic efficiency good. Power requirements surprisingly low.

9. Heavy and enduring parts.

THEREFORE, The Morris Type R Slurry Pump is the best you can buy for your needs . . . dollar for dollar.



"Equipment Costs and Other Items in Engineering Economics," which was published in the December 1946 issue, the following errors occur:

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On page 97, in the table "Cost of Electrical Equipment," the item "Motor" should read "Motor In-stallation."

The following data on gas holder costs were omitted from the paragraph "Tanks and Gas Holders" on page 97.

Gas Holder Costs

	Dollars
Water Seal	Per Cu. Ft.
10,000 cu. ft.	1.00-1.20
100,000	0.55-0.65
1,000,000	0.25-0.35
Day Seal	

1.20-1.3
0.65-0.7
0.30-0.4

On page 99 an error was made in quoting some water utility costs. The following are the correct data:

Water, per 1,000,000 gal.	
Process, filtered, softened	\$150-400
Process, distilled	400-1,200
Cooling tower	50-200
Cooling, raw	10-50

Add Corrosion Report

To the Editor:

Sir:-We have reviewed the data submitted by us for your Twelfth Biennial Report on Materials of Construction (November 1946, pp. 95-150). Both you and we have made mechanical errors in transposing the data.

Our errors can be corrected by making the following changes:

P. 125, Nos. 801, 846, 849: change "150° max." to "100° max."

P. 143; under oxalic acid insert lines reading:

- '718 / Koroseal / All %; 100° max. / TD' "801 / Acidseal / All %; 100° max. / BIPTDF"
- "846 / Saniprene / All %; 100° max. / BIPTDF" "849 / Superflex / All %; 100° max. / BIPTDF"
- P. 144, Nos. 718, 801, 802, 846, 849, 855: change "A" to "X" and delete entries in Applications column.
- P. 146, No. 718: change "X" to
- "A / All %; 150° max. / TD"
- P. 146, Nos. 801, 802, 846, 849, 855; change "X" to "A / All %; 150° max. / BIPTSDF"

Your errors can be corrected by changing the following:

- P. 121, No. 802: change "802" to "801"
- P. 122, No. 856: change "Triflex" to "Vistanex"
- P. 123, No. 856: change "Triflex" to "Vistanex"
- P. 126, No. 718: add "150° max."
- Add the following footnote to the table which begins on p. 120: "Where Acidseal, Saniprene, Superflexite, or Triflex are assigned a resistance rating of 'A' with a maximum temperature of 150° F., satisfactory resistance can usually be obtained up to 212° F. with somewhat shortened service life."

E. E. STARNER

Industrial Products Sales Div. B. F. Goodrich Co. Akron, Ohio

and Other you get FULL CORROSION RESISTANCE plus EASIER FABRICATION with Carpenter STAINLESS TUBING!

Nitric acid cooling coils made from 12 gauge, 3" O.D. Carpenter Stainless Tubing-Type 347.

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CAL ENGINE

You do not have to sacrifice analysis when you order this Stainless Tubing. Because of the manufacturing methods Carpenter uses, you get the full corrosion resistance required for your job. And each length of this tubing is 100% hydrostatically tested. To save money with less equipment down-time, fewer tube replacements, be sure your Stainless Tubing orders specify Carpenter.



Easy to clean and keep clean, Carpenter Stainless Tubing is ideal for jobs where sanitary requirements are rigid. The tubing in this food dispenser is 3/8" x 16 gauge.

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A note on your company letterhead is needed to start your Carpenter Stainless Tubing Slide Chart on its way to your desk. Along with Physical Properties of various types, the chart gives information on Velocity Constants and Mass Velocity Constants, as well as data on sq. ft. internal and external surface per lineal foot of tube. Write for your Carpenter Stainless Tubing Slide Chart today.

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MORE THAN ONE-HALF OF BRITISH CHEMICAL CAPACITY CLOSED BECAUSE OF COAL SHORTAGE

Special Correspondence

WITH NEARLY two million workers out of their jobs in the first week of the countrywide power cut and millions more temporarily threatened with unemployment, there is no need to emphasize the gravity of Britain's fuel crisis. It was brought to a head by the exceptionally severe weather which tied colliers to their ports, froze rivers and canals, slowed down rail and road transport, and kept mineworkers from the pits. But the hard core of the problem is much older. For years now it has been impossible to lay in sufficient coal in summer, while the manpower was too small for swift output expansion in winter.

Coal stocks were dangerously low when this winter began, and bigger output a man-shift did little more than offset the production loss caused by contraction of the labor force. Early in December came the first shock: industrial coal and power consumption was cut by 5 percent, at a time when most factories needed bigger supplies. There followed protracted but unsuccessful negotiations for a graded cut in fuel supplies with preferential treatment for industries of vital importance. Meanwhile deliveries fell off so sharply that in practice few firms in the main industrial areas received more than 60 percent of their November allocation. On January 20, a new system of coal allocation was instituted at short notice. It provided for full allocations to power stations and gasworks, cuts 20 to 25 percent for basic industries, and more severe cuts for luxury and semi-luxury trades. Most industrialists welcomed it as permitting planned productionif on a lower scale than desirable.

Freezing of waterways and snowdrifts on the railroads made short shrift of this supposedly realistic system. By the end of January some industrial areas were without coal, at the beginning of February shedding of loads by power stations became a serious embarrassment to industry, on February 9 industrial electricity supplies

sumers, and by the middle of the month firms which still kept their staffs employed on maintenance were forced to lay off most of their men. It was not until February 24 that in one region, the Midlands, electricity was again supplied to industry, and when this happened many firms even in this privileged area found they had not enough coal for anything like normal operations. In the chemical industries as elsewhere firms with electricity-generating

were stopped except to essential con-

where firms with electricity-generating plant of their own escaped the general shutdown, provided they had enough fuel to keep their generating plant going. Others, independent of electric power, also carried on, though at great inconvenience, until a temporary improvement in the weather and emergency arrangements again permitted loading and unloading of coal. Most chemical firms, however, had to retrench sharply.

ICI Hard Hit

In the chemical sections of Imperial Chemical Industries, 4,000 men were discharged in the first week of the power crisis, and this figure was expected to be multiplied three or four times in the following week. The company's dyestuffs division was at a virtual standstill. The explosive division was closed. Only the company's salt division worked comparatively normally as it relies on its own source of power, and in the metals division the factories in South Wales which are oil-fired remained in operation.

Medicinal products, soaps, oils and fats were exempted from the general power cut, but the coal shortage did not pass these sections of the chemical industry altogether unnoticed. A leading cement producer reported approximately 60 percent of his works closed, and this is typical of the building trades in general. Of Dunlop Rubber's 14 factories only one was working by the middle of February. Murex' metallurgical and metal refining factories at Rainham ceased production. Turner and Newall, producers of asbestos and magnesia, had to stop production in six or seven of their 14 factories.

Taking the chemical trades as a whole, it was estimated that by the middle of February more than half the capacity had been put out of commission. This does not mean that production was halved at a moment's notice, for before the nation-wide electricity cut many chemical firms had been forced to slow manufacturing operations. But there is little doubt that by mid-February British manufacturers produced only half the amount of chemicals which they are committed to supply to their customers, and when a resumption of production became again possible, chemical manufacturers at first produced only small quantities of most of their products.

Paradoxically enough, the production stoppages are unlikely to involve consumers of chemicals in greater inconvenience that they are used to, for their requirements also have been reduced. Although after stoppage of production, most chemical manufacturers made deliveries out of previous production, supplies were delayed by priority for fuel transports and the severe weather. Little new business is being placed because consumers are unable to foresee their future requirements.

Export shipments also have fallen off sharply, and in the long run it is feared the export business will suffer seriously from the fuel difficulties. For coal-tar acids the Control has already issued a new directive cutting down the quantities available for export; 40 percent only of the tonnages delivered to domestic consumers will be licensed for shipment abroad, and the larger licenses issued earlier have been invalid.

Tar-acids are among the few chemicals with a steady hard-currency market. That the authorities, despite the urgent need for bigger dollar-carning exports, deemed it necessary to cut down exports of a commodity sent chiefly to the United States shows the severity of the fuel crisis. In the absence of any prospect of early relief



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This modern type evaporator (patents applied for) provides the following advantages over conventional evaporator construction:

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- a-No structural supports required.
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- c-Less floor space required.
- d-Climate permitting, may be set out of doors.
- 2-Operating Advantages
 - a-Lower steam-vapor pressure drop losses.
 - b-Fewer points for vacuum leakage.
 - c-Real accessibility to outside tube areas for cleaning.
 - d-Lower maintenance due to unit construction and absence of structural steel supports.

A General American engineer will gladly give further details to your operating department.

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by short-term measures, it is anticipated that a comprehensive rationing and allocations system will be imposed on households as well as industrial fuel consumers.

Future Planning

In the long run the present fuel difficulties should be to the advantage of the chemical industry in so far as they underline the need to make the best possible use of the coal output, As there is little hope of an increase in production in excess of the steadily growing demand for fuel, any improvement in the stock and supply position depends on qualitative rather than quantitative measures. There is much scope in British industry for an improvement of fuel-burning appliances and the avoidance ow wasteful methods in the conversion of fuel into heat and power, and opportunities in this field will no doubt be tackled now with greater energy. More use also will be made of possibilities to subject coal to chemical processes before its use as fuel. The expansion programs of coaltar distillers, organic chemicals producers and others interested in this field has unfortunately been held up in the past by plant shortages and delays in the execution of orders for new plant.

A shortage in industrial qualities of coke and coke-oven products has been one of the most embarrassing effects of reduced coal supplies for public utilities. It has drawn attention to the plight of industries dependent on coal distillation products, and there is a possibility that the government, while unwilling to authorize large scale coal imports, will in future show more understanding for the needs of British industries in need of coal-tar derivatives. If, to avoid a repetition of the present fuel crisis next winter, larger quantities of coal are processed during the coming summer, this alone should help to improve the position of the British inorganic chemicals industry which is now suffering seriously.

The rise in the cost of coal fuel and the supply difficulties caused by insufficient production and transport delays have for some time acted as a stimulus for the conversion of coalburners to oil-firing, not only in new plant but also in older installations. This tendency has been actively encouraged by the Government and will be greatly furthered by the most recent experience. Oil-burning appliances have been used in British industry for some time, but mostly on a small scale only. The selection for new plants of sites outside the old-established industrial areas favors this development in so far as it reduces the transport advantage of coal from domestic fields.

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FRENCH CHEMICAL INDUSTRY PLANS DEVELOPMENT IN PRODUCTION OF FERTILIZERS AND COAL-TARS

Special Correspond.n e

POSTWAR readjustment of the French chemical industry will be greatly affected by worldwide economic conditions and domestic political developments as well as by the industry's ability to meet changing condi-tions. The final Saar, Ruhr, and general German territorial and economic settlements will determine what coal and fuel raw material basis the French chemical industry can count on in the future. Plans call for considerable development in fertilizers and coal-tar in the Upper Rhine area. Destruction of French plants as a result of war operations varied in the great French chemical centers around Paris, Marseilles, Lyon, Rouen, the North, and Alsace, and some reparations in plants will be asked for.

France also expects to take over a share of former German chemical exports. In the prewar period French products such as pharmaceuticals enjoyed considerable prestige in some of the smaller European countries (now primarily in the Russian orbit) and in South America as well as in France's assured preferential market in her Empire, which is still second in size and population only to Britain's.

Domestic chemical needs presumably will continue to center around fertilizers and agricultural chemicals, while exportable surpluses ultimately will result in dyes, pharmaceuticals. essential oils, perfumes and cosmetics, argols and tartrates, electrochemicals based on southern French waterpower, naval stores based on relatively undamaged forests, fifth largest in Europe, superphosphates based on North African phosphate rock, and abundant Alsatian potash. Potash, bauxite, salt. and fluorspar are the main minerals found abundantly in France. Coal-tar products, sulphur or pyrites, colonial fats and oils probably will continue as import requirements.

Following the semi-starvation of French soils during the war, fertilizer needs are high. Several fertilizer and agricultural chemical plants were destroyed or damaged and many were shut down for lack of raw materials and manpower. Before 1939 France's yearly output of nitrogenous fertilizers was 180,000 tons (nitrogen content).



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With better supplies of coal, coke, pyrites, and transportation prewar production rates were nearly equalled the middle of 1946. With additional imports from United States, Chile, and Norway, French agriculture had from 100,000 to 110,000 tons nitrogen for the agricultural year ending June 1946. It is hoped to increase this to 225,000 tons of nitrogen for the year 1946-7. Needs are actually considerably higher because of the cumulative deficit of nitrogenous and other fertilizers resulting from insufficient supplies in the war years. Ammonia compounds, nitric, and sulphuric acids are being produced in increasing quantities in the Nord districts but are scarce in Centre and Midi where local factories have not yet completely resumed operations. The French also hope to transfer some German installations to France to help relieve the nitrogen shortage.

Superphosphate Production

Superphosphate production stopped completely from the end of 1942 to the beginning of 1945 when North African phosphate supplies again be-came available. From July 1945 to June 1946 total output of superphosphate in France amounted to 726,000 tons as against 1,200,000 tons in 1938. Shortages of pyrites for sulphuric acid hindered recovery, as did the fact that Germans had dismantled a number of lead chamber acid plants to recover the lead. As a result, 1946 sulphuric acid production was not expected to exceed 800,000 tons as against requirements estimated at 1,200,000 tons monohydrate.

To avoid piling up an excess of phosphate stocks while sulphuric acid plants are being rebuilt, phosphates are being treated with nitric acid and a mixture of nitric and sulphuric. Pyrites are being imported from Spain and Portugal, and increasing coal al-locations and transport facilities are boosting production of both acid and superphosphate in the direction of prewar levels. Some untreated phosphate rock and ground phosphate is being exported from France, but it is estimated that for the 1946-7 fertilizer year less than 5 percent of the expected superphosphate output of roughly one million tons will be exported.

The only fertilizer currently exported in appreciable quantities is potash. With the reincorporation of Alsace-Lorraine-the fourth time in three-quarters of a century that the territory has changed hands-France has gained control of the 11 state potash mines which formerly supplied 70 percent of French potash output, as well as the private Kali St. There'se mines, whose works were most heavily

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Engineers and Economists to International Industry

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Sectional view of Williams over-running hammermill with heavy liners and grinding plate for limestone and other hard material. Particular attention is directed to the grinding plate adjustment which assures uniform close contact of hammers and grinding plate at all times. Also note the metal trap which provides an outlet for the escape of tramp iron.

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damaged. The remainder of the mines, liberated February 1945 by the Allies, are in fairly good operating condition. In prewar years France exported about half her potash output when under the European Potash Cartel 30 percent of world export markets were assigned to France and 70 percent to Germany. At that time French potash output was second only to that of Germany and ahead of that of the United States.

French potash production is now exceeding prewar levels, and considerable stockpiles are being accumulated since transportation difficulties are hampering shipments. With stockpiles plus current output, a total of 218,000 tons (K_2O content) was distributed to French agriculture in the 1945-6 season as compared to a prewar 300,000 tons. In 1938 France exported 272,000 of 572,000 tons potash produced. In 1946 it was planned to export some 280,000 tons, or 42 percent, of the 650,000 ton anticipated potash output.

ticipated potash output. Total annual consumption of agricultural insecticides and fungicides is estimated at between 135,000 to 150,000 tons, most of this being used in wine-producing areas. About 90,000 tons sulphur were distributed in the 1945-6 crop year, compared with a 75,000 ton consumption in prewar years. A considerable part of this was imported. Little sulphur is produced from gypsum, although two rich deposits are now being prospected for this purpose in Provence. War-damaged sulphur-refining plants at Bassens and Sete are being repaired at a cost of 20 million francs.

Supplies of copper sulphate, chiefly used to prevent mildew on grapes, were especially short during the war, but are now satisfactory. It was hoped to meet about one-fifth the requirements through imports in 1946. In 1945 practically all copper sulphate imports were from the United Kingdom. Home production plus imports supplied about 100,000 tons for the 1945-6 season as against a 1938 consumption of about 80,000 tons.

Australia Slow To Develop Postwar Chemical Outputs

FAILURE of Australia's mining and power industries to keep abreast of expanding industrial capacities during the war, neglect of economic cost calculation in wartime plant construction, desertion of workers to prewar pursuits, and other wartime hangovers have so far stymicd attempts by chemical manufacturers to seek a new lease of life. This is a pity because installations for production of industrial chemicals rank among Australia's most highly deng de famoues ner, frandeel ni gill was i al lap played i hare, colo i har, we h anaring bags anly, we feel ing ante por fan Salesan lin an talk

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veloped units of industrial equipment. Many of these now appear to have little economic value. These observations apply in the first place to governmentoperated or subsidized plants, but even Imperial Chemical Industries is having trouble with its conservatively planned and expanded plant.

Coal production did not strikingly expand during the war, but sufficient fuel and process coal was made available to chemical plants by restricting coal consumption in other industries. Hydroelectric power production did expand, but not sufficiently to take care of all industries when working at unrestricted capacities. In a desire to decentralize productive capacity, individual plants were designed for outputs much too small to be economic. Inaccessible locations were chosen for security reasons.

New Nitrogen Plants

Four nitrogen fixation plants erected during the war produced, during the whole of the war, the nitrogen equivalent of only 16,000 tons of TNT, 12,-500 tons of cordite, 9,000 tons of nitrocellulose, 3,700 tons of nitroglycerin and 1,400 tons of ammonium nitrate. One of these plants is now producing ammonium sulphate at a rated capacity of 12,000 tons a year. conversion of the other three, also of 12,000 tons each, is hanging fire. Sulphuric acid, the other important component of the fertilizer, is not produced by more economic methods. Existing sulphuric acid plants were converted and new ones designed to operate on pyrites in place of sulphur, naturally under conditions that do not bear close auditing by profit-bent shareholders.

As a result of wartime advancements, a total of 112 industrial chemicals never produced commercially before 1940 went into production over the war years. Solvents and plasticizers in production included acetone, butyl acetate, butyl alcohol, mixed higher ketones and dibutyl phthalate. Among the pharmaceuticals and intermediates produced, and partly still in production, were acetanilide, aniline, anthranilic acid, dicyandiamide, dimethyl phthalate, diphenvlamine, ethyl formate, food phosphates. chloramine T. cyanide, saccharin. salicylic acid. phenothiazine, paranitrochlorbenzene, pectin, and sulfanilamide. Plastics and intermediates, now nearly entirely out of production, included ethylene. ethylene polysulphide. formaldehvde. hexamine, methyl methacrylate, phenol. phthalic anhydride, polystyrene, and urea-formaldehvde cements. A wide range of rubber accelerators and antioxidants was produced and remains partly in production.

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Phosphoric Glass Developed By Russian Scientists

PHOSPHORIC glass through which ultraviolet rays can penetrate but which blocks infrared rays, has been developed by the experts of the Soviet Scientific-Research Institute of the Glass Industry, following several years of experimental work. It contains no silicon and is made of aluminum phosphate, a waste product in making phosphoric fertilizers. If a small quantity of ferrous salts is added, it acquires a bluish moonlike color and the ability to arrest infrared rays.

Slight modifications in recipes and methods of production endow the glass with various new properties. Thus, a phosphoric glass may be produced fusing at 350 deg. C., or a glass capable of resisting a temperature of 800 deg. C. Refractory phosphoric glass is used for peep holes on furnaces. It may be made to expand under the effect of heat and it has been actually soldered in metal and vice versa. Glass peep holes in divers' helmets, holes in bathyspheres, or thin tungsten wires in electric bulbs may be combined with metal into a single whole, without complex and non-too-durable washers.

Phosphoric glass is produced at present at the semi-industrial plant laboratory of the Soviet Scientific-Research Glass Institute. Regular production is to be organized soon for industry. The production of consumers goods out of phosphoric glass is a thing of the future. The target for 1947 is 38 million square meters of glass, but in 1950 the Russians expect to produce fully 80 million square meters of glass.

Strikes Close Australian Chemical Plants

A PROTRACTED strike at several ICIANZ plants (Imperial Chemical Industries of Australia and New Zealand) has bottlenecked Australia's entire chemical industry, particularly the alkali branch. There is no prospect of

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WM. L. BARRELL CO., Inc., 40 Worth Street, New York, N. Y., Sales Agents

immediate settlement, and unless key chemicals can be rushed from overseas, a severe chemical famine will add another headache to Australia's harried postwar industrial leaders.

Chlorine is still produced in Melbourne by ICIANZ, but not in sufficient quantities to meet requirements. Chlorination in city water systems has already become a serious problem, and production of DDT, refrigerants and other chlorine compounds has been curtailed. Sodium hypochlorite, of great importance in Australia because of its uses as a bleaching reagent and as a sterilizer in dairying, breweries and butter canning, is running dangerously short.

The strike at the Botany caustic soda plant has accentuated the shortage of a product already severely rationed. The carbon bisulphide situation has become so desperate that several ore-dressing mills may be compelled to shut down unless flotation reagents based on this chemical become available from abroad. Other chemicals affected by the strike are sodium sulphide, zinc chloride, hydrochloric acid, trichlorethylene, carbon tetrachloride, phenothiazine, neozone, MBT and MBTS.

The government-owned Deer Park nitrogen fixation plant (Haber), which was to be operated by ICIANZ for production of 12,000 tons of sulphate of ammonia annually, recently was converted to produce methanol. While this proved an easy way out of sulphuric acid shortages, shortage of coal and coke is now throttling the methanol project also.

Chemical Engineering Position

AUSTRALIA is looking for a qualified person to fill the position of lecturer

in charge, Chemistry Department, Technical Education Branch, Depart-

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chemical engineering, preferably with

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International Congress Will Be Held In London

WHEN the Tenth International Congress of Pure and Applied Chemistry was held in Rome in 1938, it was decided to hold the Eleventh Congress in London in 1941 in association with the centenary celebrations of the Chemical Society in London. It has now been decided to hold them, the celebrations of the Chemical Society on July 15-17, and the International Congress on July 17-24. A provisional program for the Congress calls for registration on the evening of July 16 with an informal reception of delegates and members. The opening ceremony by the president of the Congress will take place on the morning of July 17 at Central Hall, Westminster.

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Japanese Fertilizer Co., Ltd., **On Restricted List**

THE Japanese Fertilizer Co., Ltd., has been added to the schedule of restricted concerns by a new SCAP memoranda to the Japanese government. The company is prohibited from making any disposition of its assets without SCAP authorization. The Japanese government also has been ordered to make reports indicating the extent of the firm's control of other fertilizer producers.

The concern prohibited from selling or otherwise disposing of any capital assets including lands, buildings, major items of equipment and securities, "is to be dissolved and a government distribution corporation established in its place," Col. U. H. Kupferer, chief of SCAP's Anti-Trust and Cartels Division, said. The concern is a joint stock company handling distribution of all the fertilizer produced in Japan, as well as functioning as a lending agency for fertilizers and acting itself as a producer.

New Chlorine Plant In **Operation** in Peru

PRODUCTION of liquid chlorine has begun at Hacienda Paramonga, Peru, and is expected to reach approximately 800 metric tons annually. Domestic requirements are estimated at 100 tons yearly. The remainder will be exported.



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THE CORROSION FORUM

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Edmond C. Feller, ASSISTANT EDITOR

Wet and Dry Chlorine vs. Materials of Chemical Plant Construction

Part III of a three-part symposium in which representative manufacturers of corrosion resistant materials discuss the suitability of their products for equipment exposed to wet and dry chlorine gas and chlorine water

DURIMET, CHLORIMET J. L. TRAUB The Duriron Co. Dayton, Ohio

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D^{URIMET} T (22 Ni, 19 Cr, 3 Mo, 1 Cu, 1 Si, 0.07 C max.) and Durimet 20 (29 Ni, 19 Cr, 3 Mo, 4 Cu, 1 Si, 0.07 max. C) have been used for chlorine gas, wet and dry, and chlorine water.

One prominent manufacturer of water chlorinating equipment has found after extensive tests that Durimet 20 is quite satisfactory for han-dling chlorine water up to 3,000 p.p.m. of chlorine at room temperatures. At this concentration slight pitting occurred under the gasket surfaces, whereas at 2,500 p.p.m. no

visible corrosion took place. A large paper mill has been using Durimet T for handling chlorine water in slime control for a number of years and reports satisfactory service where velocities are low. The equipment in service in this instance is Durimet pipe, fittings and dispersers.

The lower cost of the high-silicon irons and their generally more satisfactory life has limited the use of Durimet in the services under consideration. They have been used where machinable alloys are required and metals preferred to other materials

Equipment available in Durimet consists of pumps, valves, mixing nozzles, steam jets, fans, fittings, and special castings. Durimet, being a machinable alloy, is available for use in the production of other manufacturers special equipment where patterns suitable for making stainless castings are used. Durimet T is also available in hot rolled and round bar stock in limited quantity. Durimet 20 at the present time is available in castings only.

Neither of the Durimets is recommended for wet chlorine gas or chlorine water at elevated temperatures without prior testing under operating conditions. One authority, however, has reported Durimet as being satisfactory in moist chlorine at temperatures up to 800 deg. F.

Chlorimet No. 3, a nickel-base alloy (62 Ni, 18 Cr, 18 Mo, 3 Fe and 0.07 C) possesses excellent corrosion resistance to chlorine, wet or dry, and chlorine water at room temperatures. Test reports have indicated it to be suitable for moist chlorine up to a temperature of 850 deg. F. Chlorimet No. 3 is available in pumps, valves, tank outlets, fans, etc. It is a new alloy and is not available at the present time for special equipment. It is produced only in the cast form.

Table 1-Corrosion Tests in Organic Chlorinations (Water Absent)

- Test 1: Plant corrosion test in chlorination of acetylene to give acetylene tetrachlo-ride. Test made in catalyst box of con-tinuous chlorinator; 115 deg. F.; 282 days
- duration.
 Test 2: Plant corrosion test in chlorination of methane. Test made in bottom of pilot plant chlorinator; 446 deg. F.; 222 hr. duration.

	Corrosion Rate, Mils per Yr.	
	Test 1	Test 2
Monel	<0.1	6
Nickel	<0.1	2
Inconel	<0.1	2.5
Ni-Resist Type 1.:	1	280
Ni-Resist Type 3	0.7	43
< = Less than.		

NICKEL, NICKEL ALLOYS W. Z. FRIEND International Nickel Co., Inc. New York, N. Y.

NICKEL, Monel, and Inconel are re-sistant to dry chlorine even at considerably elevated temperatures. At high temperatures they are among the most resistant materials. Experience has shown that the useful upper temperature limit for the use of nickel and Inconel is approximately 1,000 deg. F., and for Monel about 850 deg. F. This resistance also extends to wet chlorine gas so long as the temperature is always well above the dew point of the chlorine-water vapor mixture.

Ni-Resist is also resistant to dry chlorine at atmospheric temperatures. The upper temperatures for its use are about 400 deg. F. for Type 1 Ni-Resist (14 percent Ni, 6 Cu), and about 450 deg. F. for Type 3 Ni-Resist (30 percent Ni).

Monel is a standard material for trim on chlorine cylinder and tank car valves, for orifice plates in chlorine pipelines, and is used frequently for parts of chlorine dispensing equip-ment. Common applications of Monel and nickel are for reactors, agitators, heating coils, valves, piping and other parts in connection with the chlorination of organic materials where the reactants are essentially water free. The results of a number of corrosion tests under such conditions are shown in Table I.

None of these materials is resistant to wet chlorine at temperatures below the dew point of the chlorine-water mixture, nor in continuous exposure to chlorinated water solutions except in very dilute chlorine concentrations. The effect of the presence of appreci-

N.A.C.E. PROGRAM

See page 220 for a program of the technical papers to be presented at the third annual convention of the National Association of Corrosion Engineers, Chicago, April 7-10

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Queer Looking, Aren't They?

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Table II—Corrosion Tests in Organic Chlorinations (Water Present)

- Chlorinations (water resemp)
 Test 1: Plant corrosion test in chlorination of perchlorethylene to form hexachlore-thane. Mixture contains water and is saturated with chlorine; atmospherie temp.; 50 days duration.
 Test 2: Plant corrosion test in chlorination of ethanol. Mixture contains chlorina-tion products of ethanol, HC1, chlorine and water. Test made in liquid phase of primary chlorinator; 3½ ft. from chlo-rine inlet; 200 deg. F.; 20 hr. duration.

	Corrosion Rate, Mils per Yr.		
	Test 1	Test 2	
Monel	72	2,100	
Nickel	35*	500	
Inconel	49†	2,200	
Ni-Resist Type 1	140	5,200	
Ni-Resist Type 3	100		

* Perforated by pitting; specimen orig-inally 31 mils thick. † Pitted to maximum depth of 8 mils.

Table III-Corrosion by Dilute Chlorine-Water Solutions

- Test 1: Plant corrosion test in filtrate from washer handling chlorine-bleached paper stock. Filtrate contains 0.011 gm. per 1. free chlorine (pH 3.5) : 90 deg. F.;

- per 1. free chlorine (pH 3.5): 90 deg. F.; 72 days duration.
 Test 2: Plant test in chlorine-bleached paper stock containing 0.15 gm. per 1. HC1 and 0.02 gm. per 1. free chlorine; room temp.; 90 days duration.
 Test 3: Lab. test in water sol. containing 0.1 percent HC1 and 0.1 percent free chlorine; 86 deg. F.; 6 hr. duration; velocity 16 ft. per min.
 Test 4: Lab. test in water sol. containing 0.3 percent HC1 and 0.3 percent free chlorine; 86 deg. F.; 12 hr. duration; velocity 16 ft. per min.

	Corrosion Rate, Mils per Yr.			
	Test 1	Test 2	Test 3	Test 4
Monel	1.4	43	2,200	2,100
Nickel	1.8		140	210*
Inconel Ni-Resist	<0.1		13	44*
(Type 1)	7.5	23		

* Pitted : < less than.

able condensed water on corrosion in organic chlorinations is shown in Table II.

The results of a number of tests in dilute acid chlorine-water solutions are given in Table III. It will be noted that Monel was considerably more resistant to the filtrate containing 0.011 gm. per liter free chlorine than to the solution containing 0.02 gm. per liter free chlorine.

In alkaline chlorine solutions such as the sodium or calcium hypochlorite solutions used for bleaching and sterilizing purposes, Monel, nickel, and Inconel are frequently resistant, where available chlorine concentrations are as high as 3 gm. per liter, in discontinuous operations, such as cyclic textile bleaching, where the bleaching cycle is followed by rinsing and acid "scouring" in the same vessel. In higher concentrations, attack is likely to be severe and accompanied by pitting. These materials are resistant to continuous exposure to the very dilute hypo-chlorite solutions, usually containing less than 500 ppm. available chlorine, used for sterilizing purposes. In the

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Table IV-Effect of Inhibitors on Corrosion by Sodium Hypochlorite Solutions

Sol. Comp.,	Corrosion Rate, Mils per Yr.		
Gm. per L.	Nickel	Monel	Incone
6.5 avail. Cl +			
No inhibitor	52	113	12
0.5 sod. sil	10	18	2
0.5 TSP	20	8	2
2.0 sod. sil	1	2	1
2.0 TSP	9	3	1
3.3 avail. Cl +			
No inhibitor	30	39	ă
0.5 sod. sil	4	1	1
0.5 TSP	6	4	ĩ
0.1 avail. Cl +			
No inhibitor	4	4	2
0.5 sod. sil	0.5	0.3	0.7
0.5 TSP	0.6	1	0.7

washing of hypochlorite-bleached paper stock, Monel is used for wire covers and other parts of vacuum washers and for lining the vats and repulper sections of these washers.

Inhibitors, such as sodium silicate (water glass) or trisodium phosphate, have marked effect in reducing corrosion rates of nickel, Monel, and Inconel in hypochlorite solutions. The inhibitive effect may extend to solutions containing as much as 6.5 gm. per liter available chlorine as shown by the corrosion test results given in Table IV.

CHEMICAL STONEWARE

F. E. HERSTEIN General Ceramics and Steatite Corp. Keasbey, N. J.

THE MANUFACTURE of chlorine is one of our most important industrial processes and also one of the most difficult for which to choose a material of construction due to the extremely corrosive nature of hot wet chlorine. In its dry state chlorine can be handled successfully by steel or iron but when wet it will attack most metals and as a result non-metallic materials of construction are widely used both in the manufacture and handling of wet chlorine. Chemical stoneware is one of these materials. It is completely inert to hot moist chlorine and has the advantage of being easily fabricated into the shapes required for the equipment used in the manufacturing process. In this process, chlorine is evolved electrolytically in cells from brine, transported from the cells where it is cooled from approximately 180 deg. F (the temperature at which it leaves the cells) to 60 deg. F., dried with sulphuric acid and then compressed into cylinders or tank cars which are the usual means of packaging. When the chlorine leaves the cells it is saturated with moisture which must be removed before it can be handled commercially. Most of this moisture removal takes place in the coolers and the balance is accomplished in the dryer. After the chlorine has left the dryer it is relatively noncorrosive and may be han-

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Write for Shriver Filtration Book on how to select the right filter.



T. SHRIVER & COMPANY, Inc. 802 HAMILTON ST. HARRISON, N. J.



dled in iron or steel. From the point where it leaves the cells to the exit from the dryer stoneware is widely and, for some applications, exclusively used. Since the gas issuing from the cells is hot, the tendency of stoneware to fail under acute thermal conditions was formerly a serious disadvantage but in recent years a stoneware body developed primarily for chlorine plant use, called SP-22, has proved satisfactory from this standpoint and has been widely adopted.

In the collection of the gas from the cells the use of stoneware starts with the cell connector pipes which lead from the top of the cells to the collecting manifolds which are stoneware pipes 8 to 10 in. in dia. with a connection for one or more cell connectors. The manifolds may be the familiar bell-and-spigot type or butt ended with wrapped joints. Two or more manifold lines will lead into a larger header of stoneware. All of the fittings, which include valves or dampers of different types, tees, elbows, and safety seals, are also made of stoneware. From the headers a stoneware line of a size to suit the capacity of the plant (10 to 14 in. I.D. is the usual range) runs to the cooler. It is common practice to install this line in a trench and spray it with cooling water to lessen the load on the coolers.

The cooling operation is usually divided into two stages. In the first stage the gas is cooled from 180 deg. F. (or less if substantial cooling takes place in the carrying lines) to 100 deg. F. by means of cooling water which can be either from a sprav tower or pond or from a source which will give a temperature of no greater than 90 deg. F. In the second stage the gas is cooled to approximately 60 deg. F. using chilled water or brine at approximately 40 deg. F. as a cooling medium. The same type of equipment is used for both stages. In the past stoneware disk and S-bend coolers were used, but at present the most popular type is the Hart cooler, which consists of two or four manifolds connecting a number of stoneware cooling tubes. The tubes are sloped so that the condensed water will discharge at a trap at the bottom of the lower rear manifold. Formerly one of the disadvantages of stoneware for this application was its low rate of heat transfer, but these coolers are now constructed by using SP-22 stoneware (which does not have a particularly high heat transfer rate) for the manifolds and a stoneware body called B-41 which has a heat transfer rate three to four times that of standard stoneware for the tubes where the heat transfer takes place. Over-all coefficients, of approxi-

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350 VERONA AVENUE

mately 30 B.t.u. per sq. ft. per deg. F. per hr. are attained in the water cooler, and approximately 10 in the brine cooler.

When the gas leaves the coolers it contains moisture equivalent to the vapor pressure of water at 60 deg. F. and this moisture must be removed if the gas is to be compressed in iron compressors and handled in steel or iron cylinders. This drying is accomplished in stoneware drying towers, which are used almost exclusively, by allowing sulphuric acid to come in intimate contact with the gas in countercurrent flow. Two alternate types of equipment are used in this step, namely: the familiar packed tower, and the Green or cascade tower, also called "drip" tower. Since the latter is much more widely used and is gradually replacing the packed type it will be described. It consists of a bottom and cover with a number of intermediate sections in between. Each intermediate section is composed of a bell and spigot section approximately 12 in. high with an orifice of approximately one fourth the diameter in the center of the bottom of the section and a circular plate with a raised edge which is supported over and overhangs the orifice. Sulphuric acid enters at the top and flows down the tower, forming an absorption surface on the circular plate and the bottom of each section. The chlorine enters at the bottom of the tower and flows up through each orifice and over each absorption surface and is discharged at the top.

The same properties which make chemical stoneware so well adapted for manufacturing purposes also make it suitable for the usual handling applications which include, absorption and reaction towers, duct and exhausters for either concentrated gas or fumes, reactors (limited by size and pressure) and piping, fittings and pumps for handling chlorine water. Stoneware is not generally used for dry chlorine as more economical materials can be used.

Annual Convention N.A.C.E.

NATIONAL Association of Corrosion Engineers has scheduled its 1947 conference and exposition, for Chicago, April 7-10. The entire proceedings technical sessions, banquet, manufacturers exhibits, and N.A.C.E. committee meetings—will be held in the Palmer House. The program is as follows:

Monday, April 7, 9 a.m. Registration and Opening of Exhibition Hall.

Monday, April 7, 2 p.m. General Assembly: "Opening Address," F. J. McElhatton, for

ECURACITY-Up to 900 me discharge capaci

EDAE-Suitable for a 1930 p.s. Body is ac ad such higher press

BEING-List price, \$1 14 presure,



GOOD NEWS for the CHEMICAL INDUSTRY

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QUICK FACTS

- SMALL SIZE-Height, 7"; diameter, 41/4"; 1/2" pipe connections.
- BIG CAPACITY-Up to 900 lbs. per hour continuous discharge capacity, depending on pressure.
- PRESSURE—Suitable for operating pressures up to 250 p.s.i. Body is actually built to withstand much higher pressures.
- ORDERING-List price, \$14.00. Specify operating pressure.

- A new, low cost **ALL-STEEL** steam trap

THE NEW Armstrong No. 3211 forged steel trap is designed L and built to meet the needs of the chemical industry for a small size, moderately priced, high quality steam trap. It's tough!-the forged steel body will withstand hard knocks that would shatter ordinary cast iron traps. It's fire-resistant!-no danger of the body weakening under high pressure when exposed to fire. Inside, it has the same all-stainless steel operating mechanism that's used in Armstrong traps built for pressures up to 1500 p.s.i.!

This new trap is now in production in the Armstrong factory. If you are in need of traps of this type, see your local Armstrong representative at once. If it is an urgent matter, write, phone, or wire ARMSTRONG MACHINE WORKS, 858 Maple St., Three Rivers, Michigan.



CHEMICAL ENGINEERING • MARCH 1947 •



FULLER ROTARY COMPRESSOR

For conveying dry pulverized materials, you can't beat the set-up illustrated above . . . the unit system of Fuller-Kinyon Pump and Fuller Rotary Compressor. It's equipment designed and built by us for one particular purpose—economical conveying.

This installation is used for conveying pulverized phosphate rock. Material is delivered from a pulverizer to a bin directly above the pump, fed to the pump by a Fuller Feeder, the pump conveying the pulverized rock to a mixer bin in the plant. Rate of conveying, 10 to 25 tons per hour, is controlled by the feeder in accordance with the requirements of the process. The pulverized rock has a fineness of 58 to 62 percent through a 200 mesh screen.

Compressed air of high pressure was available, but rather than reduce this high-pressure air, with it's attendant losses, it was decided to install a Fuller Rotary Compressor to discharge direct to the pump at 406 c.f.m., 15-lb. pressure. In other words, the perfect set-up . . . air where and when needed, and at the proper pressure to do the work most efficiently and economically.

FULLER COMPANY, CATASAUQUA, PA. Chicago, 3 - 120 So. LaSalle St. San Francisco 4 - 421 Chancery Bldg. Washington 5, D. C. - 618 Colorado Bldg.



FULLER-KINYON, FULLER-FLUXO AND THE AIRVEYOR CONVEYING SYSTEMS . ROTARY FEEDERS AND DISCHARGE GATES ... ROTARY AIR COMPRESSORS AND VACUUM PUMPS . . . AIR-QUENCHING INCLINED-GRATE COOLERS PULVERIZED-MATERIAL COOLER . . . AERATION UNITS MATERIAL-LEVEL .. MOTION SAFETY SWITCH SLURRY VALVES ... SAMPLERS INDICATORS .

Panhandle Eastern Pipe Line Co., President N.A.C.E.

- "A Challenge to the Corrosion Engineer," H. H. Anderson, Shell Oil Co.
- "On the Other Side of the Fence," Tom Holcombe, Dearborn Chemical Co.
- General Business meeting, 4 p.m., members only.

Tuesday, April 8, 9 a.m.

Chemical Industry Symposium:

- "Prevention of Ferric Ion Corrosion During Acid Cleaning," J. L. Wasco, H. A. Robinson and F. N. Alquist, Dow Chemical Co.
- "Plastics for Corrosion Control," J. W. Shackleton, E. I. du Pont de Nemours & Co.
- "Corrosion Resistance of Hastelloys," C. G. Chisholm, Haynes Stellite Co.
- "Effects of Different Ions on Corrosion of Aluminum," R. H. Brown and A. B. McKee, Aluminum Co. of America.

Water Industry Symposium:

- "Effects of Various Waters on Aluminum," R. H. Brown and D. W.
- Sawyer, Aluminum Co. of America. "Corrosion Costs to the Water Industry," H. E. Jordan, American Water Works Assn.
- "Treatment of Water in Army Supplies in New England," G. P. Loschiavo.
- "Cathodic Protection of Hot Water Tanks," J. M. Bialosky, Armour Research Foundation.

Wednesday, April 9, 9 a.m.

- **Communications Industry Symposium:** "Corrosion of Radio Equipment," L. P.
- Morris, Galvin Mfg. Co.
- "Corrosion of Underground Cables," A. G. Andrews, Michigan Bell Telephone Co.
- "Effect of Multiple Drainage," J. M. Standring, American Telephone and Telegraph Co.
- "Principles of Corrosion of Under-ground Cable Sheath," V. J. Albano, Bell Telephone Laboratories.

Oil Industry Symposium:

- "Arsenic as a Corrosion Inhibitor in Sulphuric Acid," A. Wachter, R. S. Treseder and M. K. Weber, Shell Development Co.
- "Silicates for Corrosion Inhibition in the Oil Industry," Wm. Stericker, Philadelphia Quartz Co.
- "Cathodic Protection of Pipe Lines," Alan C. Nelson, Plantation Pipe Line Co.
- "Mechanism of Inhibitor Action," Norman Hackerman, Uni. of Texas.

Electrical Industry Symposium:

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You won't NEED to worry about getting valves that run up heavy maintenance expense if you follow this simple formula when you buy and instill valves, and then give them reasonable care. In fact, you'll be headed towards extra savings.

By choosing Jenkins Valves you get the product of valve specialists whose ability to build extra value into valves has been recognized for over 80 years. In addition you get the expert counsel of Jenkins engineers whenever you need help on the selection or placement of valves for any piping layout.

Let the Jenkins ABC formula be your valve-buying guide . . . for the lowest cost in the long run. Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.



On this outside screw and yoke valve (flanged) the spindle rises up through the yoke sleeve and serves as an indicator. All pressure-containing parts are "semi-steel" for extra strength. The cast bronze sent ring is removable. Rolled rod bronze spindle. Valve can be repacked under full pressure. ONE OF OVER 600 EXTRA VALUE VALVES MADE BY JENKINS VALVE SPECIALISTS

JENKINS Fig. 651 Renewable Bronze Seat Ring IRON BODY GATE VALVE

1 W

125 lbs. Steam

200 lbs.

0.W.G.

CHEMICAL ENGINEERING • MARCH 1947 •

BAKER TRUCK triples storage space cuts handling time and labor costs



1. Stock arrives in box cars, in 30'' and 50'' rolls, and varying lengths and widths. 36'' rolls weigh from 300 to 1000 lbs. 50''' rolls weigh 1000 to 3000 lbs. Illustration shows Baker Truck placing bridge plate in position prior to unloading.



A single Baker Electric Fork Truck mechanizes movement of large rolls of paper used in process of making corrugated board-from box car to corrugating machines. The truck has been giving continuous, satisfactory service for 7 years. Illustrations and captions describe, step-bystep, the flow pattern in this modern paper conversion plant. They may suggest answers to similar problems in other plants.



6. Rolls needed for production are trans-ferred from Baker truck onto steel dollies with concave decks matching contour of rolls. Dollies run on narrow-gauge tracks extending to the roll stands.

For the FORT NIAGARA CORRUGATED BOX DIVISION of the ROBERT GAIR COMPANY

North Tonowanda, N.Y.

No Man-Handling from box car to production!



3. 36" rolls arrive in separate cars, and are unloaded onto a platform with incline leading into plant, where they are re-moved by the Baker Truck and taken to storage.



4. Baker Truck tiers rolls horizontally to celling height, 50° rolls three high and 36° rolls four high. Thus the truck more than triples the value of storeroom floor space. Bottom rolls are placed on 2° boards to permit entrance of forks.



5. Detiering of rolls is accomplished by positioning truck with fork backs against bottom roll, removing wedge block, and releasing brake which allows two top rolls to lower into position. Before taking roll away, new bottom roll is wedged.

Let the Baker Material Handling Engineer show you how an inte-grated material flow system can make similar savings in your plant.

BAKER INDUSTRIAL TRUCK DIVISION of The Baker-Raulang Company 2164 WEST 25TH STREET . CLEVELAND, OHIO In Canada: Railway and Power Engineering Corporation, Ltd.



Guy Strand and Line Hardware." C. J. Couy, Duquesne Light Co.

- "Use of Cable Pulling Grease as a Cor-rosion Preventive," H. S. Phelps, Philadelphia Electric Co.
- "Cathodic Protection of Lead Sheath Cables," H. A. Robinson and R. L. Featherly, Dow Chemical Co.
- "The Electrical Engineer's Responsibility for Recognizing Corrosion as a Factor in the Design of Electrical Structures," M. C. Miller, Ebasco Services, Inc.

"Cathodic Protection of Lead Sheathed Power Cables," I. C. Dietze, Los An-geles Dept. of Water & Power.

Wednesday, April 9, 2 p.m.

Gas Industry Symposium:

- "Results Obtained With Pearson's Holiday Detector," A. H. Cramer and W. R. Fraser, Michigan Consolidated Gas Co.
- "Alloying Steels for Corrosion Resist-ance to Gas Condensate Fluids," K. Eilerts and F. O. Greene, U. S. Bureau of Mines.
- "Statistical Analysis of Test Containers for Condensate Well Corrosion Studies," V. V. Kendall, National Tube Co.
- "Chimney Liner Corrosion Resulting from Gas Fired Furnaces," G. B. Johnson, Minneapolis Gas Light Co.

Wednesday, April 9, 7:30 p.m.

- Banquet and Introduction of New Officers:
- "The Engineer's Contribution to Free " in the International Contribution of the International Contribution o Enterprise," Edwin Vennard, Middle West Service Co., Chicago.

Thursday, April 10, 9 a.m.

General Industry Symposium:

- "Oxidation of Stainless Alloys," J. T. Gow, Battelle Memorial Institute.
- "Thermogalvanic Corrosion," R. M. Buffington, Servel, Inc.
- "Nondestructive Methods of Deter-mining Metal Wall Thickness," . G. Kerley, Shell Oil Co.
- "Guide to Selecting Corrosion-Resistant Materials," L. G. Vande Bogart, The Crane Co.

Cathodic Protection Symposium:

- "Aluminum Galvanic Anodes." Part I, Laboratory Tests, R. A. Hoxeng and R. H. Brown, Aluminum Co. of America; Part II, Field Tests, Ellis Verink, R. A. Hoxeng and R. H. Brown, Aluminum Co. of America.
- "Why Cathodic Protection Sometimes Fails to Protect," W. E. Huddleston, Huddleston Engineering Co. "Selection and Location of Anode Sys-
- tems for Cathodic Protection," D. B. Good, Texas Pipe Co.
- "Electrical Measurements in Cathodic Protection," J. M. Pearson, Susquehannah Pipe Line Co.



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PETRO-CHEM **ISO-FLOW FURNACES**

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CHEMICAL ENGINEERING • MARCH 1947 •

for four of the largest lube oil plants built this year



LAYOUT OF A TYPICAL MERZ PLANT FOR THE RECOVERY OF VEGETABLE OILS Illustrating just one application for Solvent Extraction

SOLVENT EXTRACTION

MERZ PROCESS for

xclusive with Home

in the Western

Hemisphere

Merz Solvent Extraction Plants are the most up-to-date batch plants systematically developed since 1882. Renowned for their highly developed heat of extract—the negligible loss of solvent—their highly developed with economy—their safe and nearly automatic working . . . and for the wide range of raw materials they will process . . . and for the high quality and purity of their products—Merz plants are generally throughout the world as the most efficient for their purposel Merz plants in every case are designed to meet the special requirements of the material to be treated. They allow for working at a predetermined temperature, and are therefore particularly suitable for selective extrac-tion of two or more solutes from one raw material. Unknown matter temperature, and are therefore particularly suitable for selective extrac-tion of two or more solutes from one raw material. Unknown matter is previously tested in the laboratories to find out the best method of

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is previously tested in the laboratories to find out the best method of treatment. Merz plants can be arranged to work in series, providing greater capacity with maximum economy. In many cases, existing plants can be modernized and adapted to the Merz System. As exclusive licensees and fabricators in North and South America, for Merr Solvent Extraction Plants and also for the highly officient Merr

As exclusive licensees and fabricators in North and South America, for Merz Solvent Extraction Plants, and also for the highly-efficient Merz Edible Oil Refining Systems, we will be glad to provide additional information regarding your own problem on request. SIX ADVANTAGES* OF MERZ PROCESS AS APPLIED TO EXTRACTION OF VEGETABLE OIL (illustrated in diagram)

Never more than 1% of oil remains in the residues as against losses of up to 10% The residues are richer in allumna there are relevant on the residues are richer. by the pressing process. 2. The residues are richer in albumen than press cakes and accordingly of higher 3. Residues from the Marganetic sector is a sector of the sect

- Residues from the Merz process can be stored indefinitely and can be fed to stock without grinding.
 Oils recovered are of twee external color and characteristic stored in the store of the store o Wilnout Erinding.
 Oils recovered are of pure natural color and cleaner than those obtained by pressing.
 They can easily be converted into first-class edible oils.
 Mere places are simple in degine and complete Their sectors. They can easily be converted into instellass edible oils. 5. Merz plants are simple in design and operation. Their maintenance costs and capital outlay are much less than that of presses. 5. Merz plants permit the individual treatment of all kinds of eite code and end and the outlay are much less than that of presses.
 6. Merz plans permit the individual treatment of all kinds of solvents, whether inflammable or non-inflammable, and either hot, cold, or in vapor form.

- * Equally important advantages exist in other applications Equally important advantages exist in other applications of the Merz process. Write for complete details regarding Merz plants and their advantages for your own material.

PARTIAL LIST OF MATERIALS SUCCESSFULLY EXTRACTED BY THE MERZ PROCESS ANIMAL AND MARINE OILS AND FATS & SUIPHUR

ANIMAL AND MARINE UISS AND TAIS & SUITHUR B VEGETABLE OILS & ALKALOIDS & INSECTICIDES & WAXES & RESINS & ASPHALT AND BITUMEN WAAES RESINS BASENALL AND BELOWER CHLOROPHYLL BESSENTIAL OILS B LACTIC ACID B SPENT FULLERS EARTH & SPENT CATALYSIS SPENT FULLERS EAKIN B SPENT CATALTIS B COTTON AND WOOL WASTE (Regenerated) B CARBAZOL B ACME COPPERSMITHING & MACHINE CO., ORELAND, PA., U. S. A.

DESCRIPTION OF PROCESS: Crush-

ed seed is charged into Extractor L from Hopper C; solvent from Tank S, and weak solution from the preceding charge stored in Miscella Tank are fed into the Extractor L where it quickly dissolves the oil. This solution passes through a specially designed filter bottom to Chamber M, separated from Extractor L by an intermediate division bottom, and connected with Calandria Heater F. Circulating rapidly, the evaporation of the solvent commences at once. While the concentrated solution passes back to M, and is there mixed with fresh solution coming from L, the solvent vapors rise to the Condensers C-1, and C-2. There the solvent is recovered according to requirement, either hot (Water Separator S-1), or cold (Water Separator S-2), and returned to Extractor Luntil a test indicates that practically no oil remains in the seed. The weak solution in L is then usually collected in B and used again in the following charge. Any solvent remaining in the seed residues, as well as in the oil, is driven off by live steam, accelerated by the use of suitably designed mechanical stirring gear, which also aids in discharging the residue.

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FROM THE LOG OF EXPERIENCE

Dan Gulleben, ENGINEER

A BOLD SALESMAN of the American subsidiary of Ruth's Steam Storage Co. of Sweden blew in one morning 20 years ago full of pep. The Canada Sugar Refinery of Montreal was the only western hemisphere refinery to possess a steam storage system. He was eager to extend the benefits of European experience but he said wherever he went he was stymied by the question, "has Pennsylvania installed it?"

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EMICAL END

The capacity of the 14 good old orthodox 500 hp. boilers working at 150 lb. exceeded the average demand but the savage peaks from the pan foor occasionally depressed the pressure till the lights grew dim. Under such a condition a "thermal flywheel" would be advantageous and it would furthermore postpone the need for the inevitable new steam plant till a more propitious time. The salesman proposed to supply an accumulator with all the accessories for our erectors for the price of \$60,000, and, he added, "you operate it for 60 days and after that either pay for it or tell us to take it out." This proposition was promptly accepted and four months later the accumulator got on the line. Forthwith two of the boilers were shut down. Sixty days later we sent the check.

A STEAM ACCUMULATOR is a large pressure tank that stores heat while the boilers are delivering a surplus and returns it while delivery is deficient. The storage is accomplished by the condensation of the surplus steam in a large volume of water un-der pressure. When the "overflow" valve senses an increase of a pound or more in the pressure of the steam from the boilers, indicating a surplus production, it admits steam through the nozzles immersed in the water in the tank. The steam condenses. Its latent heat increases the temperature of the water and the pressure adjusts itself accordingly. If the surplus production continues, the pressure eventually equalizes with the supply at 150 lb. and the temperature at 366 deg.

The refinery process employs two pressures, 30 lb. for the white sugar vacuum pans and 10 lb. for various other purposes. When the turbine bleeder at 30 lb. or the exhaust at 10 lb. is deficient, as evidenced by pressure drop in the headers, a reducing valve supplies the deficiency from the accumulator instead of directly from the main steam line from the boilers. In case the boiler output should continue to be deficient over a long period, the accumulator pressure would drop to the process pressure and the flywheel would be temporarily run down. However the large pressure gage on the firing floor indicates to the fireman when he is to increase or decrease the fuel supply. This can also be made automatic. When the tank is fully loaded, about 90 percent of its contents is water under the header pressure of 150 lb. and the temperature of 366 deg. In this condition it has the capacity to supply 60,000 lb. of dry saturated steam before the 10-lb. pressure level is reached and the time required to do this is whatever it takes to pass through the re-ducing valves. Under the conditions of the old boilers, the steam entered the accumulator with 5 percent moisture and it left dry. Accordingly it was necessary about once a week to drain a little water back to the feed tank. The new steam plant built four years later in '32, delivered super-heated steam and this required an occasional replenishment through a connection with the feed pump.

THE PROCESS was improved by the accumulator as to efficiency and output by reason of the reduction in the fluctuations of the steam supply. The efficiency and output of the boilers as well as the maintenance cost were also improved because of the reduction of the violent fluctuations. The maximum result of a sudden jump of 140,-000 lb. per hr. in the steam demand, which occurred when two pan supply valves were simultaneously spun open, was drop in steam pressure, water carry-over, dimming of lights, motors kicking out because of speed loss and consequent voltage drop, and finally near heart failure to the power plant men. On the other hand a sudden large reduction in steam demand left a heavy bed of incandescent coal on the stokers that could not expend itself except through the safety valve.

It is conceivable that a sugar boiler could be taught to open the steam valves with discretion but we did not have that kind of sugar boilers. Steel is plastic compared to human habit. Accordingly the performance of good sugar boilers was improved by fitting the Swedish "overflow" valve with a double impulse whereby the supply from the boiler house is cut off in case the pressure should drop to some adjustible limit of, say, 125 lb. This smoothed out the wrinkles in the power engineer's forehead.

SCOTCH MARINE BOILERS, of revered memory, which the searfaring owners of sugar houses near the shores of Lake Michigan used to install, intrinsically possessed accumulator capacity. But for the advantageous flywheel effect, the pressure must be allowed to fluctuate. Thus the separate boiler maintains the pressure for the benefit of the power plant while the accumulator permits fluctuation between the lowest process pressure and the supply pressure, i.e. between about 20 and 50 lb.

LACK OF ROOM on the ground required the accumulator to be installed above the pan house roof 130 ft. above

Diagramatic sketch of Ruth steam accumulator in Pennsylvania Sugar Co. As a "thermal flywheel" accumulator smooths out load on boilers by storing steam when demand is light, returning it when demand is great



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1,743,826 skilled workers live and work in Southern New England.

here is a fact worth remembering: 10% of all industrial workers in the U.S. to offer, write for the new, 32-page illive in Southern New England ... more skilled workers per thousand population than any other part of the country!

The availability of skilled labor is only vour plant in Southern New England. Street, Boston 10, Mass.

If your business requires skilled labor, For a complete, concise resume of all the advantages that New England has lustrated booklet, SOUTHERN NEW ENGLAND FOR TOMORROW'S INDUSTRY. Address: P. E. Benjamin, Mgr., Industrial Development, New one of the many advantages of locating Haven R. R., Room 201G, 80 Federal

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the street, while the control valves and instrument panel were located on a platform directly under the roof. The tank, weighing 145 tons empty or 500 tons loaded, was built by a shipbuilder of superior skill of Manitowoc, Wis., applying traditional shipbuilder quality of workmanship. The 13-in. rivets however could not hold the calking tight against the expansion and contraction due to the rapidly fluctuating steam temperatures. All joints were therefore calk-welded on the outside.

OPERATION WAS INSTITUTED

by massive Gus Lundberg sent over from Sweden. The room temperature under the roof of the pan house where the valves are located was 115 deg. To counteract the heat, Gus drank beer and water by the quart. The mechanism of the Swedish control valves of wondrous precision receives its pressure impulse through a flexible corrugated diaphragm, which, after some millions of deflections, requires replacement. On an occasion the store room lacked a spare and thus required temporary manual operation. A re-quest was phoned to New York to mail a supply. Instead of mailing it, they dispatched it by messenger and thus limited customer inconvenience to two hours.

At the beginning of the late War a goodly number of diaphragms was in stock but by '44 the operators grew uneasy. The steel was analyzed and a local shop promised to spin new ones but priorities postponed delivery for three months. The shop accomplished the job but before their success could be anticipated a cable was sent through the war zone to Sweden. They wired that the parts were in stock but shipment was subject to the governmental requirement of war department ap a noise or proval and the receipt of the price of 75c. for the material plus \$14 for air

Accumulator as it appeared after installation was complete. Lack of space on the ground required its location on the roof of the pan house

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• MARCH 1947 • CHEMICAL ENGINEERING

Adaptioneering AT WORK



Typical of Sprout-Waldron's successful "ADAPTIONEERING" is this highly efficient method of reducing sheet pulp—in **one** operation without intermediate handling—into a cottony fluff free from nodules and adaptable to many processes.

Labor cost is practically non-existent, capacity per horse-power is high and maintenance expense is insignificant.

Sprout-Waldron has promoted its ADAPTIONEERING service as a result of many requests for assistance from processing engineers for help in specific problems. The combination of fine machines and engineering skill, developed through Sprout-Waldron's years of processing experience, adapted to highly specialized applications has produced in many instances exceptional savings in labor and material costs. This valuable ADAPTIONEERING service—ingenuity + machines + experience—is at your command.

If you reduce—the size of any material, or mix one material with another, or handle any material in bulk, you may realize considerable savings by consulting Sprout-Waldron.

SPROUT-WALDRON & COMPANY

MANUFACTURING ENGINEERS



The high-pressure dehydration unit here illustrated is a property of the United Gas Pipe Line Company at Carthage, Texas. It represents the most advanced design, construction, and operating technique; and the drying agent employed is FLORITE DESICCANT. The Stone & Webster Engineering Corporation, who designed and constructed the plant, are users of FLORITE in various types of equipment, large and small, for oil and gas companies and for other branches of industry.

Natural gas, propane, butane, gasoline, air, nitrogen, carbon dioxide, refrigeration compounds, all are treated with superior drying efficiency by use of FLORITE. Selectively adsorbs 4 to 20% its weight of water—is regenerated by heating to 350°F. Write for literature, names of important users in your own field.



Department A 220 Liberty Street

Warren, Pa.



Close-up of accumulator during installation. It was fabricated by a Wisconsin shipbuilder of superior skill

mail postage. It required four months to cut the red tape and get the shipment. In the meantime, in order to verify the specifications and shop numbers, the accumulator company expended for prepaid telegrams double the billing for the shipment.

PERFORMANCE INCLUDED

some unexpected services. The Monday morning start of the refinery required one pulverizer on the boiler that was on the line over the weekend. This was operated at full capacity and the surplus steam sent to the accumulator. By the time the tank was filled, the steam demand began to exceed the capacity of one pulverizer. Then the accumulator supplied the difference till the demand was able to absorb the coal input of two pulverizers. When two pulverizers plus the supply from the accumulator wasn't enough the second boiler was put on.

Once a year the switchboard has to be "killed" for overhaul. In preparation, the accumulator is fully charged and then the steam and power plants are shut down. A half day later the electricians have finished their job. The accumulator then supplies the steam for an engine generator and this in turn drives the boiler fuel oil pump, and presently the plant is back in operation. The pressure drop in the accumulator during a shutdown is about 3 lb. per hr., which covers valve leaks and condensation. When a sudden disturbance has shut down the steam plant the accumulator has maintained power production till the boilers can be restarted. It has happened that the feed pump turbine has tripped out. In this predicament the load is partly shifted to the accumulator while the feed pump is restarted.

The control valves of the accumulator are an awe-inspiring complexity which the sugar boiler is afraid to touch. Formerly the reducing valve that supplied the old 80-lb. coil pans was located conveniently on the pan floor and a safety valve was provided on the roof to protect the 80-lb. line and pan coils. Now and then old Henry, the sugar boiler, adjusted the

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ENGINEERU

benefit by the





Men working together, for production, can give America what it needs: more and finer products ...greater values...better standards of living... for all! Slow-downs or forced idleness deprive everyone of the gains industry can offer only through more production.

Only through cooperation for production can America benefit by the great technological advances of recent years. Modern MOSINEE papers, for instance, custom-made to meet specific requirements, are helping to improve products, slash costs, raise standards of living.

MOSINEE paper technicians are equipped to create paper with scientifically controlled chemical and physical characteristics to improve many products and processes. Call MOSINEE!



CHEMICAL ENGINEERING • MARCH 1947 •

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HE BUILDS NEW WAREHOUSE WITH EVERY LOAD

Warch the swing

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Industrial Trucks

"TT WAS just like finding 30,000 square feet of warehouse space when we replaced our old lift truck with a new Crescent electric PALLETIER," a factory superintendent told us. "The space was up there between our old stacks and the girders of the roof. So for the cost of a Crescent PALLETIER we practically built a new 30,000 foot warehouse."

The Crescent PALLETIER can help you find extra storage space-high above the floor-right in your own warehouse. The space is free... for the cost of the PALLETIER is quickly offset by lowered materials handling expenses. Write for the PALLETIER bulletin today.

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- Operator spots and tiers without stirring from seat
- All control levers at driver's **Angertips**
- Full magnetic control protects against forced acceleration
- Inspections and adjustments simplified by easy accessibility to all mechanisms
- Minimum maintenance costs

This is the truck to take loads off your mind.



reducing valve to increase the pressure for greater speed at the pans. Then the safety valve would blow, but a cloud of steam above the roof meant nothing to a sugar boiler. When Tom came up from the boiler house with blood in his eye, Henry affected complete ignorance of his old valve. One Sunday Tom moved the safety valve to a position near the reducing valve inside of the house. The next day he was rewarded. While lingering unobserved on the pan floor he suddenly saw Henry in precipitate flight from an earsplitting roar which he thought was an explosion of the works.

A FURTHER SERVICE performed by the accumulator was postponing the necessity for a new steam plant for a few years to provide time for the collection of design data. The cost of the installation had exceeded the estimate by \$6,000 which the Old Man passed up with a shrug as the engineering department's besetting sin. However this item covered flow meters installed in front of the vacuum pans and various gateways for steam flow. The Old Man did not know it but there was a new million-dollar steam plant in the offing.

A progressive sugar refinery tends to reduce its steam consumption as equipment and technique improve. On the other hand the power consumption goes up as kilowatts (at onethird cent per kwhr.) replace manpower (at about \$1.00 per hr. for a twentieth of a horsepower or less, plus costly supervision). An ingenious packing device using 5 hp. may do the work of six men. An intelligent char distributing system requiring 20 hp. and a capital expenditure of \$30,000 abolishes the most uncomfortable 12man job in the house which was almost impossible to man under current abundance. Even the performance of the accounting department was improved by the expenditure of 30 hp. for light- "at monthy known ing, power driven typewriters and business machines, and air conditioning. A taptarter. Furthermore there was an opportunity Induce has record to make a profitable extension to the byproducts plant to produce dry ice and this required 1,000 hp. of power and no additional steam. To avoid wasting exhaust steam, higher steam pressure was required from the boilers.

The new steam plant alluded to in the Log this month will be the subject of a column or two in the near future. Dan also has one in the works on manlifts, together with a code for their safe design and operation. Dan's code is based on his own 25 years' experience with manlifts, plus correspondence with manual manufacturers, state officials and over 100 other users.

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> Neat, compact, reliable. Self-powered and self-contained. Uses Sylphon bellows thermostat assembly.

Sylphon Regulators available with Dial Indicating Thermometer

Pictured above is Fulton Sylphon's of No. 923-T Temperature Regulator. Long well and favorably known for its dependable performance in the control of liquid temperature ... rugged No. 923 regulator has recently been

further improved through the addition

of a dial indicating thermometer.

The thermometer indicates the temperature being maintained at the regulator bulb...obviates the necessity of installing a separate thermometer adjacent to bulb. Adjustments can be made easier, quicker, and more accurately.

Also available on Sylphon Regulators Nos. 921, 921-Q, and 923-Q. For complete information, write for your copy of Catalog EC-20 today.



Handsomely illustrated catalog, prepared specifically for your industry, describes No. 923-T and other temperature regulators.

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Clarity of filtered liquors must be satisfactory for quality standards. Likewise, production efficiency demands ample flow for desired output. Nine grades of Dicalite filteraids give a wide range of both clarity and flowrate, increasing flexibility of operation to meet virtually any condition. Hard-tofilter liquors can be clarified satisfactorily and at low cost; variations in liquors from day to day can be handled to give output of uniform quality. Suspended solids of all types, from ordinary size to as small as bacteria, can be removed to give liquors with brilliant clarity. A Dicalite Engineer is freely available for information, or for more practical help in cooperation with your technical or production staff. Send for your copy of Dicalite Bulletin B-11—no charge or obligation.

THE DICALITE COMPANY



but so is Flowrate

The above chart lists eight of the nine grades of Dicalite filteraids. It shows their comparative "speed" and flowrate, which can be used to guide selection to meet varying production demands.

DICALITE FILTERAIDS

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G. M. Buffett

George M. Buffett has been appointed technical director of the Pittsburgh Plate Glass Co.'s new paint plant at Springdale, Pa. Dr. Buffett has been associated with the firm's paint division at its Milwaukee, Wis., plant during the past 19 years.

Peter Colefax has been elected president of American Potash & Chemical Corp., Los Angeles. He succeeds Frederick Vieweg, who has resigned after 28 years of service. Mr. Vieweg will remain on the board of directors and will serve as a consultant.

J. J. Mellon, who has been associated with the Allen-Bradley Co., Milwau-kee, for the past two years, has been appointed chief engineer of that company.

Robert A. Nisbet has been appointed superintendent of the Waterford works of the General Electric chemical department. The Waterford, N.Y. works, now under construction, will be used for the manufacture of silicone products.

Roland P. Soule, vice president in charge of engineering and research for the American Machine and Foundry Co., has been elected a director.

Mortimer W. Brenner has rejoined Schwarz Laboratories, Inc., where he will be engaged in coordination of brewing problems and consultations pertaining to plant and process operations



I. B. Duckworth

John B. Duckworth has been made an assistant director of research of Standard Oil Co. (Indiana) and J. G. Bailie has been advanced to assistant chief chemist.

M. L. Crossley, director of research, Calco Chemical Division, American Cyanamid Co., has been selected to receive the 1947 gold medal of the American Institute of Chemists. The medal is awarded annually for "noteworthy and outstanding service to the science of chemistry or the profession of chemists in America." Presentation of the medal will be made at the annual meeting of the Institute in May.

W. Fletcher Twombly has been appointed technical director of the Witco Chemical Co., New York. This is a new position created because of expanding manufacturing and research activities. Before joining the organi-zation in January 1946, Mr. Twombly was an assistant director of the Chemicals Bureau of WPB.

William A. Hamor of Mellon Institute received the honorary degree of doctor of laws at the commencement of the University of Miami on January 30, 1947.

Max Neuhaus, formerly director of research of Jefferson Chemical Co., has been named manager of Jefferson's technical and research department, with Paul P. McClellan and John C. Paul as assistant managers.



J. A. Mooney

J. A. Mooney, general superintendent since 1945, has been made resident manager of the South Charleston plant of Westvaco Chlorine Products Corp. M. H. Norton succeeds Mr. Mooney as general superintendent at South Charleston. Thomas F. Jackson has been appointed resident manager of the Carteret, N. J. plant.

Kenneth R. Brown, director of research and James R. Frorer, general manager industrial chemicals department, have been elected to the board of directors of Atlas Powder Co.

H. Arthur Howe has been named superintendent and Clarence H. Slayton, Jr., engineering manager for the compound division, and George P. Lehmann manager of the plastics division of the General Electric chemical department, Pittsfield, Mass.

Jake T. Nolen has joined the chemical division laboratory staff of the Du Pont plastics department as a group leader

Lawrence Brown has resigned as chief of the Industrial Division of the Office of War Mobilization and Reconversion to become assistant to the president of Publicker Industries, Inc.

Herbert M. Hodges has retired as overseas director of the Monsanto Chemical Co.

C. R. Freburg has resigned his position with the research department of

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TANKS 18-8 Stainless Steel. Highly polished No. 4 finish inside and out. Pitched bottom, self-draining. Stainless Steel covers. Stands pipe leg type. Built-in agitators for fast or slow speed, if desired. 25, 35, 50, 60, 100, 160, 200, 300, 400 and 500 gallon sizes . . . also built to special specifications.



BATCH CANS

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72 oz. with handle. Also some one, two and four - quart FLAT dippers.



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Immediate Delivery CONSOLIDATED SIPHON SUPPLY CO., INC. DEPT C., 22-24 WOOSTER ST., NEW YORK CITY Carrier Corp. to become a member of the engineering division of Southern Research Institute of Birmingham, Ala.

Hubert L. Williams has been appointed assistant to the president and general manager of American Plastics Corp., manufacturers of casein plastics in Bainbridge, N. Y.

Frank W. Warner, Jr., engineering manager of the General Electric plastics divisions for the past three years, has been named engineering policy manager of the company's chemical department.

Karl T. Compton, president of the Massachusetts Institute of Technology received the Washington Award from the Western Society of Engineers on February 26, in Chicago.

Stephen B. Binkley has been appointed assistant director of research of Bristol Laboratories Inc., Syracuse.

Charles E. Mears has been appointed manager of the new nylon yarn plant under construction near Chattanooga, Tenn., it has been announced by E. I. du Pont de Nemours & Co.

Ralph E. Menzel, associate professor of chemistry at the Michigan College of Mining and Technology, Houghton, has been elected chairman of the Upper Peninsula Section of the American Chemical Society for 1947. He succeeds Allan F. Olson, chemical engineer of the Cliffs-Dow Chemical Co., Marquette, who was the first chairman of the Section, chartered in 1946.

F. B. Langreck is now technical advisor, and J. M. Graham, Jr., and W. Kenneth Menke are assistant directors of Monsanto Chemical Co.'s general development department.

Paul J. Flory, head of fundamental research at the Goodyear Tire and Rubber Co. research laboratory, Akron, has been chosen as the 1947 recipient of the Leo Hendrik Baekeland Award of the North Jersey Section of the American Chemical Society. The award, consisting of a gold medal and \$1,000 in cash, is given biennially to an American chemist under 40 in recognition of accomplishments in pure or industrial chemistry.

Cliff Slusser has resigned as vice president in charge of production and as a member of the board of directors of the Goodyear Tire & Rubber Co. He will continue with the company as vice president and general manager of



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	1010	Under 2	195	1 to 11/2 NPA
ļ	700	Max. 5	197	2 to 2 1/2 NPA
1	500	5 to 10	192	21/2 to 3 NPA
	400	5 to 10	192	4 to 51/2 NPA
ļ	200	5 to 10	192	Brown-Block
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needed for ordinary mills, the new Model Morehouse SB1400 Mill produces four times as much—better and more efficiently. This outstanding performance has been proven on a wide variety of materials both wet and dry—in chemical and general industrial fields.

The unit is portable, requiring no special foundation. Modern design and scientific engineering result in smooth operation—noise and vibration are negligible. Equipped with vertical shaft type motor, and efficient cooling and fume-collecting features, it is economical and dependable. Priced far below ordinary mills, the Morehouse Hy-R-Speed Model SB1400 will save you substantial amounts both in first cost and in operation. Write today for full information.

MOREHOUSE INDUSTRIES 1156 San Fernando Rd., Los Angeles 31, Calif. Since 1898 the subsidiaries which operate Goodyear's domestic textile plants and coal mines. Mr. Slusser is succeeded on the board of directors and as vice president in charge of production by Russell DeYoung. Fred W. Climer was elected to a new vice presidency of the parent company in charge of industrial relations.

R. C. Ernst, professor and head of the department of chemical engineering, and director and executive vice president of the University of Louisville Institute of Industrial Research, has been appointed dean of the Speed Scientific School of the University of Louisville.

Harry P. Newton, assistant director of the Southern Regional Research Laboratory of the U. S. Department of Agriculture, New Orleans, has been elected chairman of the Louisiana Section of the American Chemical Society.

Wayne C. Edmister, formerly senior process engineer with Foster-Wheeler Corp., is now senior chemical engineer with Delner Corp., a subsidiary of Hydrocarbon Research, Inc.

Charles S. Redding, president of Leeds & Northrup Co., received the honorary degree of Doctor of Science at the mid-winter commencement exercises of the University of Pennsylvania February 15.

George F. Rugar, manager of product development of the Diamond Alkali Co., Painesville, Ohio, has been elected chairman of the Northeastern Ohio Section of the American Chemical Society. He succeeds Marvin Achterhof, chief chemist of the Ohio Rubber Co.

W. H. Garrett, for many years a director of Monsanto Chemicals Ltd., and works manager at Ruabon, has been appointed director of production. He will be responsible for the production of all Monsanto plants in the United Kingdom—Ruabon, Sunderland and the new works which are being erected at Newport. W. E. Hamer has been promoted to research superintendent in charge of process investigations, and J. W. Barrett is research superintendent in charge of exploratory and applicational research. N. F. Patterson has been appointed works manager of the company's Ruabon works.

Carl Borgmann, formerly head of the chemical engineering department of the University of Colorado, has been appointed to the faculty of the Uni-



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That's just exactly what the man said.

You've probably said it, too — as you leafed through the advertising pages of a current issue of THIS magazine.

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To keep in touch with the parade-----READ THE ADS. BELT, CH. uch sew Roper vent uch up principle, t Transpace and reduce ipid to the pumping uniteraid, then deco uppring efficiency if the gurs to handle i score liquids at a method without changes and certations and applare a high metho

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Embodying the new Roper venturi suction and discharge principle, the new Series "K" pumps are rugged, compact units that save space and reduce power costs. Liquid to the pumping gears is properly accelerated, then decelerated, improving operating efficiency and the ability of the gears to handle a wide range of viscous liquids at standard motor speeds without changing pump size to avoid cavitation and noise. Roper pumps have a high suction lift... are unusually quiet and operate efficiently in either direction.

They are precision built, self-lubricated by the liquid pumped, and adaptable to a wide range of jobs . . . pressure lubrication, hydraulic service, fuel supply or transfer work pumping clean liquids. Equipped with mechanical seal or packed box, with or without relief valve. May be direct connected, belt or chain driven. Interchangeable mounting brackets and adapters . . . provisions for either hub, flange, or foot mountings.

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WHAT IT IS: An entirely new design application giving results unachieved with conventional pump designs. From the outside of the case the two ports are elongated, tapeted openings extending to and across the full center area of the gara bores. It is a proportional means by which liquid velocity is kept in step with the velocity of the pumping gears.



WHAT IT DOES: Causes the liquid to pass through the pump with a minimum of energy loss from turbulence, friction, and cavitation. Provides a uniform distribution of liquid across the gear face increasing efficiency by reducing recirculation losses. Adds quietness and reduces power cost. Provides the means for handling a wider range of viscous liquids at standard motor speeds.



ROPER Rotary Pumps



for REMOVING TRAMP IRON from AIR BLOWN MATERIAL

You want a magnet with POWER, constant, efficient, dependable power, ELECTRICALLY ENER-GIZED magnetic power that will definitely remove tramp iron and metallic refuse from such material as cotton, wool, shoddy, etc. You want automatic cleaning of the magnet that will remove the tramp iron by a simple push button touch, without the messy, laborious, time consuming manual cleaning operation.

You want a magnet designed and built by experienced magnetic engineers. If you have the problem of tramp iron in wind blown material, consult your Stearns Magnetic sales representative or write Stearns Magnetic, Milwaukee 4.



versity of Nebraska, effective next July 1.

O. B. J. Fraser has been appointed as assistant manager of the development and research division of the International Nickel Co. He succeeds H. J. French, who recently was made assistant vice president of the company. William A. Mudge has been appointed director of the technical service section succeeding Mr. Fraser, and William F. Burchfield succeeds Dr. Mudge as assistant director.

George S. Evans, of the Mathieson Alkali Works, has retired from his position as metallurgist in charge of fused alkali products for the metals trade but continues to be affiliated with the company as consultant.

W. L. McCracken has been appointed director of research and manager of alkali manufacturing by Detrex Corp., Detroit. This promotion gives Dr. McCracken complete charge of chemical research and development engineering, as well as the chemical manufacturing operations carried on at the Detrex Hillview Plant.

Harold M. Patterson, who for the past three years has been manager of the Taunton works of the General Electric plastics division, has been named engineering manager of the division.

Winton I. Patnode, chemist on the staff of the General Electric research laboratory at Schenectady, has been placed in charge of the Hanford branch of the laboratory at Richland, Wash.

John H. Blomquist has been promoted to the position of research supervisor in the nylon section of the rayon technical division of the Du Pont company in Wilmington.

Anderson W. Ralston of Armour Research Laboratories, Chicago, has been named winner of the 1947 Midwest Award of the St. Louis Section of the American Chemical Society. The gold medallion award is made annually by the St. Louis group in recognition of "meritorious contribution to the advancement of pure or applied chemistry or chemical education." Presentation was made at a dinner at the Coronado Hotel, St. Louis, March 10.

T. L. Swenson who was expected to transfer from director of the Western Regional Research Laboratory to the Washington office of the Bureau of Agricultural and Industrial Chemistry has accepted a position with Stanford Research Institute, Palo Alto. In THOUSANDS OF DOLLARS SAVED IN 4 YEARS BY

RIBBON & CARBON Company, Inc.



Four years ago, Old Town Ribbon & Carbon Co. of Brooklyn, N. Y., well-known manufacturers of carbon papers installed a Paul O. Abbé allsteel ball mill, jacketed for temperature control. Its capacity was 1000 lbs. for each batch.

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According to their figures, savings effected prior to the installation of this 2,000 lb. unit through lower labor, maintenance, and power costs in four years amounted to THOU-SANDS OF DOLLARS as compared with cost figures previously established for the same work when done by roller mills.

Similar case histories in your own industry are recorded here for your consideration when buying grinding and mixing equipment.



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Write for our 20 page Catalog No. 145 which completely describes the operation and construction of our complete line of cooling towers.

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C. H. Wheeler Water Cooling Towers are installed in practically every State and in many other countries where the weather is cold, such as Canada, arid as in Mexico, and tropical as in Colombia, South America. From this it is obvious that every water cooling tower presents its own individual engineering considerations, in order to insure correct operation under the climatic extremes of its location. . . . C. H. Wheeler Water Cooling Towers have one exclusive feature which is "Our Experience," and this is second to none. We have been building cooling towers since the days of horse cars and gas light, so today no water cooling problem would be new to us. We guarantee every one of our towers to produce the results for which it is designed.

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NON-CORROSIVE Through and Through

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HAVEG

is a solid structural material

It is a molded plastic, resistant throughout its entire mass to practically all acids, bases and salts; to chlorine, many solvents and other chemicals except those of a highly oxidizing nature.

HAVEG equipment is molded in light, inexpensive molds into many strong, durable shapes with seamless, solid walls. Tanks, for instance, are molded in one piece 10' in diameter and 12' high.



No process equipment buyer or user should be without complete information on HAVEG equipment. Send for Bulletin F-4. HA-1-47



his new position he is in charge of the food investigations of that research agency.

John G. Copeland, Jr., has been appointed assistant superintendent of the Hercules, Calif., dynamite and ammonia plant of Hercules Powder Co.

Ritner W. Tomlinson has been appointed superintendent of the Easton, Pa., plant of the Pennsylvania Salt Manufacturing Co. Mr. Tomlinson previously was plant superintendent of the Pennsalt plant at Cornwells, Pa., and the Greenwich plant in Philadelphia.

Herman Kerst, Jr., formerly with Edwal Laboratories, Chicago, is now with National Cylinder Gas Co. as research chemist in their chemical engineering department.

W. L. Hyden, assistant director of the cellophane research section at the Yerkes plant of the technical division of the rayon department of E. I. du Pont de Nemours & Co., Buffalo, N. Y., has been promoted to the position of director of auxiliary sections, consisting of personnel, planning, development, and patent service. Dr. Hyden will be stationed in Wilmington. A number of other promotions were included in a series of organiza-tional changes. F. H. Swezey, director of the acetate research section, Wilmington, was appointed a senior research associate at the acetate process rayon plant, Waynesboro, Va. G. P. Hoff, director of nylon research, was made director of acetate research, and G. M. Kams, director of engineering research, was appointed director of cellophane research. They will be sta-tioned in Wilmington. W. W. Heck-ert, assistant director of nylon research, was made director and E. W. Spanagel, manager of nylon research was made assistant director of cellophane research at Buffalo. W. C. Eberlin, manager of engineering research, Wilmington, was transferred to Waynesboro as assistant director of new fibers research. C. E. Miller, supervisor of engineering research at Waynesboro, remains there as manager of cellulose acetate research. R. A. A. Hentschel, supervisor of engineering research at Buffalo, was made manager of pioneering research there and F. R. Millhiser at the Spruance plant, Richmond, Va., was promoted from supervisor of viscose rayon research to manager of that section. Hood Worthington, assistant director, engineering research section, Wilmington, was made assistant director, nylon research section, Wilmington.



Particles into fluid or plastic materials.

An examination of the turbine design shows why it is possible for a single machine to perform these two distinct operations. Liquid is broken up into



minute globules by high velocity impact at top of turbine. Suspended material is mechanically sheared by the rotor and stator teeth, and hydraulically sheared by the final smooth surfaces of rotor and stator.

Eppenbach Mills are available in laboratory and production sizes. Capacities range from $\frac{1}{2}$ to 3600 galions per hour or higher.

Write for complete details. Ask for a copy of Catalog No. 401.



• MARCH 1947 • CHEMICAL ENGINEERING

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1809—"Canning" was discovered by Nicolas Appert, a Frenchman. His crude food preserving methods, using bottles for containers, won for him great acclaim and a grant of 12,000 francs from the Emperor Napoleon.



1850—The art of canning had spread far and wide. In home kitchens, barns, crude buildings, food was "preserved" for future use. Work was done by hand, mostly by women. Electrical horsepower was still to come.



As early as 1915, Howell engineers were working with machinery manufacturers to apply industrial type motors that were destined to up production, eliminate unnecessary human handling of foodstuff and cut costs.

Then canning became a major industry!

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ENGINE



wise-buy industrial type Howell

Howell Enclosed, Fan-Cooled Motor-Type K

CHEMICAL ENGINEERING • MARCH 1947 •

foday—Progress in harvesting, processing, distribution and the use of specially designed, electricallydriven machinery have upped production and made Canning a major industry.

Now millions enjoy at low cost, foods out of season, vegetables, soups, meat products, and other foodstuffs.

In the Canning Industry, you'll find Howell industrial type electric motors driving conveyors, rotating kettles, operating cookers, fillers, weighing, counting and packaging machines, and cleansing apparatus. You'll find them in all other great industries, too.

If you want motors to operate under gruelling conditions—motors that are precision-built specially for industrial use—buy horsepower by Howell.

Motors! They're designed for the toughest tasks in industry; consequently, they perform better on all jobs!

HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH. Manufacturers of Quality Industrial Type Motors Since 1915





for CORROSION-RESISTANT

Durisite is one of the few bonding mortars which will handle strong and weak alkalies, strong and weak acids, and all solvents. It will handle acids and alkalies alternately.

- Durisite can be stored indefinitely, without deterioration
- Durisite is non-toxic has no dangerous effect on the skin
- Durisite is dense, non-porous absorption less than 1/2 of 1%
- Durisite is quick setting chemical hardening

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Send today for Bulletin 810 — Fiftysix pages of helpful information every engineer can use. No cost. No obligation.



OBITUARIES

Joseph F. Winkler, well known specialist in refrigeration, died suddenly in Philadelphia, January 16.

Howard S. Roberts, 56, member for 30 years of the research staff of the Geophysical Laboratory, Washington, D. C., died January 30.

Laurence Blackhurst, 61, for ten years manager of the Du Pont plastics products division, died January 31.

Richard Bernhard, 73, chief engineer of The Traylor Engineering & Manufacturing Co. of Allentown, Pa., died February 2.

Charles A. Brown, 76, distinguished scientist in the field of sugar chemistry and agricultural chemistry, former chief of the Bureau of Chemistry, died in Washington February 3.

Harold De Witt Smith, 50, vice president and treasurer of A. M. Tenney Associates, Inc., died in Mexico City February 10.

Robert W. McClellan, 64, special assistant to the general manager of the Du Pont ammonia department, died at his home in Wilmington February 11.

Moses Gomberg, 81, one of the world's foremost authorities on organic chemistry, and retired chairman of the University of Michigan's chemistry department, died in Ann Arbor February 12.

Herman W. Falk, 79, founder and chairman of the Falk Corp., Milwaukee, died in Florida February 17.

Eugene M. Fleck, 54, president of the Vitro Manufacturing Co., died in Pittsburgh February 17.

Ludwig Schaefer, 63, chairman of the board of the Maywood Chemical Works, Maywood, N. J., died at his home in Paramus, N. J., February 22.

Samuel A. Tucker, 77, curator of the Chandler Chemical Museum at Columbia University and former professor of electrochemistry, died in New York February 23.

Horace A. Shonle, 54, director of the organic chemical research division, of Eli Lilly & Co., died in Indianapolis February 24.

Alfred F. Lichtenstein, 70, former president of the Ciba Co., Inc., died in New York February 24.



TYGON

plastic

Corrosion-Resistant

Tygon, the chemically inert plastic, possesses distinct advantages for gasketing in acid handling service. It is tough, flexible, highly resistant to corrosion. The slight swelling that occurs under exposure to certain chemicals adds to its effectiveness as a gasketing material. It is most effective through a temperature range of 0°F. to 150°F. Tygon is available in sheet, tube or rods from which you may cut your own gaskets, or we can furnish gaskets or diaphragms molded to your specifications.





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Inox every day di inary new K.A.C. I spentions of grindi blaching and homo The K.A.C. Kan inprove your prod is your plant. Let us know wi

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NGINEER

REVOLUTIONIZING the PROCESS INDUSTRIES

The new FLOW-MASTER K.A.C. Head—Heart of a processing technique adaptable to hundreds of products as diverse as mustard and grease, as far apart as soap and peanut butter.

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Almost every day the Marco laboratory finds new applications for the revolutionary new K.A.C. Kom-bi-nator—one machine that combines any or all of the operations of grinding, mixing, blending, texturizing, emulsifying, stabilizing, bleaching and homogenizing into a single, fast, low-cost, continuous process.

The K.A.C. Kom-bi-nator may be applied to your processing operations to improve your products, lower your costs, save space and power consumption in your plant.

Let us know what your processing problems are, and the Marco laboratory will let you know what savings the K.A.C. Kom-bi-nator can make for you. PROCESSED ON THE HOW-MASTER IS THE FIRING THAT CAN BE SAID OF ANY PRODUCT

FLOW-MASTER Pumps—Homogenizers Kom-Bi-Nators Equipment For The Process Industries

MARCO COMPANY Inc. Wilmington 50, Del.

A NEW "SOLID" SPRAY NOZZLE



Here is a new nozzle with two round tangential inlets (instead of several small slots) which permit relatively large solid particles to pass right through and out the orifice. Produces fine breakup, even distribution, and solid cone spray suitable for numerous applications.

Available in Brass, or made to order in any machinable material. 1/4" I.P.S. capacities from 12 to 75 gph @ 10 lbs. water pressure.

Send Monarch an outline of your spray problem — if the liquid can be sprayed with direct pressure at all — Monarch can furnish the nozzle.

NOZZLES FOR:

- ACID CHAMBERS
- AIR WASHING
- CHEMICAL PROCESS-ING
- COOLING POND
- DESUPERHEATING
- GAS SCRUBBING
- HUMIDIFYNG
- OIL BURNER
- SPRAY DRYING

Do you have our Catalogs 6A and 6C?

MONARCH MFG. WORKS, INC. 2730 E. WESTMORELAND ST. PHILADELPHIA 34, PA.

INDUSTRIAL NOTES

Pittsburgh Plate Glass Co., Pittsburgh, has announced construction of a \$1 million paint plant at Long Branch, Ontario. This plant is an addition to the present production facilities of Murphy Paint Co., Ltd., in which the company holds a substantial interest.

St. Regis Paper Co., New York, has formed a new sales district in its multiwall bag division. The new district covers Pennsylvania, excluding Philadelphia, it is called the Mid-Atlantic District and has headquarters in Allentown. Burton A. Ford, vice president, will supervise the new office.

Tube Turns, Inc., Louisville, has made Arthur McCutchan senior research engineer of the product engineering and research department.

Vapor Recovery Systems Co., Houston, has closed its Tulsa office. John L. Shaunty, Mid-Continent manager, is now in charge of business in the Tulsa area. His office is in the Texas M & M Bldg., Houston.

Raybestos-Manhattan, Inc., Passaic, N. J., has opened a consolidated office in Cleveland, at Union Commerce Bldg. Other Cleveland divisional offices have been combined in this office. R. F. Tobin is manager.

Bechtel Corp., San Francisco, is the new name for Bechtel Brothers Mc-Cone Co.

Rockwell Manufacturing Co., Pittsburgh, has made three new appointments. C. A. Wiken is vice president in charge of engineering. J. E. Ashman is the company's controller and A. E. McIntvre is general manager of the Pittsburgh Equitable Meter division.

Atlantic Steel Co., Atlanta, Ga., has elected R. S. Lynch to the position of president. C. F. Stone was elected chairman of the board of directors.

Edwal Laboratories, Inc., Chicago, has promoted E. W. Lowe to chairman of the board of directors, W. S. Guthmann to president, and W. B. Hendrey to vice president in charge of sales.

Gotham Instrument Co., Inc., New York, has made James P. Henderson general manager and chief engineer.

Hayes Mfg. Corp., Grand Rapids, Mich., has bought the American Engineering Co. Rensselaer W. Clark, president and general manager of the Hayes Corp. was elected president of American. Headquarters will be in Grand Rapids.

Minneapolis-Honeywell Regulator Co., Minneapolis, has elected L. M. Morley vice president. Mr. Morley will continue as vice president in charge of sales for the Brown Instrument Co.

Hercules Powder Co., Wilmington, has opened a branch office in Cincinnati, Ohio, for the sale of chemicals. Henry Grace has been appointed manager of the new office.

Rapids-Standard Co., Inc., Grand Rapids, Mich., has adopted the trade name "Durastan" to designate its line of phenolic plastic caster wheels.

Jefferson Chemical Co., Inc., New York, has made Dr. William H. Bowman sales department manager. G. W. Larson has joined the department's staff to take charge of its technical sales service work.

General Electric Co., Pittsfield, Mass., has made the following promotions in the compound and plastics division, chemical department; John L. McMurphy, manager, compound division; H. Arthur Howe, superintendent; Clarence H. Slayton, Jr., engineering manager; J. Rae Stirrat, sales manager, compound division; and Nathan A. Freuden, plastic division sales manager.

Arco Co., Cleveland, has promoted John W. French to the position of sales manager of the production finishes department.

Formica Insulation Co., Cincinnati, has completed a large part of its expansion program. The new facilities will provide for an increase of 50 percent over 1946 production.

Francis Joseph Weiss, Washington, has moved his residence from 4110 Jenifer St., N. W., to 5316 Twentyeighth St., N. W., Washington 15, D. C. He is an economic consultant for the chemical industry.

DoAll Co., Minneapolis, has moved its general sales office into expanded quarters at 254 North Laurel Ave., Des Plaines, Ill.

Northern Equipment Co., Erie, Pa., has appointed W. W. Hicks & Co., 567 Banning St., Winnipeg, Manitoba, as sales and service representative.

E. I. du Pont de Nemours & Co., Wilmington, has appointed C. R. Mac-

MIGHTY JOB FOR A MIGHTY JOB

THIS Buffalo SINTERING FAN

One of the toughest air handling jobs in Industry is performed by this Buffalo Sintering Fan.

The Sintering Process recovers iron ore dust in steelmaking. The fan is used to supply high-pressure, high-temperature dust-laden air to a combustion chamber, where the ore dust is turned into a slag which can be recovered. Supplying air continuously against high pressure, this fan is subjected to the abrasive action of gritty ore particles, and temperatures up to 400° F.

Probably you will never consider the purchase of a Sintering Fan, for there are not many such applications in the entire country.

However, the engineering experience and the factory "know-how" which makes "Buffalo" the logical choice for such "extreme-service" jobs is also available to you on your everyday air-moving and conditioning work. "Buffalo" builds complete lines of ventilating fans, both centrifugal and axial flow, power plant fans, industrial blowers and exhaust-

ers for every service, and complete lines of air conditioning cabinets, central systems and unit coolers.

Write for Bulletins

BUFFALO FORGE COMPANY

BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

501 BROADWAY

Note the husky construction of this Buffalo Sintering Fan, under construction in one plant.

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FANS for INDUSTRY

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other parts one-piece solid metal product with no woven structure to ravel. It is stiff, tough, and strong; in filters, strainers and other uses for industrial wire mesh it supplements woven mesh and is most applicable in the finer sizes beyond the limits of perforated metal. Lektromesh combines high accuracy of hole dimensions with a smooth sur-face, and is readily fabricated by drawing, stamping, welding, soldering or othe processes. In sizes 40 to 400 mesh .. in standard rolls or fabricated into part to your specification. electro-deposition γd screen made metal Lektromesh is

We will be pleased to send you samples of LEKTROMESH for your further consideration.

THE C. O. JELLIFF MFG. CORP. Southport, Connecticut



Bride as manager of the products division of the plastics department. He will make his headquarters in New York.

Liquid Conditioning Corp., Linden, N. J., has appointed the Engineering Sales Corp., Boston, as its New England representative.

Carborundum Co., Niagara Falls, New York, has designated Fred L. Born sales representative in the Dallas district. He will succeed William Crocker who now has headquarters in Houston. James Daar has been transferred to the St. Louis territory.

Titeflex, Inc., Newark, N. J., has completed its reorganization program. The old management is continuing to direct all activities.

Gifford-Wood Co., Hudson, N. Y., has promoted William E. Herb to general sales and advertising manager. Walter G. Engler has assumed the position of eastern district manager, with offices in the Graybar Bldg., New York. William J. Chambers is western district manager with offices in Chicago.

Magnolia Airco Gas Products Co., Houston, has elected J. F. Pryor to the post of president.

Michigan Chemical Corp., St. Louis, Mich., has assigned William F. Green to the position of eastern sales manager for pharmaceutical and industrial chemicals with offices at 230 Park Ave., New York.

Dean & Barry Co., Columbus, Ohio, has elected Arthur N. Masse president. At a recent election the following new members were elected to the board of directors: Ralph A. White, Col. E. C. Jones, Fred Holden, and Luther L. Boger.

Taylor Instrument Cos., Rochester, N. Y., has made Robert E. Paxson sales representative with headquarters in St. Louis, Mo.

Chemical Mfg. & Distributing Co., Easton, Pa., has appointed the Lehigh Valley Chemical Co., Allentown, Pa., distributor in the Lehigh Valley and neighboring territory.

Raybestos-Manhattan, Inc., Passaic, N. J., has appointed George W. Marshall, Jr., general sales manager of the asbestos products division.

Fulton Sylphon Co., Knoxville, Tenn., has appointed John O. Tragard eastern regional sales manager. His new duties will include supervision of the This new manual shows you exactly How to use COLORS

FROM psychological effects of individual colors on people—to specific formulas for mixing colors to meet the requirements of artists, painters, decorators, etc.—this new manual brings together the important pointers you should know in order to apply colors for best effect. Compact and well illustrated, the book provides a unique yet simple system for speedy, accurate identification and selection of a wide variety of today's standard and popular hues, tints, tones, and shades—including 242 formulas for mixing them. Clear descriptions of each are given and 96 are shown in their exact color.

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Just Published

PRINCIPLES OF Color and Color Mixing

By J. H. BUSTANOBY, Color Consultant 130 pages, 7¹⁄₄ x 97⁄₅, illustrated with color charts, \$4.50

THIS is an exceptionally useful guide for anyone concerned with making a discerning use of colors. Aside from the practical discussions of pigments, mediums and mixing procedures, it suppiles scientific and usable facts on aesthetic values of color and the specific influence of color on our daily living. The book includes other important data on the legibility of colors, color combinations at a distance, and sensations caused by colors. A sound explanation of various color systems is given and the author's original color charts are furnished as a new kind of key to effective color matching and mixing.



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PLES OF and Mixin

BY, Color Comi x 9%, illustra charts, \$4.50

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NGINE

NOW...A VALVE THAT LAUGHS AT CORROSIVES AND ABRASIVES ... and cannot LEAK, "FREEZE" or JAM!



* Pressures, Vacuum to 150 lbs. * Temperatures to 150° F. * Sizes 1/2" to 6".

- Applicable for air and water lines and special services.
- Used in every industry that handles corrosive or abrasive fluids.
- Diaphragm separates mechanism completely from fluids handled.
- Shut-off positive—even with solids trapped on seat.
- Closure not dependent on metal-tometal contact.
- Cannot leak in any position.

Requires no re-seating.

Requires no re-packing.

- Diaphragm replaceable with valve in line.
- Special pressure operated types for automatic or pilot control.

FOR BULLETIN giving complete data, write McAlear Manufacturing Company, Automatic Control Division of Climax Industries, 1939 S. Western Ave., Chicago 8, Illinois.



CHEMICAL ENGINEERING • MARCH 1947 •

Portable or Side Entering AGITATORS

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territory north of Richmond, Va., and from the Atlantic seaboard west to Buffalo, N. Y.

Hercules Powder Co., Wilmington, has made LeRoy T. Barnette manager of plastics markets of the cellulose products department. He will supervise the sales of all cellulose products to the plastics industry.

Revolvator Co., North Bergen, N. J., has completed a new office building at their plant in North Bergen.

Clarostat Mfg. Co., Brooklyn, N. Y., has appointed I. J. Youngblood vice president in charge of sales.

Mutual Chemical Co. of America, New York, has named Thomas F. Moore to the position of sales manager.

Hammel-Dahl Co., Providence, R. I., has made Nielsen & Fryer, Inc., of 152 East Superior St., Chicago, their dealer representative in the Chicago trading area.

Reliance Electric & Engineering Co., Cleveland, has elected Fred E. Harrell manufacturing vice president.

Alloy Steel Products Co., Linden, N. J., has added H. V. Evans Jr. and H. C. Grieme to the sales department.

United States Stoneware Co., Akron, appointed Hubert Royer sales manager of the chemical stoneware division. His office is located at 60 East 42nd St., New York.

American Meter Co., New York, has appointed Arthur F. Benson production manager and William G. Hamilton, Jr., sales manager.

National Technical Laboratories, South Pasadena, Calif., has added E. C. Bowen to the staff as a sales engineer for the New England and New York area.

Shell Chemical Corp., San Francisco, has named B. K. Read assistant sales manager of the company's Eastern Division.

Borg-Warner Corp., Chicago, has appointed John A. Comstock to the post of engineer of materials at the Ithaca plant of the Morse Chain Co.

United States Steel Corp., Chicago, has promoted Alfred G. Finlay to the position of manager of stainless steel division, general sales department, United States Steel Supply Co. He will make his headquarters at 1319 Wabansia Ave., Chicago. B. S. ChapCo., White THE SIMPLEST WAY North Bergen new office but North Bergen TO FABRICATE AN EFFICIENT STAINLESS PIPING SYSTEM Co., Brookhrn V ge of sales al Co, of Anni named Three osition of sile a io., Providence i A Fryer, lac. of Chicago, there the Chicago take USE P.P.& E. STAINLESS WELDING FITTINGS The use of Pittsburgh Piping and Equipment Stainless Steel Welding Fittings provides utmost fabricating simplicity. Any CAP conceivable piping system can be constructed with a minimum 12 of equipment, using these fittings, simply by straight cutting of AND DESCRIPTION OF & Engineering tubes to desired lengths and plain butt-welding. Fitting and ected Fred E. H welding time is thereby reduced, and a cleaner, lastingly efficient system is assured, since pockets and sharp corners that cause pressure drop and accumulation of product in lines ate eliminated. P. P. & E. Stainless Steel Welding Fittings include 180° Returns, 45° and 90° Elbows, Reducers, Tees, Caps, and Lap Joint Stub Ends. They are annealed, blasted, and passivated for maximum corrosion-resistance. Sizes (I.P.S.) range from $\frac{34}{10}$ to 12"; tube sizes from 1" to 12". The ends are accurately machine tool cut, and beveled to $87\frac{1}{20}$ with approximately 1/16" straight face. All elbows are 'long radius' -1 $\frac{1}{2}$ times nominal pipe diameter—to provide utmost freedom of flow. ducts Co., La the sales departur Rover sales man neware divion These fittings are available from stock in Stainless Types Nos. 304, 316, and 347. Other analyses, including Nos. 302, 308, 309, 317, 321, 410, and 430, are available on special order. Catalog S-309 gives complete specifications and list Co., New York prices. A copy will be sent to you upon request. F. Benson pri William G. Ha CONCENTRIC REDUCER tical Labort Calif, ha d e staff as a sub a 90° ELBOW 180° RETURN LAP JOINT orp., San Frans STUB END Read assistant in - TRACES mpany's Eastern Emiration STAINLESS STEEL DIVISION , Chicago, In 45° ELBOW AND EQUIPMENT COMPANY Corp., Chi G. Finlar II 10 Forty-Third Street—Pittsburgh, Penna. Woolwarth Building, New Yark Chamber of Cammerce Bldg., Indianopolis Peoples Gas Building, Chicago Public Square Building, Cleveland 10 High Street, Boston 3618 Washington Avenue, Houston Whitehead Building, Atlanta les departa Supply Co. marters at 1 ro. B. S. O 525 Market Street, Son Francisco

CHEMICAL ENGINEERING • MARCH 1947 •

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NGINEER

DUST Collection

Only Buell Dust Recovery equipment affords these six extra-efficiency features: 1—The "Shave-Off"; 2—Large Diameters; 3—Extra-Sturdy Construction; 4—Correct Hopper Design; 5— Split-Duct Manifolding; 6—Inner Welds Ground Smooth.

Write for Buell's book—"The van Tongeren System of Industrial Dust Recovery".

BUELL ENGINEERING CO., INC. Suite 5001-70 Pine Street, New York 5, New York



van Tongeren DUST RECOVERY SYSTEMS DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC" ple, Jr., has been elevated to the position of assistant sales vice president of United States Steel Corp. of Delaware.

H. K. Porter Co., Inc., Pittsburgh, has placed Roland E. Nelson in the position of manager of the Chicago office.

Heyden Chemical Corp., New York, has added Vincent R. Rebak to its New York sales organization.

Alloy Steel Products Co., Linden, N. J., has placed Herbert V. Evans, Jr., and H. C. Grieme on its sales staff.

Republic Flow Meters Co., Chicago, has appointed Christian W. Marks manager of its Cleveland district. Eugene N. Davidson is the new manager of the St. Louis district.

Northern Equipment Co., Erie, Pa., has named William L. Hunter general manager. Harold A. Schlieder succeeds him as chief engineer. Francis W. Bunting is assistant chief engineer.

General Electric Co., Pittsfield, Mass., has appointed Frank W. Warner, Jr., engineering policy manager of the chemical department. Arthur G. Gustafson is now manager of the construction division of the chemical department.

Kennametal, Inc., Latrobe, Pa., has opened an office at 528 White Building, Buffalo, N. Y. Harry W. Bearfoot will serve as tool engineer and representative at Buffalo.

St. Regis Sales Corp., New York, is moving its wire tie division production facilities from Oswego, N. Y., to Cleveland, Ohio, and expects to be in full operation there soon.

Pennsylvania Salt Mfg. Co., Philadelphia, has appointed Barton I. Hogarth to the newly-created position of purchase engineer in the equipment and supplies division. His work will be with equipment and accessories.

H.B.M

WITH N

Permanente Products Co., Oakland, Calif., has appointed Floyd R. Carpenter as manager of its development division. Mr. Carpenter will have offices in Oakland.

Agaloy Tubing Co., Springfield, Ohio, has promoted C. E. Jones to the position of vice president.

Sprout, Waldron & Co., Muncy, Pa., has established a New England residence for their representative in that territory, B. C. Lee, at 77 Vernon Ave., Middletown, R. I. FOR HIGHER CONDUCTIVITY... EQUIP YOUR ELECTRIC FURNACES WITH N . B . M Electrode HOLDERS

> To provide maximum service and efficiency, your electrode holders should combine: • High electrical and thermal conductivity • Great structural strength. Strength is important to assure a tight grip. The greatest resistance in the entire circuit occurs between the holder and electrode. Ill-fitting, oxidized holders may waste up to 500 KW.

The special copper alloy we have perfected for N-B-M Electrode Holders has an extremely dense, non-porous grain.

N · B · M Electrode HOLDERS

AMERICAN

Brake Shoe

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DIVISION

This provides greater strength-clamps electrodes in a vise-like grip that assures the best possible contact. By combining maximum gripping strength and conductivity, this well-balanced formula reduces resistance, saves you power.

To insure absolute pressure-tightness, all water-cooled castings are carefully tested under 50 to 75 pounds hydrostatic pressure.

For longer life and more efficient performance under the most rigorous conditions, specify



ST. LOUIS . NEW YORK

N.B.M ELECTRODE HOLDER ASSEMBLY WITH NOSE AND WEDGE

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LUBRIPLATE Lubricants actually condition bearing surfaces and stop progressive wear. They prevent rust and corrosion and resist steam, hot water, many acids and other adverse conditions. LUBRI-PLATE is in a class by itself. Use It and make one bearing outlive two. Write or phone for facts and figures.





CONVENTION PAPER ABSTRACTS

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Construction Costs

PRESENT day construction costs are a serious problem to the chemical industry since many new production plants, which would have shown adequate returns on investments in the prewar period, exhibit a different picture today. The problem of building new productive capacity is further intensified by federal and state taxes which take a significant portion of income. Construction cost and tax increases have reduced return on investment to only one to two thirds of the prewar level.

Engineers play an important part in reducing plant investment, since by minimizing use of power-facilities, manpower, materials in storage, and through the elimination of over design or safety-factors, the engineers can reduce initial plant investment.

Another important technique of popular use in recent years is continuous processing, and its steady gain over batch processing. Of the many advantages, a reduction in the amount of investment per unit of output is among the most important in making proposed installation yield adequate returns on invested capital.

R. A. Kinckiner, E. I. du Pont de Nemours & Co., before American Institute of Chemical Engineers, Atlantic City, Dec. 2, 1946.

Liquid Insulators

ELECTRICAL machine design has outstripped the development of insulation to meet the increased demands of voltage and temperature.

Continued reliance on paper and mineral oil to provide the backbone of electrical insulation is inexcusable in the light of chemical progress. The use of mineral oil is costly in terms of inefficiency and hazard, for under high voltages and temperatures mineral oil breaks down into flammable products and also allows the escape of power. Engineering subterfuge to eliminate the waste by mechanical methods, is, however, not the answer. The fundamental problems and opportunities presented by proper synthesis of insulating materials are too great to warrant anything but a first-hand chemical attack.

To take the place of mineral oil, a whole new class of liquid insulators, named "askarels," has been developed. They are non-flammable, and when decomposed by electric currents they give off no explosive or flammable gases. Their use has removed many of the limitations formerly set up for mineral oil filled apparatus.

Askerels are derived from benzene. The askarel used in transformers is a blend of chlorinated benzene and chlorinated diphenyl. That used in capacitors consists of chlorinated diphenyl alone. Both types are stable even under the highest voltage stresses commercially used.

Frank M. Clark, General Electric Co. before the Alabama Section, American Chemical Society, Birmingham, Jan. 23, 1947.

Americium et al

NUCLEAR chemistry has reached a new milestone in its revolutionary advance with the isolation in pure form of americium, one of the four new elements discovered in the production of atomic energy.

This achievement, which has made it possible to study americium, element 95, for the first time on the ultramicrochemical scale, is remarkable because the amount of the substance available was even smaller than the infinitesimal quantities used in isolating plutonium, element 94, and neptunium, element 93.

One of the facts already learned about americium is that it possesses even greater radioactivity than plutonium and is therefore a highly dangerous substance with which to work.

Even if this element should become available in ordinary amounts, that is, milligram amounts, it will always be necessary to conduct its investigation with special precautions and using the special techniques for handling highly alpha-active material. The investigation of the chemical properties of americium will demand investigators who are well trained with handling highly alpha-active materials.

It is now almost certain that the four transuranium elements do not exist in appreciable amounts on the face of the earth, although natural plutonium has been found in minute quantity. It is possible that some transuranium isotope or isotopes,

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formed by a mechanism as yet not conceived, may exist. Further searches for such elements might be worth while.

Of the four transuranium elements so far reported, the one which offers the greatest hope of providing the base material for developing an atomic energy industry is plutonium.

Much more likely to be used for study in the future is neptunium, since one of its isotopes, neptunium 237, has relatively low radioactivity and therefore is relatively safe to handle from the health standpoint. Neptunium 237 is fissionable, like plutonium and uranium, but fission occurs too frequently to use the isotope in an atomic bomb.

An isotope of curium, element 96, which is designated as curium 242 and is the heaviest isotope of any element so far reported, can be produced by neutron bombardment of americium. Although curium has not yet been isolated in weighable amounts, curium isotopes with an atomic weight as high as 246 may be produced and may eventually become available in pure form for chemical investigation.

Glenn T. Seaborg, University of Callfornia, before Rochester Section, American Chemical Society, Nov. 18, 1947.

Growth of Synthetic Aliphatic Chemical Industry

A SINGLE strategic branch of the chemical industry, synthetic aliphatics, born only 21 years ago, produced more than one billion dollars worth of material last year. The industry is more than doubling its size every five years and that it serves every one of America's basic industries.

In a comparison of organic with inorganic chemical production, the dollar value of the organics is three times that of the inorganic despite the large tonnage of the latter. Aliphatics account for 65 percent of the tonnage and about 50 percent of the dollar value of the organics.

This fast-growing aliphatic industry has introduced several hundred new materials since 1925. Many of these are products well known as antifreezes, hydraulic brake fluids, lacquers, household cleaners, alcohol rubbing compounds and intermediates for plastics and synthetic rubber. Others, more obscure but equally important, are used in the synthesis of pharmaceuticals, the production of rayon, for metal processing and for hundreds of other purposes.

United States plants out-produced the German aliphatic industry. For 1945, United States production of important aliphatic chemicals was 24 times as great as the maximum Germany ever reached before her plants lese |

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Photographs courtesy of Hawley & Hoops, New York, N. Y.

These Wissco Belts Carry Candy Through a "Turkish Bath"

During operation, the doors of this steaming machine are closed and live steam removes the starch coating from molded, gum-arabic-base candies as they ride back and forth over 9 Wissco Conveyor Belts.

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Several features of Wissco Belts commend their use in this steaming machine. Their open mesh allows free circulation of steam, while the extreme flexibility of these belts permits operation over small pulleys and insures economy of design.

Wissco Belts are widely used in the canning and packing industry and are the accepted standard for heat treatment of metals, glass and ceramic ware, and for the processing of chemicals and other materials. Each belt is custom-engineered for the specific task it must perform, thus assuring long, dependable service.

Send for illustrated catalog showing types and advantages of numerous conveyor belt constructions. Address our nearest sales office.

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were bombed out. Germany, lacking petroleum and natural gas, was forced to make these chemicals from coal. As a result, German research followed different patterns, and some German discoveries which are now arousing interest in this country may accelerate even further the rapid United States growth.

The effect of the war on the United States aliphatic industry was to lower the number of new compounds introduced between 1940 and 1945. Despite this, more than 16 entirely new chemicals were shipped in carloads and tank cars for the first time in that five-year period. In the five prewar years between 1935 and 1940, 56 new chemicals had been introduced.

This branch of the chemical industry is still growing at a rapid pace. Production facilities for existing chemicals are being expanded, and units to produce still newer chemicals are going up at an increased rate. Studies are being made of the many possible raw materials, and markets are widening so rapidly that only a part of the demand for the many chemicals can yet be satisfied. Also, because of the industry's return to intensified private research on new materials, the introduction of new compounds will ac celerate in the next five years.

H. B. McClure, Carbide and Carbon Chemicals Corp., before New York Section, American Chemical Society, New York, Feb. 7, 1947.

Atomic Power Plants

MAJOR single use of atomic power being studied most intensively at present is the possible use in plants designed for the generation of electricity. Fuel supply requirements and large amounts of water for steam wan generation have previously limited the areas in which central power stations may be used, particularly to areas which are not so fortunate as the West in having great hydroelectric installations. Atomic power electric generator stations, on the other hand, can be placed anywhere in the world.

As more atomic power units are installed, the cost of producing electric power as fuel will probably continue to decrease. While we have no precise figures on the availability of fuels, it is known that uranium is spread all over the world. Plutonium, which can be made in piles, is an atomic fuel as good or better than U-235. Furthermore, when thorium is placed in a pile, it is converted into U-233, another material useful as an atomic fuel. Someday scientists may find a way to produce, in the power plant, as much new fuel as is burned up.

The atomic power plant of the future will consist of the so-called "pile

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many handling problems, providing a compact, efficient, economical unit for handling many materials. They require a minimum of space, operate on any plane, can receive or discharge materials at various points, and can be made dust-tight.

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area," where atomic power is pro-duced, the electrical generating area, a chemical separations area for working over atomic fuels, and a building for the "United Nations Inspection and Research Laboratories." Shielding of atomic power units for protection from injury due to radiations will be one of the first considerations of engineers who design atomic power plants. Shields used at the Hanford Engineer Works are not just a mass of concrete, but carefully engineered structures.

Operation of an atomic power plant will not be a job that an engineer can step into overnight. Operating crews would receive three to six months training either in a plant already in operation or under a "start up" crew. The period of training will be completed before the crew actually takes over operation of the plant.

Start-up crews will be supplied by the builder to train superintendents and plant operating crews. Both groups will include men who follow an entirely new profession-health instrument engineers. Their job will be to check areas carefully to find potential hazards from radiations. They will be on duty every shift.

Much has been said about the dangers of working in atomic power plants. This type of work can be extremely safe under good management. Not one single case of an injury due to radiation is on record at Hanford, and the injury frequency rate from all causes is lower than that of any other industry. Cumulative figure to date for accidents at Hanford is only 0.67 accidents per million man-hours worked; and for 1946 this figure was only 0.407.

C. P. Cabell, General Electric Co., be-fore the San Francisco Engineering Coun-cil, San Francisco, Jan. 25, 1947.

Continuous Neoprene Production

A continuous method has been developed which converts a neoprene latex into purified synthetic rubber. The manufacturing method gives a milk-like dispersion of tiny rubber particles that looks like latex obtained from the rubber tree.

Before such goods as tires, hose, and other articles can be made, it is necessary to separate the synthetic rubber from the water and chemicals used in the manufacture of the latex. Such a latex can be coagulated by the addition of chemicals or acids and the solid rubber thus obtained. It was desirable to produce the synthetic rubber without the necessity of adding chemicals that must be removed later or by the use of excessive labor.

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For over 80 years, American industry has looked to Cole for elevated tanks, flat storage tanks, and pressure tanks and vessels that are correct in design-dependable in service.

Elevated tanks 5,000 to 2,000,000 gallons, with hemispherical, ellipsoidal or conical bottoms; pressure vessels of special alloy steel and kindred materials; creosote treating cylinders, and an entire range of pressure vessels for chemical, textile and timber-treating plants; tanks for storage of butane and propane gas, etc.

Write us for quotations, and a copy of our publication—"Tank Talk."



In the new process, the latex is fed to a cold revolving drum, the film of ice and rubber is removed and thawed. and the water is them removed by squeezing the film and passage through drying ovens similar to those used for drying textiles. The dried film is, very thin and resembles a sheet of elastic transparent paper. This film when dried is fed into machines which squeeze it together into the form of J a rope about an inch in diameter. The roped GR-M is then continuously cut into sections and packaged by auto-1 matic machinery ready to be shipped to the fabricators of rubber goods.

M. A. Youker, E. I. du Pont de Nemours & Co., before regional meeting of the American Institute of Chemical Engineers, Louisville, Feb. 17, 1947.

The Lanham Act

ON JULY 5, 1947, the new Federal Trade-Mark Act known as the Lanham Act takes effect. In general, enternead p what the Lanham Act has attempted sour own de to do is to gather all of the pertinent provisions of the trade-mark laws of anote will a the United States into a single co- ind paper, statute the best practices of trademarking as they appear to the drafts at a man of the Act. The general effect of the statute is to broaden the opportunities for the registration of trademarks, to eliminate technicalities that strendable, lo heretofore have barred the registration traterals, of such marks, and to prescribe with particularity the effects and remedies in wheth use available to the registrant of a trademark under the statute.

There are a large number of novel provisions in the Lanham Act, for example, the provision that registration may be permitted to two concurrent users of the same mark.

The Act has substantially liberalized the use of geographical marks and surnames. Little change has been made in the law with respect to the use of marks which are "merely descriptive or deceptively mis-descriptive" of the goods upon which the marks are used. To the same end the statute has introduced some specific limitations upon the use as trade-marks of marks that have become "the common descriptive name of an article or substance upon which the patent has expired."

An innovation is the provision that the Federal Trade Commission may bring a proceeding to cancel a trademark which has become "the common descriptive name of an article or substance on which the patent has expired," or a trade-mark which has been abandoned or one which was fradu lently registered. It is hoped that the passage of the Lanham Act and the increasing publicity which has thus been given to proper trade-mark prac-

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• In 2 minutes you can take a pair of scissors and a sheet of ordinary letterhead paper and fold this little model and prove right on your own desk why Ajax Lo-Veyors are so practical.

This little model will convey anything you have handy, tobacco crumbs, bits of paper, paper clips, even a lead pencil.

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They are widely used for conveying foundry sands, cereals, chemicals, glass,

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Cut a strip of paper or cardboard about 1'' wide and 7'' long. Fold as indicated in this sketch.

Hold the 2 short ends down on your desk or table with 2 fingers, place some tobacco crumbs or ashes or other material at one end of the conveyor and tap lightly, as indicated, on the other end of the conveyor.

Watch it run along the length of the model.

coal,—in fact, dry aggregates of most any kind.

The Ajax Shaler reciprocating drive is a completely enclosed unit connected to the conveyor pan. Entire conveyor pan and drive float on springs. They are not dependent upon heavy anchorage to the building for application of the drive force.

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tice that there will be little opportunity for the Federal Trade Commission to employ this extraordinary remedy.

The definition of a trade-mark as it appears in the Act is of particular significance for the definition indicates that not only names and decorations of a graphic character can be registered as trade-marks but that we shall be permitted to register other "de-vices" used to identify goods. Thus packages of peculiar and distinctive configuration lend themselves to trademark use and tablets of distinctive form will similarly be given a new recognition in trade-mark law.

Not only will there be adequate broadcasting of the information necessary to take advantage of the law, but there will be a meticulous and thorough study made of the Act and its many provisions. This study will insure not only a better recognition of the principles of trade-mark practice as they affect each industry but they will mello insure that if the law contains any errors these can be brought to the attention of Congress before the law becomes effective next July.

Casper W. Ooms, U. S. Commissioner of WWW Patents, before the American Pharmacen-tical Manufacturers' Association, New York, Dec. 11, 1946.

Teflon Plastic Uses

Use of Teflon tetrafluoroethylenc resin, a new DuPont plastic, for gaskets on lines carrying nitrating acids and as a primary insulation for armature conductors on traction motors, has been reported successful.

A service life of at least one year on the acid lines has been attained with gaskets of Teflon, and in every case failure was mechanical rather than chemical in nature. The normal serv-ice life of gaskets of other materials is one to two weeks.

Thin tapes of the plastic permit the summer She operation of a motor at higher temperatures and with higher efficiencies than are practicable with present insulating materials. Preliminary tests water mo have indicated also that a motor in-sulated with Teflon should have a longer life before rewinding becomes necessary. The excellent electrical properties of Teflon, coupled with its stability under heat, give it many potential applications in the power field, where one of the limiting features in the design of electrical equipment has been the lack of a suitable insulating material that will withstand high temperatures.

The plastic is unharmed by temperatures up to 575 deg. F. and withstands every known solvent. It has an extremely low dielectric loss factor, even at frequencies up to 3,000 mega-



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The most recent addition to the "Century" Flat Asbestos Sheet family is K&M "Century" APAC -a sturdy, light-weight material that's highly resistant to the common enemies of most building materials. Fire, rodents, termites, weather, rot . . . APAC withstands them all, and seems to stay eternally young. Its 4' x 8' sheets are ideal for many types of industrial construction, such as walls, partitions, ceilings, elevator shaft linings —in fact APAC has as many uses as a building has surfaces.

K&M "Century" Flat Asbestos Sheet Materials hold the right answer to many construction problems. Write to us for full information on what they can do for YOU.



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When you require intricately shaped stainless steel equipment, bring your drawings to a fabricator who has had special experience in producing difficult shapes.

The fabricating of stainless steel requires skill even in the making of standard shapes. When odd shaped vessels are con-

structed, even greater skill is required. Your fabricator must have special tools and dies, tested manufacturing techniques and above all long experience with the behavior of stainless steel during fabrication to produce vessels that give maximum efficiency-longer life for your application.

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cycles. It is being produced on a semiworks basis at the company's plant at Arlington, N. J. It is manufactured in a variety of forms and converted by machining and molding into finished articles. Volume production, planned within the next two years, will result in reduced costs, and the initial fabrication difficulties will be overcome through the development of new techniques.

Everett B. Yelton, E. I. du Pont de Nemours & Co., before the Society of Plastics Engineers, Pittsburgh, Feb. 5-1947.

Teach Accident Prevention In the Schools

KNOWLEDGE of accident prevention is as important to the engineer as arc his basic sciences and mathematics. There are approximately 262,000 engincers in the United States and 10,000 more will graduate in June. The time to impart a knowledge of accident prevention is during the engineer's formative years in school.

The objectives of the engineer are to conserve-whether it be life or money or time or material-and the student should be given the opportunity to acquire the fundamentals of accident prevention in his engineering. At present it is believed that the training should be offered by integrating the fundamentals of safety in certain specific engineering courses and work has even been undertaken to prepare syllabi for aiding instructors in those courses in the integrating work.

John V. Grimaldi, Association of Casu-alty and Surety Executives, before the American Society of Mechanical Engi-neers, New York, Dec. 6, 1946.

Continuous Fractionation Of Tar Acids

THERE is now under erection (at Bolsover) a plant for the continuous fractionation of tar acids, having a throughput capacity of 20,000 gal. of tar acids per week. The feed is to be once-run or crude acids from which water and pitch have been removed.

The plant consists of five fractionating columns in series, the overhead stream from each of these columns to comprise a finished grade of acid. The shells of the columns are electricallywelded steel plate and are fitted with cast-iron decks with patented vacuum service bubble-caps. All the reheaters attached to the columns are heated by means of oil circulated from the oil heater and vacuum conditions are maintained by a three-stage steam jet air ejector with intercondensers connected to each column.

The products recovered overhead from the five columns will be as fol-

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SIZE IS ONLY RELATIVE

Power plants designed and built by Stone & Webster Engineering Corporation vary in size from small boiler units for industries to large central steam generating stations for utilities.

We welcome the opportunity to apply our wide experience and demonstrated ability to the design and construction of plants of any size.



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s operating conditions change, the proper medium for economical filtration may change. Hot acid, cold caustic and varying percentages of solids all demand different FILTER MEDIA. If you are considering making any changes in your present processing, why not submit the new filtration problem to us?

We have a wide selection of industrial FILTER MEDIA and need only detailed information on your individual filtration problem to recommend the proper FILTER MEDIA for your jobs.



HAMDEN 14, CONNECTICUT CHICAGO . SALT LAKE CITY lows: No. 1 column, 80 percent phenol; No. 2 column, 80 percent orthocresol; No. 3 column; 49 to 51 percent meta-cresol; No. 4 column, xylenols free from high-boiling tar acids; No. 5 column, high-boiling acids free from xylenols.

The plant will be so arranged that No. 1 column may be used for the recycling of the 80 percent phenol with a view to concentrating to 98 percent.

On the control panel there will be in all some 70 controlling instruments and flow and temperature indicators, The reheaters and condensers etc. will be fabricated of stainless steel, while all pumps handling reflux and finished products will be in duplicate.

W. A. Bristow, Low Temperature Car-bonisation, Ltd., before Institute of Fuel, London, Jan. 22, 1947.

Chemical Treatment of Los Angeles Sewage

As THE result of legal action, the City of Los Angeles was directed by court order to chlorinate or otherwise disinfect sewage prior to its discharge into the ocean at Hyperion. Following this directive, the Division of Sewer Maintenance, during the summer and fall of 1945, conducted extensive odor and mosquito control experiments in ewers, storm drains and open channels, using a 1-2 percent chlorinated hydrocarbon called Cloroben. Preliminary results obtained both on sewage screenings temporarily dumped onto the ground for storage and on sewage being bypassed in a 16-in. sewer, were most satisfactory, not only as to the small cost of the chemical involved but also in the simplicity of its operation. In the latter test, using concentrations of 1-2 ppm., sewer odors were eliminated and bacteria content reduced by 90 percent.

Following laboratory tests, it was decided that from four to nine hours contact time would be necessary for complete disinfection of the sewage system. This contact time would be available to approximately 90 percent of the sewage received at Hyperion. With the longest flow in the system over 55 mi. in length, some sewage requires 18 hr. to reach its discharge point. The entire system is over 3,000 mi. in length; and there are approximately 25 main intercepting lines, 20 sewage pumping plants and four ven-tilating plants. Average daily flow is 165,000,000 M.G.O.

Having previously installed 30-gal. wooden dosing barrels with ordinary 0.5-in. gas cocks, extensive application of Cloroben was started in February, 1946. A shock dose of 5 ppm. for the 24-hr. flow in each trunk line was continued for three days. Subsequent

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INTER CHEMICAL ENGINEERING • MARCH 1947 •



Here is a concise manual to help the practicing engineer, technician, industrial representative, and others concerned with the control of product quality. It plainly ex-plains the proper, effective use of statistical methods in detecting variations in industrial products, and in determining causes of such fluctuations. Useful details tell how continued and proper use of modern statistical methods can show inaccuracies of pres-



ently used in-dustrial data and point out assembled how data can be made the basis for reliable prediction of future product quality. Just

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dosing varied from 1-3.5 ppm. for a period covering the summer months. Daily sampling of the shore waters adjacent to Hyperion showed reasonably satisfactory results.

While the dosing continued, certain beneficial results were noted to be occurring within those lines receiving the chemicals: (1) Total sulphides were reduced from a previous 1.5-25 ppm. to traces and a maximum of 1.5 ppm., while H₂S in the atmosphere was reduced from a high of 50 ppm. to only traces; (2) slime growth was inhibited and killed almost to the point of no

longer being discernible; (3) the usual heavy moisture vapor in the sewer structure was totally absent.

Following the highly favorable results noted above, it has been decided that year around addition of Cloroben to the Los Angeles sewage system is good maintenance practice. During the winter months, a reduced dosage of 0.5 ppm. could possibly be used, but during the summer months, 1.5-2 ppm. may be advisable.

A. A. Appel, Bureau of Maintenance and Sanitation. Los Angeles City, before the Arizona Sewage and Water Works Asso-ciation, Phoenix, Ariz., Nov. 23, 1946.

FOREIGN LITERATURE ABSTRACTS

Inhibiting Combustion of Magnesium and Its Alloys

TESTS on the inhibition of magnesium combustion were made as follows: approximately 1 g. of magnesium was placed on an iron plate in a closed tube bent at its upper end. A small tube placed in front of the metal over the gaseous current and turned toward the bottom permits ignition and guarantees complete combustion in atmospheric air. Gas or a gaseous mixture can be substituted for the current of air almost instantly just by closing the lower tube. The effect of inhibition is already apparent when the air contains 0.5 percent silicon or boron fluoride. The brightness of the flame decreases and some of the metallic magnesium may condense at some distance on the tube. Contents of 0.1 percent rarely have any effect, whereas contents of 1 to 0.3 percent silicon fluoride or sulphur dioxide, and from 1 to 0.2 percent boron fluoride are sufficient to extinguish the flame immediately or at least in a minute. Water accelerates the combustion. Humidity reduces or suppresses the passivating action. It permits spontaneous ignition during foundry opera-Oxidation protuberances are tions. absent because the extinguished metal



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Economy is based not only on the initial cost of a drum, but on its life. For instance, a Hackney Two-Piece Acid Drum lasts longer than any other type. It is therefore, most economical when its cost is allocated over the greater number of trips. Its long life is due to its seamless cold drawn construction. There are no longitudinal or chime seams—only one circumferential butt weld located between and protected by two I-bar rolling hoops.



Because of the corrosive action of many products, this point becomes very important. With the seamless head construction of the Hackney Two-Piece Acid Drum, there is no chance for excessive corrosion to set in. Bung failures are minimized by special heavy forged spuds attached by a two-pass weld. Then, after fabrication, a special heat-treating process increases resistance to corrosion.

for full details and get the whole story of Hackney advantages in the Shipment of sulphuric acid, caustic potash, bydrofluoric acid and other products requiring careful handling.



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GASES, LIQUIDS

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A machine needs guts* to make a tumbler

Wear-resistant Ampco Metal protects glass-making machines against production-interrupting breakdowns

*"The manufacture of glass containers requires more from a machine than any other automatic production process," according to engineers at the Hartford Empire Company, Hartford, Conn., leading producer of glass-making machinery. "Equipment must run 24 hours-a-day, month after month except for mold and job changes. Add high temperatures, constant vibration and stress . . . and you have the ever-present threat of a machine breakdown.

"We use Ampco Metal for bushings, bearings, gears, and other vital parts subject to this punishment. Ampco Metal has the guts for hard wear and it won't corrode. It gives an extra margin of safety. We can install Ampco Metal parts and forget about them!"



is smooth under the oxide layer. The magnesium remains passible toward 700 deg. in atmospheres which can extinguish it. With contents of 2 percent boron fluoride and 3 percent silicon fluoride, the metal can be divided with an iron wire without igniting. The alloys of magnesium with a given percentage of foreign metal remain passive like magnesium, except those with sodium or potassium, which are much more flammable and difficult to extinguish. These experiments showed that (1) passivating agents are effective in small quantities if they are not diluted with too much air and if humidity is avoided; and (2) the presence of water vapor plays a very important role in magnesium founding, whatever its source may be.

Digest from "Inhibition of the Combustion of Magnesium and its Alloys" by R. Delavault, C. R. Acad, Sci. 221, Nos. 14, 15, 16, 17 and 18, 1945; Chimie et Industrie 56, No. 2, 120, 1946. (Published in France.)

Asphalt-Rubber Mixtures

A STUDY was made of the stability to heat of asphalt-rubber mixtures in powder form, including the influence of the type of asphalt, the proportion of rubber, the temperature and the time of heating. The penetration and the melting point of these mixtures was measured and a note made of their appearance to the naked eye and under the microscope. All the mixtures containing 5 percent rubber hardened gradually and became smooth to the eye. On the other hand, the mixtures with 10 percent rubber became soft after heating-less so with normal asphalt 25 and more so with the tough asphalts R-85/40 and R-75/55. Their surfaces became more and more granular to the eye and, at an increased temperature (235 deg. C., the softening appeared more rapidly, and then decreased with continued heating. At the end of 4-5 hr., hardening was again noted. Microscopic study showed that this behavior is due to a change in the colloidal state of the system. When heating was started, the swollen rubber particles were in suspension in the bitumen. Then there was a reversal of phases: the swollen and depolymerized rubber became the continuous phase. This phenomenon may be accompanied by coagulation of the asphaltenes. This reversal of phases is facilitated by the presence of light hydrocarbons and an increased percentage of rubber, the two factors tending to increase the volume of swollen rubber. With prolonged heating, the phenomena of softening, granulation, and syneresis disappear. Under the influence of chemical changes, the rubber no longer has a coagulating effect on the asphaltenes.

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HASTELLOY alloy C agitator shaft and blades are used in a reaction vat. Whip and unbalance in the agitated fluid often places considerable stress on the shaft; high-strength HASTELLOY alloy is not affected by this stress.



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Some practical experiments have shown that with mixtures of more than 7.5 percent rubber and with blown bitumens, the asphalt-rubber system is not stable if the period of heating is too long and the temperature too high.

Digest from "Exhaustive Research on the Asphaltic Bitumen Rubber Powder System" by J. M. van Rooijen, *Rev. Gen. Caoutchouc* 22, No. 12, 237-243, 1945; *Chimie et Industrie* 56, No. 3, 226, 1946. (Published in France.)

Phosphoric Acid Catalyst In Alkylation

A SYSTEMATIC investigation was made on the effect of phosphoric acid as compared with other well-known catalysts in the alkylation of aromatic compounds with various agents, the first of which was alcohol. Although numerous patents mention phosphoric acid as an agent for alkylation of the aromatic ring, there has been little publication of reports of research work on this subject. The experiment was carried out by adding the aromatic hydrocarbon to phosphoric acid with a specific gravity of 1.85-1.87, and then slowly adding alcohol with continuous stirring. Each group of aromatic compounds seems to require the selection of proper conditions for good results. Reaction temperatures of 80-90 deg. were generally used, but the temperature had to be raised to 130 deg. in the case of chlorobenzene. Yields as high as 80-90 percent of the theoretical of monoalkyl derivatives were obtained under optimum conditions. Such yields were obtained in condensations of toluene with tertiary butyl alcohol and isopropyl alcohol. Up to 90 percent yields could be obtained with propyl chlorobenzene. Alkylation of benzene gave poor yields. Ethanol and other primary alcohols also gave poor results. Toluene condensed with allyl alcohol gave a 10 percent yield of allyl toluene and a 40 percent yield of diallyl toluene. No one has heretofore succeeded in introducing the allyl group into the aromatic nucleus with good yields. Dialkyl benzenes formed in these reactions are always substituted in the para postion. Their ortho-isomers are formed in negligible quantities. The radicals of branched chain alcohols are isomerized to tertiary radicals during the reaction. In no case is there resinification or formation of marked amounts of polyalkyl derivatives. Alkylation in the presence of phosphoric acid may involve formation of an ester and its interaction with the aromatic compounds.

Digest from "Alkylation of Aromatic Compounds in the Presence of Phosphoric Acid. I. Condensation of Alcohols with Aromatic Hydrocarbons and with Halogen Derivatives" by I. P. Tsukervanik, Zhurnal Obshohei Khimi XV, 699-703, 1945. (Published in Russia.)



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CNEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

Official Statistics

CHEMICAL FACTS AND FIGURES. Second edition. Compiled by M. F. Crass, Jr. Available from Manufacturing Chemists' Association, 608 Woodward Building, Washington 5, D. C. 401 pages. \$2.

ORIGINALLY published in 1940, the second edition includes significant chemical statistics published by official agencies since that date. Included are factual data, graphs and statistics relating to organic and inorganic chemical production, sales, wholesale prices, foreign trade, research, employment, wages, finance, taxes, safety, minerals, and production and sales of allied products such as plastics, synthetic rubber and fertilizer materials. A detailed and complete index is included.

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ENGINE

RADIANT HEATING. By T. Napier Adlam. The Industrial Press, New York. 472 pages. \$6.

Reviewed by J. A. Massaro THIS text will be of greatest interest to heating and ventilating engineers. Mr. Adlam, the author, on the basis of his experience of over thirty years in the field, presents an extremely practical treatise on radiant heating and cooling.

The comprehensive work minimizes the theoretical background while emphasizing the application of radiant heating and cooling to air conditioning in actual problems, thereby greatly assisting the engineer in applying these systems to residential, commercial, industrial and institutional buildings. Typical problems are solved step-wise by the use of simplified working data supplied profusely in chart, graphical, and tabular form. There are also many illustrations, both photographic and diagramatic, clearly indicating the various applications possible, with all details of design and installation shown. One chapter describes the use of radiant heat in melting snow on pavements and in streets, promising an efficient and low cost method of removing snow and ice.

Because of the application of radiant heating and cooling in the field of air conditioning, the book is of more than passing interest to the chemical engineer. A more uniform, non-draft, and more easily controlled system of air conditioning results. These facts are important to the proper design and operation of chemical laboratories and those chemical engineering installations requiring an air conditioned atmosphere for the efficient processing of certain fine chemicals and pharmaceuticals. Also, the possible use of radiant heating and cooling in many other chemical and chemical engineering applications may suggest themselves, particularly to those chemical engineers engaged in original design and installation of processes which cannot be heated or cooled by the more conventional methods that are in practice.

The real value of this book will be appreciated by all who actually apply it to designing and installation problems employing radiant heating and cooling.

For Laymen

CHEMISTRY FOR THE EXECUTIVE By Ralph K. Strong. Reinhold Publishing Corp., New York. 445 pages. \$6.

Reviewed by H. C. Parmelee MANY a technically trained man has often wished that the Big Boss had a better understanding of the technology of his business, but has usually shrunk from the task of enlightening him. And well he might! But in Professor Strong's book the chemist has a ready medium of education that he can

RECENT BOOKS RECEIVED

- Mechanisms of Reactions at Carbon-Carbon Double Bonds. By C. C. Price. Inscience, \$2.50.
- Meson Theory of Nuclear Forces. By W. Pauli. Interscience. \$2.
- The New Fibers. By J. V. Sherman & S. L. Sherman. Van Nostrand. \$5.
- Nuclear Physics Tables and an Introduction to Nuclear Physics. By J. Mattauch & S. Fluegge. Interscience. \$12.
- Oil for Victory. By the editors of "Look." McGraw-Hill, \$3.50.
- Portland Cement Technology. By J. C. Witt. Chemical. \$10.
- Synthetic Food Adjuncts. By M. B. Jacobs. Van Nostrand. \$5.50.

recommend to the lay executives of his company with reasonable assurance that diligent reading will insure more than a bowing acquaintance with the science.

Admitting that he has undertaken a difficult assignment in writing "A Layman's Guide to Chemistry," the author nevertheless achieves a degree of success that warrants his effort. He has produced much more than a popular treatment of the wonders of chemistry for light reading and recreation. This volume calls for serious, purposeful study by the executive who genuinely wants more than a smattering of science, and who believes that the knowledge gained will be helpful to him in his business. Nor should the idea of "purposeful study" frighten anyonc unless he is beyond the stage of mental growth and expansion.

Professor Strong has handled his subject uniquely. The book is written in the form of 17 half-hour office interviews (sought by the Big Boss) between two characters created for the occasion: Mr. Executive and CHEM-MER, the former acting as interlocutor and the latter as end-man. Supplementing each oral lesson are some notes and data to refresh the memory of MR. Executive, and a bibliography for further reference. In this manner CHEMMER runs through successive interviews on the elements, oxides, acids and bases, gases, solutions, crystals, and colloids. There are three lessons on organic materials; one each on foods, fuels, metals, and synthetics; and a final interview on the economics of things chemical. Although written for the layman, the book should find a place also in the libraries of technologists and educators.

Statistics

GOVERNMENT STATISTICS FOR BUSI-NESS USE. By Philip M. Hauser and William R. Leonard. John Wiley & Sons, New York. 422 pages. \$5.

Reviewed by R. F. Warren HERE is a comprehensive discussion of statistics collected by the government and a description of material available to potential users. Twenty



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Manufacturers of High Pressure Compressors for Air and Gases for more than 80 Years experts in the various fields of government statistics explain what information is available from the federal government, the agencies where it can be obtained, and how it can be used in the study of economic and business problems.

The largest producer of statistics in the world is the United States Government. Many of these data are byproducts of functions of the departments that collect them. Others are collected when some organization or individual shows that there is a need for a particular series. To turn out this vast wealth of information, an elaborate pattern of agency responsibility has been established, and this pattern is thoroughly explained here.

War's effect on collection of information is discussed along with an explanation of the derivation of important business indicators like the Federal Reserve Board Index and the sampling techniques of the Bureau of Labor Statistics. Bench Mark industrial statistics on manufacturing, current industrial series, mineral statistics, agricultural data, wholesale, retail and service trades information are described under their respective headings. Among the other statistical series of available information covered in these pages are: International trade and payments, transportation, communication, electricity, accounting, money, credit, banking, prices, popula-

tion, housing, construction, and labor. The editors have done a commendable job in collecting and presenting the various chapters in this book. The authors of each of the chapters have done a great service in explaining just what can be found in the mountain of information collected in Washington by the various governmental agencies.

RECENT BOOKS and PAMPHLETS

Asbestos. By Oliver Bowles. Published by The Ruberoid Co., 500 Fifth Ave., New York 18, N. Y. 40 pages. History, characteristics, sources, mining and uses of the "silk of the mineral kingdom."

Industrial Opportunities in Puerto Rico, U. S. A. Available from G. B. Tallman, Arthur D. Little, Cambridge 42, Mass. 49 pages. Manpower, materials, markets and monetary considerations for American business seeking plant sites on U. S. soil.

American Standards. Published by American Standards Association, 70 East 45th St., New York 17, N. Y. 23 pages. 864 standards approved by the Association for national use by industry.

How to Buy or Lease Surplus Real Estate. Available from WAA Regional Offices of Real Property Disposal. 16 pages. A guide for organizations and individuals in taking steps necessary to acquire government owned surplus real property.

Fluorspar Resources of New Mexico. By Howard E. Rothrock, C. H. Johnson and A. D. Hahn. Bulletin 21, published by New Mexico Bureau of Mines & Mineral Resources, Socorro. 245 pages. \$2.50. An exhaustive study of the geology, mining, milling, uses and marketing of New Mexico fluorspar. 60 photographs, maps and figures are included.

• MARCH 1947 • CHEMICAL ENGINEERING

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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittance should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

Inorganic Chemicals. U. S. Production 1939-1946. Bureau of the Census, Facts for Industry, Series M 19A-Supplement. A special resume of Census and W.P.B. statistics. Free on request to Bureau of the Census, Washington 25, D. C. Processed.

Bureau Chief Reports. Annual reports of the chiefs of various bureaus, departments, and other agencies were submitted to Congress early in the calendar year covering the fiscal year closing June 30, 1946. Those interested in individual items of this character should address requests to the individual bureau or agency of interest.

Typical Analyses, Bituminous Coal, Districts 12, 14, and 15. By A. C. Fieldner, et al. Bureau of Mines, Data Book Vol. 7. Price 25 cents.

Consumption and Trends in the Use of Fertilizer in the Year Ended June 30, 1944. By A. L. Mehring, et al. Department of Agriculture, Circular No. 756. Price 10 cents.

Growth and Rubber Accumulation in Guayule as Conditioned by Soil Salinity and Irrigation Regime. By C. H. Wadliegh, et al. Department of Agriculture, Technical Bulletin No. 925. Price 10 cents.

The Production of Itaconic Acid from the Crude Aconitate Obtained from Sugarcane Molasses. By J. A. Ambler, et al. Bureau of Agricultural and Industrial Chemistry, AIC-132. Mimeographed.

Exploration of Lookout Mountain and Sand Mountain Coal Deposits, Dade and Walker Counties, Georgia. By John R. Troxell. Bureau of Mines, Report of Investigations R. I. 3960. Mimeographed. A Spray for Destroying Overwintering Larvae of the Codling Moth on Apple Tree Trunks. By M. A. Yothers and F. W. Carlson. Bureau of Entomology and Plant Quarantine, E-712. Mimeographed.

Directory of the Bureau of Animal Industry. Revised to July 1, 1946. Department of Agriculture. Price 10 cents.

Silverfish. By E. A. Back. Department of Agriculture Leaflet No. 149. Price 5 cents.

Variation in Maximum Allowable Assembly Time with Age in the Pot at Time of Spreading for Four Resin Glues. By W. Z. Olson and H. D. Bruce. Forest Products Laboratory, Madison, Wis. No. 1546. Mimeographed.

Exploration of Leasing Block No. 28 in the Nenana Coal Field, Alaska. By H. Marstrander, et al. Bureau of Mines, Report of Investigations R. I. 3951. Mimeographed.

Exploration of Sedanka Zinc Deposit, Sedanka Island, Alaska. By B. S. Webber, et al. Bureau of Mines, Report of Investigations R. I. 3967. Mimegraphed.

PB Bibliographies. As an aid to distribution of documents, Office of Technical Services is now issuing in mimeographed form certain bibliographies. These merely list by number, title, and price the PB documents which have been released in certain fields thought to have wide interest. Subjects to be covered include atomic energy, plastics, deterioration, infra-red, iron ores, jet engines, guided missiles, rocket motors, fluorescent lighting, magnetic tape machines. acetylene, beryllium-aluminum alloys, pyrometers, protective equipment, plywood, cutting tools, chlorine, and soap and detergents. Those desiring any of these special lists will be sup-







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Work Stoppages Caused by Labor-Manage-ment Disputes in 1945. Bureau of Labor Sta-tistics, Bulletin No. 878. Price 10 cents.

Characteristics of State Plans for Old-Age Assistance, Aid to the Blind, and Aid to De-pendent Children. Social Security Administra-tion, Publication 62. Price 35 cents.

Mineral Statistics. Preliminary estimates of the production of minerals and metals during 1946 are being issued by U. S. Bureau of Mines through brief mimeographed statements of its "MMS" series. The reports issued very early in the year are quite preliminary and give few details. Much more complete summaries will begin to appear later, probably before mid-summer. Ultimate revisions appear as the chapters of Minerals Yearbook. Those inter-ested in specific commodities should request data regarding those items. No general mail-ing lists are maintained for all commodities.

Washing Characteristics of the Pittsburgh Coal in a High-Sulfur Area in Greene County, Pa. By Thomas Fraser and William L. Crentz. Bureau of Mines, Technical Paper 689. Price 15 cents.

Mineral-Dressing Characteristics of the Red Iron Ores of Birmingham, Ala. By Will H. Coghill and G. Dale Coe. Bulletin 464. Price 35 cents.

Determination of the Size of Submicroscopic Particles by X-Rays. By A. Guinier. Bureau of Mines, Information Circular I.C. 7391. Mimeographed.

Sulfur in Petroleum. II. Boiling Points, Freezing Points, Densities, and Refractive In-dices of Some Sulfur Compounds. By William E. Haines, et al. Bureau of Mines, Report of Investigations R. I. 4060. Mimeographed.

A Method for Determining Simultaneously the Oil and Water Saturations of Oil Sands. By Cleo G. Rall and D. B. Taliaferro. Bureau of Mines, Report of Investigations R. I. 4004. Mimeographed.

Secondary-Recovery Practices and Oil Re-serves in the Eastern Part of the Delaware-Childers Field, Nowata County, Okla. By Ken-neth H. Johnston and C. H. Riggs. Bureau of Mines, Report of Investigations R. I. 4019. Mimeographed.

Properties of Louisiana Crude Oils. III. Ad-ditional Analyses. By O. C. Blade and E. L. Garton. Bureau of Mines, Report of Investi-gations R. I. 4034. Mimeographed.

Exploration of Choteau Titaniferous Magne-tite Deposit, Teton County, Mont. By N. L. Wimmler. Bureau of Mines, Report of Investi-gations R. I. 3981. Mimeographed.

National Motor-Gasoline Survey, Summer 1946. By O. C. Blade. Bureau of Mines, Re-port of Investigations R. I. 4063. Mimeo-craphed Summer graphed.

Exploration of the Gold. Silver, Lead, and Zinc Properties, Eureka Corporation, Eureka County, Nevada. By E. O. Binyon. Bureau of Mines, Report of Investigations R. I. 3949. Mimeographed.

Exploration of Southern Cross Iron Deposits, Deer Lodge County, Mont. By N. L. Wimmler. Bureau of Mines, Report of Investigations R. I. 3979. Mimeographed.

Pilot-Plant Production of High-Grade Mag-netite Concentrates, Cranberry, N. C. By Frank D. Lamb and D. A. Woodard. Bureau of Mines, Report of Investigations R. I. 3980. Mimeographed.

Exploration of New Planet Iron Deposit, Yuma County, Ariz. By Joseph B. Cummings-Bureau of Mines, Report of Investigations R. I. 3982. Mimeographed. 3982

Exploration of the Minarets Iron Deposit, Madera County, Calif. By C. L. Severy. Bureau of Mines, Report of Investigations R. I. 3985. Mimeographed.

Exploration of Cape Mountain Lode-Tin De-posits. Seward Peninsula, Alaska. By Harold E. Heide, et al. Bureau of Mines, Report of Investigations R. I. 3978. Mimeographed.

Exploration of Harding Tantalum-Lithium De-posits, Taos County, N. Mex. By John H. Soulé. Bureau of Mines, Report of Investiga-tions R. I. 3986. Mimeographed.

Pilot-Plant Investigations, Production of Sponge Iron with Producer Gas. By D. R. Torgeson, et al. Bureau of Mines, Report of Investigations R. I. 3994, Mimeographed.

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112. Insulating Varnishes. General Elec-tric Co., Pittsfield, Mass.—40-page booklet, CDR-13, contains complete technical and application data on this company's insulat-ing varnishes. Includes specifications, electrical properties, film properties, cure and aging, chemical properties and baking and air-drying cycles of each type of varnish. 36 grades of varnish are descibed.

113. Electric Motors. Electric Machinery Mfg. Co., Minneapolis, Minn.—Publication No. 188 is a four-page folder showing cut-away views and details of construction of the E-M heavy-duty squirrel-cage in-duction motors designed for drip and splash-proof construction in large power ratings from 100 to 1,000 hp., 1,800 r.p.m. and lower

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124. Portable Burner. Aeroil Products Co., West New York, N. J.—Bulletin 304. 4-page leaflet featuring the portable power-driven burner for obtaining temperatures up to 2,000 deg. F.

125. Protective Coatings. United Chrom-ium, Inc., New York, N. Y.—4-page de-scriptive folder giving properties, applica-tion data and typical uses of Ucilon, a protective anti-corrosion coating.

126. Chemicals. Carbide and Carbon Chemicals Corp., New York 17, N. Y.— Two new booklets have recently been issued which describe some of the chemical compounds manufactured by this company. The first of these is entitled "Organic Nitrogen Compounds." Form 4770 is a 31-page booklet which presents the properties, specifications, and uses of the alkyl amines, alkylene amines, alkanol amines, and acetoacetarylamides. Charts are used to give physical constants, comparative hygroscopicities, and neutralization curves. Applications in various industries are outlined. These componds are used for such purposes as emulsifying.
A second booklet, Form 4769, entitled "Organic Chlorina ed compounds" gives information on 12 chlorinated compounds in dustrially important as solvents, fumigants and chemical intermediates. Information is given on the properties and uses, specifications, solubilities, comparative stability to reducing and oxydizing agents and constant boiling mixtures. Contains charts showing variations of certain properties with respect to temperature. Includes a comprehensive bibliography.

127. Instruments. Combustion Control Corp., Cambridge, Mass.—Bulletin 604 is a four-page leaflet featuring the Fireye combustion control equipment manufac-tured by this company. Illustrates and describes flame failure safeguard equip-ment, boiler feed water controls, and other integral parts of the complete combustion control system. Contains several diagram-matic sketches showing installations on oil and gas burners.

128. Instruments. Photoswitch Inc., Cam-bridge, Mass.—Bulletin 504 is a four-page folder illustrating and describing various photoelectric and electronic controllers made by this company.

129. Ball Bearings. Dodge Mfg. Corp., Mishawaka, Ind.—Bulletin A-120 contains 20 pages which illustrate and describe the line of SC ball bearings made by this company. Photographs and sketches of the various bearings such as pillow blocks, hanger bearings, flanged units, are in-cluded. Selection tables aid in choosing the right bearing for different types of applications. List prices are included.

130. Textile Chemicals. The Calco Chemi-cal Div., American Cyanamid Co., Bound Brook, N. J.—Technical Bulletin No. 783 entitled The Dyeing and Lanaset Resin Treating of Wool Hosiery is a reprint which discusses the problems of treating wool hosiery with this company's Lanaset resin. resin

131. Chemicals. Union Bay State Chemical Co., Cambridge, Mass.—Folder contains loose-leaf sheets which describe in some detail many of the products made by this compary. company

132. Electrical Equipment. Signal Engi-neering & Mfg. Co., New York, N. Y.--20-page catalog No. 6 featuring medium duty power relays made by this company. In-cludes information on selection of relays, operating characteristics, contact circuit arrangements, contact ratings and other data on small and medium power relays.

133. Tachometers. Herman H. Sticht Co., New York, N. Y.—Bulletin 735 describes Jaquet Indicators (chronometric type ta-chometers) imported from Switzerland by this company. Specifications are included as well as photographs of various models.

134. Air Conditioning. W. B. Connor En-gineering Co., New York, N. Y.-Bulletin 106-A. 18-page booklet featuring the Type G Dorex activated carbon air recovery panels for air conditioning systems and



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money requires skilled engineering-rigidly controlled foundry practices-plus long experience. Gardner-Denver centrifugals do a better job because they are hydraulically and mechanically right -because their water passages are properly proportioned-because castings are absolutely smooth. For complete information about any of the pumps shown on this page, write Gardner-Denver Company, Quincy, Illinois.





SINCE 1859



Easy accessibility is a feature of Gardner-Denver Double-Suction, Single-Stage Centrifugal Pumps. Available in sizes to cover all heads up to 300 feet. In the first year of operation, these pumps often save enough in power costs to pay for themselves and their motors.



Low in first cost—easy to install; Gardner-Denver Side-Suction Pumps are ideal for replacement of outmoded units in general service. Capacities up to 2.3 million gallons per day or 1600 gallons per minute can be handled at heads up to 100 feet.



Upside down-or right side up-these Gardner-Denver Close-Coupled Centrifugals operate efficiently-take little space-because pump and motor are combined. Gardner-Denver Close-Coupled Centrifugals are designed for capacities up to 250 gallons per minute and heads up to 250 feet.

WHY CARRY WHEN YOU CAN CONVEY

Carrying is the oldest form of material handling—modern production demands faster, cheaper and more efficient material handling — conveyors.

Investigate the use of conveyors. Conveyors handle a wide variety of parts, packages, units, cans, bottles, barrels, bundles, drums and boxes. Available in light, medium or heavy-duty types — portable or stationary — as systems, sections or units — power or gravity fed, they give you remarkable savings in time, money and manpower conservation. They relieve confusion and congestion.

Standard Conveyor Company has the experience and facilities to engineer, recommend and furnish the right type of conveyor for your particular needs.

Write today for catalog No. CM-37 "Conveyors by Standard" — a ready reference on conveyor types and systems.

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PRODUCTION LINES No congestion — order and cleanliness when production moves on conveyors.



WAREHOUSES Merchandise flows in and out of storage with order and system on conveyors.



LOADING DOCKS Load or unload shipments in half the time with conveyors.





ROLLER-BELT-SLAT-PUSHBAR CONVEYORS - PORTABLE CONVEYORS AND PILERS • SPIRAL CHUTES • PNEUMATIC TUBE SYSTEMS

units to purify air, improve ventilation, and to save cooling and heating. This equipment is described in detail as to purpose, function, application, operation, and service. Construction and dimension details are illustrated and performance data for the various types of equipment and sizes are tabluated. Several applications are described.

are described. 135. Paints. Pittsburgh Plate Glass Co., Pittsburgh, Pa.—32-page booklet featuring the use of color in manufacturing and processing plants. The booklet demonstrates that by following the principles of color dynamics, efficiency of operation and quality of production can be improved. It shows how selecting the proper color schemes for industrial plants can bring about greater worker efficiency. Many applications of color dynamics applied to machines, walls and ceilings and floors are illustrated. Specifications for colored surface coatings to be used in different applications are given.

136. Electric Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin 71 R 6421. 12-page booklet illustrating and describing the Type F20-150 sealed Unitop oil circuit breakers made by this company. These are frame-mounted outdoor oil breakers equipped with this company's Ruptor interrupting device. Construction features and operating details are illustrated by cut-away views.

137. Mildew Proofing Agents. Givaudan-Delawanna, Inc., New York, N. Y.—A glossy print of a map showing the areas in the United States which are vulnerable to attacks of mildew and fungi which attack textile, paper and other similar materials.

138. Respirator. Mine Safety Appliances Co., Pittsburgh, Pa.—2-page leaflet featuring the Clear-Vue respirator made by this company. Features of construction are shown.

139. Instruments. Meylan Stop Watch Corp., New York, N. Y.—6-page leaflet illustrating and describing the various stop watches available from this company.

140. Silicones. Dow Corning Corp., Midland, Mich.-12-page catalog describing the various silicone products made by this company. These include greases, fluids, varnishes, resins. Physical properties are tabulated, and some of the important characteristics are described.

141. Materials Handling. Lewis-Shepard Products Corp., Watertown, Mass.—8-page illustrated booklet describing the power Jack Lift, a new electric lift truck made by this company. Important features are illustrated and described, and dimensions as well as capacities are given for the various models. Specifications for the different models are listed. Several applications are shown.

142. Wire Rope Clamps. National Production Co., Detroit, Mich.—40-page booklet featuring the Safe Line wire rope clamps made by this company. Contains detailed sketches and cut-away views of this clamp with description of how it works. Many application photographs are shown. Includes tabulated test results as well as tables of sizes, dimensions, weights, and list prices.

143. Instruments. General Controls Co., Glendale, Calif.—Catalog No. 52-C contains 52 pages covering the complete line of automatic pressure, temperature and flow controls made by this company. Various models of instruments are described and illustrated and specifications, dimensions, capacities, together with list prices are included. Contains cut-away views of many of the instruments and valves, as well as installation hook-ups.

144. Boilers. Titusville Iron Works Co., Titusville, Pa.—Bulletin B-3075 contains eight pages giving complete details on the Scotch marine power boilers made by this company. Detailed diagrams illustrate the various types of boilers and specification tables are included.

145. Materials Handling. Market Forge Co., Everett, Mass.—4-page leaflet featuring materials handling equipment such as manually operated lift trucks, load skids, and gravity conveyors.

146. Laboratory Equipment. Aetna Scientific Co., Cambridge, Mass.—Bulletin F contains eight pages illustrating and describing laboratory type water stills. Operation is described and details of construction are shown. Bulletin D is a 10page booklet illustrating and describing laboratory type sterilizers and autoclaves.

ENGIN

Penn-Drake Highest Quality



PETROLEUM PRODUCTS

WHITE OILS Penn-Drake offers a complete line of highest quality U.S.P. White Oils ("Drakeols"), and in addition, a series of technical grade White Oils. All grades are refined to exact specifications. They are free from acids, alkalies and other impurities; they conform exactly to specifications and retain their desirable qualities.

PETROLATUMS PENN-DRAKE Petrolatum offers a wide selection of standard grades and colors, as well as specially developed grades to meet special requirements. Made from the finest grades of Pennsylvania crude oil, PENN-DRAKE PETROLATUM is pure; resists oxidation, light and heat; is odorless and tasteless.

SULFONATES Penn-Drake PETROSULS consist of a series of fully refined petroleum sulfonates. For use where surface-active agents are required or desirable. Two types are offered:

PETROSUL 745 SERIES—a low molecular weight, oil-soluble, "mahogany soap", readily soluble in cold water, forming a clear solution.

PETROSUL C SERIES—high molecular weight petroleum sulfonates in either aqueous or petroleum oil concentration.

SOLVENTS Penn-Drake solvents include INSECTI-SOL, a deodorized, 100% volatile, long-floating, non-staining base for insecticides; SUPER-SOL for moth-sprays, odorless paints, home dry cleaners, metal parts cleaners and other uses. Special solvents made for Rubber and other applications and specifications.

NAPHTHAS VM&P Naphthas, dry cleaning and other naphthas as specified. Included also are kerosene, gasoline and. similar products.

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Eliminates DOUBLE PIPE COOLERS

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These coolers are equipped with automatic cleaning and sterilization features set at pre-determined intervals. Cleaning or sterilization occurs while cooler is "on stream." All internal surfaces are accessible for inspection and cleaning during periodic shut-downs. Designed for either continuous or batch operation to cool from as high as 360°F. to as low as 60°F. All operations are automatically controlled to minimize operator attention.

There are no moving parts to wear. These units can be furnished in sizes to meet your requirements and fabricated of the proper materials to meet your conditions. When writing please state kind and quantity of material to be cooled and temperature range, amount and temperature of cooling water available, steam available and pressure.

We will be pleased to give complete information as to operation and costs.

The GUARDITE CORPORATION Vacuum Process Engineers 332 S. MICHIGAN AVENUE • CHICAGO, ILLINOIS

CHEMICAL ECONOMICS

H. M. Ballers, MARKET EDITOR

PRODUCTION AND CONSUMPTION OF CHEMICALS HEADED FOR NEW RECORD IN FIRST QUARTER

Production data for industry in gencral and the chemical industry in particular indicate that activities so far this year have been on a rising scale and chemicals appear to be headed for a new quarterly record both from the standpoint of production and consumption. Based on the index of the Federal Reserve Board, the largest monthly output of industrial chemicals in the war period was reached in June 1945 when the index stood at 412. The revised index for last December is f22 and the preliminary figure for January is 425. Hence the January rate was close to 6 percent above the wartime peak.

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Industrial consumption of chemicals closely follows the production curve and in many cases is restricted because some of the more important chemicals are not available for the fulfilment of all requirements. Chemical Engineering index for January is 217.74 compared with a revised figure of 204.35 for last December. The January number hit a level above the record high reported for last October. If the latter part of March brings no material change, the first quarter of this year will represent an increase of approximately 10 percent for consumption of chemicals as compared with the corresponding period of 1946 and a little higher than the record level of the final quarter of last year.

Consuming demand for chemicals in 1946, generally forced productive facilities to operate at capacity. Changes in capacities were reported in both directions with some plants dropping in efficiency because of the cumulative wear on equipment and with new capacities being added particularly through the transfer of government facilities to private operators. The net change was in favor of expanded capacity. Since plants were operated for the greater part of last year at as high a rate as possible, there is not much chance for a large increase over 1946 outputs until further additions have been made.

Some new sulphuric acid capacity was added in the latter part of last year and expanded facilities were found for producing ammonia and nitric acid. It is expected that chlorine capacities will be increased this year and this should work in favor of more plentiful supplies of caustic soda although some producers are reported to be considering cutting down production of limesoda caustic so as to increase the available supply of soda ash. In the meantime the scarcity of soda ash continues with prospects of only moderate relief in the latter part of the year. The Naval Stores Research Division

The Naval Stores Research Division of the Department of Agriculture has issued its report covering the October-December 1946 quarter and the figures for production bear out earlier estimates that wood rosin is gaining in

Chemical Engineering Index

Industrial Consumption of Chemicals

1935 = 100

	Dec.	Jan.
	Revised	1947
Fertilizers	47.30	47.10
Pulp and paper	20.77	21.60
Petroleum refining	19.53	19.38
Hass	20.40	24.90
Paint and varnish	23.87	23.50
ron and steel	10.27	12.90
Rayon	18.37	20.40
Cextiles	10.57	12.42
Coal products	8.52	9.90
eather	4.50	4.65
Explosives	6.60	6.89
Rubber	6.20	6.50
Plastics	7.45	7.60
	204.35	217.74

importance and that facilities for its production are being widened so that a new production high will be reached in the present calendar year. Production of rosin in the first three quarters of the present crop year was 1,368,373 520-lb. drums of which 689,802 drums was wood rosin. Production of wood rosin by quarters was 210,194 drums, April-June; 226,977 drums, July-September; and 252,651 drums, October-December. Hence there has been a steady growth in output and this is expected to become more evident as the present year advances.

While paint manufacturers complain about the shortage of some essential raw materials including pigments and drying oils, the volume of sales has been rising sharply with some producers reporting that their sales in the last three months were the highest in the history of the respective companies. Sales are given in terms of value which has raised the question about the extent to which the total figure has been affected by the rise in unit values. Total sales of paint, varnish and lacquer for 1946 show a rise in value of almost 24 percent over the 1945 figure. Possibly a more accurate view of the increase in volume may be found in the report for sales of lacquer which are given in gallons as well as in dollars. On a gallon basis, sales of lacquer last year were fractionally more than 20 percent ahead of those reported for 1945 and this rate of gain may hold substantially correct for the paint industry as a whole.



CHEMICAL ENGINEERING • MARCH 1947 •



F ERTILIZER tag sales in the 16 states for which records are compiled, were equivalent to 1,435,000 tons according to the National Fertilizer Association. This is an increase of 7 percent over the equivalent tonnage for January 1946 and is the largest on record for January of any year. While this statement reflects directly upon activities in the fertilizer industry, it holds almost equally true of other large chemical-consuming industries and may be regarded as a trend toward steady expansion in requirements for chemicals.

While the possibility of labor troubles has not been removed, the fact remains that the first quarter of this year has seen industry moving ahead with much less disturbance that was the case in the like period of last year. With this advantage manufacturing lines have been able to turn out more finished products and there are no signs, so far as chemicals are concerned, that consuming needs are being reduced.

Reviewing the various segments which make up the composite outlety (0) for chemicals, it is found that in cases where full capacity rates are not being the maintained, this is due to shortages—the either of labor, raw materials, packaging, or transportation facilities-and lefter is not to a lack of consuming markets. Steel mills speeded up activities last month and apparently can continue for a long time without fears of a wedesler to buyers market. Pulp and paper plants, isowheth have moved up from the levels reported for the closing months of last summerde year and petroleum refineries have when it been more active. Soap makers enlarged their schedules in the final quarter of last year and made more Her surely a progress in the current quarter.

Paint makers have found some reaution lief in the linseed oil situation as a result of the purchase of 40,000 tons of oil from the Argentine scheduled to arrive in the four month period of February to May. Paint outputs have grown to a point where requirements for drying oils can not be measured by prewar standards and as sales of paint are expected to cross a billion dollars this year, it is evident that all paint-making materials must be provided in larger volume than ever before.

Rubber consumption last year amounted to 1,034,190 long tons of which only 277,562 tons was natural rubber. In addition 275,497 long tons of reclaimed rubber were consumed.

ENGIN

FAIRBANKS-MORSE POMONA VERTICAL TURBINE PUMPS

> WATER-LUBRICATED: OPEN IMPELLERS.

You can take your choice at the "BIG STORE"...

The "Big Store" is an American institution, where a man can get a better buy from a broader choice. That's why most buyers go to a Fairbanks-Morse-Pomona dealer for their vertical turbine pumps.

They know that these dealers are not restricted in their recommendations. They know that they'll get impartial help in buying the right pump.

For instance, Fairbanks-Morse offers a choice of oil or water lubrication, open or closed impellers. This is greater surety of getting skilled, unrestricted service in obtaining the pump that is most suited to your particular pumping work.

VISIT YOUR NEAREST FAIRBANKS-MORSE- Pomona dealer: Take advantage of the extra value in trading from the "Big Store in the pump industry"!

FAIRBANKS-MORSE

SALES

DIESEL LOCOMOTIVES + DIESEL ENGINES + MAGNETOS + GENERATORS + MOTORS + PUMPS + SCALES + STOKERS + RAILROAD MOTOR CARS and STANDPIPES + FARM EQUIPMENT

OIL LUBRICATED: **CLOSED IMPELLERS.**



A name worth remembering

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U. S. Production of Synthetic Organic Chemicals (Cont. from page 294)

November 1946, November 1945 and 1	Sleven-Month I	OURNE 101 1940 a	10 1349	
	November 1946	November 1945	Total, Ele 1946	ven Months 1945
Formaldehyde (37% by wt.)	41,470,0 60	27,725,786	420,623,771	448, 570, 210
Netnanoi: Synthetic. Natural ⁸	44,316,435 1,392,342	37,713,847 1,867,374	448,439,691 14,574,787	446,159,05 918,244,73
Naphthalene: Tar distillers (less than 79° C.). Tar distillers (79° C. and over). Coke-oven operators (less than 79° C.). Penjeillins	13,929,474 8,105,767 7,891,531 2,721,866	16,766,374 7,677,695 6,960,925 820,848	167,371,417 88,241,707 65,149,163 25,453,798	191,028,95 70,211,46 80,502,63
Phenol, synthetic and natural. Phthalic anhydride. Styrene (government owned plants only)	18,307,208 11,245,647 29,321,428	$\begin{array}{r} 14,262,100\\7,880,751\\24,260.551\end{array}$	179,540,618 98,359,414 339,899,270	190,077,27: 114,756,84 350,706,13;
Toluene: Coke-oven operators ⁶ . All others ¹⁰ .	1,733,010 1,547,140	1,625,959 1,530,135	15,172,530 14,368,255	25,919,20 121,534,48

All data in pounds except benzene (gal.), creosote oil (gal.), toluene (gal.), and peni-cillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commis-sion except where noted. Absence of data on production indicates either that return were unavailable or confidential. ¹ Excludes the statistics on recovered acid. ² Aci produced by direct process from wood and from calcium acetate. ³ All acetic anhydrid including that from acetic acid by vapor-phase process. ⁴ Produced or purchased by tar distillers. ⁶ Statistics are given in terms of bulk medicinals only. ⁶ Statistics cole lected by Bureau of Mines. ⁷ Total production including data reported both by coke oven operators and by distillers of purchased coal tar. ⁶ Reported to U. S. Bureau of the Census. ⁶ Reported in gal. by Bureau of the Census but converted to Ib. for com parison with the production of synthetic methanol. ¹⁰ Includes toluene produced from petroleum by any process. ¹¹ Includes refined cresylic acid from petroleum.

U. S. Production of Chemicals, Yearly Totals, 1939-1945

Collection Discontinued After September 1945

		TT	1945	1944	1943	1942	1941
	Chemical and Basis	Unit	JanSept.	Total	Total	Total	Intal
	Aluminum acetate (basic) ¹	M lb.	843	651	889	785	2
1	Aluminum hydroxide:1						
	Light or litho (100 percent Al(OH) ₃)	M lb.	2.227	2,769	2,321		
	Trihydrate (100 percent Al ₂ O ₃ 3H ₂ O).	M lb.	2	2	8,778	2	1 MARCONE
	Aluminum stearate (technical) ¹	M lb.	6.873	8.539	7,601		_
	Ammonia-aqua (NHs content)1.4	Tons	12,894	14, 126	14.755	11.825	14.07
	Ammonium-aluminum sulphate (technical)	M lb.	14,483	17,114	23,813		
	Ammonium bromide (100 percent NH4Br)1	M lb.	342	419	405		
	Ammonium carbonate (commercial)	M lb.	2	2	2,969	5	
	Ammonium nitrate, grained from solution (100 percent						0
	NH ₄ NO ₃)	Tons	140,867	219.581	219.988		
	Ammonium silicofluoride (100 percent (NH4) SiF6)	M lb.	3,314				
	Barium chloride (100 percent BaCla)1	Tons	12,817	17.504			
	Barium carbonate (100 percent BaCO ₂)	Tons	17,369	25,308	28,959	24,628	1
	Barium hydroxide (100 percent Ba(OH)*)1	Tons	1.412	1.621			
	Barium nitrate (100 percent Ba(NO ₃))	Tons	2	11,133	13.386	16.877	
	Barium sulphide (100 percent BaS)	Tons	23 365	31 789			
	Bismuth subcarbonate (100 percent) ¹	M lb.	387	331	655	504	36
	Black ash	Tons	57 933	77 759			
	Calcium carbonate (ppt.)I	Tons	71 648	91 756			
	Calcium chloride (100 nercent CaCle)	Tons	205 705				
	Calcium stearate (technical)	Mlb	1 420	1 918	1 815		
	Carbon hisulphide (100 percent CS ₂)	Tons	129 217	160 235	140 887	140.038	139.27
	Chlorine, liquid (100 percent Cla)	Tons	325,902	446 881	446 546	405,454	364.97.
	Chromic acid (100 percent CrO ₂) ¹	Mh	2	18 597	15 690	11.547	18.75 164
	Chromium oxide green (C.P.)	Mib	5 334	8 435	11 777		D
	Cuprous oxide (100 percent Cu ₂ O))	Mib	9 375	11 226	7 285		
	Ferrous sulphate (100 percent FeSO ₄) ¹	Tons	67,061	74 890	65 160		
	Iodine, resublimed (100 percent)	M lb.	497	612	770		
	Lead nitrate (100 percent Ph(NO ₃) ₂)	M lb.	5 037	6 801	7 333		
	Lead neroxide (dioxide)	M ib.	802	1 122	209	527	1.701
	Magnesium carbonate (hasic)I	Mib	68 648	96 020	95 950		
	Mercuric chloride (100 percent HgCla)I	M lb.	1 137	957	1 703	968	1,03, 0060 (
	Mercurous chloride (100 percent HgCl)I	Mib	556	567	830		
	Mercuric oxide:1		0011	001			च at tem
	Red (N. F.).	M lb.	1.446				
	Yellow (100 percent HgO).	M lb.	1.002				227.5
l	Phosphate, defluorinated ⁷	Tons	66.985	68.507			- mark
	Phorphorus:1	1 0 240	00.000	001001			22.
	Red (technical).	M lb.	437	1.289	1.085		Te Dst
l	White (vellow) (technical)	M lb.	128 867	170 070	157,440	143.244	112,27
l	Phosphrous oxychloride (100 percent POCla)1	M lb.	11 039	17 656	16.355	11.021	7.07-000
I	Phorphrous pentoxide (100 percent P2O6)	M lb.	10,736	15,140	1		- Jonho
l	Potassium-aluminum sulphate (potash alum)1	M lb.	7,203	9,075			
I	Potassium bichromate and chromate	M lb.	4.876	7.329	9.552	10,121	10,515
1	Potassium bitartrate (technical).	M lb.	2,010	2	1,995	2,699	4.03
1	Potassium bromide (100 percent KBr)	M lb.	2.823	3, 192	3,322		
1	Potassium chlorate (100 percent KClO ₃) ¹	M lb.	15 921	19.876	22,279	23,711	19,347 2810
1	Rare earth chlorides (technical)	Mib	749	1 151	900		
1	Silver evanide ¹	Moz	2 466	2 234			
1	Sodium acetate (100 percent Na(CoH2O2)1	Mlb	10 139	11 917	10.825	17.042	12,928
I	Sodium bromide (100 percent NaBr)1	Milb	1 137	1 554	5.182		- the de
1	Sodium silicofluoride (100 percent, Na-SiF-)1	Mib	13 881	20 705	0,100		
	Sodium sulphide (60-62 percent Na ₂ S)	Mlb	68 925	90 834	102.494	117.847	114,791
	Sodium sulphite (100 percent NasSOs)	M lb	50 025	62 636	51 988	50,863	36,779
I	Sodium thiosulphate (true) (100 percent No.S.O.)	Mib	30 046	51 539	01,000		
1	Sulphur chloride (technical)	Tons	23 272	30 627	33 403	33.687	25,288 -
1	Tannic acid (technical)	Mlb	20,213	475	465	886	1,279 - 141
I	Tartaric acid (technical)	Mib	1 0 3 12	10	6 404	5.842	7,981
1	Zing hydrosulphite (technical)	M lb.	1 389	1 270	0, 101		
I	Zine stearate (technical)	Mlb	6 641	4 031			
1	and broad and (bechanded)	A/R A5/9	0,011	1.301			

¹ No comparable data are available from the 1939 Census of Manufactures. ⁵ Data cannot be published without disclosing operations of individual establishments. ⁹ The 1939 data are for aluminum chloride anhydrous, crystal, and solution, on a 100 percent AlCls basis. ⁴ Data for a small amount of aqua ammonia have not been reported by one company since 1942. Excludes byproduct ammonia liquor from coke-oven opera-tions. ⁶ Minerals Yearbook, Review of 1940, Bureau of Mines, U. S. Department of the Interior. ⁶ Currently published by the U. S. Tariff Commission in "Facts for Indus-tery," Series 6-2. ⁷ Includes superphosphate, defluorinated, and phosphate rock.



Write for descriptive **Bulletin 700**

Charles Englehard Inc. 900 Passaic Ave., East Newark, N.J.


Gives STEPLESS balancing . . . Needs no standardizing!

FOR THE FIRST TIME in an automatically balanced thermocouple instrument, measurement of temperature is not only continuous, but STEPLESS. That's because Dynalog Thermocouple Instruments use a simple, variable, balancing capacitor instead of traditional slide wire.

FOR THE FIRST TIME, the measured voltage is compared directly to a Standard Cell. This eliminates the need for a dry cell battery requiring periodic standardization and replacement.

FOR THE FIRST TIME. in thermocouple measurement, the new Dynalog Recorders and Controllers offer you the advantages obtainable only

RO

in an instrument designed from start to finish for electronic operation . . . advantages which provide an unequalled combination of speed, sensitivity, and freedom from maintenance.

Whenever you need dependable, hairline control of temperatures, count on the unique advantages of these thermocouple-type recorders and controllers. Dynalog Controllers are made in air-operated (Model 40) types, and onoff or 3-position electric (Rotax) actions. Write for full details in Bulletin 397. The Foxboro Company, 16 Neponset Ave., Foxboro, Mass., U.S.A. Branches in principal cities.

ELECTRONIC INSTRUMENTS

CHEMICAL ENGINEERING • MARCH 1947 •

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The Heart of a Good Filter is its FILTER LEAVES!

Established 1909

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You Can Depend On KLEIN FILTERS and FILTER LEAVES • Positive Filtration ... No Clogging • Full Drainage

Klein Ideal Diatomaceous Earth Filters and the exclusive Klein Filter Leaves, in combination, assure positive filtration at all times. Operation, cleaning and maintenance costs are at a minimum with Klein Filters. In addition, many

radical innovations are incorporated in Klein Ideal Filters. You'll want to know about all of these if you have an industrial, chemical or food filtration problem in your plant.

Write for latest Klein Bulletin

> Klein Filter Leaf—If damaged, metal cloth easily replaced. No rivets. Note horizontal headers—central duct—Klein Cleanout Cap.

FILTER & MANUFACTURING COMPANY 1225-29 School Street • Chicago 13, III.



completely atomizes and thoroughly burns...

the lowest and cheapest grades of fuel oil and tar; requires low oil pressure and temperature; operates continuously without cleaning or clogging. Internal atomizing feature uses steam or compressed air for atomization. Type "SA" Oil Burner is equally adaptable to all types of industrial heating, power or process furnaces. It is suitable for firing above stoker grade as alternate fuel.

FOR BURNING WASTE MATERIALS ...

Type "S-A-D" Refuse Oil Burner operates with waste material pumped directly to the burner and blended with fuel oil in the venturi chamber; insures stability of ignition; reduces fumes and stack solids; uses steam or compressed air for atomization; functions entirely on fuel oil where supply of waste in intermittent; and assures continuous operation without cleaning or clogging.

Write for Bulletin 21, it gives complete data about these Oil Burners.



CHEMICAL ENGINEERING Weighted Index of Prices for CHEMICALS Base = 100 for 1937

'his month			123.79
ast month			123.41
farch, 1946			109.13
farch, 1945	• • • • •	• • • • • • • • • • • • • • • • • • • •	108.93
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IN

CURRENT PRICES

The accompanying prices refer to round lots, Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to March 10.

INDUSTRIAL CHEMI	CALS	
Acetone, tank, lb	\$0.07 -	R4 02
Boric, bbl., ton	119.00 -:	123.00
Citric, drums, lb.	.221-	.23
Hydrofluoric, 30%, drums, lb	.12 -	.12
Lactic, 44% tech., light, bbl., lb.	.073-	.07
Muriatic, 18°, tanks, 100 lb	1.05	
Oleum, tanks, wks., ton.	18.50 -	20.00
Oxalic, crystals, bbl., lb	.13 -	.14
Phosphoric tech., tanks, Ib	13 00 -	
Tartaric, powd., bbl., lb	.541-	.56
Alcohol, amyl from pentane,		
Alcohol, butyl, tanks, lb.	.131	.25
Alcohol, ethyl, denatured, No. 1		110
special, tanks, gal	.821	• • • • • •
Aluminum sulphate, com. bags,	.014 .	
100 lb	1.15 -	1.25
Ammonia, annydrous, cyl., 10 tanks. ton.	.10 -	.20
Ammonium carbonate, powd.,		
casks, lb	.091-	.10
Amyl acetate, tech. from pentane,	30.00	
tanks, lb.	.21 -	
Aqua ammonia, 26°, drums lb	.021-	.03
Arsenic, white powd., bbl., lb	.06 -	.08
Barium carbonate, bbl., ton	67.50 -	75.00
Nitrate, casks, lb	.091-	.11
Blanc fixe, dry, bags, ten	67.50 -	72.50
Bleaching powder, f.o.b., wks.,	2 75 -	3.00
Borax, gran., bags, ton	48.50	
Calcium acetate, bags, 100 lb	3.00	
Carbide, drums, ton.	.09 -	.10
Chloride, flake, bags del., ton	21.50 -	38.00
Carbon bisulphide, drums, lb	.05 -	.05
Chlorine, liquid, tanks, wks., 100	.00 -	.00
lb	2.00 -	2.30
Copper carbonate, bbl., lb.	.24 -	.25
Sulphate, bags, 100 lb.	7.60 -	7.75
Diethylene glycol dr lb	.45 -	.50
Epsom salt, dom., tech., bbl., 100		
Ib Ethyl acetate tanks lb	2.05 -	2.25
Formaldehyde, 30%, tanks, lb.,	.002	
wks	.032-	• • • • • •
Glaubers salt, bags, 100 lb	1.25 -	1.50
Glycerine, c. p., drums, extra, lb	.55 -	.60
White, basic carbonate, dry,		
casks, lb	.154-	
Red, dry, sck., lb.	.18 -	18
Arsenate, powd., bags, lb	.201-	.21
Lithopone, bags, lb.	$.05\frac{1}{2}$.06
Methanol. 95%, tanks, gal	.60 -	
Synthetic, tanks, gal	.24 -	
Phosphorus, yellow, cases, lb	.22 -	.20
Chlorate, powd., lb.	.11 -	.11
Hydroxide (c'stic potash) dr.,	071-	0.9
Muriate, 60%, bags, unit		.53
Nitrate, ref., bbl., lb	.081-	21
Prussiate. vellow. casks. lb.	.19 -	.20
Sal ammoniac, white, casks, 100	4 197	= 00
Salsoda bbl 100 lb	4.75 -	1.20
Salt cake, bulk, ton	20.00 -	
Soda ash, light, 58%, bags con-	1 20 -	
Dense, bags, 100 lb.	1.28 -	
Soda, caustic, 76% solid, drums,	2.50	
Acetate, del., lb	.051-	,06
Bicarbonate, bags, 100 lb	2.25 -	
Bisulphate, bulk, ton	20.00 -	24.00
Bisulphite, bbl., lb	.03 -	.04

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Connage Travels for Less...

THE MERCURY **''TRACKLESS** TRAIN''

Mercury "Tug" electric fractor provides fume-free motive power for train of Mercury"A-310" trailers.



"BANTY" GAS TRACTOR

Smallest gas tractor made -yet develops a drawbar pull in excess of 2000 lbs. A favorite throughout industry for its power, stamina and compact size.

"HUSKIE" GAS TRACTOR

This rugged haulage unit is all that its name im-plies — a powerful, 6-cylinder, 4-wheel tractor — built to haul any wheeled load it might encounter in industry

TYPE "A-310" TRAILER

Here's the 'burden-bearer' of the 'Track-less Train' -- an all-steel, all-purpose, castor-steer trailer available in wide range of platform and body types. Easy-running, may be instantly coupled or detached.



CHEMICAL ENGINEERING • MARCH 1947 •

Free of any fixed path-the versatile "Trackless Train" travels wherever material movement dictates-long hauls, short hauls or snaking through congested areas to deliver more tonnage at lower cost.

Every ton hauled for less because the "Trackless Train" keeps loads on wheels . . . easy to move, no "dead" weight. Moves more tonnage by merely adding more trailers ... no increase in power units.

Learn how this versatile, low cost material handling system can serve you. For complete information, ask a Mercury Sales Engineer to call. There is no cost or obligation.

FREE: BULLETIN 201-6

Illustrates and describes all Mercury equipment – including latest additions to Mer-cury's expanded material handling line. Request your copy of this 48 page catalogtoday.

FORK-TRUCK ---- TRACKLESS TRAIN" When moving materials over 200 feet— do the job faster, at less cost by Fork-Truck- "Trackless Train." In this system, fork-truck loads trailers-tractor hauls trailers to destination-where fork truck speeds unloading.







An Important Starting Material for the Synthesis of Pharmaceuticals, Insecticides and Fungicides

• As a starting material for the synthesis of pharmaceuticals, insecticides and fungicides, Reilly 2-Aminopyridine merits your consideration. A few of the intermediates readily prepared from 2-Aminopyridine are depicted above.

In addition to 2-Aminopyridine, Reilly also furnishes four methyl aminopyridines, as follows: 2-Amino-3-Methylpyridine, 2-Amino-4-Methylpyridine, 2-Amino-5-Methylpyridine and 2-Amino-6-Methylpyridine.

Reilly Aminopyridines are available in 95% purity.

REILLY TAR & CHEMICAL CORPORATION

Reilly Coal Tar Chemicals For Industry

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Indianapolis 4, Indiana 2513 South Damen Avenue, Chicago 8, Illinois

This 56-page booklet and supplement, describing Reilly coal tar chemicals, acids, oils, intermediates and bases, will be sent on request.



CHEMICAL ENGINEERING Weighted Index of Prices for **OILS & FATS**

Base = 100 for 1937

This month						340.10
Last month	• •	• • •	• • •	• • • • • •	• • • • • • • • •	317.78
March, 1946	• •	• • •	• • •		• • • • • • • • •	145.80
viaren, 1945	•••	•••	• • •	• • • • • •		145,85

Chlorate, kegs, lb	\$0.061 C	0.001
Cyanide cases dom lb	\$0.00 - 3	0.065
Fluoride bbl lb	.142-	.15
Hamogulabite here 100 lt	07 -	.08
Hyposulphite, bags, 100 lb	2.25 -	2.50
Metasilicate, bbl., 100 lb	3.40 -	4.00
Nitrate, bulk, ton	32.00 - 3	8 50
Nitrite, casks, lb	063→	07
Phosphate, tribasic, hags, 100	1004	-01
lb	2 50	
Principiate vel hare lh	0.00	*****
Silicato 400 da ala 100 ll	.12 **	.121
Sincare, 40, dr., wks., 100 lb.	.95 -	1.00
Supplite, crys, bbl., lb.	.021-	.021
Sulphur, crude at mine, long ton.	16.00	
Dioxide, cyl., lb.	.085-	00
Dioxide, tanks, lb	044-	.00
Fin crystals, bbl., lb	48 _	*****
Zine chloride gran bbl lb	. 10	*****
Ovide load free ham lb	.001	.06
Oride, lead fice, bags, ib	.092-	.097
Uxide, 55% leaded, bags, Ib	.112-	.111

OILS AND FATS

Castor oil, No. 3 dr., lb	\$0 334-
Chinawood, oil, tanks, lb	.39 -
Coconut oil, Ceylon, N. Y., Ib	.21 -
Corn oil crude, tanks (f.o.b. mill),	
1b	.32
Cottonseed oil crude (f.o.b. mill),.	
tanks, lb	.35
inseed oil raw, car lots, dr., lb.	.38
Palm, casks, ib.	nom.
reanut oil, crude, tanks (mill), ib.	.34 ~.
Lapeseed on, renned, DDL, ID	.32
Monhadon light proved dr lb	.30 ~.
Crude tanks (f a b factory) Ib	191_
Freese vellow loose lb	. 102
leo stearine. lb	nom.
leo oil. No. 1 lb.	.30 -
Red oil, distilled, bbl., lb	.281
Callow, extra, loose, lb:	.223
COAL TAR PRODUC	CTS
Alpha-naphthol, crude, bbl., lb	\$0.58 - \$
Alpha-naphthylamine, bbl., lb	.35 -
niline oil drume lb	19 -

Alpha-naphthylamine, bbl., lb	.35 -	.36
Anilino colto bbl. lb	.12 -	.123
Depaoldobydo toob dy lb	. 22 -	.24
Benziding has bbl lb	.40 -	.00
Benzoid acid USP kees lb	.10 -	.70
Benzol 00% tenks works gol	.04 -	. 30
Bongyl chloride tech dr lb	.17	91
Pote nephthal tech drume lb	.20 -	-41
Crosol USP dr lb	.20 -	. 44
Creeville agid dr. who god	1 00	1 05
Dinhanyl bbl lb	1.00 -	1.00
Disthylaniline dr. lb	.10	50
Dipitrotoluol bbl lb	19 _	10
Dipitrophenyl bbl 1b	.10 -	.10
Dip oil 15% dr gel	.22 -	25
Diphenylamine dr fob mba.	.20 -	. 60
Ib	25 -	
Hagid bbl lb	.20	52
Hydroquinone bbl lb		95
Naphthalana flaka bhl lb		10
Nitrobenzene dr lb	.052	00
Para-greeol bbl lb	41 -	.00
Para-nitrogniling bbl lb	42 -	43
Phonol USP tanks th	101_	11
Pioria agid bbl lb	30	32
Peridina dr gal	1 55 -	1 60
Recordingl tech kers lb	68 -	70
Saliavlia agid tech bbl lb	26 -	27
Salvent nanhtha www.tanka.gol	25 -	
Toluidin bhl lb	1 00 -	
Tohol drums works gal	23 -	
Yriol com taple col	23 -	
Ayloi, com., tanks, gai	.20 .	
MISCELLANEOU	S	
Casein, tech., bbl., lb	nom.	
Dry colors:		
Carbon gas, black (wks.), lb	\$.04 -	\$.07
Prussian blue, bbl., lb	.42 -	.43
Ultramarine blue, bbl., lb	.13 -	.24
Chrome green, bbl., lb	.25 -	.40
Carmine red, tins, lb	5.50 -	6.00
Para Toner, lb	.80 -	.95
Vermilion, English, bbl., lb	2.60 -	2.70
Chrome yellow, C.P., bbl., lb	.24 -	.26
Gum copal, Congo, bags, lb	.09 -	.55
Manila, bags, lb	.09 -	.15
Damar, Batavia, cases, lb	.10 -	.22
Kauri, cases, lb	. 18 -	.60
Magnesite, calc., ton	. 58.75	
Pumice stone, lump, bbl., lb	.05 -	.07
Rosin, H., 100 lb.	11.50	
Shellac, orange, fine, bags, lb	.72	
Bleached, bonedry, bags, lb	71	
T. N. bags, lb	.67	
Jurpentine, gal.	1.30	

• MARCH 1947 • CHEMICAL ENGINEERING

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WINONA, MINNESOTA U.S.A. October 17, 1946 Mational Engineering Company 549 West Washington Blvd. Chicago, Illinois Gentlemen:

We are very such pleased with the engineering and laboratory conducted that the equipment recommended will save us considerat from tests are previously had. We heartily recommend this equipment where a fast and uniform

another vote of confidence

THE J.R. WATKINS COMPANY

Very truly yours. PRE J. R. WATKINS COMPANY

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OILS AND FATS

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tenh., dr., Ib. bbL, lb. SP, kegs, lb. mks, works, gal

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ICAL ENGLY

at less cost

Wherever you find Simpson Mixers handling dry, semi-dry or plastic materials, you'll find satisfied users ... users who like the uniformly high product quality, increased mixing speed, and the lower production and maintenance costs made possible through the mulling principle of controlled mixing.

The money-saving features of Simpson Mixers are not just idle claims ... they are job-tested and proved on hundreds of chemical process installations.

National Engineering service is yours for the asking. Write today.

SIMPSON Intensive Mixers

604 Machinery Hall Bldg. • Chicago 6, Ill.

Simpson Mixers are built in 10 sizes, from 1/5th to 50 cu. ft. capacity. Available with oil, steam or water jackets, for vacuum mixing, and also in corrosion-resistant materials.

Manufacturers and Selling Agents for Continental European Countries-The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia – August's Limited, Halifax, England. For Canada – Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand – Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

NEW CONSTRUCTION

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Car

Proposed Work

- Calif., El Segundo-Standard Oil Co. of California, 605 West Olympia Blvd., Los Angeles, plans to construct a filling plant warehouse, barrel reconditioning building and loading platform at refinery here. Estimated cost \$740,500.
- Fla., Miami—Peau d' Or Corp., Biscayne Bay near 13th St. Causeway, plans to construct a plant for the manufacture of suntan oil and creams. Estimated cost \$100,000.
- Kan., Hugoton—Stanolind Oil & Gas Co., Stanolind Bldg., Tulsa, Okla., plans to construct a Synthol plant to have a daily capacity of 100,000,000 cu.ft. of natural gas compressed; also a gasoline plant. Estimated cost \$4,500,000 and \$1,000,000 respectively.
- Mass., Springfield—Monsanto Chemical Co., Monsanto Ave., plans to construct a factory building. Gilbert Small & Co., Inc., 10 State St., Boston, Mass., Archt. Estimated cost \$839,800.
- Mo., Hannibal—Interstate Cotton Oil Refining Co., Sherman. Tex., plans to construct a vegetable oil processing plant. Girdler Corp., 224 East Bway., Louisville, Ky., Cons. Eng. Estimated cost \$2,000,000.
- N. Y., Glenham—The Texas Co., 135 East 42nd St., New York, N. Y., plans to construct a laboratory building here. Estimated cost \$400,000.
- O., Toledo—E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., plans to construct a paint and chemical manufacturing plant here; also system to eliminate waste and odors at Tremainsville Rd. plant. Estimated cost \$480,898 and \$125,000 respectively.
- O., Youngstown—General Fireproofing Co., Youngstown, O., plans to construct a 4 story, 110x180 ft. addition to its plant. Estimated cost \$1,000,000.
- Okla., Muskogee—Corning Glass Co., Corning, plans to construct a pyrex glass plant here. Estimated cost \$600,000.
- Tenn., Memphis—Central Soya Co., Inc., Ft. Wayne Bank Bldg., Fort Wayne, Ind., has purchased property of International Sugar Feed Co. here and will improve and enlarge same. Estimated cost \$500,000.
- Tenn., Tiptonville-West Tennessee Soya Mill, Tiptonville, plans to rebuild its plant recently destroyed by fire. Estimated cost \$600,000.
- Tex., El Paso-Standard Oil Co. of Texas, Humble Bldg., plans to construct a new distillation plant unit, also storage plant. Estimated cost \$1,300,000 and \$750,000 respectively.
- Tcx., Freeport—Dow Chemical Co., c/o Charles B. Frink, Freeport, Tex., plans to construct a hydrocarbon plant here to consist of six buildings. Estimated cost \$4,700,-000.
- Tex., Velasco-Dow Chemical Co., Freeport, plans to construct a chlorine plant here consisting of nine buildings. Estimated cost \$8,000,000.

-	Current I	Projects	Cumulative 1947		
	Proposed		Proposed	<i>.</i>	
	Work	Contracts	Work	· Contracts	
/ England	\$840,000	\$55,000	\$895,000	\$1,767,000	
dle Atlantic	400,000	185,000	2,505,000	7,255,000	
th	1,200,000	1,375,000	1,665,000	4,748,000	
dle West	1,606,000		1,716,000	3,344,000	
t of Mississippi	22,850,000	6,845,000	46,886,000	37,456,000	
West	741,000	290,000	1,803,000	2,008,000	
ada	•••••		10,566,000	1,100,000	
Total	\$27,637,000	\$8,750,000	\$66,036,000	\$57,678,000	

Contracts Awarded

- Ark., El Dorado—Lion Oil Co., T. H. Barton, Pres., has awarded the contract for two additions to chemical plant, one pelleting and gagging plant for reducing liquid ammonium mitrate solution to solid grained form and for bagging the grained finished fertilizer, including two towers, cooling, drying and conditioning units, bagging and storage facilities, etc., to Winn Senter Construction Co., Railway Exchange Bldg., Kansas City, Mo. Estimated cost \$1,000,000.
- Calif., El Segundo-Standard Oil Co. of California, 605 West Olympia Blvd., Los Angeles, has awarded the contract for a boiler shop at its plant to Morrison-Knudsen Co., 810 Title Guarantee Bldg., Los Angeles. Estimated cost \$235,000.
- Conn., North Haven—Montowese Brick Co., Montowese, North Haven, has awarded the contract for a 1 story, 70x160 ft. brick plant, including kiln drying facilities, to Dwight Building Co., 152 Temple St., New Haven. Estimated cost \$55,000.
- D. C., Wash.—Eastman Kodak Co., 1350 Okie St., N. E., has awarded the contract for a 3 story developing plant addition to J. L. Parsons, Jr., 224 Homer Bldg. Estimated cost \$65,000.
- Ga., Doraville—Atlantic Refining Co., 260 South Broad St., Philadelphia, Pa., will construct an oil terminal here using own forces. Estimated cost \$300,000.
- Ia., Mount Pleasant—Michigan-Wisconsin Pipe Line Co., c/o Michigan Consolidated Gas Co., 415 Gilford Ave., Detroit, Mich., has awarded the contract for a gas compressor station to Ford, Bacon & Davis Construction Co., 39 Bway., New York, N. Y. Estimated cost \$1,000,000.
- Kan., Lakin—Colorado Interstate Gas Co., P. O. Box 1087, Colorado Springs, Colo., has awarded the contract for a dehydration plant and 8,400 hp. compressor station, to Stearns-Roger Manufacturing Co., Union National Bank Bldg., Houston, Tex. Estimated cost \$685,000 and \$1,200,000 respectively.
- Mo., Robertson (St. Louis 21, P. O.)—Lloyd A. Fry Roofing Co., Madison, Ill., and Robertson, has awarded the contract for a 1 story, 150x750 ft. roofing plant in Hazelwood Subdivision, to Campbell, Lowrie & Lautermilch, 400 North Madison St., Chicago, Ill. Estimated cost will exceed \$250,000.

- Mo., St. Louis—Johnston Tinfoil & Metal Co., 6106 South Bway., has awarded the contract for a 1 story 109x122 ft. addition to its plant to Woermann Construction Co., 3800 West Pine Blvd.
- Mo., St. Louis-Vestal Laboratories, Inc., 4963 Manchester Ave., has awarded the contract for a 1 story, 80x120x140 ft. warehouse to Woermann Construction Co., 3800 West Pine Blvd.
- Nev., Reno—Eagle Picher Co., 125 East 7th St., has awarded the contract for a group of industrial buildings, including laboratory building, on Route 40, 18 mi. east of here, to Western Knapp Engineering Co., 760 Folsom St., San Francisco.
- N. J., Deepwater—E. I. du Pont de Nemours & Co., Inc., Deepwater, will construct a manufacturing building here with own forces. Estimated cost \$120,000.
- N. M., Jal—El Paso Natural Gas Co., El Paso, will construct a compressor station here. Work will be done by force account. Estimated cost \$190,000.
- Tenn., Old Hickory—E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., will construct an addition to its cellophane plant here with own forces. Estimated cost \$299, 760.
- Tex., El Paso—El Paso Natural Gas Co. will improve and enlarge its compressor stations here. Work will be done by force account. Estimated cost \$225,000.
- Tex., El Paso—Standard Oil Co. of Texas, Womble Blvd., has awarded the contract for a distillation plant unit and expansion and improvements at refinery to Hudson Engineering Corp., 2711 Danville St., Houston, \$1,125,000 and \$110,000 respectively; products storage facilities to Chicago Bridge & Iron Co., 5625 Clinton Dr., Houston, \$550,000.
- Tex., Houston—Pittsburgh Plate Glass Co., 101 Crawford St., has awarded the contract for additional plant expansion to W. S. Bellows Construction Co., 716 North Everton St. Estimated cost \$400,000.
- Va., Norfolk—U. S. Gypsum Co., c/o Tidewater Construction Co., contractor, 538 Front St., will construct a gypsum plant. Estimated cost \$700,000.
- W. Va., Morgantown—Seneca Glass Co., 709 Beechurst Ave., has awarded the contract for a 1 story manufacturing plant to Baker & Coombs, 319 Demain Ave. Estimated cost \$75,000.



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ter—E. I. du Pont & h ., Deepwater, wil can ag building here ni matted cost \$120,000.

El Paso Natural Call construct a compress will be done by foren ast \$190,000.

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-El Paso Natural Carla I enlarge its comprant in a will be dene by foreau ost \$225,000.

-Standard Oil Ca el yid, has remited de m attion plant mit ad eme ementos at refears to la Corp., 2711 David (David Station to Station (125/001 and 511200 m exits storage destine to Statron Ca., 3615 Chan 50,000.

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Engineered to stand up on even the toughest jobs, Thomas Flexible Couplings can be supplied in special corrosion resisting materials for the chemical industries.

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Fig. 1097—150-pound Stainless Steel Separ-able Body, Reversible Seat "Y" Valve. Lower half of body can be unbolted and turned through arc of 180 degrees to make 90-degree angle valve.

Fig. 1971 — 300 - pound Stainless Steel Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke-bonnet and taper wedge solid disc.

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Fig. 1891 Q. O.—Flanged end, O. S. & Y. Liquid Level Gauge. Offset pattern. Has quick opening thread on stem and cross levers for chain operation. For 150 pounds W. W. P.

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Fig. 2315—Stainless Steel Flush Bottom Tank Valve for metal tanks and auto-claves with steam jackets. Fig. 2465-G—Stainless Steel Quick Opening Gate Valve with flanged ends, sliding stem and bolted flanged yoke.

150 W.P.

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Fig. 1968—150-pound Stainless Steel Gate Valve with screwed ends, outside screw rising stem, bolted flanged yokebonnet and taper wedge solid disc.



Fig. 2433—Flanged End Stainless Steel Swing Check Valve for 150 pounds W. P. Bolted cap.



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N the processing of animal food, protein was extracted from fish scraps mixed with acid in settling tanks. This method wasted time, space and materials, and was accompanied by highly offensive odors . . . A radical change in processing was sought.

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AT&M's solution: a completely enclosed centrifugal, with an imperforate, rubber-covered, corrosion-resistant basket. Space is saved, processing is faster, and all odors are confined.



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Now a palatable food for live stock, the residue is plowed out. Or, after the addition of more acid, and a second centrifuging cycle, pure calcium is retained for poultry feed. Not a scrap is wasted. IN STICK-PRO

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They're Stick proof ... Here's Why:

- 1. INSTANT STICK-PROOF OPERATION.
- 2. Quarter-turn fully opens or closes.
- 3. Positive mechanical seal.

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- Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.
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- All operating parts protected from damaging effects of service conditions and weather.

Built into every valve is a powerful lever-and-screw device which relieves seating pressure between valve plug and body just enough to prevent friction and permit easy turning at all times and under all conditions. This exclusive LEVER-SEALD mechanism assures never-failing stick-proof operation no matter what the line contents are or how long the valve has remained in an open or closed position. Operation is positive even at temperatures as low as 40° below Zero or as high as 1120°Fahrenheit, at pressures from vacuum to 1500 pounds. The absolute reliability of HOMESTEAD LEVER-SEALD VALVE operation has kept them favorites for over 15 years, for difficult applications where temperature extremes, pressure and the corrosive action of line fluids render ordinary valves inoperative.

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ALCO Air Cooled Heat Exchangers at Warren Petroleum Company's natural gas plant, Holiday, Texas, built by J. F. Pritchard Company, perform a greater part of all cooling operations than has ever been done before by air cooled heat exchangers in any comparable plant in the entire world.

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TWO TYPES OF ALCO AIR COOLED HEAT EXCHANGERS. ALCO is in a position to give impartial counsel as to which type of cooling surface—*radiator core* or *fin tube*—to employ, since it manufactures both types.

ELIMINATE THE WATER CYCLE. ALCO Air Cooled Heat Exchangers eliminate the water cycle entirely—dissipate heat directly to the air in one operation. Where water is scarce, or has a high impurity content, this feature invaluable. Other advantages are:

- 1. Wind direction does not affect efficiency.
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- 3. Cooling surfaces are so positioned as to minimiz damage by wind-driven sand, rain, or hail.
- 4. Fans may be driven by any form of power.
- 5. Induced draft insures uniform distribution of a across cooling surface.

ADVANTAGES OF ALCO DESIGN. Selection of the type of cooing surface to be used should be determined by ecc nomics and process requirements. However, where coiditions and requirements permit, use of ALCO Fin Tut

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HExchanger Installation in the World



Air Cooled Heat Exchangers affords certain important advantages in addition to those listed in the foregoing. These additional advantages are:

1. Separate surfaces for separate cooling duties can be mounted in the same unit.

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- 2. Header design permits variation of passes to suit process requirements of a given job, thus allowing selection of minimum surface within pressure drop limitations of the process while maintaining maximum velocity required for highest rate of heat transfer.
- 3. Orifices built into manifold-header design assure uniform distribution to entire cooling surface.
- 4. Bundle design of ALCO fin tube construction eliminates all air leakage.

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The Lengpe press-forging technique offers unusual versatility in the production of uncommon shapes as well as standard products.

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MULTI-STAGE BLOWERS. Inlet volumes up to 130,000 cfm, pressure to 35 lbs gauge, un-cooled. Centrifugal type, for boosting, ex-hausting, circulating. Cannot build up dangerous pressures. Pressure volume curve favorable to parallel operation.



ROTARY COMPRESSORS, sliding vane type. Capacities for 5 to 35 psig. Air is com-pressed in cells formed by blades moving freely in and out of longitudinal slots in rotor. Quiet, smooth operation. Notably low maintenance. Units start unloaded.





DRY VACUUM PUMPS. Range to 281/2 inches hg vacuum. Same principle as rotary compressors except that inlet is hocked up to chamber to be evacuated and exhaust is open. Operates free of vibrations or pulsations. No inside valves. Saves floor space.



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What kind of pipe do you need...to fight acid-corrosion?

All-Lead Pipe? National Lead's Chemical Lead Pipe has a long record of successful applications. And there are definite reasons for this. First, it is made of practically pure lead. which is free from bismuth and contains a small amount of copper to increase corrosion resistance. Second. it is fabricated by an extrusion process which assures uniform wall thickness, free flow and freedom from porous or defective spots.



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That's our regular lead pipe. It has become "standard" throughout industry. But, maybe you need extra corrosion resistance at high temperatures . . . greater tensile strength and toughness . . . higher endurance to vibratory stress. Our Tellurium Lead Pipe fills the bill there.

Or. maybe your *extra* problem is erosion. Then, you should consider our Antimonial Lead Pipe. made with a base of either Chemical or Tellurium Lead. By adding 6% of antimony we almost double the tensile strength and greatly increase hardness and stiffness.

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strength of iron or steel, we give it to you . . . with a lead lining. Our "United" Lead-lined Cast Iron or Steel Pipe has proved highly serviceable under severe conditions. It has the outer strength you need to stand pressure or other mechanical stress; the inner stamina to resist corrosion.

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This new electroplating barrel is built on proven principles with a new design slant made possible by Du Pont "Lucite." It outpoints any similar barrel previously tested in its resistance to plating solutions...ease of loading and unloading...lighter weight ...transparency...low electrical conductivity ... extreme durability and long life.

Here's an example of how the many excellent properties of Du Pont "Lucite" acrylic resin combine in an important industrial product to return more service per dollar of investment. Look to "Lucite"...and other Du Pont plastics...for improving existing equipment and for planning the new. Write for literature. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Room 103, Arlington, N. J.

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The Brown *ElectroniK* Potentiometer has been responsible for moving labratory techniques into the plant. Greater accuracy, sensitivity and speed of response has made it a leader in the fields of chemical analysis and composition control.

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This Hypersorption column is shown under construction at our Carteret, New Jersey works. It will be erected at the Midland, Michigan plant of the Dow Chemical Company. • The photographic view is from the top down, showing (a) the cooling section, (b) the charge and product manifolds and (c) the heating section. The heat is supplied by a Dowtherm vapor heating system. • A complete technical description of the Hypersorption process is presented in a reprint from the Trans. A.I.Ch.E. (August 1946) titled "Hypersorption Process for Separation of Light Gases" by Clyde Berg, Research Department, Union Oil Company of California.

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PROBLEM: Operating personnel in a large power plant was experiencing equipment damage due to vibration and failures of pipe lines carrying compressed air to various plant stations. The problem was to locate the source of trouble and correct it.

Solution: Chicago Metal Hose engineers were consulted and through their knowledge of the science of FLEXONICS,* recommended the installation of *Rex Vibra-Sorbers* at determinable locations in the piping system.

RESULT: Line failures ceased when transmitted vibration was absorbed by *Rex Vibra-Sorbers* (available in various alloys). Disturbing noise also was eliminated. When you have a vibration problem, ask for a C.M.H. engineer and he'll help you reach a satisfactory solution! *the science of FLEXONICS "The controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplifled in the basic products of Chicago Metal Hose Corporation.

LEADER IN THE SCIENCE OF FLEXONICS

CHICAGO METAL HOSE CORPORATION

Maywood, Illinois • Plants: Maywood and Elgin, Illinois

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EAGLE SUPERTEMP **BLOCK INSULATION** is easy to apply!

Eagle Supertemp Block is lightweight, easyto-handle. It cuts like cheese with a knife or saw to fit odd-shaped areas. Fits snugly over minor irregularities, such as rivet heads.

Cuts heat losses to the bone!

Because it's basically Mineral Wool, Supertemp Block is literally honeycombed with dead air cells. From these highly effective heat barriers, it derives extremely low thermal conductivity... and becomes one of the most efficient insulations you can install!

Other Supertemp Block advantages



Great strength. Despite its light weight, Supertemp Block has good transverse breaking strength. Withstands all normal handling and usage.

All-purpose—only one type block needed.

High Refractory Value. Withstands a full range of temperatures up to 1700° F.





is negligible.

Permanent. Physically and chemically stable. Will not deteriorate. Data sheets with complete technical information are available on request.

To speed application of Eagle Supertemp Block, we recommend Eagle Insulstic, a strong, paste-like adhesive that holds insulation in place during application.



FITS SNUGLY

OTHER EAGLE INDUSTRIAL PRODUCTS INCLUDE:

EAGLE INSULSEAL. A protective coating for insulation. Trowels on - dries to a hard finish.Withstands up to 450°F.

EAGLE SWETCHEK (black). A prepared, asphaltic base, rust-inhibitive anti-condensation compound.

EAGLE "43" FINISHING CEMENT. A hard white finish coating for all types of indoor insulation within a range from 70° F. to 800° F.

EAGLE-PICHER INSULATIONS **High and Low Temperature**

Made by THE EAGLE-PICHER COMPANY . CINCINNATI (1), OHIO

Eagle Super "66" Insulating Cement • Eagle L-T and M-2 Felt • Eagle Supertemp Block • Eagle Blankets • Eagle Pipe Covering Eagle Insulseal • Eagle Loose Wool • Eagle Insulstic • Eagle Swetchek

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USERS OF PROCESS EQUIPMENT

BARS (HOT ROLLED • COLD DRAWN • CENTERLESS GROUND) • BILLETS • SHEETS • PLATES • STRIPS SPECIAL SHAPES • RINGS • CIRCLES • CASTINGS

Jessop Stainless Steels have excellent resistance to many forms of corrosion at both normal and elevated temperatures in industrial and commercial applications. This means longer equipment life, better product control and lower maintenance cost. Their high strength-low weight ratio opens new fields of possibilities in equipment design. They withstand temperatures as high as 2100°F depending upon operating conditions and type of stainless used. Jessop Stainless Steels offer a wide variety of properties from which the proper combination may be selected to meet your particular needs. They are available in all commercial forms. Consult us on your problems.



Tailor made Specialty Steels CHEMICAL ENGINEERING • MARCH 1947 •

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BRITISH INDUSTRIES FAIR LONDON & BIRMINGHAM, MAY 5-16, 1947

This is your first opportunity in seven years to see your old suppliers in Britain and to meet new ones.

Overseas Buyers are invited to Britain for the 1947 British Industries Fair. It will enable them to establish personal contact with the makers of the immense range of United Kingdom goods displayed in the London (Lighter Industries) and Birmingham (Hardware & Engineering) Sections of the Fair. The careful grouping of exhibits will assist buyers to compare the products of

BRITAIN PRODUCES THE GOODS

competing firms with a minimum of time, trouble and expense. Special arrangements to suit individual markets can be discussed and terms and conditions of business settled direct with the manufacturer, since only the actual producer or the sole selling agent may exhibit.

★ For full details of the 1947 Fair apply to the nearest British Commercial Diplomatic Officer or Consular Officer, or the British Trade Commissioner in your area.

> CHEMICALS and ALLIED PRODUCTS will be shown in London

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BSE



Here's Another "Hersey" Drying Wood Chips and Sawdust for Wood Flour Production

Similar Hersey's are being effectively used for cannery waste and other by-product recovery; such as, root starches, vegetable and fruit waste. sweet potato meal, Bagasse and similar materials.

Like other Hersey Dryers, this one has "all five" Hersey Engineering features:----

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PRODUCTS

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exhibit.

- 2. Uniformly dried product no matter what the particle size, within reasonable limits.
- 3. Completely automatic operation.
- 4. Moderate initial cost.
- 5. Negligible upkeep.

HERSEY Engineers have specialized in drying "know-how" for sixty years. There are over 1,100 Hersey Dryers now in operation.

If you have a drying problem "Call the Hersey Drying Engineer!"

HERSEY MANUFACTURING COMPANY SOUTH BOSTON. MASSACHUSETTS

Address All Inquiries Outside of the U.S. A., Canada and Panama to the Westinghouse International Electric Company, 40 Wall Street, New York City, N. Y.

CHEMICAL ENGINEERING . MARCH 1947 .

327

You Can SEE That It's ONLY the SIDE of a V-Belt

That Grips the Pulley and *Gets the Wear!*



Straight Sided V-Belt

How Straight Sided V-Belt Bulges When Bending Around Its Pulley

Gates V-Belt with Patented Concave Sidewall

Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt Is Bending Over Pulley

You can actually feel the bulging of a straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.

Look at a V-Belt in its sheave and you see at once that the *sides* of the belt do all the gripping on the pulley and get all the wear against the sheave-groove wall.

Notice, too—it's the *sides* that pick up all the power delivered by the driver pulley. The sides *transmit* that power to the *belt as a whole*. And then, once more, it's the sides—and the sides *alone*—that grip the driven pulley and *deliver* the power to it.

That is why you have always noticed that the sidewall of the ordinary V-Belt is the part that wears out first.

- and Here Is How the CONCAVE SIDE *REDUCES Sidewall WEAR and Lengthens Belt Life!

Clearly, since the sidewall is the part that wears out first, anything that prolongs the life of the sidewall will lengthen the life of the belt.

The simple diagrams on the right show exactly why the ordinary, straight-sided V-Belt gets excessive wear along the *middle* of the sides. They show also why the Patented Concave Side greatly reduces sidewall wear in Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belts can possibly give.

*More Important NOW That STRONGER Tension Members are Used

Now that Gates Specialized Research has resulted in V-Belts having much stronger tension members—tension members of Rayon Cords and Flexible Steel Cables, among others—the sidewall of the belt is often called upon to transmit to the pulley much heavier loads. Naturally, with heavier loading on the sidewall the life-prolonging Concave Side is more important today than ever before!



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UNITE New York 17

328

FOR THE MAN WHO APPLIES UCILON TO HIS TOUGHEST CORROSION PROBLEMS

PICK THE TOUGHEST corrosion problem you have—the one where you stand to suffer biggest losses, and spend most money on maintenance. Now consider how Ucilon can change that picture for you. Its use rewards you *doubly*—by stopping corrosion of equipment—by cutting your maintenance expenses. For in actual use, Ucilon has proved to be *more* resistant to *more* corrosives for *longer periods of time* than all ordinary maintenance paints!

Here's a case in point: A large plant manufacturing hats had a serious corrosion problem because of extreme humidity in the felt room. That problem was eliminated when they coated all machines with Ucilon. They reported that *never* had any maintenance paint been able to withstand the beating Ucilon was taking!

A metal-working plant offers another typical example: Ucilon was applied on tanks and equipment used in their steel blackening process, where it was subjected to spillage of a boiling, 40% caustic solution. After a month, it was still in perfect shape on these "tough spots"—*more* than enough time to prove Ucilon would outlast any coating previously tried!

SEND FOR THIS BULLETIN

It'll pay you to get complete details on Ucilon. Write your nearest Unichrome office for these four pages of facts on its properties, uses, and methods of application.

WHAT IS UCILON*?

UCILON is a surface coating material formulated from new and improved inert synthetic resins. It is air drying and can be applied to any metal, wood, or concrete surface by brushing, spraying or dipping. Upon evaporation of the solvent, a hard, durable "plastic" coating is formed.

UCILON is remarkably resistant to acids, alkalies, salts, alcohols, oils, water, cleaning compounds, and industrial oxidants. It has excellent flexibility, toughness, adhesion—and no taste or odor when dry. It is non-toxic, fungus-inhibiting, has good electrical resistance, and gives an attractive glossy finish.

*Ucilon is a trademark registered in the U. S. Patent Office, by United Chromium, Incorporated, for a synthetic resinous coating material.



UNITED CHROMIUM, INCORPORATED

Detroit 7. Mich.

Waterbury 90, Conn.

PROCESSES AND MATERIALS

FOR SURFACES THAT SURVIVE

Chromium Plating • Porous Chromium • Unichrome* Copper Unichrome Lacquers • Ucilon* Protective Coatings Unichrome Stop-Off Locquers and Compounds • Unichrome Dips Unichrome Rack Coatings • Anozinc* Compounds • Unichrome Strip *Trade Mark Reg. U. S. Pat. Off.

Chicago 4, III, Dayton 2, Ohio Los Angeles 11, Cal.

51 East 42nd St., New York 17, N. Y.

CAL ENGIN

The Interchangeable Plug und Jour may in Masoneilan Percentage Piston Control Valves Gives You

5 VALVES IN ONE

Percentage Pistens and Seat Rings

Because the trim size of

Masoneilan Percentage Piston Valves is interchangeable, you can easily change any valve from one size to another by merely replacing the plug and seat ring. Since trim sizes are available in $\frac{34''}{2''}$, $\frac{36''}{36''}$, $\frac{14''}{4''}$, and $\frac{16''}{8''}$, it means that you get 5 valves in one by simple conversion of the trim.

The flow range of orifice sizes of from $\frac{3}{4}$ to $\frac{1}{8}$ inch represents a relative capacity ratio of 36 to 1. The capacities of the Percentage Piston Valves have been selected and spaced for the primary purpose of covering the desired range of flow with the minimum number of trim sizes.

In addition to interchangeable trim, these control valves give you the excellent flow characteristics of larger size valves even down to the $\frac{1}{8}$ " size. The orifice diameter has been held to a minimum to reduce the errosive effect of high velocity fluids. Forged steel globe type body provides unusually large capacity. Investigate Masoneilan Percentage Piston Control

Investigate Masoneilan Percentage Piston Control Valves. Catalog 301 gives complete information on construction, characteristics, selection and other important data. Write for your copy.

MASONEILAN

MASON-NEILAN REGULATOR COMPANY 1197 Adams Street, Boston 24, Mass., U.S.A.

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No. 38

Air-to-Open

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Air-to-Close



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IN THE WORLD

ONE recognized standard



THE COTTRELL PROCESS OF ELECTRICAL PRECIPITATION

FOR GAS CLEANING, smoke abatement and removal of dust, fume, tar and other suspended matter from gas, there has been one universally accepted process for more than thirty years. In answer to your special problem, a Cottrell installation incorporating this rich experience in research, development and worldwide operation means the complete fulfillment of your requirements.

RESEARCH CORPORATION

NEW YORK 17: 405 LEXINGTON AVENU CHICAGO 3: 122 SO. MICHIGAN AVENU

CHEMICAL ENGINEERING • MARCH 1947 •

HEAT AND CORROSION RESISTING CASTEINGS

Midvale manufactures two groups that find multiple uses in many important industries. For instance-the great chemical and steel industries, the automotive industry and oil refineries with all their feeders, depend upon such characteristics in hundreds of parts and items. To name a few-tubes, pump parts, supports, hangers, beams, boxes, pots, covers, trays, liners, grids, pans, retorts, baskets, fixtures, holders and spacers for carburizing, annealing, normalizing and malleabilizing purposes. Design proved by non-destructive inspection, with Midvale's penetrating 2,000,000 volt X-ray tube.

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

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Designed, Cast and Machined to rigid specifications

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DUCT

Stainless Steel POPSICLE* filling machine, automatically measures and delivers exactly enough fluid POPSICLE* liquid to make 24 confections simultaneously. The design features extreme sanitation; great

accuracy; easy complete assembly and disassembly for thorough cleaning.

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



STAINLESS STEEL Measuring Valve... for the production of "Popsicle"*

by COOPER ALLOY

The Measuring Valve illustrated is typical of the many Stainless Steel items produced by Cooper Alloy for the process industries. It combines sound cast-

FOUNDRY CO. 🕰

POPSICLE

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Specialists in Corrosion Resisting Stainless Steel . . . for a Quarter of a Century

JERSEY

THE COOPER

ing practice; accurate machining and lapping; and sanitary polishing.

CHEMICAL ENGINEERING • MARCH 1947 •

HOW TO GET LONGER SERVICE FROM GLOBE AND ANGLE VALVES



Re-Grinding Type for occasional throttling service



Semi-Plug Type for frequent throttling service



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Full-Plug Type for severe throttling service

READING-PRATT & CADY





Reading-Pratt & Cady Distributors Are Located in Principal Cities Send for this file-size folder Just ask for DH-1032

THESE THREE TYPES of union bonnet bronze globe and angle valves could be called "good, better, best." And if you are interested in ultimate costs, it will pay you to select a better valve than the service requires. Here's why:

The semi-plug type costs one-third more than the re-grinding type—lasts four times as long. The full plug type costs two-thirds more than the re-grinding —lasts eight times as long.

These figures are, of course, approximate. But they do serve to illustrate a point. And the point is -get in touch with your Reading-Pratt & Cady distributor for bronze globe and angle valves.



READING-PRATT & CADY DIVISION AMERICAN CHAIN & CABLE



334

. , . and put an end to its excessive prices

WHAT you're paying for dust is probably a lot more than it would cost to get rid of it. Dust—even invisible dust—is a constant drain on efficiency, product quality, lighting, worker morale, plant maintenance. Eliminating it costs relatively little for initial investment, practically nothing for operation.

Full-Plug Type

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Let Pangborn-world's largest manufacturer of dust control and blast cleaning equipment-survey your plant to uncover costly "dust pockets". A "Dust Pocket Survey" is made by qualified engineers, with no obligation. Also write for Bulletin 909A which describes cost-cutting opportunities with dust control and exclusive features of Pangborn dust control equipment. Address Pangborn Corporation, 283 Pangborn Boulevard, Hagerstown, Md.

TURNS DUST LOSSES

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PANGBORN CORPORATION

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HAGERSTOWN, MARYLAND

80 TONS OF EFFICIENCY

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A BARRAN BARRAN

Detail view of the electrical opening and closing limiting mechanism showing head in open position.



Center head clutching mechanism which permits closing ends separately or together.

Eastern Sales Representative Henry E. Jacoby, M. E. 205 East 42nd Street New York 17, N. Y. Phene: MUrray Hill 4–3518 Western Sales Representative B. M. Pilhashy 1033 Merchants Exchange Bidg. San Francisco 4, Calif. Phone Do 0375 SPERRY

• Eighty tons of efficiency for the manufacture of malt extract awaiting shipment at the Sperry plant, Batavia, Illinois. This Filter Press, one of the largest on record, measures 42 feet in length and stands eight feet high. Filter plates measure 61 by 71 inches.

It is typical of Sperry's ability to build *exactly* the right filter press for the job... from the smallest laboratory unit to the largest industrial installation.

The design and manufacture of every Sperry press is based on a thorough study of the problem...plus over a half-century of experience and research in all types of industry. Why not put a Sperry engineer to work on your filtration problem? There's no obligation.

D. R. SPERRY & COMPANY BATAVIA, ILLINOIS Filtration Engineers for Over 50 Years



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CHEMICAL ENGINEERING • MARCH 1947 •

C L E A N COMPRESSED AIR

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For agitating, blending, or pressure displacement. Where a process requires air it may be insured against contamination with a Nash Compressor, because only clean air, free from dust, heat, or oil, is delivered. One moving part, no pistons, no internal lubrication. Ask for Bulletin No. 236.

THE NASH ENGINEERING COMPANY SOUTH NORWALK, CONNECTICUT, U. S. A.



opening new doors

Research is finding Chlorine a useful key to the synthesis of other chemicals, especially organic materials. Wider and wider becomes the range of the services that Chlorine renders to the development of our civilization. It is an important agent in the manufacture of the newer insecticides, bactericides and weed-killers—and it's finding new uses in the fields of solvents, protective finishes, synthetic detergents and plastics. Chlorine continues to be important for sterilizing food equipment . . . bleaching pulp, textiles and other products. Wyandotte Chemicals Corporation—one of the world's great producers of Chlorine—is alert to the promise of this chemical. So users of Chlorine can continue to look to Wyandotte for expert, up-to-the-minute service. A request for advice about the adaptability of Wyandotte Chlorine to your purposes will receive careful attention.

WYANDOTTE CHEMICALS CORPORATION WYANDOTTE, MICHIGAN . OFFICES IN PRINCIPAL CITIES

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There is a size and type LOUIS ALLIS electric motor for every industrial requirement.

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Your Electric Motor Requirements

The day of trying to use a standard motor for a special job is about over.

Machinery designers, and production managers have learned that it is much more efficient and economical to obtain a motor with exactly the electrical and mechanical characteristics required to perform a specific job than it is to try to doctor up a standard "shelf" motor to do the job.

Speed and horsepower are no longer the major measuring stick of motor requirements—they are merely incidental to the many other characteristics available in electric motors today.

For over forty years we have been developing special motors for special jobs—our engineering department has a wealth of experience along this line—

Our engineering development department has created many outstanding — perhaps revolutionary — improvements in electric motor design, construction and performance — motors that have given a splendid account of themselves on highly specialized jobs for many years.

The same careful and exacting design, engineering and construction that have made LOUIS ALLIS special motors famous for their dependability is also reflected in all Louis Allis STANDARD motors.

Our engineering development department will welcome the opportunity of discussing your special electric motor problems with you.

THE LOUIS ALLIS CO., MILW AUKEE 7, WIS.



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Just west of Beaumont, Texas...



Just 25 miles southwest of Beaumont, Texas, is the gasoline absorption plant of the McCarthy Oil and Gas Corporation. Here natural gas is gathered

from the field, compressed and then put through an absorption plant where the natural gasoline is extracted. In this plant, ten 8-cylinder (800 BHP) Clark Right Angle Gas-Engine-Driven Compressors are equipped with the proper compressor cylinders to give three stages of compression.

McCarthy Oil and Gas Corporation selected these Clark units for their absorption plant at Winnie, Texas, after a thorough field investigation to determine the unit that was most applicable to their particular problem, especially in relation to:

1. Reliability of operation. 2. Low installed cost per horsepower. 3. Low operating cost, and 4. Low maintenance cost.

For complete information on Clark Compressors and Clark engineering service for any type or size of installation, write, wire or phone:

CLARK BROS. CO., INC., OLEAN, NEW YORK New York • Tulsa • Houston • Chicago • Boston • Washington Los Angeles • London • Caracas, Venezuela • Bucharest, Roumania



SETS THE PACE IN COMPRESSOR PROGRESS



Write your ownicke

BUY OR LEASE ENTIRE PROPERTY . . . OR TH PART YOU WANT.

2 BUY OR LEASE DESIRED BUILDINGS . . . SEPA RATELY OR IN GROUPS . . . WITH OR WITHOU EQUIPMENT.

3 BUY PRODUCTION EQUIPMENT AS FUNCTIONA UNITS . . . FOR ON-SITE OR OFF-SITE USE.

Here is an excellent opportunity for a chemical producer to acquire top-quality equipment that may be utilized in place or removed for use elsewhere.

Manufacturers of a variety of products can acquire and profitably put to use, separately or in groups, these well-located factory buildings which are in ready-to-use condition.

DESCRIPTION OF FACILITY

LAND: Approximately 830 acres, including approximately 295 acres on which the docks and buildings are located, part of which lies west of U. S. Highway No. 31; approximately 510 acres of improved land for expansion purposes or outdoor storage are located east of U. S. Highway No. 31. There are also 5 brine well sites, of 5 acres each, connected with the plant by underground pipe lines.

LOCATION: The site, fronting on Pere Marquette Lake and adjacent to U. S. Highway No. 31, is about 3¼ miles from the downtown section of Ludington, Michigan.

UTILITIES: Water: Processing water and that for fire protection, is pumped from Pere Marquette Lake. The water from this lake is used without treatment except that for boiler purposes. The distribution system is designed for a maximum demand of 15,000 gallons per minute at 80 pounds pressure.

Sanitary Sewage is discharged through sewer lines to a final lift station on the site where pumps with capacity of 260 gallons per minute discharge the sewage to the City of Ludington Sewage System.

Power Facilities: Included is a modern steam-electric generating plant in which are installed the following:

Two 6,000 kw turbogenerators, 3phase, 60-cycle, 13.8 kv, 3,600 r.p.m., operating steam pressure 400 psi at 700° F, condensing with automatic extraction at 135-165 psi.

Two 250,000 lbs. per hour, each, Riley steam generators, operating steam pressure 400 psi at 700° F, pulverized coal. Proposals will be considered for the disposal of the power facilities in whole, or in such parts as of themselves constitute complete functional power producing units, for use in place or for removal at the purchaser's expense for his own use elsewhere.

Gos is used for testing purposes in the plant laboratories. This is manufactured gas furnished by the Michigan Consolidated Gas Company.

TRANSPORTATION: Railroad: There are spur tracks on the Plancor site from the Pere Marquette R. R.

Highways: The plant is connected by paved streets, in the City of Ludington, Michigan, with main highways.

Water: A dock 2,500 ft.long, built on wood piles on adjacent Pere Marquette Lake, provides excellent dock facilities.

EQUIPMENT:

Powerhouse Equipment: Includes Steam Generating Units, Coal and Ash Handling Systems, Dust Collectors, Water Treating Systems, Turbine Generators, tanks, heaters, compressors, etc.

Evaporator Equipment: Tanks, filters, evaporators with condensers, crystallizers, agitators, mixers, pumps, presses, motors, instruments, etc.

Lime Dorr Equipment: Dorr thickeners, classifier mechanism, hydroseparator mechanism, turbo-mixer, slurry mixers, tanks, reducers, bucket elevator, pumps, etc.

Moore Filter Plant Equipment: Steel filters, clarifier mechanism, thickener mechanism, tanks, blowers, agitators, washer, drying tumbler, extractor, heaters, trucks, etc.

Shelf Dryer Equipment: Tanks, complete stoker units, including: grate stokers, ash handling system, coke bunkers, conveyers, elevators, scales, rotary mixers and screens, pulverizers, scrubber towers, etc.

Lime Kiln Equipment: Steel rotary kilns and slakers, conveyers and elevators, scales, hoppers and bins, screens, pulverizers, exhaust equipment, etc. Carbonate Plant Equipment: Tan blowers, mixers, agitators, moto pumps, instruments, etc.

Machine Tools: Drilling, grinding a milling machines, shapers, saws, pr threader and cutter, bending machin hydraulic press, rotary machine, shea and other miscellaneous tools.

Cranes: There are numerous cranes a hoists throughout the plant, includis one 150-ton overhead crane, span 9 one 25 and one 10-ton traveling cran with spans of 50' and 47' respective two 2-ton and two $1\frac{1}{2}$ -ton monora

Also items of Laboratory and Test Equipment, Furniture and Fixtures, ; Portable Tools.

BUILDINGS: The more important larger buildings are: Office Buildi approximately 14,800 sq. ft.; W houses, 12,900 and 14,200 sq. Repair Shop, 39,000 sq. ft.; Pov house, 67,200 sq. ft.; Shelf Dr 27,100 sq. ft.; Moore Filter, 43,100 ft.; Evaporator Building, 20,000 sq. Lime Kiln Building, 17,300 sq. ft. M smaller buildings and structures.

CREDIT TERMS may be arran Consideration will be given prior for small business. War Assets Adm tration reserves the right to reject an all proposals.

Final written proposals for the sal lease of this facility will be received the War Assets Administration, Offic Real Property Disposal, P. O. Box 1 Detroit, Michigan, until April 16, 19 10:30 A.M., E.S.T., at which time proposals will be publicly opened read at the address below. Proposals should carry on the outside of sealed, velopes, the identification: "Sealed posal for Plancor 477—Dow Magnes Corporation".

Information on how to prepare submit a proposal may be obtained f any War Assets Regional Office.

Willicket on this Superb Plant (NEAR LUDINGTON, MICHIGAN)

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et Equipment L againers 13.00

Features

Excellent plant layout—permanent, readily-adaptable buildings—strategic location regarding markets, raw materials-rail, water, highway, air transportation.



Most of these buildings, if not utilized for the purposes originally intended, could be converted to varied manufacturing and industrial purposes.



For additional information about this property address: **ASSETS ADMINISTRATION** WAR GOVERNMENT OWNED OFFICE OF REAL PROPERTY DISPOSAL SURPLUS PLANTS 19TH FLOOR, UNION GUARDIAN BUILDING DETROIT, MICHIGAN 1053-T

MEMICAL ENGINEERING . MARCH 1947 .



The corrosive liquids and vapors passing through heat exchangers, condensers and evaporators in petroleum refineries and chemical plants are a constant threat to continuous operation because of the possibility of premature tube failure. Aside from interruption in service, leaky tubing may involve product contamination, injury to personnel and equipment, and, of course, the expense of replacement.

Bridgeport considers the question of service life so important that a consistent program of corrosion research is maintained, involving extensive laboratory work as well as actual field and service tests to help customers obtain longer tubing life.

Although Bridgeport's tubing is used in thousands of plants – i.e., Duplex Tubing for ammonia refrigeration; Arsenical Admiralty in oil refineries; Arsenical Muntz* for severe sulfur corrosion; Cuzinal (aluminum brass) for resisting air impingement corrosion; Duronze IV** (aluminum bronze) for hot brine and seaboard power plants; Cupro Nickel for high water velocities, etc. – each corrosion problem is considered individually. Bridgeport's Technical Service Department works closely with customers in solving corrosion problems and trying out test lots of tubing and corrosion test specifications under actual operating conditions.

Contact the nearest Bridgeport office for this service, and write for free copies of Duplex Tubing Bulletin No. 746 and the 112-page Condenser Tube Manual. *Reg. U. S. Pat. No. 2118688 ** Reg. U. S. Pat. No. 2000

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This information is not intended for use as a basis of negotiations. The Corps of Engineers reserves the right to reject any or all proposals.

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D 22	0.07 Max.	1.25	0.75	19.50	9.00			75,000	36,000	50	135
D 22-M	0.07 Max.	1.25	0.75	19.50	9.00		Se. 0.25	80,000	40,000	45	160
D 22-XM	0.07 Max.	1.25	0.75	19.50	10.00	2.25		82,000	42,000	50	170
D 23	0.20 Max.	1.25	0.75	19.50	9.00			75,000	36,000	45	140

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LEBANON CIRCLE (L) 22 AND 23

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Right:—"Varec" approved Internal Safety Valve, Fig. No. 507, with Flanged Connections.

Below: — C u t a w a y v i e w o f "Varec" approved Internal Safety Valve, Fig. No. 506, with Screwed Connections.

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Drawing above shows how sun pinion, idler and ring gears mesh in a planetary system. Gears are of heat treated steel, and mounted entirely on ball or roller bearings. The sun pinions each mesh with three equally spaced idlers, thus reducing pitch line velocity, noise and wear. Gear ratios cover a range of 4 to 1 up to 106 to I, with sizes up to 100 H.P. Efficiences as high as 98% are obtained.

This widely used Unit is distinctly superior to the "old spur gear type" Speed Reducer-and has many advantages over parallel shaft reducers. Compactness and ruggedness are inherent in the Planetary form of gearing (see illustrations herewith)-and it is well suited for installations where space is limited-where neat appearance is desired—and where a simple base plate design is preferred; then too, it is very well balanced and neat in appearance.

Also available in Double Reduction Units







Industrial Gears and Speed Reducers **LimiTorque Valve Controls** IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

CHEMICAL ENGINEERING • MARCH 1947

for **PROVEN RESULTS** specify McGRAW-HILL Mailing Lists

You can save time, avoid needless expense, increase your results by having McGraw-Hill Lists do your mail advertising job!

Three quarters of a century of practical experience is made available to you when you turn your direct mail jobs over to McGraw-Hill. And these seventy-five years of leadership in the development and perfection of lists assure you the maximum results at the lowest cost per order or inquiry.

Those who are acquainted with mailing lists know that year-after-year acceptance of lists does not come by chance or luck. Accepted lists, like McGraw-Hill's, hold their places by merit alone. Nor does success one day guarantee success the next. Vigilant eyes must constantly add new names, delete, change, check, recheck, etc. Inferior lists are dropped as soon as shortcomings are noticed . . . "good lists" yield to better lists.

For seventy-five years expert list users have preferred McGraw-Hill by long odds. No matter how few names you use---whether your business is large or small---the best lists, McGraw-Hill Lists, are the most economical in the long run.

The world-wide reputation McGraw-Hill has earned as builders of the finest mailing lists was born of constant research in our office and in the field—constantly adding



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office and in the field—constantly adding new names . . . developing new markets, new avenues of revenue for direct mail list users.

McGraw-Hill Mailing Lists are built —and constantly maintained—to provide, as accurately as humanly possible, complete rosters of the industries we serve.

Investigate their tremendous possibilities in relation to your own product or service. Your specifications are our guide in recommending the particular McGraw-Hill lists that best cover your market. When planning your industrial advertising and sales promotional activities, ask for more facts or, better still, write today. No obligation, of course.

Direct Mail Division, McGraw-Hill Publishing Co. 330 West 42nd Street, New York 18, N. Y.				
Please send me, at no cost, mailing list information that will cover my markets.				
Name Title	1			
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City and State				
Product or Service				

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"PENNSYLVANIA" SERVICE APPLICATIONS

"Pennsylvania" STEEL BUILT Crushing Machinery is specialized for the Primary, Secondary and Finer reductions of Industrial Minerals, Ores, Refractories, Heavy Chemicals, Cement - Making Materials,

Limestone, Agstone, Burned Lime, Gypsum Rock, Chalk, Plastics, Tankage, Bituminous Coal,—with special types for breaking down agglomerated Chemicals for processing.

"PENNSYLVANIA"

ARMORWELD SINGLE ROLL CRUSHER

Powerfully **STEELBUILT** with wide reduction ratios, ARMORWELD Series Single Roll Crushers are specialized for small Primary and heavy Secondary reductions of Industrial Minerals, Ores, Cementmaking Materials, Limestone and Gypsum Rock. to sizes efficient for further processing.

Heavily welded steel unit frame construction, patented toggle release for tramp iron protection, —and quick adjustment for product sizing,—are outstanding characteristics of these modern "Pennsylvania" Single Rolls.

Six (6) sizes

Capacity range 50 to 300 tons hourly.



Developed originally for the reduction of abrasive materials to granular products, by smashing impact. "Pennsylvania" REVERSIBLE Impactors are rapidly finding broader applications.

These REVERSIBLE Impactors make secondary reductions, in either closed or open circuit, to sizes for efficient grinding and other processing, on materials listed above under Service Applications.

Absence of cage attrition,—symmetrical wear on all internal parts, and quick accessibility, sharply cut maintenance cost and reduce power demand.

Fifteen (15) sizes.

Capacity range 5 to 500 tons per hour.

OUR LABORATORY TESTS CLOSELY REFLECT COMMERCIAL RESULTS. FORTY YEARS' EXPERIENCE - AT YOUR SERVICE

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This housing, furnished to the Massachusetts Institute of Technology for research work, is indicative of the versatility, skill and experience of Downingtown Iron Works, Inc. in handling metal fabrication.

The Genetron (Housing for high or variable voltage Electro-static Generator) is 5'6'' I.D. x 16'5'' high—tested for 400 pounds Working Press. The shell and elliptical head are of 1'' A.S.T.N. A-212 Firebox quality steel having a minimum tensile strength of 70,000 pounds. The $6\frac{1}{2}''$ finished thickness) base is flat for easy accessibility in mounting internal and external equipment. It is to be used in Research-Nuclear Physics for the study of high intensity x-ray beams.

Downingtown Iron Works, Inc. has, for more than 30 years, specialized in the fabrication of metals. We are fully equipped to handle complete jobs in the correct metals and methods of construction required to provide absolute satisfaction in operation. Engineering consultation is available to aid you in plans and specifications for your difficult jobs.

We also maintain a Heat Transfer Division under the direction and supervision of men thoroughly trained and experienced in this field. Consult us about your heat transfer problems.



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Worthington Offers the Broadest Range of Standard Corrosion-Resistant Pumps in the U.S.



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Type HBLC (Worthite) 2-stage, high-speed, high-pressure, centrifugal pump, suction pressure only on stuffing box.

Select Worthington corrosion-resistant pumps for chemical and process services. You'll find the right pump in Worthington's standard line, which covers the broadest range of capacities and heads in the U.S. These, and all other Worthington centrifugal pumps, are backed by the longest and most extensive



Types CQ and CT (Worthite) and types CR, CU (Antaciron) centrifugal pumps, closed and open impellers. Extremely heavy construction, adjustable thrust bearing.



Types KEB and KED (Worthite) single and double elbow propeller pumps for evaporator and crystallizer circulation.

experience . . . which insures correct application . . . and will help you solve your most difficult pumping problem.

Write us, using this coupon, or telephone the nearest of our 36 district offices and get proof that there's more worth in Worthington.



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ORI	HING	TON	Company

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NAVY TYPE TERMINAL

AND

STUFFING

TUBES

SEALED BID SALE

If you use or sell fittings to take electric cable through walls, ceilings, floors, decks, bulk-heads, housings, tanks, etc., here are items you can use. The component parts are made of Brass, Steel, Bronze or Aluminum and may be adapted to the production of a variety of industrial equipment. Best quality (used for battleships and submarines during the war) and at a price you set yourself. \$1,200,000 worth of these fittings will be placed on sealed bid sale in March. Make sure you have an opportunity to bid. Write today to each of the WAA offices listed below and ask to have bid offering lists mailed to you. Each of the listed offices will be conducting its own sales. You have 12 chances of being low bidder.

List of WAA offices conducting sales of Navy Type Terminal and Stuffing Tubes during March:

Atlanta • Birmingham • Boston • Los Angeles • Minneapolis • New York Portland • Richmond • Philadelphia • San Francisco • Spokane • St. Louis

NO PRIORITIES NEEDED

OFFICE OF GENERAL DISPOSAL

WAR ASSETS ADMINISTRATION

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia • Portand, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Tulsa



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The War Assets Administration is today the world's largest single supplier of valves and fittings. For instance, you can buy those hard-to-come-by valves and fittings for water, oil and steam lines from *any* WAA Regional Office and, more important, you can get delivery NOW. Prices are so low that extra profits are practically assured either on re-sales or installation jobs. Purchases must total \$300 or more. All items offered subject to prior sale.

> Valve sizes: ½" to 24" Fittings sizes: ¼" to 36" Pressure ranges: 100 lbs. p.s.i. to 3000 lbs. p.s.i.

While every Regional Office has a supply of valves and pipe fittings, the largest inventories are located in these cities:

VALVES

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San Francisco Portland, Oregon Nashville Philadelphia New York

All valves and fittings are sold under existing priority regulations of WAA and of the National Housing Expediter. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area, and then to purchase the materials offered herein. EXPORTERS: Your business is solicited. If sales are conducted at various levels you will be considered as a wholesaler. Any inquirles regarding export control should be referred to Office of international Trade, Department of Commerce, Washington, D. C.

See our display booth at Western Metal Exposition and Congress Show at Oakland, California, March 22 to 27, 1947.

OFFICE OF GENERAL DISPOSAL



WHA STIS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock Los Angeles • Levisville • Minneopolis • Nashville • New Orleans • New York • Ornaha • Philadelphia Portland, Ore. • Richmand • St. Louis • Sals Lake City • San Antonia • San Francisco • Seattle • Spokane • Tulsa I II IL



FOR SALE OR LEASE ON SITE ... in whole or in part

Modern, high-quality equipment designed for daily production of 140 tons ACETIC ACID and 720 tons ACETIC ANHYDRIDE

This facility, identified as "Plant A" of the Holston Ordnance Works is located about one mile south of downtown Kingsport, fronting on the South Fork Holston River and adjacent to U.S. Highway No. 81. It consists of approximately 94 acres with various manufacturing and processing buildings aggregating a total floor area of approximately 540,000 sq. ft.

The principal buildings are: Acid Concentrator, 46,000 sq. ft.; Acid Making, 8 floors, 25,000 sq. ft.; Catalyst, 3,800 sq. ft.; Two Anhydride Making, one of 92,000 sq. ft. and the other 49,000 sq. ft.; Anhydride Refining, 8 floors, 55,000 sq. ft.; Steam Plant, 55,300 sq. ft.; and Refrigeration Plant, 13,000 sq. ft. Remainder of buildings include: Office, Laboratory, Storage, Pump House, Maintenance, etc. Plant is completely equipped for the

manufacture of the chemicals mentioned above. Included are such items of production equipment as: catalyst units, preheaters, condensers, coolers, exchangers, vacuum jets, desuperheaters, refrigeration units, boilers, furnaces, decanters and overflows, coal and ash-handling systems, aluminum and wood tanks, etc.

NOTE: The Processes and Much of the Equipment **Are Subject to Private Patent Rights**

Also included in this offering, for use in place, are: lead-in electrical transmission line, substation, transformers, switch frame, process steam boiler, plant (coal-fired), capacity 970,000 lbs. per hr. at 400 psi and 575 degrees.

Data herein are necessarily abbreviated and are not intended for use as a basis for negotiation.

Final written proposals for the purchase or lease of "Plant A-Holston Ordnance Works" in its entirety, or any portion thereof, will be received by the War Assets Administration, Office of Real Property Disposal, P. O. Box 1172, Nashville, Tennessee, until 11:00 A.M., C.S.T., Monday, March 31, 1947, at which time all proposals will be publicly opened and read. Information on how to prepare and submit a proposal may be obtained from any War Assets Administration Regional Office.

> CREDIT TERMS may be arranged. War Assets Administration reserves the right to reject any or all proposals. For complete details address:

ISTRATION OFFICE OF REAL PROPERTY DISPOSAL NASHVILLE, TENNESSEE

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OWNED **SURPLUS PLANTS**

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WANTED CHEMICAL ENGINEER

To do and supervise process design and develop-ment engineering in a small but expanding plant manufacturing fine chemicals. Will have charge engineering methods. Must have engineering education from first class engineering school, thorough training in organic and inorganic chemistry, and at least 5 years experience in synthetic chemical manufacturing. Industrial engineering education or experience desirable. Location in northeastern Illinois, fitty-five miles from Chicago, Good salary to right man.

P-996. Chemical Engineering 520 North Michigan Ave., Chicago 11, III.

WANTED CHEMIST

Here is an excellent opportunity for an experienced chemist for good position with a wood preserving organization. The ability to head a department is necessary and a background of research relative to product improvement and market development is desired. Salary is open, dependent on experi-ence and ability. Include complete details in first letter. Replies are confidential.

P-101, Chemical Engineering 520 North Michigan Ave., Chicago 11, Ill.

RESEARCH DIRECTOR EXPERIENCED Electro Chemist—Metallurgist Mowledge of gold alloy solutions essential; Conduct research program for large manufacturer in New York Area Excellent Position & Salary for top all around man. Resume to include age, education, experience & references. P-999, Chemical Engineering 300 West 42nd St., New York 18, N. Y.

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WANTED

EXPLOSIVE CHEMIST: Graduate with Laboratory experience in Dynamite Plant. Location—Western Pennyivania, Permanent position with large organ-ization. In reply give full particulars including educational background, experience and references.

P-102, Chemical Engineering 330 West 42nd St., New York 18, N. Y

WANTED SALES ENGINEER

with experience in chemical engineering plants with filters and centrifugals for the Cleveland area. Selary and incentive. Excellent opportunity with well-known company.

P-128, Chemical Englneering 520 North Michigan Ave., Chicago 11, Ill.

WANTED

CHEMICAL ENGINEER: Experienced in supervi-tion and production of dynamite and nitroglycerin. Location-Western Pennsylvania. Permanent posi-tion with large organization. In reply give full periculars including educational background, ex-perience and references.

P 103, Chemical Engineering, 330 West 42nd St., New York 18, N. Y



CHEMICAL ENGINEERING • MARCH 1947 .

WANTED CHEMICAL ENGINEER

Exceptional opportunity for Chemical Engineer in Exceptional opportunity for Chemical Engineer in process and product improvement and development. Must have industrial experience in manufacture of resins, protein or starch adhesives or similar manufacturing operations. IO years experience de-sirable. Applicant must have thorough knowledge strable. Applicant must have thorough knowledge of chemistry and have demonstrated ability to work effectively with associates. Location east 200 miles from New York City. Give full information including education, experience, references and salary desired in first letter.

P-963, Chemical Engineering 330 West 42nd St., New York 18, N. Y.

CHEMIST OR TECHNICIAN Experienced in latex Rubber Plant near New York City.

Give Full Details, Salary Expected

P-106, Chemical Engineering 330 West 42nd St., New York 18, N. Y.

POSITIONS VACANT

POSITIONS VACANT TWO MEN as technical sales representatives to design, sell, and service Chemical Process Equipment in North Eastern States. In reply give complete technical and personal informa-tion. Haveg Corporation, Newark, Delaware. CHEMICAL AND Mechanical Engineers: For production shift foremen in chemical plant manufacturing anyhdrous ammonia, ammo-nium nitrate, nitric acid, related products. Re-quirements-3 to 4 years' operating experience in allied industries. Permanent position with aggressive Southwestern petroleum company. Good starting salary with excellent opportuni-ties for advancement. P-979, Chemical Engi-neering, 520 N. Michigan Ave., Chicago 11, 111. WANTED: SALES Engineer for West Coast Branch large industrial instrument manufac-turer. Man with instrument experience in process work between 25 and 30 years of age preferred. Must be graduate chemical, me-chanical or electrical engineer and willing to take aptitude test. P-107, Chemical Engineer-ing, 68 Post Street, San Francisco 4, Cal.

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18, N. Y. PROJECT ENGINEERS, Chemical or Mechani-cal-to take responsible charge pilot plant design and operation involving both organic and inorganic processes. Background with proc-ess equipment manufacturer desirable. Stable heavy chemical industry in Northeastern Ohio. P-111, Chemical Engineering, 520 N. Michigan Ave., Chicago 11, 111. UNION MECHANICAL and Chemical Engl

Ave., Chicago 11, 111.
 JUNIOR MECHANICAL and Chemical Engl-neers with industrial experience are required as permanent additions to the staff of an indus-trial Development Department located in Minnesota. Program relates to new products from wood. Submit details education, experi-ence, references, salary requirement, and photograph. All replies will be considered con-fidential and will be acknowledged. P-112, Chemical Engineering, 520 N. Michigan Ave., Chicago 11, 111.
 DRAFTSMEN. (EXPERIENCED)

Chemical Engineering, 520 N. Michigan Ave., Chicago 11, 11.
 DRAFTSMEN (EXPERIENCED) — two me-chanical, one electrical, for permanent work in expanding organization. Diamond Alkali Co., Painesville, Ohio.
 FOOD TECHNOLOGIST to investigate process-ing problems in manufacturer of nationally known food products. Location—New Jersey. Group leadership ability essential. Send de-tailed information on education and experience. P-113, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.
 CHEMIST WANTED for fertilizer laboratory in Tennessee. State qualifications, age and salary expected. P-114, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.
 PRODUCTION SUPERVISOR: Chemical Engi-neering Graduaté. Minimum 3 years' produc-tion experience. Must have ability to plan and organize work and train subordinates. Please sive details of personal history, education, ex-perience, and approximate salary. Location— Baltimore, Maryland. P-116, Chemical Engi-neering, 330 W. 42nd St., New York 18, N. Y.

DESIGNERS

MECHANICAL . STRUCTURAL With experience on Design and Lay-out for Construction and Mechanical Installation of

Commercial and Industrial Buildings including Chemical Plants, Power Plants and Laboratories. Air Conditioning, Pressure Vessels and Especially Process Piping.

Wanted for work in our Cleveland, Houston or New York Offices.

Lengthy employment, with good salary, for those who qualify. Send complete resume stating ex-

perience, education, salary require-ment and date of availability to either of the following addresses:

THE H.	K. FER	GUSON C	OMPANY
	Fergu	son Bidg.	
East 11th	& Waln	ut, Clevelan	d 14, Ohio
	1054 M.	& M. Bldg	
1 Main St	treet	Houst	on 2, Texas
19 Rector	Street	New York 6	, New York

WANTED

ENGINEERING DIRECTORS

Chemical Engineers or Mechanical Engineers thoroughly experienced in design and construction of chemical or refinery plants. Salary, up to \$25,000. Many other positions open for Engi-neers with experience in the Chemical Industry.

FRANKLIN EMPLOYMENT SERVICE 225 S. 15th St. Phila. 2, Pa.

POSITIONS VACANT

CHEMICAL ENGINEER: To conduct studies of present plant operations and individual items of equipment. Operate pilot plants and pro-duction equipment on new processes. Capable of preparing good and complete reports. Some experience in process engineering desirable, Please give age, education, details of experi-ence, and approximate salary. Location-Baltimore, Maryland. P-115, Chemical Engi-neering, 330 W. 42nd St., New York 18, N. Y.

SELLING OPPORTUNITY OFFERED

SELLING OPPORTUNITY OFFERED WE WISH to add a sales engineer to our field staff. He must be a graduate mechanical, chemical or sanitary engineer with at least 6 years field selling experience. Age preference between 30 and 40. We manufacture a heavy industrial specialty, frequently designed to order. It is sold throughout industry. The man selected will spend several months in New York in training and will then be assigned briefly to a territory for further experience. Then, depending upon his development he will be assigned a territory of his own. This is an unusual opportunity for a resourceful and hard working man. Send full educational and busi-ness history to: RW-109, Chemical Engineer-ing, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICES

FOR CHEMISTS, chemical and metallurgical engineers, write Chemical Department, Posi-tion Securing Bureau (Agency), 45 John Street, New York. Telephone Cortlandt 7-9650.

EXECUTIVES—Industrial & Sales Engineers. Through our nationwide Service we negotiate for the better positions with well-established, aggressive companies. Your personal require-ments met by individual procedure. Strict confidence assured. Details on request. Jep-son Executive Personnel & Research Service (not an agency), 287 Porter Building, Kansas City 2, Missouri.

City 2, Missouri. SALARIED POSITIONS \$2,500-\$25,000. This thoroughly organized confidential service of 37 years' recognized standing and reputation carries on preliminary negotiations for super-visory, technical and executive positions of the calibre indicated, through a procedure individ-ualized to each client's requirements. Retain-ing fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 260 Dun Bidg., Buffalo 2, N. Y.

(Continued on page 372)

EMPLOYMENT SERVICES (Continued from page 371)

(Continued from page 371) EXECUTIVES \$3,600-\$25,000. This reliable service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if em-ployed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. B, 109 Church Street, New Haven, Conn.

POSITIONS WANTED

ADVERTISING COPYWRITER; experienced, good knowledge production; ads appear in this magazine regularly. Age, 34; college grad-uate, imaginative, likes to work hard; available shortly, excellent references from present em-ployer. PW 117, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.

42nd St., New York 18, N. Y. RESEARCH EXECUTIVE; Ph. D. 36. Wide experience inorganic products and processes, extractive metallurgy, mineral raw materials, development, promotion, sales. Will also con-sider consultant position advising on proposed processes, markets, or research programs. PW-118, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.

St., New York 18, N. Y. CHEMICAL ENGINEER, B.S., 1942, desires position in product application, sales, design or work where technical background is ad-vantageous. Two years experience in pilot plant, organic research, and new product de-velopment. Ex-Naval Officer, now employed, age 26, married. PW-119, Chemical Engineer-ing, 330 W. 42nd St., New York 18, N. Y. CHEMIST FORMER

ing. 330 W. 42nd St., New York 18, N.Y. CHEMIST, FORMER executive, age 55, 30 years diversified experience, analysis, pro-duction, research and development plastics, resins, bituminous and asbestos products, casein, and other industrial products, seeks connection. Good references. Reasonable sal-ary, N.Y. area preferred. PW-120, Chemical Engineering, 330 W. 42nd St., New York 18, N.Y.

N. Y. CHEMICAL ENGINEER, Ph. D.: 12 years pre-eminent experience and qualifications in heat transfer and absorption equipment design and promotion. Capable of establishing manufac-turer in new lines in these fields and develop-ing regional office. Contact with leading users. PW-121, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.

W. 121, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.
CHEMICAL ENGINEER, M. Ch. E. additional graduate work in pure chemistry. 5 years Chemical equipment, design, plant layout and development; 2½ years mechanical design. Seeks position as project engineer or in process development work. Age 32. Married. PW-139, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.
CHEMICAL ENGINEER, 25, B. Ch. E., gradu-ate work in engineering and business. Tau Beta Pi, A. I. Ch. E., single. Experience in or-ganic chemicals from petroleum. 3 years in process development, 1 year in field. Desire position with small company in Mid-west or South. Interested in development or produc-tion, also sales engineering. PW-995, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.

CHEMICAL ENGINEER M. S.-M. I. T.

31/2 years successful sales development and process development in thermoplastics and organ't chemicals. 3 years administra-tive and latioson responsibilities overseas as Naval officer. Tau Beta PI, Sigma Xi. Age 27. Health excellent. Proven ability to present facts effectively, sell ideas. Desires responsible position technical assistant to sales or production executive, or in process development.

PW-997, Chemical Engineering 330 West 42 St., New York 18, New York

EXECUTIVE-ENGINEER

20 years experience including administra-tion and consulting in vice-presidential capacity, director of engineering, super-vision of operations, development, design, construction. PW-998, Chemical Engineering 330 West 42nd St., New York 18, N. Y.

AVAILABLE

Soda Ash and Caustic Soda Expert on up to date production offers services in advisory or permanent capacity. Qualified to establish new plant or to improve existing processes

PW-884, Chemical Engineering 520 North Michigan Ave., Chicago 11, Ill.

POSITIONS WANTED

POSITIONS WANTED CHIEF OF Production and labor relations, 11 years with prominent drug house. Knows harmaceuticals, capsules, vitamins, tablets. PW-122, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y. CONSTRUCTION MANAGER or General Su-perintendent, Mechanical-Civil Engineer, 44, native American, 25 years diversified, progres-sive, Domestic and Foreign experience, Field Engineering, and Construction Supervision and management including costs, etc., with major companies in refining, power, heavy chemicals, rayon, mass housing, etc., including important Government jobs. Good health. Speak Spanish, Portuguese, German and some French. Avail-able immediately. Prefer Latin America or Europe, PW-123, Chemical Engineering, 330 W. 42nd St., New York 18, N. T. PROCESS ENGINEER, M. Ch. E. 7 years diver-sified experience in design of chemical equip-ment, process development and engineering. Seeks position utilizing above background with central engineering department of pro-gressive Eastern Chemical Co. PW-130, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y. SELLING OPPORTUNITIES OFFERED

SELLING OPPORTUNITIES OFFERED

SWISS CHEMIST, Doctor in Chemistry, seek-ing sales representation for chemical prod-ucts to be introduced into Switzerland. RA-124, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.

INEW YORK 18, N. Y. INDUSTRIAL LINES Wanted: Representa-tives-Disiributors of national manufacturer, located several principal citles, with excellent industrial contacts and coverage, engineering background, anxious to locate one or more ad-ditional items of equipment or materials. Ex-cellent sales results assured. Write Box 312, Church St., Annex, N.Y.C.

FOR SALE

Proven Piani increases for Synthetic Aro-matic Chemicals for perfume and flavor trades. Complete line of perfume formulae. In-quiries invited. FS-991, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y. flavor e. In-

SUPERIOR REPRESENTATION

Sales Executive, Engineer, opening Sales Office, Midtown New York. Can offer intelligent, responsible representation to a manufacturer of process equipment, finished or fabricated materials or equipment sold in the chemical or petroleum fields. Well known in engineering and purchasing circles throughout East. No financing required.





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300 gal

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- ALUMINUM
 ACUUM STILLS, KETTLES, TANKS
 Steam Jack, KETTLES, 20, 25, 30, 50, 60 and 80 gal.
 Closed STOBAGE TANKS, rectangular shaped, 78'x34'x60'', 700 gal. capadiy.
 Closed STOBAGE TANKS, rectangular shaped, 56''x46''x72'', 800 gal. capadiy.
 Closed Jack, agitated Kettles with colls; 1--1,200 gal., 1--900 gal.
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DRYERS

- DURTERS
 2-Buffalo 32" x 90" Atmospheric DOUBLE DRUM DRYERS, M.D.
 2-Buffalo 42" x 90" Atmospheric DOUBLE DRUM DRYERS, M.D.
 2-Buffalo 32" x 72" Atmospheric DOUBLE DRUM DRYERS, M.D.
 2-A. N. 4' dia. x 9' long atmospheric double drum dryers complete.
 2-B. & C. 25" dia. x 60" face Atmospheric DOUBLE DRUM DRYERS, m.D.
 2-B. & C. 25" dia. x 60" face Atmospheric.
 2-Direct heat ROTARY DRYERS; 5'X30', %'X5'.
 2-Mission dia atmospheric dia atmospheric.
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ALUMINUM JACKETED

KETTLES 6-"Wearever" 20, 30, 40 gal. 1- 506 gal. with Agitator. 1- 750 gal. with Agitator. 1-1200 gal. with Agitator.

STAINLESS STEEL KETTLES

1-Stainless Steel Kettles 20, 40, 60, 80 gal.

CRYSTALLIZERS VACUUM PAN DRYERS

- Buffovak's 6' dis. Jacketed Pan Dryers or Crystalliners-800 gallon capacity-cast iron-jackets cast integral with

- STAINLESS STEEL TANKS 20-Now 250 Vertical closed Stainless Steel Tanks, 38" dia. 452" teep. 2-900 gal. Vertical closed Stainless Steel Tanks. Steel Tank. I-New 300 gal. Vertical Stainless Steel Tank.

- CHEMICAL ENGINEERING . MARCH 1947 .

SPECIAL PURCHASE

26-Aluminum Jack, KETTLES, 30-gal. cap. 8—Stainless, Jack. KETTLES, 30-gal. can.

VIBRATNG SCREENS

- 1-Robins "Gyrex" 3'x8'6", 2 decks, V-drive and 5 HP motor. 1-Kennedy 3'x7', 2 decks, V-drive and 5
- HP motor. 4_
- -Tyler Hummer, 3'x5' No. 33, two 4'x5' No. 39, single. -Sturtevant 3'x6' Moto Vibo, single deck. all enclosed. 2-
- 1-40"x84" Rotex, single deck.
- 5-UNUSED Robins, "Vibrex" 2'x8', single deck

HYDRAULIC PUMPS

Aldridge Pump Co. Vertical Triplex HY-DRAULIC PUMPS, 2%"x8", equipped with Herringbone Gears, 67.5 gpm. Maxi-mum pressure for intermittent duty 2,200 lbs., for continuous duty 1,800 lbs. Pump and motor mounted on common bed plate. Motors are 75 HP. 3,60,220/440 volts. 1740 RPM. Complete with starting panel, consisting of G. E. motorstarter switch, and capacitor.

Purchased new \$½ years ago. Excellent condition. Available for immediate delivery

MISCELLANEOUS

- 1-6'x6' OLIVER FILTER UNIT, complete.
 3-J. H. Day, Size D. 600-lb. DRY POW-DER MIXERS, M.D.
 2-150 gal. copper steam jacketed KET-TLES.

- 18.
- gal. cap.
 2.-Copper steam jacketed agitated KET-TLES, 1--54" dia. x 42" deep, 300 gals.; 1--36" dia. x 31" deep, 70 gals.
 1.-J. H. Day anger POWDER FILLER.
 2.-Stokes No. 15.
 2.-Colton No. 3 TOGGLE Globule PBESS-ES, for making capsules.
 4.-250 gal. closed GLASS LINED TANKS.
 1.-Day matic Scale six head Capping

- TANKS. 1—Pneumatic Scale six head Capping Machine. Approximately 300 feet of STEEL BALL BEARING ROLLER CONVEYOR, from 17 to 32" widths.



PURCHASED NEW 1942 TO 1944 SOME UNUSED

Available For Immediate Shipment

- 7—Oliver Rotary Continuous VAC-UUM FILTERS, 11'6'' dia. x 18' face, each 640 sq. ft. filtering area. Complete.
- 3-VACUUM PUMPS, Chicago Pneu-matic, duplex, 36" x 36" x 13", each with direct connected 250 HP 3/60/440, 225 RPM synchronous motor with exciter, starting equipment, etc. 6760 CFM at 22".
- American Rotary Continuous VACUUM FILTERS, 12'6" dia. x 2—American 23' long, 10 discs, approx. 2000 sq. ft. filtering area each. Now equipped with steel leaves. Wood leaves can also be furnished.
- 2-Ingersoll-Rand Dry VACUUM PUMPS, 31" x 13" Type ES. 2830 CFM, with V-belt drives.
- 3—COAL PULVERIZERS type E-35, made by Babcock & Wilcox Co. Complete with exhausters and 100 HP 3/60/440 volt motors, full starting and control equipment. Capacity 6000 to 15000 pounds per hour.
- 2-#30-NF all steel HAMMER MILLS, made by Williams Crusher & Pulverizer Co., St. Louis.
- 2-Goslin-Birmingham EVAPORA-TORS, 6-effect, each evaporator having a total heating surface of 58,200 sq. ft. Electronite steel tubes; welded steel bodies. Each evaporator designed to evapor-ate 172,230 lbs. of water per hour from a feed of 588,030 lbs. per hour of soda-alumina solution. Complete with condensers, pumps, motors, controls, instruments, etc.
 - Will split and sell in multiples if necessory
- -6' x 50' Louisville DIRECT HEAT ROTARY DRYER with combus-tion chamber, exhauster, Buffalo air washer for dust elimination.
- 5-Industrial UNIT HEATERS, each 645,000 BTU per hour. motors, fans, etc. With

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- "AMERICA'S BEST **BUYERS**" WANT YOUR IDLE SINGLE ITEMS TO COMPLETE PLANTS SEND YOUR LIST NOW
- LABELING MACHINES

World straightway sutomatic LAB-ELER, M.D.
Weeks McDonald straight line fully sutomatic LABELERS, motor driven.
World and Ermold semi-automatic LABELING Machines.
Burt auto, wrap around LABELER, now set for 1 gt. cans. M.D.
Knapp auto, LABELLERS, 1 ½ gal. and 1 1 gal. cans. M.D.

UNION STANDARD EQUIPMENT Rebuilt-Guaranteed

SPECIAL: Pneumatic Scale Co. Packaging Unit for setting up, Filling and Closing Cartons.

Package Machinery Co. Type CA-2 Foil or Cellophane Wrapping Machine.

- Vacuum Pans with and without heavy duty agitators, sizes 20", 3', 4', 5', 6' Glass-Lined Vacuums.
- Pfaudler 150 gallon and 125 gallon Pan with heavy duty agitator.
- Mixers-F. J. Stokes, J. H. Day, New Era, Hottman, etc. From 2 gallons to 450 gallons, with and without jackets, single and double arm agitators.
- Horix Model HE Stainless Steel and Sanitary Automatic Rotary Filling

OVER 5.000

Machine. Handles up to $\#2\frac{1}{2}$ cans and can be used for bottles up to 32 oz. with minor change in parts. Will fill vinegar, salad dressing, wines, soups with small bits from 50-65 per minute.

- Mullers & Sizers-4', 6' and 9' sizes.
- Roller Mills—Day, Lehman 12" x 30" Kent 9"x24". Soap Mills—N. E. Heavy Duty types.
- Sifters-Rotex 20"x18", Gayco 4' Air Separator and Sifter; Allis-Chalmers Low Head.
- Centrifuges—Tollhurst 26", Crescent Morris 40" Basket Centrifuge.

Jacketed Kettles-With and without agitators, Copper, Aluminum and

AVAILABLE FOR IMMEDIATE DELIVERY

Complete Flour Milling Plant including Mikro 24" Pulverizer, Wolfe Flour

Stainless Steel. Give full require-ments. Vertical Mixers, Hobart, ments. Read, Century.

- Filter Presses-Shriver, Oliver, Sweet-land, Johnson, 12", 24", 30" sizes. Write detailed requirements.
- Wrapping Machinery—Package Machinery. American Machine & Foundry, Hayssen, Gellman and others. Send samples with requirements.
- Ermold Semi-Automatic Labelers World Fully Automatic.
- Fillers-Karl Keifer Rotary Wisco-U. S. Bottlers-Acme C-10-N. E. High Speed Viscous and Semi-Viscous Fillers-Filler - Mch. Co. Stainless Steel Piston-Karl Keifer #10 Piston Filler.

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Grinding Machine, Separators, Conveyoring, etc. CASH FOR MODERN Write—or Wire Collect MACHINES SINGLE IN STOCK MACHINES UNION STANDARD EQUIPMENT CO. OR Send for Our . 318-322 Lafayette Street New York 12, N.Y. Latest Catalog ENTIRE PLANT Cable Address: "CONFECMACH" Hardinge Ball & Pebble Mills—3' x 8"— Tube Mills—5' x 22' STEEL IN STOCK! Rod Mill 4' x 8', Allis Chalmers Rotary Dryer 30" x 40', 3' x 30', 5' x 30', lined STORAGE TANKS SPECIAL Centrifugal Pumps 100 gpm 120' head with A.C. motor, other sizes in stock 4-BAKER PERKINS JACKETED 500 Gallons and larger-MIXERS-#15 JMN-100 GALstorage and Pressure LON-HYDRAULIC TILT-BDtypes. Kettles — mixing 1-PFAUDLER Horizontal Stainless tanks — miscellaneous **Deairing Pug Mill Practically New** Steel Jacketed Tank 6000 Gal. ---Agitated and Insulated. tanks for all types of 12" Centrifuge S.S. Basket 3-STOKES Rotary DD2 Tablet liquids. Hammer Mills—Screens vibrating, rotary Machines M.D. 4—RAYMOND 8" Pulverizers M.D. Air Compressors-Blowers-Exhausters RECONDITIONED TANK CAR TANKS -Exp PF. 7-COPPER COATING PANS 24" -Mikro Pulverizers-12"-24" #11/2 Sturtevant Rotary Crusher, 9 x 15 Champion Write us 30" . 38" 5-WITTEMAN Double Drum Atregarding your needs. 3 Gallon double arm Jacketed Mixer mospheric Dryers-22"x38". 11-NEW STAINLESS STEEL KET-Send us your inquiries. ERMAN-HOWELL & CO. LAWLER COMPANY TLES-100 to 200 Gal. 20-NEW STAINLESS STEEL TANKS 332 So. Michigan Ave. Chicago 4 METUCHEN, N. J. 60 to 500 Gal. WHAT HAVE YOU FOR SALE? Send for our latest bulletins! IMMEDIATE DELIVERY FOR SALE **MACHINERY & EQUIPMENT** 2-Dopp 150 Gal. MD-jacketed kettles I-New S.S. 1500 gal. jacketed agitated tank-15± jacketed 2-12" x 12" Filter Presses, one lead, and one cast LEHMANN CORPORATION (of N. Y.)

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FOR SALE

1-Raymond, 4 roll, low side mill and #11 fan. Good condition. Price very low and one #1 Raymond mill. 4-61/2' x 70' or 60' Kilns or Dryers. W. P. HEINEKEN 227 Fulton St., N. Y.

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Five Roller Finisher

18" Dia. x 48", Water Connections for

Cooling or Heating 3-Rolls Vertical,

2-Rolls Horizontal. Complete with

FS-847, Chemical Engineering

330 West 42nd St., New York 18, N. Y.

drive & motor base.

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FILTERS

5-International and Kieler Disc Filters

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- 5-Oliver 8' x 6' Botary Dewaterers
- 1-Shriver 36" x 36" Rubber Covered Fil-ter Press, 15 plates 2-32" x 32" C.I. Filter Presses, 36 Cham-
- hers 6-Wood Filter Presses, 18", 24", 30", 36"
- 2—American 6'—2 Disc and 4'—4 Disc Rotary Continuous Filters
- 2-C.I. 32" x 32" Recessed, 40 Chambers.
- 4-40" x 40" C.L. P & F 44 Chambers.
- 1—Shriver 24" x 24" Jacketed Filter Press with 30 plates, frames. 5-C.I. Filter Presses, 12" x 12", 18" x 18",
- sq. 8-Oliver 8' x 12', 10' x 18' Botary Con-tinuous Filters.
- 2—Alsop Horizontal Sealed Disc Pressure Filters. SD8-NB20 & SD12-NP30.
- 1-Shriver 36" x 36" C.I. Filter Press, 35 chambers, closed delivery, washing

KETTLES-CRYSTALLIZERS-TANKS

- 3-Buflovak 375 gal. Jacketed Kettles
- 1-Devine 5' x 4' Closed Jacketed Kettle
- 2-Closed Jacketed Steel Kettles, 6' x 5' 6-Pfaudler Glass Lined Kettles, 200 to
- 800 gal 12—Alum. Jktd Kettles, 30, 60, 80, 100 gal.
- 22—Copper Kettles, Jacketed, some with Agitators, 10 to 100 gal.
- -Stainless Steel Kettles, 60, 80, 100, 150, 200, 300 gal.
- 4-Steel Jacketed Kettles, 200 to 600 gal.
- 1-Autoclave, 50 gal. agitated, 400 lb.

1-2' x 4' Horiz. Cast Iron Autoclave

- 2-Buflovak 3' and 6' dia. Crystallizers
- 1-Swenson Walker Crystallizer 40'
- 10—New Stainless Steel Tanks, 100, 200, 300, 500-gal.
- 3—Pfaudler, Alsop Glass-Lined Tanks, 200, 500-gal. 8—Aluminum Tanks, 15 to 50-gal., open
- and closed 3-Piaudler 1000 and 2500-gal. Glass-
- Lined Tanks. 4-Stainless Steel Tanks, 1000 and 5000-
- Gais 5-30" x 72" Pressure Tanks, 200-lb. pres-
- sure.

KILNS-DRYERS

- I—American 42" x 10' Atmospheric Double Drum Dryer.
- 2-Allis Chalmers, 6' x 60' Rotary Dryers 1-Christie 6' x 40' Botary Dryer
- 1-10' x 90' Botary Dryer
- l—Traylor 71/2' x 51' Botary Cooler

We Sell

GUARANTEED

RECONDITIONED

PROCESS PLANT

EQUIPMENT

CHEMICAL ENGINEERING • MARCH 1947 •

- 1-Copper Shell Rotary Dryer, 6' x 17'
- 3-Botary Vacuum Dryers, 18" x 3½, 4' x 10', 5' x 33'
- 2-Buffalo Vacuum Drum Dryers, 24" x 20", 48" x 40"
- 1-Rotary Steam Tube Dryer 6' x 27'6" I-Steiner and Hudson Gas Fired Dryer

- I-Gehnrich Gas Fired Truck Dryer
- 1-22" x 60" Atmos. Drum Dryer
- 1-41/2' x 40' Rotary Kiln or Dryer, jacketed shell. 1-2' dia. x 12' long Rotary Kiln.
- 1-Buflovak 4' x 9' Atmospheric Double Drum Dryer.

GRINDERS—SCREENS

- 6-Day-Robinson Rotex Sifters, 20" x 48", 40" x 84"
- 1-Ball & Jewell #1 Rotary Cutter.
- 3-Bantam Mikro Pulverizers
- 1-Schutz O'Neill 16" Ball Bearing Mill.
- 2-Kent, Ross Double Cage Mills, 18"
- 1-A.C. 36" x 16" Crushing Rolls
- 1-Lehmann, 5 Roll Refiner, 20" x 48"
- 1-Williams Infant Hammer Mill
- 1-Rubber Lined Pebble Mill, 3' x 3'
- 1-Krupp Beater Mill, with 40 HP motor
- 4-Raymond Mills Nos. 0000, 000, 00, 1
- 1-Raymond 3-Roll High Side Mill.
- 1-#5 Superior McCully Crusher
- 1-Tyler 4' x 5' Vibrating Screen 6-Mikro Model Bantam & ISI Pulverizers.

Specials

- 1 4-Baker Perkins 100-gal. Type **JNM Jacketed Mixers.**
- -36" x 36" Plate and Frame Filter Presses.
- 2-Bird 40" Suspended Type Centrifugal, 40 HP, 1800 RPM, NEW.
- -Fletcher 30" Centrifug steel solid basket, motor. Centrifugal, -Fletcher
- 1—ATM 40" Centrifugal, 40 HP motor, 1200 RPM.
- 1—Raymond 3-Roll High Side Mil.
- -Oliver 8' x 12' Rotary Continuous Filters.
- 24—Stokes and Kux Tablet Machines, single or rotary punch, ½" to 4" dia.

MIXERS

- l—Readco 4 gal. Double Arm Stainless Steel Mixer
- 1-Tank, with side agitator, 650 gal.
- 1-Day 30 Gal. Double Arm Jktd.
- 4-Readco, Baker Perkins 100 ga. Double Arm, Heavy Duty, Jacketed Mixers
- 9-New 1000 lb., 2000 lb. Dry Powder Mixers, motor driven
- 3-W. & P. Mixers, 1/2, 9 and 20 gal. 1-Wolfe 4' x 8' Horizontal Powder Mixer.
- 1-Robinson No. 11 Powder Mixer, 3' x 13'
- 12—Portable Electric Agitators, 1/4 to 2 HP, 1750 and 440 BPM.

PARTIAL LIST ONLY. SEND FOR COMPLETE LISTING

EQUIPMENT COMPANY

225 WEST 34th STREET, NEW YORK 1, N.Y.

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EVAPORATORS-PANS-STILLS

- 2-Copper Stills, 150, 400 gal.
- 5-Rectifying Columns, 24", 30", 48"
- 1-Scott Quad. Effect Evaporator, 8'3" dia. bodies, 2500 sq. ft. each effect
- 1-Swenson Quad. Effect Evaporator, evaporating 60,000 lb. water per hour
- 2-Swenson Triple Effect Evaperator, 1250 sq. ft. each effect, steel tubes
- 1-Zaremba Copper Single Effect Evaporator, 5' dia., 500 sq. ft. 1-Swenson Single Effect Aluminum Evape-
- rator, 100 gal. per hour.
- Buflovak Stainless Steel Single Effect Evaporator, 900 sq. ft., 7' dia.
 Copper and Iron Vacaum Pans, 4', 5', 6', 7', 8' and 12' dia.
- 3-Cast Iron Vacuum Pans, 7', 8', 12' dia.
- 1-Harris 7' Copper Vacuum Pan, let cendenser and pump.
- 4—Automatic Water S Stokes, ½, 1, 10 GPH Stills, Barnstoad,

CENTRIFUGALS

- 1-A.T.&M. 40" Suspended Type, 40 HP Motor, 1200 RPM.
- 2—Bird 40" Brand New Suspended Cen-trifugal Solid Basket, 40 hp. motor.
- Tolhurst 32", 40", 48" Self-Balancing Centrifugals, steel and copper bankets, top and bottom discharge.
- 5-12" to 30" Belt Under Driven Centrifugals

4—Sharples No. 16 Centrifuges, S.S. bowls.

MISCELLANEOUS

5-Duriron and Lead Centrifugal Pumps, 11/2" to 21/2"

1-Nash #4 Hytor Vacuum Pump, 60 HP

6—Nash Hytor Vacuum Pumps, Bronze, AL-572.

870 ft. of 18" Boller Conveyor. 4" centers.

10—12" Horizontal Belt Conveyors, from 10' to 80' centers. 1—Pneumatic Scale, 8 Spout Vacuum Filler with Automatic Single Head Capper

1-Anderson Super-Duo Oil Expeller.

2-Kiefer 72 spout Rotary Bottle Washers

10—12" Belt Conveyors, built for any length, motor driven.

-Devine, Marsh Horizontal Pist Vacuum Pumps, from 50 to 200 cfm

4-Tubular Condensers, 25 to 260 sq. ft.

25-Centrifugal, Piston and Rotary Pumps,

Screw Conveyors, 9", 12", 16" up to app. 1000'

We Buy

SURPLUS EQUIPMENT

A SINGLE ITEM

OR

ENTIRE PLANTS!

375

10—Liquid, Paste and Powder Filling Machines

6-Can and Bottle Labelers

1" to 5' discharge

10-Boilers, 100 to 500 HP.

Piston

1-Wilfley 11/2" Haveg-Lined Centrifugal

motor.

Pump

2-Sharples No. 6 Presurtite Centrifuges 2-Sharples No. 6 Super Centrifuges 2-De Laval Nos. 600, 700 Clarifiers

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RING

Guistandburg Orreinings I-Andersen RB ell expeller with 20 HP motor. 3-Telaurit 40" suspended type centrifugal extractor, steel basket; ose with 10 HP motor, two with 7½ HP motor. I-Bharpise sentrifuga, No. 6, with 3 HP, explosion-proof motor. Forgesen Auto. carton gluers and sealers.

AUTOCLAVES

I-Impregnator, famigator or pressure tunnel, 7' x 7' x 30' with raits, vacuum pump and accessories. (-Vertical, 4' x 7'6", forge welded steel, 900 lbs. pres-

1-Vertical, 42" x 24'4", forge welded steel, 600 lbs.

2-Jacketed autoolaves, 3' x 12', 5/8" shell, 100 psl.

COLLOID MILLS

Premier, Eppenbach, Chemi-Colloid. Manton-Gaulin.

CONDENSERS

Bethlebem, Devine, Schutte-Koerting: tubular, tubular vacuum; various sizes.

STILLS

4-Distillation or fractionating columns, copper or steel. (#" to 62" diameter.

DRYERS

- -Apren type single pass conveyor dryers, 18" x 23', metorized.
- 1-Double drum dryer, Black and Clawson, 30" x 60" with assessments.
- **1-Buffale deuble drum, 30" x 90", complete with acces-sories.**
- i-Devine vasuum shelf dryer, 60" x 160", double door, 20 shelvee.
- -Devine vacuum shelf dryer, 42" x 42", with 17 shelves. -Christie dryer, 70" x 40' long.
- -Fulten engineering rotary dryer, 3' x 24".
- -Proctor and Schwartz, steam heated, tray dryer, capacity-80 trays, 10" x 15" complete with acces-sories. -Huhn retary steam dryer, 3' x 13', continuous opera-
- 3-Rotary dryers, from 3' x 30' to 6' x 64'.
- 2-Single drum dryers, or flakers, 4' x 12' and 3' x 6' with accessories,
- I-Devine retery vacuum dryer, 5' x 33', with 35 HP moter and accessories.

FILLER FOR DRY POWDERS

Stokes, Stokes & Smith, National Packaging, Triangle, Edtbauer, J. H. Day, Howes, Sprout-Waldron, etc.

EVAPORATORS

EVAPURATORS I—Blaw Knox triple effect evaporator, horizontal type, 6' x 9', ell steel, Buffalo triple effect evaporators, 600 to 1200 sq. ft. 1-10' copper vacuum pan, calandria type, I-Swenson single effect, and tuminum. I-Zaremba cast iron aingle effect, 10' diameter x 12' high, 200 gallon holding capacity, copper tubes, complete with vacuum pumo and condenser. I-Monel vacuum pan, 44" x 50", lacktad. I-Simplex copper vacuum pan, 26" x 26".

FYTRUDERS

2- Allen 6" and 10" extruder-strainers.

FILLERS

- FILLERS I—Klefer, piston type Visco filler. 3—M & S, 6 piston fillers. 3—Haller retary for julces, 7, 14, and 18 spout. I—Filler Machine Co. filler, stainless, 3 piston. Buffalo and Vol-U-Meter can fillers. Fowler stainless, bleach fillers. FMC straight line and rotary syphon fillers. A—Stoke and Colton hard capsule fillers. New FMC 12Sp. Stainless Vacuum Fillers.

FILTER PRESSES

Shriver, Johnson, Sperry, etc., cast iron, plate and -frame. wood aluminum and lead; open and closed delivery.

KETTLES

I—Full jacketed, 4' x 3', agitated, 200 gallon. I—Lehigh, cast iron, coll heated, 2400 gallon, 6'9" x 9', with agitator. 2—Steel jacketed and agitated, 600 gallon. 4—Jacketed, 200 gallon, steel: closed top, agitated. Arranged for tight and locse pulley. Copper, steel, stainless, Jacketed: some agitated. New stainless kettles, all sizes: prompt shipment.

LARELERS.

- 4—Burt, Standard-Kapp or Kyler all around labelers for cans, glass, etc.
 4—Duplex New Jersey Labelrite.
- 2-Straight line fully automatic labelers, Pneumatic and Weeks-MacDonald,
- 8-World and Ermold semi-automatic labelers for spot labeling.
- i-Vac Spray labeler; handles sizes from postage stamp to 5" square and bottles from ½ oz. to i gallon.

PRESSES

Standard makes, compression, hydraulic, etc., heated platens: please submit specifications.

PUMPS

All sizes of pumps; prompt shipment; state require-ments.



The goats got frisky and we got COFFEE

It was the fact that ancient Arabs first noticed the effect of coffee-plants on their goats that led to the first processing of that delectable beverage.

MILLS

MIXERS

Ali sizes ribbon type, horizontal, ali steel mixers; prompt shipment. I-Simpson intensive mixer, 18" diameter, with double mulicr. I-Day 30 gallon, stainess, imperial mixer. I-Day, 20 gallon, Cincinnatus vacuum mixer, bett drive. 2 Bettern balanci dutha dutha diameter.

- drive. 2—Patterson horizontal double ribbon, 30" x 40" x 84". 2—Heavy duty, jacketed, 9 gallon, double arm, deuble
- gear. I---W & P. 100 gallon, double sigma arm, jacketed.

PACKAGING EQUIPMENT

I-Complete packaging set-up consisting of: Pneumatic-Scale bottom scaler, Stokes & Smith auger filler. Pneumatic top scaler for cartons ranging from 3" x 4" x 1 ½" to 6" x 9" x 2"½". Hoepner automatic, scale weigher, filler, bagger and stitcher for 5 and 10 lb. free flowing materials. Fillers for liquids, paste, powders. Envelope and bag scalers. Wrappers, cartoners, conveying lines.

SIFTERS

3—Tyler Hummer sifters, 3' x 6' to 4' x 5' 2—Combs gyratory sifters, 21" and 25"

- 2-Robinson, no. 31 gyro-sifters, 20" x 69". 3 deok pulley drive.
- I-Wolfe, 20" x 40" sifter, 6 separations, 5 HP
- Cchutz-O'Neilli, 3' x 6', single deck sifter, arranged for pulley drive.
 Rotex no. 3 sifters, 20" x 81".

TABLET MACHINES

35—Stokes and Colton tableting presses, single punch and rotary presses.



FIRST MACHINERY CORP 157 HUDSON ST. NEW YORK 13, N.Y. WOrth 4-5900

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DRYER

1-5'x30' Ruggles Cole double shell dryer, type A.

CENTRIFUGAL PUMPS

- 2-500 GPM, 360' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.
 1-520 RPM, 50' head. DeLaval Centrifugal Pump, 2340 RPM, direct coupled to DeLaval Turbine, 200# pressure, 0-5# B.P.
- 1-
- B.P. -4500 GPM, 135' head, LeCourtney Cen-trifugal Pump, 1800 RPM. -1800 GPM, 250' head, Ingersoll Rand Centrifugal Pump, 1800 RPM. -2000 GPM, 188' head—Ingersoll Rand, direct coupled to 125 H.P. 3/60/2200, 1800 RPM motor.

MOTORS AND ALTERNATORS

- -200 H.P., G.E. Synchronous motor, 3-60-4150, 600 RPM with starting panel, V-Belted exciter, New 1943. -1000 H.P. General Electric Slip Ring Motor, 6600/60/3, 600 RPM, with con-1-200
- trols.
- trois.
 1-700 H.P. General Electric, Type KF motor 2300/60/3 1800 RPM.
 16—Vertical Gear Head Motors, Crocker Wheeler TEFC 10 H.P. 220/440 Volt, 60 cycle, 3 phase, 1745 RPM. Philadel-phia Gear eutput 425 RPM.
 1-New 300 H.P. Westinghouse Type CS, 2200 Volt, 3 phase, 60 cycle, 600 RPM.

AIR COMPRESSORS

AIK COMPRESSION Air Compressor, 100# Pressure at 325 RPM, Complete with Air Receiver. V-Belted to G. E. 30 H.P. motor type K365 360-220/440 Volts, 1800 RPM with compensator.
2.—Schramm gas driven air compressors, Displacement 315 and 210 CFM, at a working pressure of 100#. Portable mounted on pneumatic tires with a spare set of steel wheels complete and self-contained. Purchased in 1945.

TRANSFORMERS

-500 KVA Maloney OISC Transformers, 13,800 volt primary, 460 volt secondary, 60 cycle, single phase with 4-21/2% minus taps on the primary, new 1942.

HOISTS

150 Yale & Towne 2 ton Chain Hoist, 20' lift, Brand New in original crates.

STAINLESS STEEL

VALVES All sized 1" to 6"--Powell, Pioneer and

Alloyco.

ELECTRIC MOTOR DRIVEN WELDERS 300 AND 400 AMPERE GENERAL ELECTRIC-HOBART-LINCOLN LATEST TYPE IN EXCELLENT CONDITION

TANKS

- 30—10'x32' horizontal storage tanks. 1/2" shell, 5%" dished heads. 20,000 gal. capacity.
 - -96"x8" straight side, 4800 gal., verti-cal warming tanks. Complete with 5 H.P. 3 ph. and 60 cy. 220/440 V. totally enclosed fan cooled motor, with Philadelphia gear reducer and agitator.

BUFFALO BLOWERS

13—Buffalo size 40 steel plate Blowers Type R. Flexibly coupled to West-ingbouse motors 25 HP 3/10/220/440/ 1750 RPM. Explosion proof. Type CS 365.

GASOLINE DRIVEN POWER PLANT

-35 KVA gasoline driven power plant, Hercules Motor Corp. engine, 41/4x43/4, Model WXLC-3, Serial No. 180572, with U. S. Motors Generator, Type M-7, 220 volt, 3 phase, 60 cycle, 1200 RPM, Serial No. 2381, complete self-contained with panelboard. Has a center tap, 110 yolts single phase. volts, single phase.

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SKINNERS UNIFLOW SET

-300 KVA Skinner Uniflow Engine Gene-rator Set 150.# LSP 0.5# BP direct con-nected to Burke Alternator 3-60-450 V. 200 RPM with Exciter.

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- AGITATOR DRIVES --General Electric Vertical Gear Reduction. Out-put Speed 5 R.P.M.-7½ HP. G.E. totally en-closed Motor-220 volts-3 phase-60 cycle. -D. O. James Bevel & Spur Gear Angle Drive Size 182 R.A. Ratio 78.2 to 1. Complete with 15 H.P. totally enclosed fan cooled motor 220 volt-3 phase-60 cycle magnetic switch and push button. --Falk Reduction Drive D.A. 1760 rpm 3.54 HP ratie 18.8 to 1 with 5 HP 1760 rpm 220 volt. 60 cycle, 3 phase motor Horizontal unit, and mounted on east iron base.

AUTOCLAVES

- AUTOCLAVES 1-51/2" Dia. x 17" Deep, 2" wall, 3" cover, lead lined, not jacketed. 1/3 gallons capacity. 1-0" Dia. x 20" deep stainless steel, jacketed, mounted on stand for tilling purposes. 5 gal-lons capacity. 1-12" dia. x 244" Vertical Forge Welded Steel 500 lbs. Pressure-1300 gals. 1-4" x 6" Vertical Iron Body Steel Jacketed 200 lbs. Pressure-600 gals. 1-0" 25" Vertical or Horizontal Forge Welded Steel Jacketed, 100 lbs. Pressure.

BARREL PACKER

- I-Motor driven barrel packer, with screw con-veyor, trough and hopper. BLENDERS
- 1-3'6" x 5' Cylindrical Blender with Stands and Drive.
- Drive. BOILERS I-Cope 70 HP Vertical Steam Fire Tube Boiler 125#, I-26" D x 45' long stack for above. Automatic Stoker for above boiler,--without motor. I-Union Iron Works 444 HP Horizontal water tube boiler, 200#W.P.

CONDENSERS

- CONDENSERS 1-Alberger Condenser-Size No. H209-A. 240-5%" copper tubes, 2 pass, C.I. body. 1-#2 Condenser 3' diameter X 8' high, 125-11/4" tubes, steel body. 1-Condenser 3' diameter X 10' high, 125-11/4" tubes steel nody. 2-Billott Ehrhart Iron Body Surface Condenser-two pass 245 sq. 1t. Surface-J/4" brass tubing & tube sheet. 2-30° x7' All Copper Condensers with 11/4" tubes -300 sq. ft. surface. -12" x9" steel condensers with 172 %" 0.D. Cop-per Tubes, 250 st. ft. surface.
- CONVEYORS

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Stock of screw, bucket, dragline and portable convevors.

CRUSHERS

- CRUSHERS 1—Allis-Chalmers 15" x 9" Type "B" Blake Jaw Crusher. Capacity 1" Material 3 tons per hour. -2" Material 8 tons per hour. Eli W. Blake 15" x 9" Eccentric Jaw Crusher. Belt Driven. -Sturtevant 5" x 10" Jaw Crusher capacity 1 to 1½ tons per hour-½" material. -Sturtevant 2" x 6" laboratory Jaw Crusher capa-city 700 to 800 lbs. per hour-½" material. -20" Champion Ice Crusher with 2 HP A.C. motor. DRYERS

DRYERS

3—Bartlett & Snow, Vertical Steel Jacketed 10' dia. x 4' high. Agitators, Reducers, 2 HP Motors.

PARTIAL LISTING ONLY

I—4' Dia. x 32' long Rotary dryer, drive and motor. I—4' Dia. x 9' long Single drum dryer. I—4' Dia. x 12' long single drum dryer.

ELECTRIC TRUCKS

3—Elwell Parker Electric Lift Trucks, Model EG, 4000 lbs. capacity, with Edison Storage bat-teries.

- 4000 lbs. capacity, with Edoks, model EG, teries.
 FILTER PRESSES
 I-12" dia. International Pressure Filter with Nickel Body and Cover-Single plate.
 I-Karl Kiefer Claritying Filter on stand.
 I-24" Sperry Filter Press Chassis only. Two eye orner feed.
 I-24" Shriver I, LOD, Filter Press.
 I-Set of Cast Iron Plates and Frames for Shriver Filter Press-Size 18"-3 Eye Corner Feed. Open delivery.
 I-#12 Sweetland Pressure Filter, 36" dia. 36 leaves.
 I-44" Fress-Size 16"-3 Eye Corner Feed. Open Delivery.
 I-#12 Sweetland Pressure Filter, 36" dia. 36 leaves.
 I-24" Flust type and frame filter press (25 plates and frames).
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TANKS

From 50 gallons to 7000 gallons in stock. All kinds. Also a quantity of mixing tanks, with agitators. Some with motors, others belt driven, Advise your requirements.

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- FURNACES I—Lydon Glass Annealing Furnace with Tempera-ture Controls, Motor, Fan, etc. I—Dispatch Electric Furnace Type C.F. 17-20 K.W. 220 volt—maximum temperature 1250 de-press F—with circulation fan and 3/4 H.P. Motor and controls—18" x 13" hearth.

SPECIAL

Spare Parts for 4% x 16" Hardinge Mill

- Juste Faits for 4/2 X to Faithing mill I—C.I. Sur Gear. I—Forged Steel Pinion. I—2 15/16" Dia. X 10' long C/S, with "V" sheave. etc. 4—C.I. Screw Adj. C/S bearing base plates. I—44" P.D. "C" Sec. 7 groove C.I. Sheave for C/S. I—Complete set WB lining, plates, bars, bolts, etc.

INSTRUMENTS

- INSTRUMENTS |--Weston Model 44 Type C. Revolution Indicator 0-1200 RPM. 2-Brown Electric Pyrometer 1200 degrees to 2600 degrees F. |-Foxboro Recording Thermometer 0 to 100 de-grees F. -Bristof Recording Thermometer. 0 to 200 de-grees F. |-Tytos straight stem, glass front, separable socket thermometer.

KETTLES

- I—8' dia. x 10' deep, iron body with heating coil, agitator and drive, 3000 gal. I—3'6" dia. x 5' deep, steel jacketed, with agitator 350 gals. I—3'6" dia. x 5' deep, cast steel, jacketed, no drive or agitator, 350 gals.
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I=100 Gal. Jacketed Copper with Bottom Outlet and Stands.
I=6'9' x 8'6" deep Iron body, Sulphonator, Propel-ler Agitator, Drive, Tight and Loose Pulley. Capacity 2000 gallons.
I=12" dia. x 3' deep, aluminum lined, Jacketed agitator, drive, tight and loose pulley.
Advise your requirements. Large and changing stock on hand.

Advise your requirements. Large and changing stock on hand.
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1-Raymond #1 Pulverizer with 25 HP motor and 50 HP motor driven fan.
1-#1 Gruendler Hammermill with 7½ HP A.C. motor.
1-#3 MIKRO Pulverizer with motor driven feeder and A.C. Motors.
1-#2 MIKRO Pulverizer with motor driven feeder and A.C. Motors.
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1-#4 Mikro Pulverizer with motor driven feeder and A.C. Motors.
1-#4 Mikro Pulverizer with 25 HP A.C. motor.
1-87 x 8' Hardinge Ball Mill.
1-87 x 8' Hardinge Eall Mill.
1-87 x 8' Hardinge Eall Mill.
1-87 x 9' Hardinge Eall Mill.
1-84 motor 4:0000 Pulverizer-motor driven, complete with dust collector, separator, eyclanes, tubular ducts, steel frame work.
1-#21 Quaker City Hammermill.
1-3' x 3' Abbe porcelain lined mill body, no doors. stands, bearings or drive.

- - MIXERS
- MIXERS 2—22" wide x 22½" deep x 5'3" long mixers with double ribbon spiral agitators. I—Jacketed body Tar Mixer. I—Sprout Waldron Grain Mixer with 12" Auger spiral.
- spiral. 1-25 Gallon Jacketed single shaft agitated mixer.
 - PUMPS
- Large stock of centrifugal, geared, rotary, pressure and vacuum pumps in stock.
- REFRIGERATION UNIT I—American Carbonic Model V5-2 Refrigeration Unit Type CO2—capacity 5 ton. I—Cascade Deep Freeze Unit, complete with com-pressors, motors, control, etc. Minimum tem-perature 120 degrees F. STACKER

STACKER --Barrett Cravens Electric Lift Truck—Type NHB 204, Capacity 2000 lbs.—18" x 24" platform— lift 12', motor 2 HP—220/440 volt—3 phase— 60 cycle—1600 r.p.m. 2--Lewis Shepard Hydraulic Lift trucks with skids.

SEPARATORS I-Dings High Intensity Magnetic Separator. I-30^o Raymond Mechanical Air Separator. Motor driven. I-5 foot dia. Gayco Separator, with motor drive.

VIBRATING SCREENS I-Jeffrey Traylor Type 4 - Vibrating Conveyor

Screen. I-Deister 3' x 6' Concentrator, Type C, single Surface Leahy Heavy Duty Vibrating Screen with I HP motor-440 Volt-3 phase-60 cycle.

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IN STOCK

- 10-Sperry 32" Sq. Iron Filter Presses. -Baker Perkins Jack. Mixer Size 15, 2-100 gals. capacity.
- 4-Rotex Sifters 20" x 81", 3 deck.
- 1-Oliver Rotary Vac. Filter, 8' x 10'
- Sharples #5A Stainless Oil Purifiers 2 H. P., latest type.
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- -18", 30" & 36" Sq. Iron Filter Press, Plates & Frames. 75-
- -Chrystie 80" x 45' Rot. Dryer. Tolhurst 40" Suspended Type Cen-trifugals, Bottom Discharge.
 Tolhurst 26" & 40" Centrifugals, M.D. 14-

- 1-Stokes #149B High Vac. Pump. 1-Hardinge, 3' x 8" Conical Ball Mill.
- 2-Devine #3 Shelf Dryers.
- 5-Rotary Screens, 18" x 72"
- 2-Door 15' Bowl Classifiers.
- 4-Day Pot Ball Mills, 24" & 32" dia.
- 1-Sturtevant 36" Rock Emery Mill.
- 4-Pfaudler Glass Lined Jack., Agitated Kettles, 350 to 750 gals.
- 4-Stainless Steel Jack. Kettles, 40, 60 80 and 375 gals. 2 with agitators. 5-New Stainless Steel Tanks, 100 to 1000 gals., open & Closed top.
- -Alum. Jack. Kettles, 60, 80 & 100 gals. New 40 gallon Pony Mixers. -W. & P. 9 gal. double arm mixer.
- 12--Filter Presses, Iron, Wood & Rubber, 7" to 42" sq.
- 1-Williams #3 "Regular" Type Hammer Mill.
- 1-Hammer Mill, 71/2 H.P. motor.
- 1-Stedman 32" Model A Spike Crusher. 300 ft .---Ball Bearing Roller Conveyor, 12" wide, 10 ft. lengths.
- New Portable Agitators, 1/4 to 1 H.P. New water stills, gas and electric. 15-
- 3-#0000 & #0 Raymond Mills. 1-Sharples No. 6 centrifuge, 2 H.P.
- 1-Blystone 2000 lb. Jack. Horiz., Spiral & Paddle Type Steel Mixer. -250 gal. Lead Lined Kettle.
- 3-Devine Horiz. Vacuum Pumps, 8" x 6" & 4" x 6".
- 1-Wall Vert. Dry Vac. Pump 4" x 21/2" 6-Autoclaves, 200 to 1000 gals.
- 12-Vertical Jacketed Kettles, up to 1000
- gals., some agitated. 15-50 gal. steel Tanks, Nettco Drives.
- 1-250 gal. Copper Jack. Vac. Still. 1-
- -Pfaudler 350 gal. Jack. Agit. Steel Kettles, Copper Lined. 1-700 gal. Copper Lined Vac. Filter.
- 15-Copper Jack. Kettles, 20 to 350 gals.
- 6-Horiz. Mixers, 25 to 250 gals. Single & Double Arm.
- 1-Faust 150 gal. Jack. Spiral Mixer. 2-DeLaval Multiple Clarifiers, #300, #301. Motor Driven.
- Attrition Mills & Disc Grinders up 6-
- to 22" Worthington 12" x 12" x 12" vac. 2-Pumps.
- 1-Schutz O'Neil 20" Pulverizer.
- 2-Double Roll Crusher, 10" D. x 14" F.
- 20-Rotary Centrif. & Triplex Pumps.
- 4-Gas Boilers, up to 10 H. P.

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