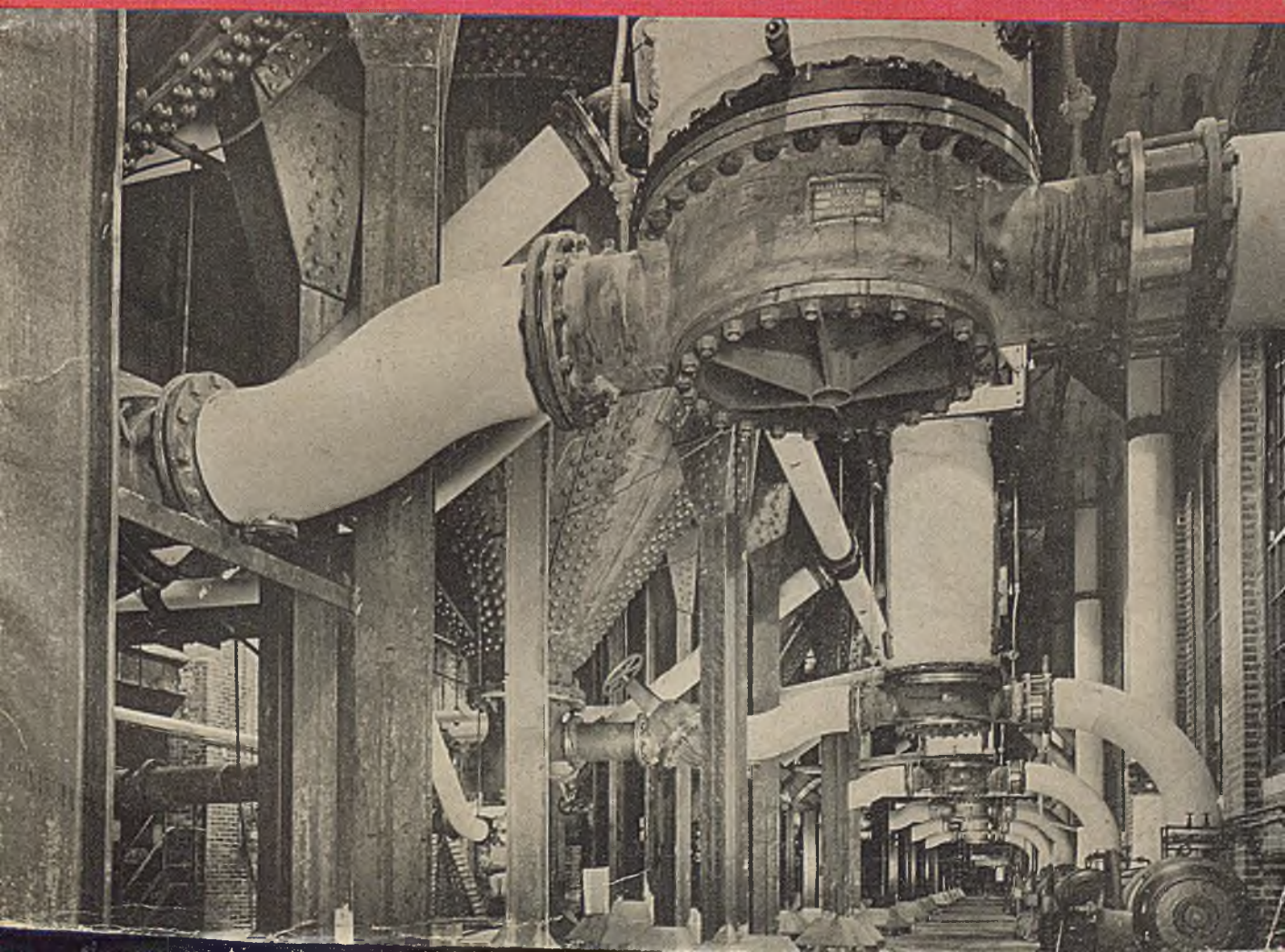
CHEMICAL & Metallurgical ENGINEERING

For DECEMBER, 1944

• UTAH DESERT YIELDS POTASSIUM CHLORIDE • DEVELOPMENTS THAT AID WESTERN PULP INDUSTRY • RUPTURE DIAPHRAGMS • SPECIFIC RECOMMENDATIONS FOR CHEMICAL PUMP PACKINGS • POTASSIUM PERCHLORATE MADE BY CONTINUOUS PROCESS • SMALL INDUSTRY MUST PLAN NOW TO SURVIVE IN POSTWAR TIMES

Stainless steel sulphite pulp circulating equipment in West Coast mill



Engineering Serial

Each month, during the past year, Tube Turns' advertisements have pointed out one single outstanding advantage of Tube-Turn seamless welding fittings. Added together, they have told a serial story of Tube-Turn engineering and performance qualities that are of prime importance to everyone concerned with designing, specifying, buying or installing piping and fittings.

Selected Tube Turns Distributors in every principal city are ready to serve you from complete stocks.

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TUBE-TURN
TRADE MARK
Welding Fittings and Flanges

CHEMICAL & Metallurgical ENGINEERING

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Tube Turn's exclusive manufacturing process produces *extra* strong fittings. Tensile tests on the stress-strain recording machine methodically *insure* the superior strength standards found in all Tube-Turn seamless welding fittings.

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Welding Fittings and Flanges

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. . . but what goes on inside?

● The Sharpies Super-Centrifuge has solved this engineer's problem. He is more than pleased with his improved product and its lowered production cost compared with his previous methods. However, something still puzzles him.

His trained mind is schooled to think in terms of cause as well as effect. To him the effect is convincingly apparent, but not so the cause. What really happens inside this machine?

If you, like this engineer, are interested in the answer just ask for our Bulletin No. 1230A. Filled with many sketches graphically supplementing the explanatory matter, this bulletin tells simply and clearly the "Inside Story" of the Sharpies Super-Centrifuge.

The SHARPLES Corporation

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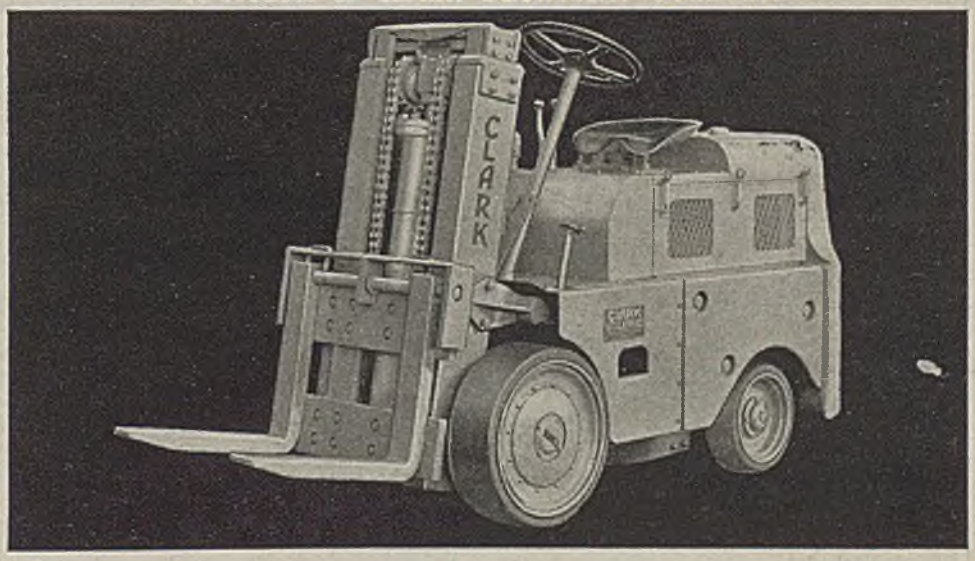

I work 24 hours a day, at home or overseas . . . wherever free men are fighting. I am always behind the lines handling the supplies that keep them fighting.

Our fighting men need all the supplies I handle now . . . I am working full time with our armed-forces to speed Victory.

But, I haven't forgotten the job I am able to do at home.

You can get me to work for you . . . thousands more of my family (we have over 60 members) will soon be available to feed your production lines . . . to save time — to save manpower — to lower costs, that more of your products, whatever they may be, will be available sooner, because I handle everything from the raw to the finished products.

I can work in the factory, yards, warehouse or on the docks.

I handle loads of 1000 to 7000 lbs. like they are as light as ducks' down.

The men and women who control me never know fatigue. . . . I do the work. At the slightest urging I am on my way, looking for material to carry, stack or tier. I save plenty of floor space too, by stacking material to the ceiling, and you should see how easy I do it.

Don't forget, like I told you, as soon as I can, when more like me are available. I'll be ready to help you. I'm tough and rough and a glutton for work.

Sincerely, *Clark Fork Truck*

P. S. I was built by the Men of Clark and they are a fine lot of Craftsmen.

CLARK TRUCTRACTOR

DIVISION OF CLARK EQUIPMENT COMPANY

BATTLE CREEK, MICHIGAN, U.S.A.

Sure, All Valves Look Alike

But..It's What's Inside That Count

Any engineer will tell you there isn't much difference in the outside appearance of most gate valves. Why should there be? It's the *inside* story that really counts. And it's that same inside story—the assembly—the simplicity of design—the rugged construction—the leak-proof machined surfaces—that has made the Darling Parallel Seat, Double Disc Gate Valve a leader in the field for more than forty years.

No. 1

THE ASSEMBLY-ONLY 4 PARTS

Two discs and two wedges—the entire working part assembly of a Darling Double Disc Gate Valve. There is no other valve with this design. The seats are parallel. The discs are *fully revolving*, seating in a different position each time the valve is operated.

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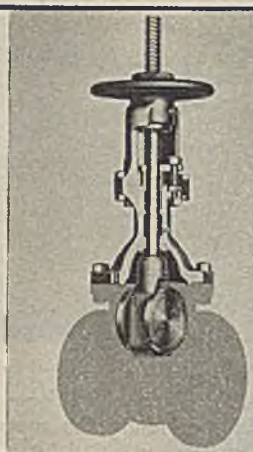
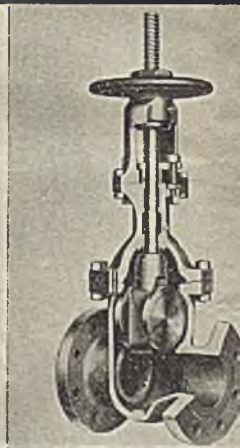


No. 3

DENSE CASTINGS THAT ASSURE GREATER STRENGTH

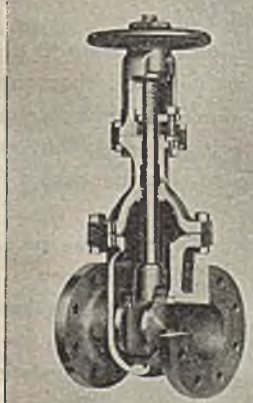
There are no "lot" testings. The body of each and every Darling Valve, like all other parts, is tested individually to its rated pressure. There are no sharp corners. Generous radii throughout eliminate casting strain and insure maximum strength. Darling Valve bodies are designed for quick, easy and inexpensive parts replacement.



No. 4

NO LEAKAGE AT ANY PRESSURE

When the discs roll into place and the parts are sealed, there is no leakage. There can't be. All seating surfaces, by special Darling processes, are super-machined to a glass-like surface that assures a complete seal for any fluid or gas passing through the line.



No. 5

THERE'S A DARLING VALVE FOR YOUR TOUGHEST JOB

No matter what that tough job involves, corrosive or erosive materials, high or low pressures or temperatures, special alloys, unusual installations, severe operating conditions, where those problems occur, that's the place Darling Gate Valve design can positively prove its value. Write for the new Darling Catalog and Data Book.

Darling manufactures a quality line of longer-lasting Gate Valves. They come in Fully Revolving Double Disc Parallel Seat, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, available in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

DV-43

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VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

Utilization of electrical horsepower is an accurate gauge to progress, both industrial and social. American industry used 33,844,131 h.p. in 1929, jumped to 45,291,319 in 1939, and, since 1939, has gained more than any other two countries in the world. For the past 27 years, Howell Motors have supplied an ever-increasing amount of horsepower for American industries. Today, Howells are serving every important industry in America.

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You're looking at the electric motor that has won a high place in American industry for dependability, quiet operation and honest value.

It is a precision-built motor throughout.

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You can load them with full confidence in their ability to stand up under the toughest jobs you can assign within the limits of safety.

Now that the War Production Board requires you to use electric motors of the lowest possible horsepower you are safe in specifying horsepower by Howell.

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The **HOWELL IDEA**
in Electric Motors
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WATCHING WASHINGTON

R. S. McBRIDE, Editorial Consultant • PAUL WOOTON, Chief of McGraw-Hill Washington Bureau • MALCOLM BURTON, Washington Correspondent

Many new container troubles are expected in industry during 1944. Elimination of cross-haul in the pulp and paper industry is demanded . . . Shortages are occurring among the most essential chemicals . . . Cut-back in production with German collapse will be between 40 and 70 percent of military requirements . . . There remains little likelihood of any further delay in authorization for chemical projects which are vigorously pressed with sound logic back of them . . . Dewey fears a serious shortage of alcohol to support synthetic rubber program . . . Plenty of alloyed metals for equipment can be had soon, if not immediately . . . Aluminum cut-back may release alkali for other industrial purposes.

Washington needs watching. From it come hundreds of rulings, and laws, and influences that determine engineering plans and executive policies for almost every one of the chemical process industries. Chem. & Met. seeks in this new department to report the facts, reflect the opinions, and report interpretations from the nation's capital as an aid for engineers and executives. Our statement of trends and forecasts cannot be infallible, no more than our reporting can be complete. Nevertheless, it is hoped that the readers will gain much information and some worthwhile guidance for the difficult job of chemical management.—EDITORS.

INSECTICIDE RESTRICTIONS

ALLOCATION rules have for quite a while applied to pyrethrum, one of the most scarce insecticides. During December WPB placed similar restrictions on the synthetic pyrethrum substitute "DDT", para-chlorophenyl tri-chlorethane. Thus even the substitute insecticides are being conserved for the most essential food-growing and public-health uses.

CONTROVERSY TAKES A HOLIDAY

THE BITTER controversy between Congress and executive officers over price control subsidies contains one fundamental issue seldom mentioned, and apparently little understood. Almost no opposition has been offered to the use of federal funds to stimulate greater needed wartime production. Money has been so used effectively by RFC to get extra copper output. Some effort has been made to get increased food production in a similar manner. Even the most severe critics of the President and of Commodity Credit Corporation appear to offer no opposition to such subsidies.

Bitterly opposed, apparently contrary to the wishes of a large majority of Congress, are consumer subsidies. They are attacked as socialistic and un-American. Certain actions of the Administration have clearly been taken apparently on the much criticized assumption that by subsidy of this sort Washington can get control of certain commodities and industries. The ultimate outcome of the controversy, which was left in the air during the Holiday recess of Congress, may not be known until March or later.

MANPOWER FORECASTS

SERIOUSLY conflicting forecasts of the manpower situation were issued during December. War Manpower Commissioner McNutt estimated a total labor force requirement of 66.3 millions by July, 1944. But quietly, though no less emphatically, top labor executives of WPB forecast some significant unemployment among factory workers by late spring.

McNutt has arithmetic evidence for his conclusions. But his extremely high estimate is reached only by ignoring the cut-back in heavy manufacturing industry engaged in certain types of military equipment, explosives, and raw materials. This cut-back has been definitely planned after consultation between WPB and military authorities. It indicates that several million men will change employment, or type of work in the same factory, even before a Nazi collapse. This cut-back will be largely accelerated as soon as the German collapse becomes a military certainty. Estimates of the magnitude of the reduction at that stage range from 40 to 70 percent.

SIGNS OF A CHANGE

EXECUTIVES of WPB expect (or perhaps it is hope) to guide the return of industry from war manufacturing back to peacetime pursuits. For example, the chemical division would be happy to determine, by granting priorities on raw materials and construction equipment, the time and the means for rebuilding or expanding chemical manufacturing as peace needs may develop. Already numerous allocation or controlled distribution plans have been relaxed to facilitate better use of chemicals for civilian purposes.

There is clear evidence at the beginning of 1944 that plenty of alloyed metals for equipment construction and most other construction materials can be had soon, if not immediately. Until the Holiday Season it appeared that the most serious barrier in the way of new equipment or remodeling plans was the prospective shortage of manpower. As that has been eliminated there remains little likelihood of long further delay in authorizations for projects which are vigorously pressed with sound logic back of them.

WOOD PULP ALLOCATIONS

IN ORDER to assure that military and essential civilian requirements be met, the Requirements Committee of WPB has drawn up a program determination. This program specifies the amount of wood pulp which will be allocated in the first quarter of this year to each producing branch of the paper and paperboard industries.

The committee estimates that total production of paper and paperboard for the next three months will run about 1,400,000 tons a month or about 2.3 percent below the monthly average for the third quarter of last year. The prospective decline, however, is 9 percent less than the estimate previously made by producers. Detailed figures for allocations of wood pulp will be found on page 148 of this issue.

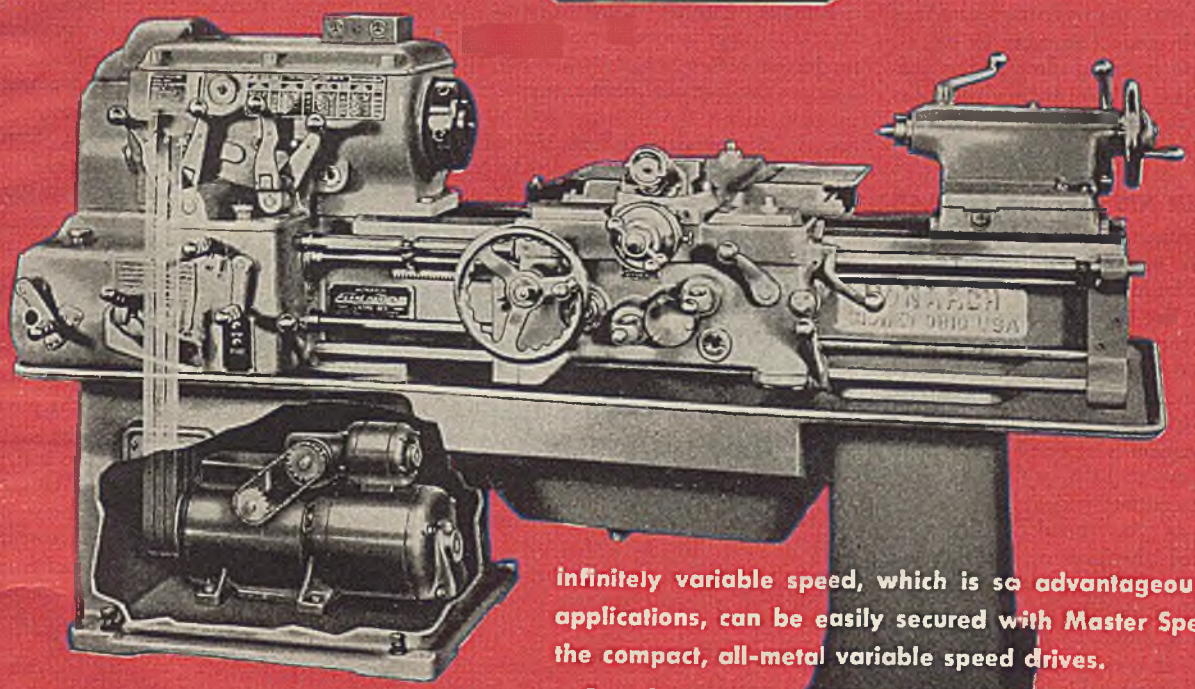
The limitations placed on distribution of wood pulp will permit the use of diversion of substantial amounts for direct military non-paper uses such as explosives, high-tenacity rayon, and other essential civilian non-paper uses. Later, a schedule will be worked out stating the exact tonnage of pulp which will be allocated for these other purposes.

PRICE FIXING CHARGED

OPA CHARGED 13 vitamin manufacturers in the federal courts of the District of Columbia with attempting to regulate profits and increase prices of synthetic vitamins. The industry has made a widely accepted reply by its explanation of price decreases which have been made as production has increased during recent months. Especially emphasized are the equivalents of price reductions for many products in which large increases of vitamin content have been provided. Some Washington observers think that this suit will

MASTER

SPEEDRANGERS



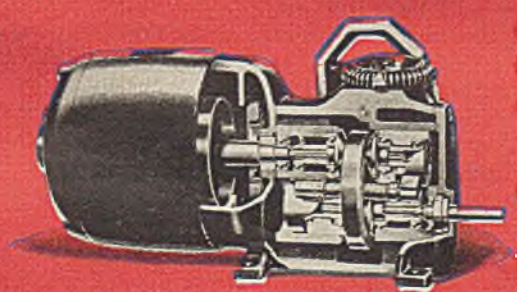
infinitely variable speed, which is so advantageous on many applications, can be easily secured with Master Speedrangers, the compact, all-metal variable speed drives.

Speedrangers can be supplied in single phase, polyphase, direct current, gearhead, unibrake, open, enclosed, splash-proof fan-cooled and explosion proof construction and with many types of mounting.

No other variable speed unit can give you such flexibility and compactness.

VARIABLE SPEED *at the flip of a switch*

The Master Speedranger shown above is equipped with electric remote control, with the control motor an integral part of the construction. The complete unit slips easily into place, saves mounting time and expense, eliminates many unneeded parts and greatly simplifies changing speeds.



The unit illustrated operates a lathe but it's use is just as advantageous on many other machine tools, mixers and agitators, reeling equipment, material processing, handling and conveying equipment . . . to name only a few.

Investigate what a really remarkable job Master Speedrangers can do for you.

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peeter out for lack of persuasiveness. It is especially emphasized by observers that this is an OPA action, not one of the Anti-Trust Division.

HIGH-PROTEIN FEED AVAILABLE

SHORTAGE of high-protein feeds was anticipated during the coming months, despite rather strenuous effort to build up supplies. But the crop reports for November 1 indicated an increase in prospective supply from 11.2 to 11.3 million tons. Other feed concentrates also are favorably situated with a grand total from 1943 crops only three percent less than the preceding year. It is hoped that byproduct recovery by process industries will make up some of this deficit. War Food Administration continues to press for the complete recovery of such wastes.

AMMONIUM NITRATE SALES PLAN

NEW ARRANGEMENTS to sell the ammonium nitrate made at Ordnance Department plants for fertilizer use will take effect February 1. For the three months ending in January the sales were made by TVA with the aid of Associated Cooperatives, Inc., and one large broker who is an importer of Canadian ammonium nitrate. That arrangement is expected to terminate, at the request of TVA, with the end of the present contract period.

Officials of the chemical division of WPB asked fertilizer companies and brokers whether they would care to take over this job of distribution. A half dozen offers were received of "fairly satisfactory conditions". It is expected, therefore, that WPB will allocate this government production through one of the government corporations which will then contract for the actual selling by one of these brokers.

The sale of ammonium nitrate will be at approximately $49 per ton, f.o.b. point of production. The selling company will get from this an allowance of $1.50, making the net realization by Ordnance about $47.50. This, generally speaking, puts the ammonium nitrate on a competitive price basis with sulphate, both that imported and that produced at coke ovens. It is expected that under these conditions about 15,000 tons per month of ammonium nitrate will be available for sale from Ordnance plants. The TVA production will be sold by that agency itself. Commercial production will continue to move through normal commercial channels.

CONTAINER TROUBLES CHANGE

NEW container troubles are expected in industry during 1944. Scarcity of wood, pulp products, and wrapping materials is growing weekly. Industry may have more difficulty getting such packaging supplies. It is even feared that prompt delivery of fertilizer to farmers may be prevented by shortage of paper bagging which was expected to replace the unavailable burlap. Somewhat less difficulty is expected in getting metal containers. Even tinned metal may be slightly more available during 1944 than during the past year. Forecasts that there would be plenty of bottles for certain industries have, however, greatly disturbed the container specialists of Washington. They warn that there is *not* going to be plenty of anything in the way of packaging material or containers. They urge the maximum possible re-use of containers of all types.

ALCOHOL CONTROVERSY

RUBBER Director Dewey, forecasting 70,000 tons per month of synthetic rubber production before 1944 ends, also estimates a serious shortage of alcohol to support that program unless the industry gets all the breaks. His estimate is that 330 million gallons of alcohol will be needed in 1944 for the synthetic rubber program alone.

Alcoholic beverage makers find small comfort in this, as it implies no holiday for them to return to beverage making. Political pressure in Washington for more whisky manufacture is great. This may result in permission for a few beverage makers to operate with whisky rather than industrial alcohol as their end product. The prohibition influence is the strongest factor against this, perhaps even exceeding in influence the Rubber Director's demand for the alcohol. But the threat of bootlegging and the thirst of highly vocal voters may influence Congress to insist on some measure of renewed beverage production.

ALCOHOL FROM WOOD

INVESTIGATION of processes for making alcohol from sawdust and other wood wastes gave favorable results as reported by J. A. Hall of Forest Products Laboratory after studies at Dow and Tennessee-Eastman pilot plants. It has been decided by the chemical engineers of OPRD that the next step should be the preparation of a set of preliminary plans and specifications for a commercial-scale plant.

Arrangement has been made for the preparation of such plans by Vulcan Copper & Supply Co. of Cincinnati, with the cooperation of Dr. Hall. It is expected that at least one commercial unit using these plans will be built, if the engineering estimates of feasibility and cost remain as favorable when Vulcan has finished its design.

Timber Engineering Co. of Washington, D. C., a subsidiary of National Lumber Manufacturers Association, may build the first plant. Presumably it would have some Government money to assist it, though that had not yet been finally determined at New Years. The purpose of such a plant would be to determine the economic feasibility of using such processes as a means for more complete utilization of lumbering wastes in such areas as the Pacific Northwest.

Government men, as well as the more objective industrial forecasters, all repudiate vigorously the claim that such alcohol can surely be made for as little as 20 c. per gal. One chemical engineer, who has seen all the experimental data to date, says, "It looks more like 50 cents to me at this early stage".

PATENTS AND MONOPOLY

DEPARTURE of Thurman Arnold from the Anti-Trust Division has not lessened the zeal of that agency, even though it is much less spectacular than heretofore. The new director, Wendell Berge, has emphasized the intention to prosecute vigorously anti-monopoly cases as fast as evidence can be gathered. His most comprehensive statement of policy was an address on December 14 before American Pharmaceutical Manufacturers' Association, when he spoke on "The Sherman Act in the Post-War Period".

He has emphasized the intention to break up cartel-type activities and monopolistic developments resting on patents or patent pools. The only brake on this trend evidenced in Washington is a recent federal court decision which emphasized that the owner of the patent still has the privilege of preventing competitive manufacture except under terms which he, the patent owner, may dictate. But the court did not, nor would other courts likely, approve of cross-licensing or pooling arrangements which build a broad patent structure having a tendency toward "restraint of trade". Berge and his staff of investigators and lawyers are hot on the trail of all such cases.

The use of the term "cartel" appears largely to be intended for getting funds from Congress or getting public support behind anti-trust projects. Not even the most zealous of the anti-trust investigators appears to have disclosed any real cartel of current or recent importance. But this does not prevent the use of the term based on "horrible examples" from former years.

FISCHER-TROPSCH PROCESS

ENGINEERS of the U. S. Bureau of Mines hope that appropriations available next July will permit the building of a small semi-works plant for engineering development work on the Fischer-Tropsch process for coal hydrogenation. If such funds are provided, the pilot plant will be built at Bruceton, Pa., where the Bureau has land and general facilities adjoining its experimental coal mine.

Work during the next fiscal year, which begins in July, will continue also at the field laboratories of the Bureau in North Dakota. The work there will include studies of methods for making lignite char and processing blue water gas from it. Gas of that character would be used as a raw material at Bruceton.

Considerable argument is heard in

PROFESSOR JOHNNY ROTAMETER ASKS THE $64.00 QUESTION

What flow rate instrument combines these features?

- ...high visibility
- ...instantaneous response
- ...low, constant pressure drop
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- ...ability to measure any corrosive gas or liquid
- ...overall accuracies as high as 99.8%

The answer is obvious—only the rotameter can offer all of these advantages in one instrument.

If you are not utilizing the rotameter to your fullest benefit, it is perhaps because you have not realized yet how superior it is to fixed orifice meters for flow rate measurement. Furthermore, the scope of the rotameter is being widened constantly by our research and by our experience in its application to industry. Today, for instance, the remote recording and controlling rotameter is a standard item in the process industries for automatically controlling the flow rate of any fluid.

Why not put yourself abreast of the latest rotameter developments by writing for our new booklet No. 10-B entitled "A New Era in Flow Rate Measurement." It is done in a semi-humorous style with large cartoon illustrations—interesting to read and highly instructive. We will gladly send it to you without any obligation whatsoever.

FISCHER & PORTER CO.

1801 COUNTY LINE ROAD, HATBORO, PA.

FLOW RATE INDICATING, RECORDING OR CONTROLLING ROTAMETERS FOR ANY LIQUID OR GAS

Washington as to whether natural gas ought to be considered as a raw material suitable for use in making synthetic liquid fuels. Proponents of such plan include those who have surplus natural-gas supplies and not enough crude petroleum or natural gasoline. Opponents of the idea argue that natural gas has a greater "form value" and that it would debase the gas to convert it to a liquid. Only after engineering studies of methods and costs have been made will it be possible to forecast either the economic or the social advantage of such conversion.

PAPER STOCKPILED

Momentarily Washington thought that it was going to have a substantial relief from pulp and paper shortages. The supply promised from Canadian sources will probably be greater during the first quarter of 1944 than was forecast during the fall months. But WPB is not relaxing its rigid rules for paper usage. It plans to stockpile a significant amount of pulp or paper so that extremely urgent uses which may develop suddenly will not cause serious interference with the war effort. Manufacturers will be required to reserve sufficient time and supplies in each of their mills to produce and deliver 100 percent of the condenser tissue made by them, 35 of the paperboard and 15 of other types of paper to fill government orders during the month of January and each month thereafter.

The industry is also being urged, almost ordered, to cut down transportation requirements for pulp and paper. The elimination of cross-haul is particularly demanded. Such precautions are needed quite as much to save railroad capacity as to minimize delays in pulp and paper deliveries.

VITAMIN IN DEMAND

Larger demand for vitamins is expected in the baking industry. Mid-December rulings of War Food Administration required that from January 16 all types of yeast-raised commercial bakery products containing white flour must contain minimum enrichment with vitamins. It is expected that this type of enrichment will be continued into the post-war period, despite a disappearance from Washington of some zealot leaders. And UNRRA wants a large supply of vitamins for use abroad in relief work. This foreign need is expected to continue for two or three years.

ALUMINUM AND ALUMINA SHIFTS

Aluminum production and alumina policies will presumably both be determined in the future by the new vice chairman of WPB, who is to handle questions of minerals and metals. This group of "operations" within WPB is to be separated from the other industrial and commodity tasks. At the beginning of January it was confidently expected that there would be no change in fundamental policy because it was announced then that the new vice chairman would be A. H. Bunker.

Cut-back in aluminum production is generally forecast in official circles but not officially. If such curtailment in demand for this light metal occurs, as is confidently expected, this will relieve very greatly the serious difficulty in getting alkali for other industries. It may even permit the continuance of some of the experimental work on a small commercial scale using alkali with low-grade bauxite. Most other alumina projects starting with clay, alunite, and other high alumina minerals do not require any of this scarce alkali. Those projects are again active in a semi-works program under OPRD.

FACTORY MORALE BUILDING

Motion pictures taken in the war zone are offered to industrial managements for morale building. These films are intended to show war at its worst. They may be run in industrial establishments or elsewhere whenever it is thought that they will help production of war goods by making clear to the industrial workers the problems at the battle front. Those wanting to use the films should communicate with Industrial Services Division, Bureau of Public Relations, War Department, Washington (25) D. C.

CHEMICAL SHORTAGES

Fewer shortages of chemicals are noted in Washington. But some of the shortages that are encountered deal with the most essential chemicals, such as alkalis and sulphuric acid. One large new acid plant has been authorized for construction in the Baltimore District. This authority was granted in order to be sure that the food program would not be handicapped by the shortage of superphosphate for which not enough acid was available. It is to be a contact plant with a rated capacity of 100,000 tons of acid per year.

HIGH-OCTANE PROGRAM

Manufacture of 100-octane aviation gasoline had begun at 34 major plants by January 1. An additional 38 plants will be completed shortly and 22 later this year. These plants will care for the total demand. In addition to these 94 major works there are 67 other establishments of small size or engaged only in component making.

The entire high-octane program has been pronounced an outstanding success by both Army and Petroleum Administration executives. It represents one of the largest chemical engineering undertakings of the war period including a $900,000,000 building program.

GOVERNMENT RULINGS

There has been announced a summary of government rulings which may have value for reference purposes in many business offices. The official announcement is as follows:

"Book 1 of the Cumulative Supplement to the Code of Federal Regulations may be obtained from the Superintendent of Documents, Government Printing Office, at $3.00 per copy. This book contains all Presidential documents issued during the period from June 2, 1938, through June 1, 1943, together with appropriate tables and index."

SCARCE METALS NOW "EASY"

As January opened it was evident that the scarcest metals of 1943 would become easily available in 1944. Pig iron, copper and aluminum are available at least potentially in greater quantity than the anticipated military demands. Hence somewhat more generous civilian allocations are confidently expected. It may be that the Controlled Materials Plan may soon be terminated, having served its war purpose. Pig iron will be removed from allocation on February 1.

CHEMICAL ALLOCATIONS

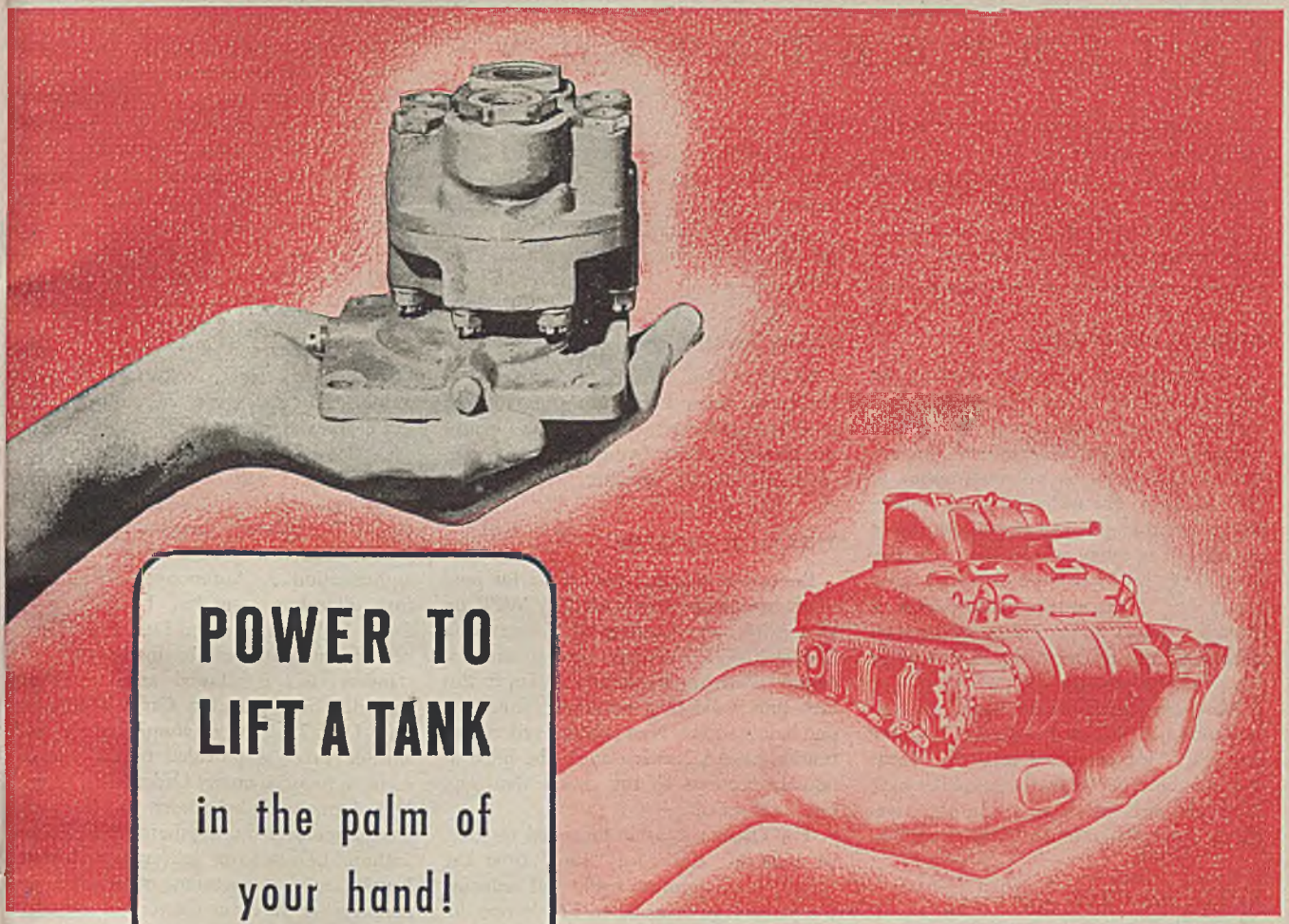
The Chemical Division of WPB is pleased with the situation in chemicals, but it is concerned lest a secondary consequence of it deceive chemical makers. Because of the lesser urgency of chemical demand, the detailed attention by officials to individual projects has lessened. Consequently, fewer reports and fewer detailed regulations are required. The officials hope that manufacturers will not let these facts fool them into expecting either a great slow-down in demand or any intention to drop most of the chemical controls. "It is not time for either of those changes in attitude".

ALUMINUM POT LINES CLOSED

The war production board recently ordered the immediate closing of four aluminum pot lines, two New York City in (Queens County,) and two in the Burlington, N. J. area. A pot line is the plant that produces aluminum from alumina.

This action was taken, WPB officials explained, to relieve the stringent coal shortage and also to lighten the transportation load entailed in hauling alumina to these plants from the Mississippi Valley. The saving in coal will be 70,800 tons a month, WPB officials said. In view of the ample production of aluminum ingots at this time, the output of these four plants can be dispensed with, officials explained.

The four pot lines which are closing had a total output of 12,000,000 lbs. of aluminum per month. They are owned by Defense Plant Corporation and operated by the Aluminum Company of America. Employees of the plants are being given a week's notice, but the plants will shut down immediately in order to save a full month's charge for electric current. Power contracts provide that when a plant shuts down after first day of any month it must pay for a full month's supply.



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INTERPRETATIONS

This installment covers orders, rules and regulations issued by the War Production Board and the Office of Price Administration during December, 1943. Copies of each item interpreted here may be obtained from the appropriate federal agency.

RUBBER PRODUCTS

Incorporating all directives issued by the Office of Rubber Director in the past four months, revised Rubber Order R-1, issued by the WPB on Dec. 4, reflects the imposition of drastic controls on consumption of the nation's diminishing crude rubber stockpile and emphasizes the liberalizing of restrictions on use of synthetic rubbers. For most of the products listed for which natural rubber is permitted, consumption is limited to a specific percentage of the total volume of the rubber compound used in the particular product.

No quota restrictions are placed on consumption of so-called "general purpose synthetics" for permitted products. However, several types of synthetic rubber have been classified as "special purpose synthetics" and placed under direct allocation.

BUTYL ALCOHOL

In an amendment to MPR-37 issued on Dec. 10, OPA increased by three cents the maximum selling price of the one producer of butyl alcohol in the U. S. territories and possessions. For all producers, the reduction in maximum prices when the seller requires the return of a container will be based upon the then applicable ceiling for the particular type of container used. No additional charge may be made for the extension of credit to the buyer. Sales and deliveries of butyl alcohol by Defense Supplies Corporation have been removed from price control. Prices of dibutyl phthalate have been reduced by 0.8 cent per lb. to reflect recent reductions in the price of phthalic anhydride.

CONSTRUCTION LIMITATIONS

Installation of processing machinery or equipment, or the relocation of any machinery or equipment within certain plants, if the cost of the installation materials is less than $500., was facilitated by WPB on Dec. 9 through issuance of Direction 2 to Conservation Order L-41 and Direction 15 to CMP Regulation No. 5. Permission to install processing machinery or equipment, or to relocate all kinds of machinery or equipment is limited to factories, plants and other industrial units having a productive floor area of 10,000 sq.ft. or more which do not make products listed on Schedule A of L-41. The amount spent under Direction 2 permission is not limited by and need not be deducted from the amount allowed under paragraph c of L-41. Under Direction 15 to CMP 5, MRO ratings and allotments may be used by persons on Schedules 1 and 2 of the Regulation to get the installation materials required for these jobs.

STEEL TUBES

WPB on Dec. 13 issued Schedule 12 of Limitation order L-211 providing that all steel heat exchanger, condenser, evaporator and similar tubes be hydrostatically or non-destructive tested hereafter.

TITANIUM DIOXIDE

Preference ratings below AA-2 for pure titanium dioxide were voided by WPB on Dec. 6 through issuance of Conservation Order M-353. Military orders are exempted when the purchaser certifies to this fact thus validating whatever rating the purchase carries. Non-military orders not bearing an AA-2 rating are to be filled as non-rated orders to the extent that supplies are available.

The Order was again amended on Dec. 24 removing the word "pure" from the definition of titanium oxide and reducing the percentage of oxide to 12. It now includes barium and calcium base extended titanium pigments and titanated lithopone.

STEEL SHIPPING DRUMS

Restrictions on the use of steel shipping drums were tightened by amendment of Limitation Order L-197, issued Dec. 29. Products affected are now listed in three categories, (1) products which cannot be shipped in any steel drum whether new or used, (2) those which cannot be shipped in new drums, seconds or rejects, and (3) products requiring WPB approval before using new drums, seconds or rejects. The Order does not apply to drums constructed wholly of heavier than 14 ga. steel, or to used drums of lighter than 23. ga. having at least 25 gal. capacity.

MISCELLANEOUS ORDERS

Iridium Conservation Order M-49 was amended Dec. 18 exempting persons using five ounces or less of iridium per month from the need to secure allocation authorization. . . . "DDT", 2,2-bis (para chlorophenyl) 1,1,1-trichloroethane, a substitute for pyrethrum in the manufacture of some insecticides, was placed under allocation by amendment to Order M-340. . . . Restrictions on acquisition of electroplating and anodizing equipment were lifted by WPB on Dec. 16 by amendment of Order L-110, thus allowing users to obtain needed spare or repair parts without filing a PD-1A Form as in the past. . . . The size of the exemption from authorization for small orders of abrasive grain, with the exception of optical finishing powders, was increased to 20,000 lb. in each two-month period beginning Jan. 1, by issuance of an amendment to Order M-319 on Dec. 16. . . . General Preference Order M-160 was amended on Dec. 16 providing for a quarterly instead of monthly filing of applications for authorization to deliver or accept delivery of beryllium. . . . Manufacturers of mechanical water coolers are now permitted to resume production of these items for industrial uses, according to Order L-38 as amended by WPB on Dec. 6 . . . . Many applications for zinc dust under Order M-11-1 will be eliminated by the amendment of Dec. 13 which increases by about 50 percent the volume of the product which may be purchased without authorization. . . . Antimony is released from allocation as of Jan. 1 according to Order M-112 as amended Dec. 4. . . . Freer use of chromium in the manufacture of stainless steel is allowed as a result of amended Supplementary Order M-21-a issued Dec. 1. . . . More aluminum for collapsible tubes is provided by an amendment to Supplementary Order M-1-i issued Dec 4. . . . Amended Order M-1-h issued Dec. 2 removes the requirement to secure authorization to cover delivery of restricted bauxite to manufacturers of alumina or abrasives, or to cover delivery of alumina to manufacturers of aluminum and abrasives. . . . Southern yellow pine and certain hardwoods were placed under strict allocation on Dec. 2 through issuance of Conservation Order M-361, covering southern yellow pine, and M-364, covering the following hardwoods: oak, ash, hickory, yellow birch, hard maple, rock elm, and beech. Provisions of both Orders are substantially the same. . . . Restrictions on the sales and deliveries of cobalt (Order M-39), molybdenum (Order M-110), vanadium (Order M-23-a) and tungsten (Order M-29) were removed by amendment of Orders covering the first three metals and revocation of the tungsten Order. Production and supply of these metals is now in excess of their use. . . . Lead-free zinc oxide was placed under allocation and its permitted uses listed in an amendment to Order M-11-a. . . . Order M-38 was amended Dec. 24 allowing lead consumers to make quarterly rather than monthly reports from now on. . . . Use of copper and copper alloys was approved for production of lubrication equipment by amendment of Order L-314. . . Direction No. 1 of Priorities Regulation 18, reported in this column last month and requiring placement by Jan. 1 of purchase orders for equipment to be delivered during the first three months of 1944, and by Mar. 1 of orders for third and fourth quarter delivery, has been revoked due to good response by industry and the large number of exemptions encountered.

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When fire breaks out at your plant, will the confusion of your men give the blaze time to get out of control? Not if they've been shown exactly what to do. Men *who know how* act swiftly and confidently to nip small fires.

Make sure your key men have the training they need. Stage a demonstration now. Let them see your equipment go into action against real fires. Explain the different types of fire and the right way to fight each of them.

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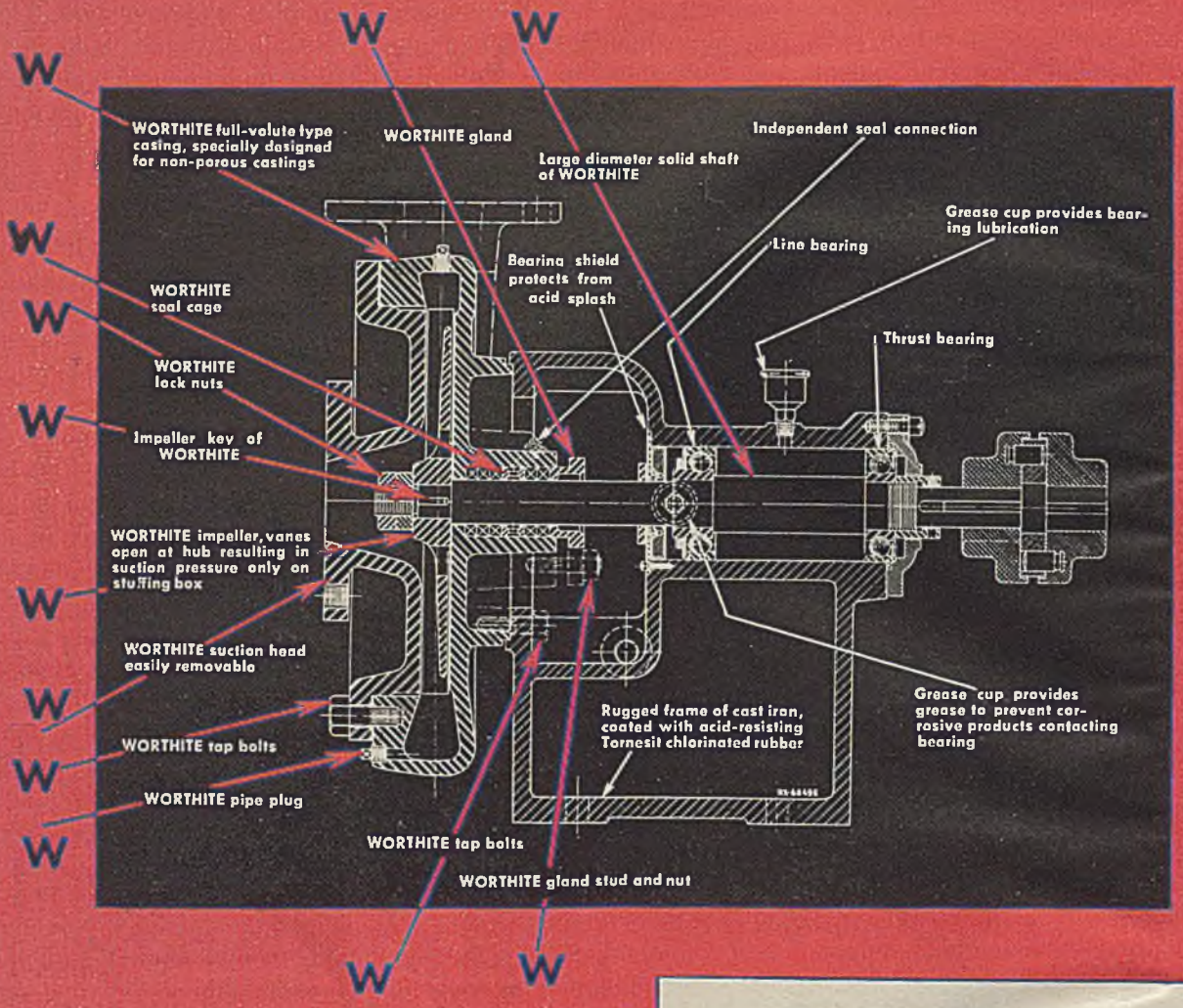

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Worthington's WORTHITE Gives You Stainless Qualities Over a Wider Range

Certain brines, acids, even some hot, strong fruit juices, that actually *stain* some stainless alloys . . . have no effect at all on WORTHITE.

WORTHITE is a complex alloy especially developed for Worthington's standard line of centrifugal pumps. It has all the desirable properties of stainless steel *over a wider range.*

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- nitric acid
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Write or call the nearest Worthington District Office or Authorized Industrial Dealer for further information.

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CP 4-1

The Spark that Lights the Flame of Victory

A pinpoint of fighting metal placed in the arc f the spectograph writes its own signature n a photographic plate. Inside the instru- ient, the light from that flame is broken up y a prism as a prism breaks up sunlight. ach element identifies itself by a series of haracteristic lines, always the same for the ame basic element. It reveals to the spec- ·ographer each constituent, what impurities re present and in what quantities.

Thus spectrography helps in controlling nspection. It keeps tough fighting steels tough, helps in development of new fighting metals. Spectrography is used too in other fields . . . chemicals, foodstuffs, vitamins. It speeds research, control, and analysis. Today, spectrography is helping to build the tools of Victory as in peacetime it helps to make better cars and better breakfast foods.

Because Bausch & Lomb had long experience with such precision optical equipment needed in education, research, and industry, it was ready for quantity production of precision optical instruments of war such as gunfire control instruments, binoculars, and aerial photographic lenses. When the last gun is fired, Bausch & Lomb will devote its enlarged experience to peacetime optical production. Through war and peace, Bausch & Lomb has continued . . . and will continue . . . to do the job it knows how to do best. *Here again optical science is seeing it through.*

For Bausch & Lomb Instruments essential to Victory—priorities govern delivery schedules.

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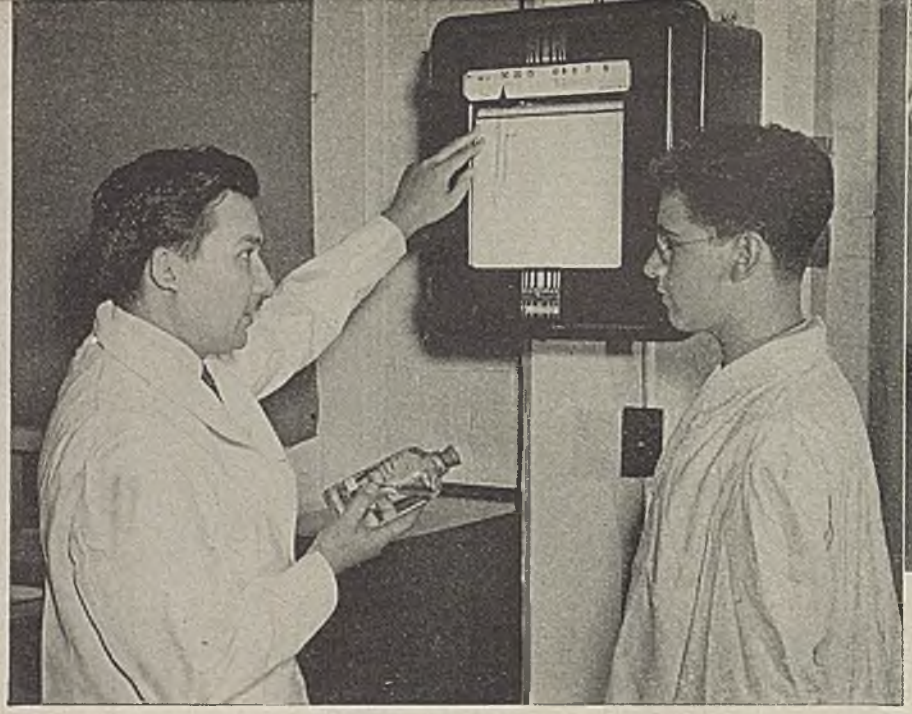


Supervisor in a Sharp & Dohme plant tells an assistant that watching the resistance of distilled water, on the Micromax Recorder, is a necessary first step in preparing "pyrogen-free" water for bottling.

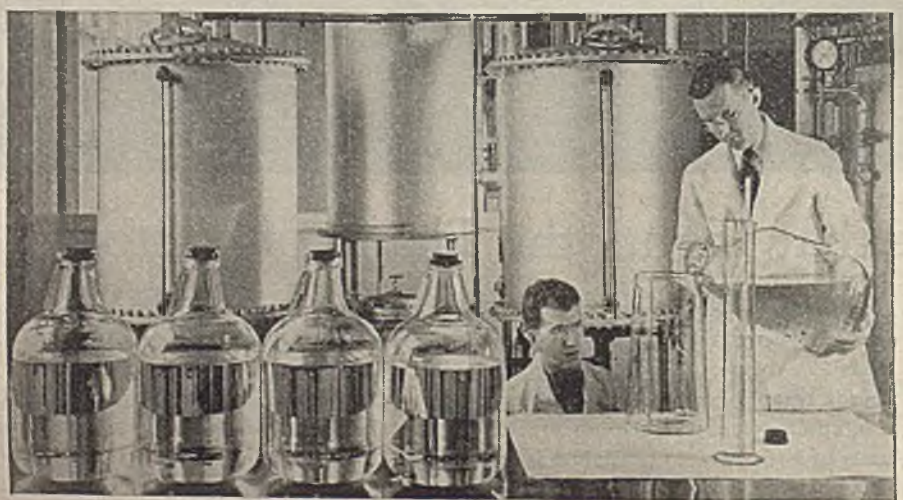
Preparing an injection of blood plasma; 250 cc of double-distilled "pyrogen-free," sterilized water from a sealed bottle is added to an equal amount of "Lyovac" (dried) normal human plasma. The result is the marvelously effective life-saving fluid, initiated by you who give your blood to the Red Cross.

STILLS PRODUCE PURER WATER With Help of MICROMAX Recorder

In the daily distilling of thousands of gallons of water for blood-plasma and other pharmaceutical use, technicians in the big Philadelphia plant of Sharp & Dohme Inc. of course check the water's purity in various ways which most businesses neither use nor need.

But S&D make at least one check which is useful wherever an automatic still is running—they measure and record the water's electrolytic resistance, as a guide to the proper operation of the still.

High resistance means purity; if the resistance drops, it is because impurity is appearing. Impurity may be due to running the still too hard, or to neglect in cleaning out its accumulated solids; or to any other condition which unbalances the still's operation. But, regardless of the cause, the result is impure water which may contaminate the larger supply and cause the rejection of the whole.



Technicians at a battery of automatic stills in the Philadelphia plant of Sharp & Dohme, Inc. The Micromax Recorder, above, continuously records electrolytic resistance of water en route to bottles, and warns if impurity appears.

And so Sharp & Dohme guard against this by using sensitive, accurate Micromax Recorders which automatically and continuously show the resistance at all times, and draw a record for use in case questions arise.

In this particular plant, the still attendants watch the recorders as a part of their routine, but other users of the same Micromax instruments equip them to open a valve and automatically divert any impure distillate. The general practice is to use just one multiple-point Micromax for an entire battery of stills.

This Micromax Recorder is a rugged, highly dependable instrument. If you need one, an L&N engineer will gladly help in its selection; or if you want a publication, ask for Catalog EN-95, free on request.

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CHEMICAL
& Metallurgical
ENGINEERING

ESTABLISHED 1902

JANUARY, 1944

S. D. KIRKPATRICK, Editor

Stockpile Money

LEAST valuable in the war effort of all the metals is the vast pile of gold that lies buried in Kentucky. Except for a few acid-proof linings for chemical autoclaves, no important war uses have been found for this so-called precious metal. How much better off would we have been as a nation had these same billions of dollars been invested in tin, chrome, manganese, nickel, tungsten and also several other of the strategic metals! Following that reasoning, some of our national leaders have found it interesting to speculate on how this stockpile principle might possibly be applied to promote our own postwar security as well as international reconstruction.

All are agreed that we have more to gain than to lose in contributing to the industrialization of Russia and China. Tremendous markets could quickly be developed in these countries for all of the capital goods and equipment which we will shortly have in such abundance. When properly installed and operating this machinery would raise living standards and thereby create new markets for consumer products. Most of these would, of course, be supplied by domestic manufacturers but it is doubtful if such markets could ever be developed except from within their own borders.

The hitch comes in finding the ways and means to pay for the original transactions. If we advance the money through international loans it can only be repaid by salable imports into this country, which would mean either manufactured goods or immediately consumable raw materials. On the other hand, if handled by the government on the basis of national security it should be possible to bring in large stores of imperishable materials that would be removed entirely from the normal channels of trade. Such stockpiles could be "sterilized" in the sense that they could be set aside under laws that would prevent their use except in a national emergency as defined by joint congressional and executive action. Likewise their accumulations could be legally restricted to supplies in excess of normal requirements, thus minimizing the effect on prices as determined in the competitive markets.

The principal advantage, other than that of the national security, would seem to lie in the possibility of removing a sizable part of the great glut of capital goods that will hang over our heads as soon as the war is over. The large holdings of the Defense Plant Corporation, in excess of those to be retained in standby condition, could be traded for vital and strategic metals. Thus the postwar market for second-hand equipment would be relieved of embarrassing surpluses. Meanwhile manufacturers of new equipment would be encouraged to bring out their improved designs that will permit us to retain our competitive advantages over the rest of the world.

On the other side of the ledger are disadvantages we cannot afford to overlook. Foremost is the continuation of governmental controls that would be involved in setting up such a basis for international barter. Powers of life and death over many basic industries would be put into the hands of public authorities that could be subject to political and economic pressures. Once the principle of sterilized stockpiles was firmly established it might soon be extended beyond the metals to include petroleum, lumber and other of our diminishing natural resources that are almost as vital to our national security. Could we carry such a heavy burden of socialization in this country and still maintain our system of free enterprise?

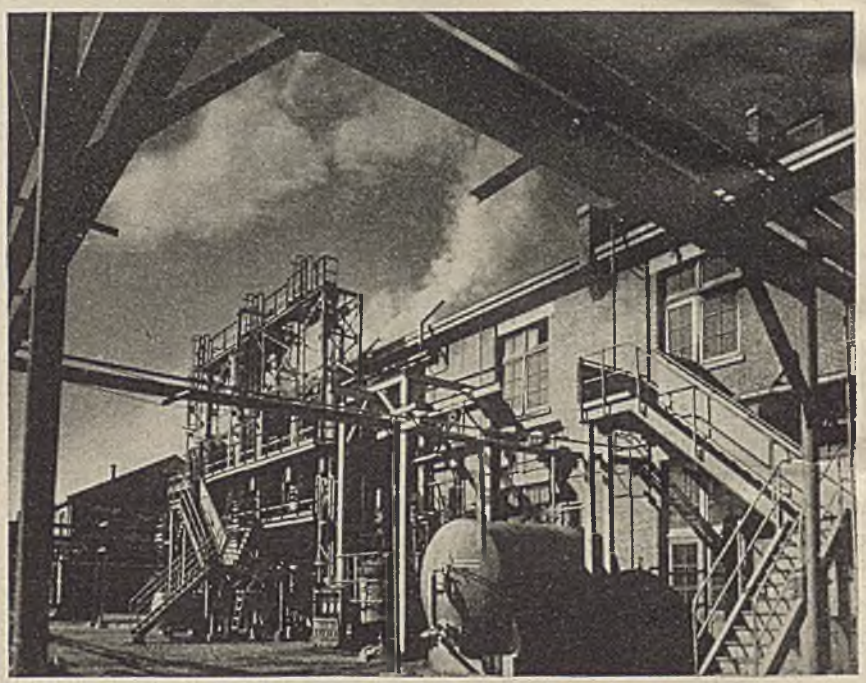
These are problems that must be faced and solved soon and soundly if we are to avoid a calamitous deflation immediately after the war is over. If the disposal of our vast facilities is left to chance, we can wreck most of our industrial economy. If we fail to provide for our own future as a nation, we can contribute little to the peace of the world.

JOHN R. CALLAHAM *Assistant Editor, Chemical and Metallurgical Engineering*

FINE CHEMICALS

Now Engineered into Mass Production

Fine chemicals, especially certain vitamins and medicinals, are being produced in large tonnages for the first time through the application of chemical engineering principles and economies. Operations are being converted, wherever possible, to a streamlined production basis, while special equipment layouts are increasing processing flexibility. One leader in this forward movement among fine chemical producers is Merck & Co., Inc., whose new Stonewall plant embodies the latest chemical engineering concepts of both flexibility and safety.—*Editors.*



A substantial portion of the nation's supply of vitamin B_2 or riboflavin passes through these vacuum crystallizers at Merck's Stonewall unit

FOR THOUSANDS of years, until after the turn of the present century, the profession of producing medicinals and pharmaceuticals, flavors and perfumes, and similar "fine" chemicals remained fundamentally extractive in nature, with roots and herbs as raw materials and alcohol as the main extractive. Elemental principles of chemistry were practiced half consciously, more from tradition than from desire to improve processes or reduce costs.

But after World War I there arose a new type of fine chemical industry which possessed the spirit of experimentation and progress. Synthesis began to be used in place of extraction, chemical science for the art of compounding, and scientific control for an apprentice's intuition. Many of the syntheses actually represented nothing more than a laboratory experiment on a large scale, with the 5-liter flask replaced by the 100-gal. still. Cost of materials was still secondary; chief considerations were uniformity and purity of product. Yet, for the first time, the industry became truly chemical in spirit. Interest swung from perfumery extracts to the synthesis of medicinals. Acetylsalicylic acid, ushering in the Age of Salicylates, became the fine chemical best seller.

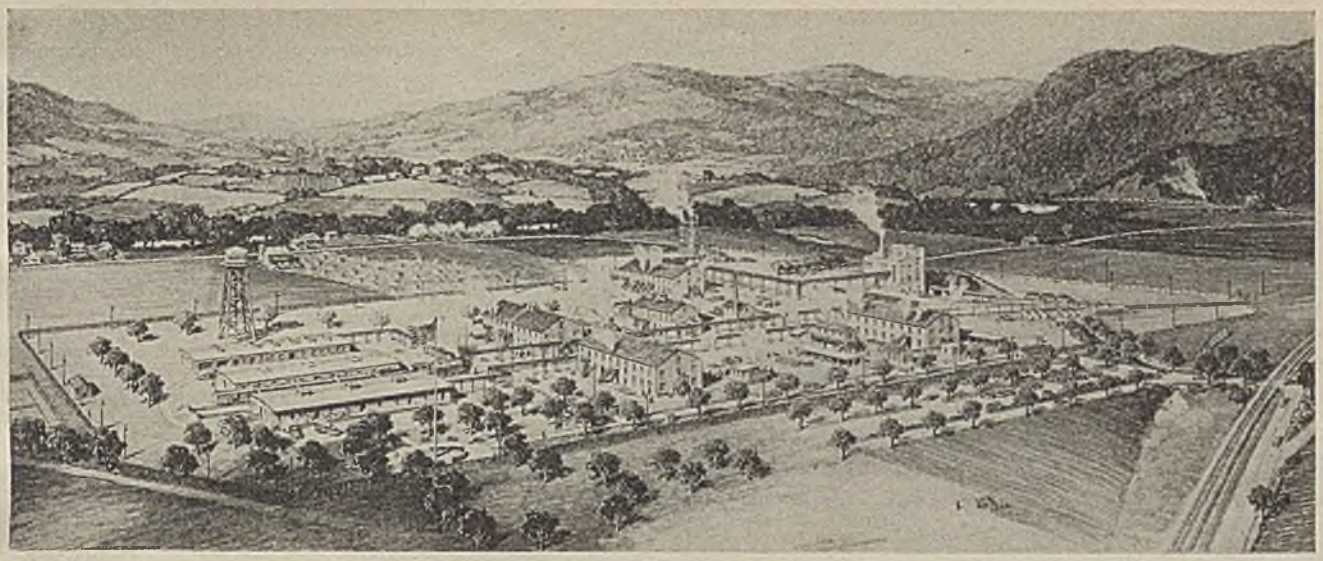
PHASE THREE

Prior to about 1935, there were very few chemical engineers in the fine chemical field and there was relatively little opportunity for those in production to apply engineering methods and equipment. The recent influx of chemical engineers, however, with their obsession for large-scale, low-cost production, is already having a profound influence on the industry.

These engineers, by stressing the concepts of unit operations and unit processes, are accomplishing near-miracles in mass production and cost reductions. Yields are being improved and labor requirements reduced by putting operations, wherever possible, on an efficient and streamlined production basis. Special equipment and plant layouts are increasing flexibility of both equipment and processes. Uniformity and purity of products are being improved through widening the range of corrosion-resistant equipment and by precise analytical and automatic processing control.

Actually, it has only been within the past few years—months in some instances—that a number of new synthetic fine chemicals, reflecting the new order of things, have approached the tonnage dignity of heavy chemicals. Outstanding among these new "near-heavies" are certain vitamins and sulfa drugs, both virtually non-existent in the market only a few years ago.

But first let us look for a moment at the first synthetic medicinal to reach a



This new Stonewall plant of Merck, located in Virginia's Shenandoah Valley, is a triumph of chemical engineering and mass production methods in the fine chemical field. Now in production are thiamin, riboflavin and Atabrine

large-tonnage status—the ubiquitous aspirin—and yet which has never been classed as a chemical engineering achievement.

The 1921 production of acetylsalicylic acid in this country amounted to some 367 tons; 1942 production was 4,085 tons, 20 percent more than our 1939 output of primary magnesium! In fact, aspirin alone then amounted in poundage to nearly one-quarter of the production of synthetic medicinals of all types. As a nation, we are definitely aspirin-eating, and as a people our national characteristic seems to be the simple headache.

And yet, aspirin has never been regarded as an achievement of American chemical engineering, being largely a German chemical development imported into this country and adopted by our own industry. Then too, few basic improvements have been made within the past 20 years in manufacturing methods. Even though aspirin is itself a tonnage chemical, it is still a "fine" chemical in the sense that production is spread over some half-dozen individual producers.

ENGINEERED VITAMINS

Synthetic vitamins have thus become the first large-scale triumph of American chemical engineering in the fine chemical field. Ascorbic acid or vitamin C, produced in Merck laboratories in 1934 by synthetic processes, was made available in commercial quantities some four years later. The 1939 production of this vitamin was only 7.8 tons, valued at $43.15 per lb. or about $86,300 per ton. Then things happened: production jumped to 17 tons in 1940, some 130 tons in 1942, and to 400 or more tons in 1943 (equivalent in potency to approximately 50,000 tank cars of fresh orange juice). The end is not yet in sight, for it is expected that ascorbic acid will become increasingly important as an industrial chemical. Meanwhile the value has been slashed some 300 percent.

Vitamin C, now made on a large-scale basis by three producers, is already of paramount use in military diet and lend-lease commitments; after the war it will be used freely to help bring a half-starved Europe nearer to normalcy. Basic raw material for ascorbic acid is dextrose, readily converted into sorbitol which is used as the source of the sorbose sugar. The synthesis, relatively simple as pharmaceuticals go, is completed in five or six steps.

Vitamin B_1 or thiamin, the publicized "morale factor," was extracted from rice polish in 1935 at a vitamin recovery of less than 1/5 oz. per ton of polish. It was only natural that the product should sell for $30 per gram. Today, however, the identical vitamin made synthetically by modern chemical engineering methods sells in bulk for 25 cents per gram, an amount roughly equivalent in potency to one-quarter ton of whole wheat.

Thiamin, also with three large producers, is probably one of the most involved of industrial chemical syntheses. Scores of raw materials and reagents are processed through a dozen or more individual steps over a period of five to six weeks. Principal ingredients in one process include ethyl formate, ethyl ethyoxypropionate and acetamide. Raw materials, however, are less important to the cost of the final product than the number of steps involved.

Ribose, a sugar obtained by fermentation and other processing of corn, is one of the basic raw materials for vitamin B_2 or riboflavin. This chemical is now in large-quantity production, thanks to the application of modern chemical engineering principles. The synthesis itself involves from ten to fifteen distinct steps and may require up to some 200 lb. of raw materials and solvents for each pound of product. Riboflavin brought $17.50 per gram in 1938, but now sells at 38–48 cents per gram.

Niacin or nicotinic acid, generally furnished in the amide form and then known as niacinamide or nicotinamide, is now one of the largest tonnage vitamins. It is being extensively used in the treatment of dietary deficiencies leading to pellagra. Incidentally, niacin, thiamin and riboflavin are the three vitamins now required in the national flour and bread enrichment program.

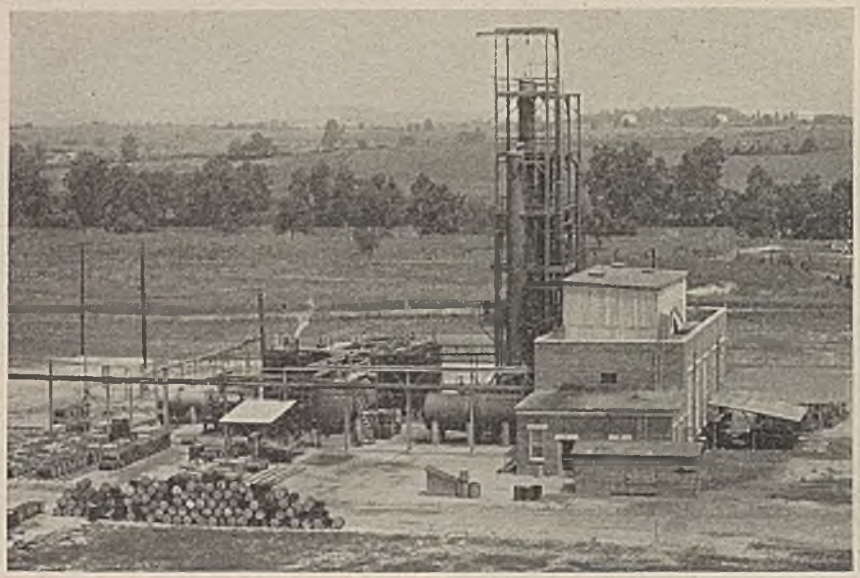
SULFA DRUGS AND ATABRINE

Relatively few engineers look upon the sulfa drugs and the anti-malarial Atabrine as chemical engineering achievements. Yet the meteoric production rise in these synthetic fine chemicals, greatly stimulated by war demands, could hardly be possible without the aid of engineering efficiency.

Sulfanilamide came into general medicinal use in 1937, when the 355,400 pounds produced by 10 concerns was valued at $4.95 per lb. Production was doubled in 1939 by six producers, with the cost reduced to $1.28 per lb. Production of sulfa drugs has since increased by leaps and bounds, and it has been estimated that 1943 output will amount to 5,000 tons. And here is the second miracle of the "miracle" drugs: aspirin has been topped, and for the first time in history a germ killer has surpassed a pain killer. That is true progress!

Small in tonnage but infinitely important as a saver of human lives is the anti-malarial Atabrine.* Demands for this

* Atabrine is the registered trade mark for the Winthrop Chemical Co. product which, chemically, is 3-chloro-7-methoxy-9-(1-methyl-4-diethyaminobutylamino)-acridine dihydrochloride and which has been given the non-proprietary name of quinacrine hydrochloride.



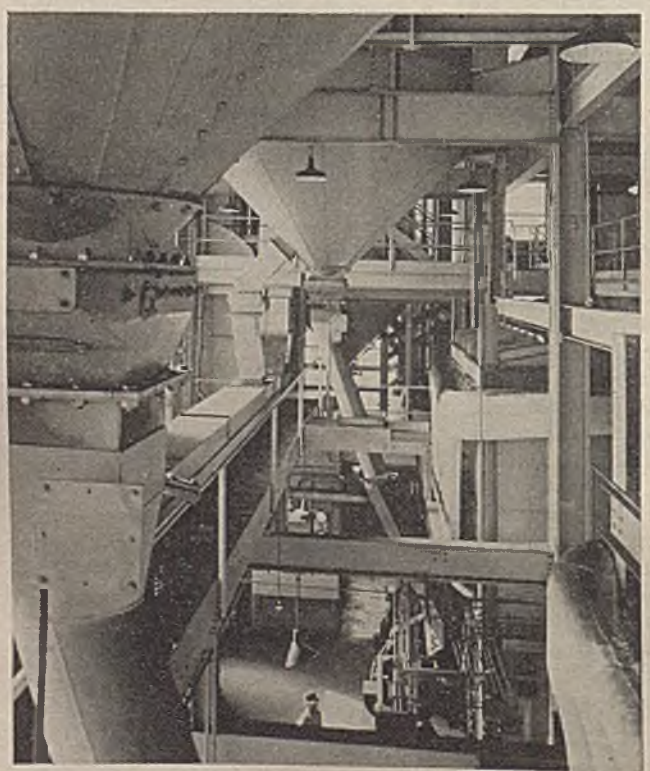
This solvent recovery plant contains four large units; two for specialized operations and two for recovery of various miscellaneous chemicals

drug in the United States during the period 1933–39 have been estimated at about 1,200 lb. annually. By December 1942, Atabrine manufacture was equivalent to the total prewar world supply of quinine and enough to treat 53 million cases of malaria. Total 1943 production was scheduled at 2.5 billion tablets, equivalent to some 600,000 lb. of pure Atabrine. Such a production, it has been estimated, would require 1,500 tons of six intermediates and 12,500 tons of other chemical raw materials and reagents.

Latest and most dramatic development in the medicinal field is the creation of the penicillin industry. Production of this material is still on a semi-laboratory basis, but within another six months output, aided by engineering methods and equipment, should be enough to satisfy all military and civilian needs. Time may yet prove that the penicillin and synthetic rubber industries, at opposite ends of the pole in regards to volume of output, may be the most valuable single contributions of the chemists and chemical engineers of the Allies during the war pentad.

This precipitous coming of age of the fine chemical industry into the heavy-chemical group is shown in United States production of synthetic medicinals, as given in Table I.

Steam needs are supplied by these 140-lb. pressure boilers



In all these developments, the firm of Merck & Co., Inc., has played a pioneering part by putting increasing emphasis on the principles and practice of engineering in the manufacture of fine chemicals. Other firms have done likewise, of course, but Merck has probably become the outstanding exception to the indictment that production of fine chemicals and efficient chemical engineering are incompatible.

Until recently, operations of this company did not lend themselves to a free application of chemical engineering, since the scale on which work was done was closer to that of the old-time drug store than that of the modern factory. Merck chemists and engineers, however, have been interested from the start in transforming the manufacture of vitamins and various medicaments from small scale operations for a limited market to multiple units and streamlined processes capable of providing for nutritional and medicinal needs on a nation-wide or even international scale. In recent years this concern has gone far toward realizing this ambition by literally jumping from the type of manipulation associated with pharmacy to mass production by multi-step chemical operations.

Most synthetic medicinals are made in equipment that may be used for more than one intermediate of a given process and sometimes even for different processes. For this reason the element of flexibility in equipment and materials handling is particularly important. Outstanding in this respect is the layout of the new Stonewall plant of Merck in Elkton, Va., described later in this article.

MERCK'S PART

Merck first began to play an important role in the field of vitamins in 1934 when it started to prepare vitamin C by extraction from gladiola leaves, followed soon by a synthetic process. In 1935, a large unit for the extraction of vitamin B_1 from rice bran was erected. However, this vitamin was synthesized by Williams and co-workers in 1936 and made available in commercial quantities dring 1937. By 1941, Merck was producing approximately as much vitamin B_1 in one month as was made in the entire year 1939; production for 1942 doubled this figure and in 1943 it was still advancing.

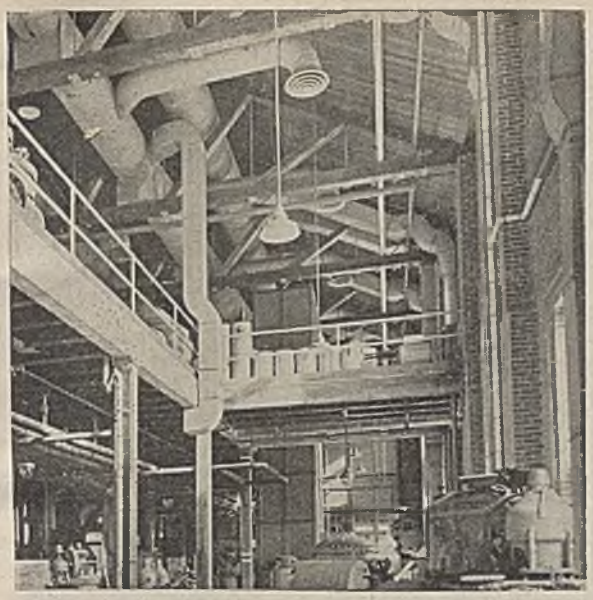
In addition, this firm has participated in the mass production of other vitamin products, the chemotherapeutic agents sulfanilamide, sulfapyridine and sulfathiazole, and is now producing Atabrine on a large scale. Penicillin will soon be produced in a large-scale unit.

On the staff of the Research and Development department, aggregating 458 members of which 45 percent are technically trained, there are some 43 chemical engineers. Approximately the same number of chemical engineers are engaged in the company's production activities.

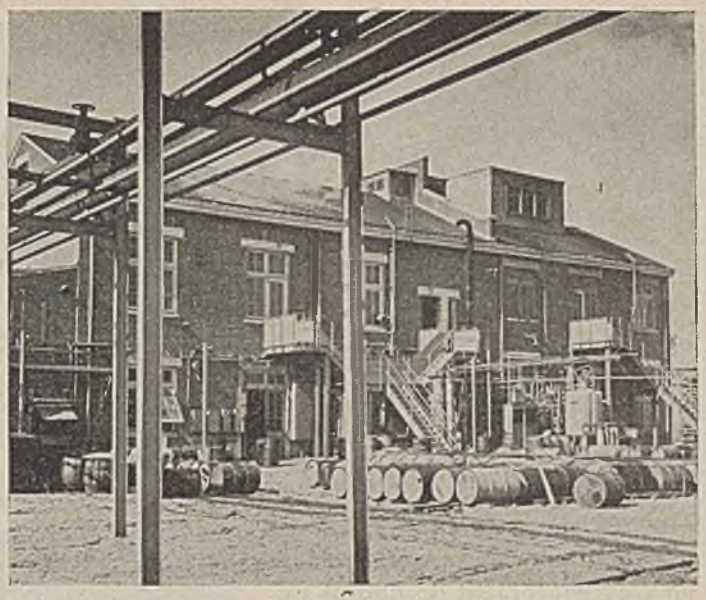
Table I—Growth of the American Synthetic Medicinal Industry[1]

	Pounds
1921	1,546,000
1930	5,450,000
1940	20,460,000
1942	38,977,000
1943 (Est.)	50,000,000

[1] Coal-tar and non-coal-tar origin.



Interior of one of the units prior to installation of equipment, showing operating mezzanine, wooden trusses and dual ventilating and conditioning systems



Typical of the type of construction at Stonewall, this building shows safety features installed; numerous exits from mezzanine and ground floor, firewall and outside electric switches

From a relatively small plant employing 1,100 people in 1930, Merck has expanded its main factory in Rahway, where 75 buildings occupy a plant site of 60 acres, to nearly 3,000 employees. In addition, the new Stonewall plant, on a 400-acre tract, employs a total of over 500 persons and the plant at Philadelphia has a personnel of some 225 persons.

VITAMIN VALLEY

Undoubtedly prophetic of the trend in the industry is Merck's newest unit, the Stonewall plant, near Elkton, Va. This unit is located in the heart of the Shenandoah Valley, made famous by Stonewall Jackson and a Blue Ridge skyline, where the open character of the countryside is a great advantage in the manufacture of chemicals and the contour of the land is suitable for waste treatment.

Main products of the plant at present are vitamin B_1 (thiamin), vitamin B_2 (riboflavin), and Atabrine, the quinine substitute. Most of the unit processes and types of reactions employed are similar to those characterizing the manufacture of synthetic aromatic derivatives and therefore will not be discussed in this article.

Planning of the new project began in 1940 with the development of a general plant layout by George P. Butler, architect. It was decided to use a standard unit type of manufacturing building developed over a period of years at Rahway. Following these basic decisions, Lockwood Greene Engineers, Inc., was engaged to survey the site and to make the structural and mechanical design of all buildings. Ground was broken in April, 1941. Manufacturing operations began in a small way in December of the same year and have continued at a constantly increasing rate.

This plant is built on a 400-acre tract, most of which lies between the Shenandoah river and a motor highway, and is provided with excellent railroad siding connections. Since this is essentially a manufacturing unit, it has no large administration buildings or product packaging and shipping warehouses. Production moves out daily in bulk to the main plant at Rahway.

In its main features, the plant is made up of two types of buildings—operating and service. There are six main operating buildings and a number of satellite buildings for special operations requiring segregation. Main buildings are constructed on a design permitting maximum flexibility in manufacturing processes.

The plant layout includes a number of service buildings, in addition to the boiler plant, solvent recovery, warehouse, machine shop and pump houses. Layout was determined by such factors as railroad requirements, convenience of routing, and safety considerations. Standard spacing of buildings was set at 200 ft., far greater than previous practice, but experience has proved that this was not at all excessive. This layout, combined with the architecture of the manufacturing buildings, gives the plant an attractive appearance.

All piping for steam and solvent distribution is on overhead structures rather than in tunnels. This decision was based partly on economic considerations and partly on safety requirements. It was considered very difficult to protect an extended tunnel system against the possible accumulation of flammable vapors.

Main buildings are 175 ft. long, 60 ft. wide, 30 ft. high to the eaves, and 45 ft. high to the peak. Wall construction is entirely of brick; the roof is supported on wooden trusses and has a slate covering. Flashings are copper and the numerous windows and doors are made up with wood framing. This construction was adopted because of the corrosive nature of the vapors involved. Height required to permit the use of mezzanines to fit into the processing was included in the design of each building.

Safety requirements called for explosion-sash throughout and many exits from the ground floor and from the mezzanine level. Ventilation requires both a heated supply system and an exhaust system to guard against explosive concentrations of vapors and to protect operators from possible toxic effects of vapors. In some cases, the exhaust system calls for 10–16 complete air changes per hour. All electrical devices must be explosion-proof, even the dial telephones, and all switches are located outside the buildings. Air conditioned rooms are provided for the finishing of certain products.

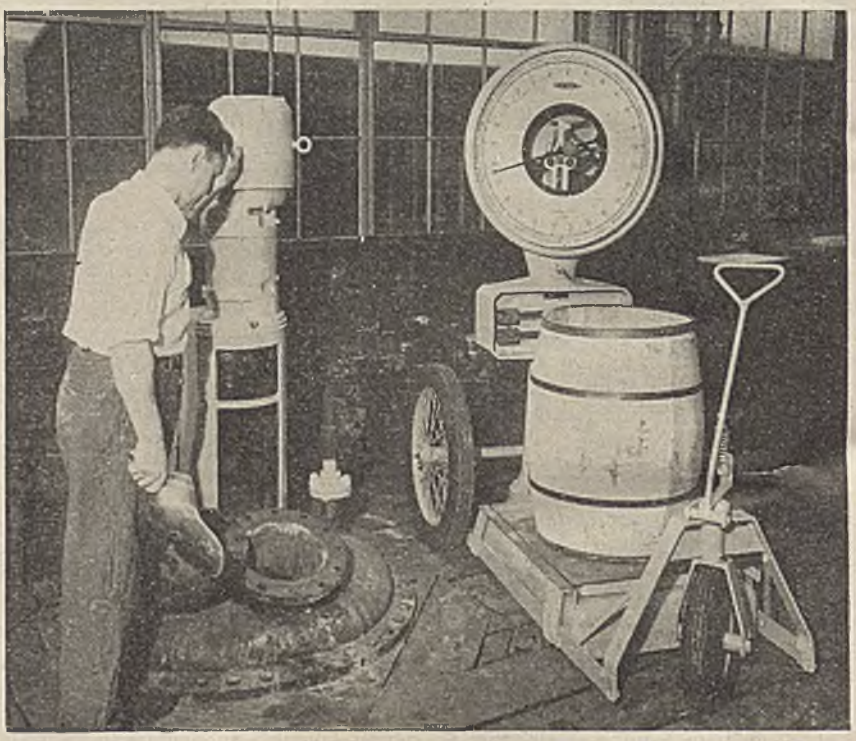
Each building is serviced with 110 v. and 440 v. power, high- and low-pressure process steam, service and drinking water, distilled water, zero deg. F. brine, compressed air and high vacuum mains.

Since this plant is equipped to handle almost every type of reaction in industrial synthetic organic chemistry, equipment is representative of all the unit chemical engineering operations. The variety of construction materials is enormous, due to the hundreds of raw materials and intermediates encountered. Included are steel, stainless steel, enamel-lined steel, glass, hard rubber, porcelain, lead, wood, acid-proof brick, plastics, ceramics, copper, tantalum, Karbate, brass, bronze, durichlor, duriron, Hastelloy, silver, Transite and cast iron. Chemical equipment and piping are highly complex, specialized and subject to constant changes.

O. A. PUTNAM *Althouse Chemical Co., Reading, Pa.*

Process Equipment on Wheels for FLEXIBILITY

This contribution is chock-full of tried and proven suggestions for making equipment do double or even triple duty. The problem in this plant has been to select or design equipment that would be flexible, easily and quickly transferable from one floor to another, and useful in a wide range of reactions and under greatly varying conditions. Mr. Putnam's experiences should be valuable where new developments are frequently placed in production or in the case of a plant operating processes intermittently. Chemical concerns can profit by his experience and recommendations in corrosion-resistant materials.—*Editors.*



Portable scales are not new but with wheels like this they are far more useful than normal in this dyestuffs manufacturing plant

A UNIQUE EQUIPMENT problem confronts a dyestuff manufacturer who must frequently place new developments into plant production. This problem is to select or design equipment that will be flexible and useful in a wide range of reactions and under greatly varying conditions. It is necessary to anticipate the needs of the future, where possible, for the advancements in dyestuffs continue to come at a rapid pace. Any special equipment designed to cover only the needs of a single new product may be useless in a short time if that particular item falls victim to progress. In any plant which must regularly cope with the addition of new items, along with regular manufacture, a little forethought and a little extra initial equipment expenditure can pay high dividends.

A pressure vessel designed for higher pressure than needed at the moment may cover the pressure requirements of some future operation. A pump capable of withstanding the corrosion conditions for one specific operation may be quickly ruined in more severe service. The same is true of valves and pipe. Smaller pieces of equipment gain considerable usefulness with easy portability.

It is obvious that all these things can be overdone and many factors must guide the engineer to a practical selection. For instance, in steel pressure vessels, it is hard to justify a margin of pressure or temperature that will cross into another A.S.M.E. code classification. Pressure margins must be balanced against decreased rates of heat transfer. A reaction vessel or autoclave for an operation that requires only heating has many potentialities if thought is given to possible use in exothermic reactions where cooling may be an important factor. It is not always necessary to incorporate extra features if the design anticipates their addition at a future time.

The corrosion problem in dyestuff manufacture is complex. The intermediates for water soluble dyes are, for the most part, processed in aqueous mediums. Extremes of alkalinity and acidity are encountered along with high and low temperatures and occasionally oxidizing conditions. Acid solutions of intermediates such as para nitrochlorobenzene sulphonic acid which have a labile chlorine atom are among the most active metal corroding agents known.

Consideration must be given to the effect of attacked metals on organic products. Whenever a product attacks metal, it is necessary to realize that perhaps there has been mutual damage and the corroding chemical has also been adversely affected. The actual dollar damage to organic products is usually far greater than to equipment. This is not apparent until more re-

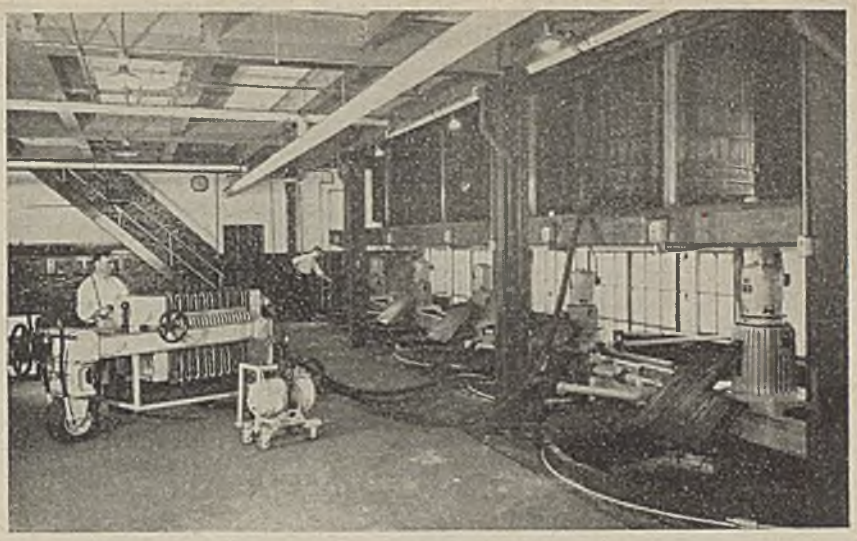
sistant equipment is installed. Since many organic intermediates are rather expensive unexpected dividends can come from this quarter.

Iron and steel are not only easily corroded in aqueous solutions but the resulting iron in solution is often detrimental to intermediate stages of manufacture and occasionally to the final product. Copper and consequently brass and bronze are particularly harmful to certain dyes. Lead, though considerably attacked, is generally harmless to finished dyes though some diazos are affected by it. Monel is satisfactory if the solutions do not attack it. If they do, the resulting copper ions are injurious. We have tested some 40 alloys for our own all-purpose corrosion resistance. In our particular case Hastelloy C has proved best though it is somewhat limited in available forms and is difficult to machine. Rubber and glass are without effect on the most sensitive materials within their practical limitations of temperature, alkalinity and solvent action. Wood in strongly alkaline solutions may have a mild reducing effect though not often serious. In general it is a remarkably resistant material.

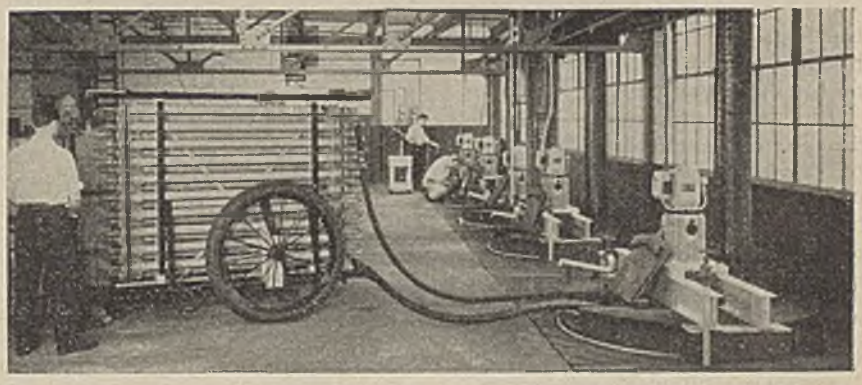
The above limitations of suitable materials leave little choice in equipment that may have to stand severely corrosive solutions. Below is outlined the equipment we have found most suitable in resisting attack in the many operations performed in aqueous mediums.

Vats for dissolving, diazotizing, coupling and for drowning out sulphonations are Louisiana cypress with four baffle staves each. All vats are covered. Agitators, all of the turbine type, are rubber covered except for a few lead covered and all-wooden ones necessary for solvent emulsions. Because of a specially built extended bearing on the bottom of the unit drives, no step bearing is used on turbine shafts under 8 ft. long. Wooden pipes convey fumes to water jet condensors. The outlet valve is a special one described below, the exposed portions of which are Hastelloy C. For heating, live steam is introduced through a portable steam jet made of the same metal. Since the special valve is of the flush bottom type and the steam jet is removable there is no place protected from agitation which can shelter even the smallest volume of product and keep it from the reaction. This feature is likewise helpful in cleaning vats to prevent contamination of subsequent batches.

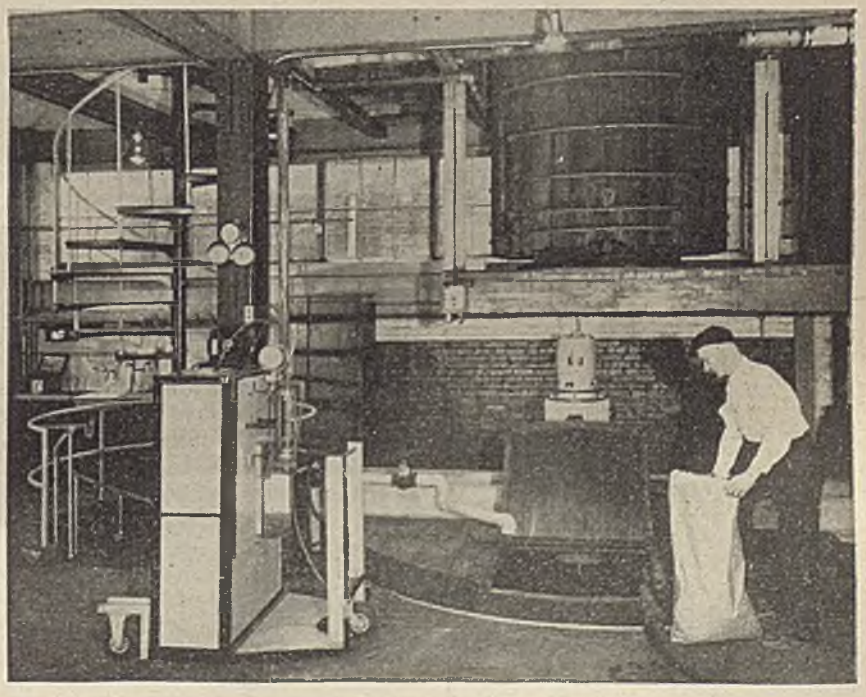
The rubber covering on the agitator is formed by spraying on many layers of a specially compounded latex which vulcanizes at low temperature. This is applied over a bonding material which has not given a single failure in over two years of service though used frequently at boiling and near boiling temperatures. Cooling with crushed ice gave some trouble with abrasion of the rubber covering at the outer end of the leading edge of the tur-



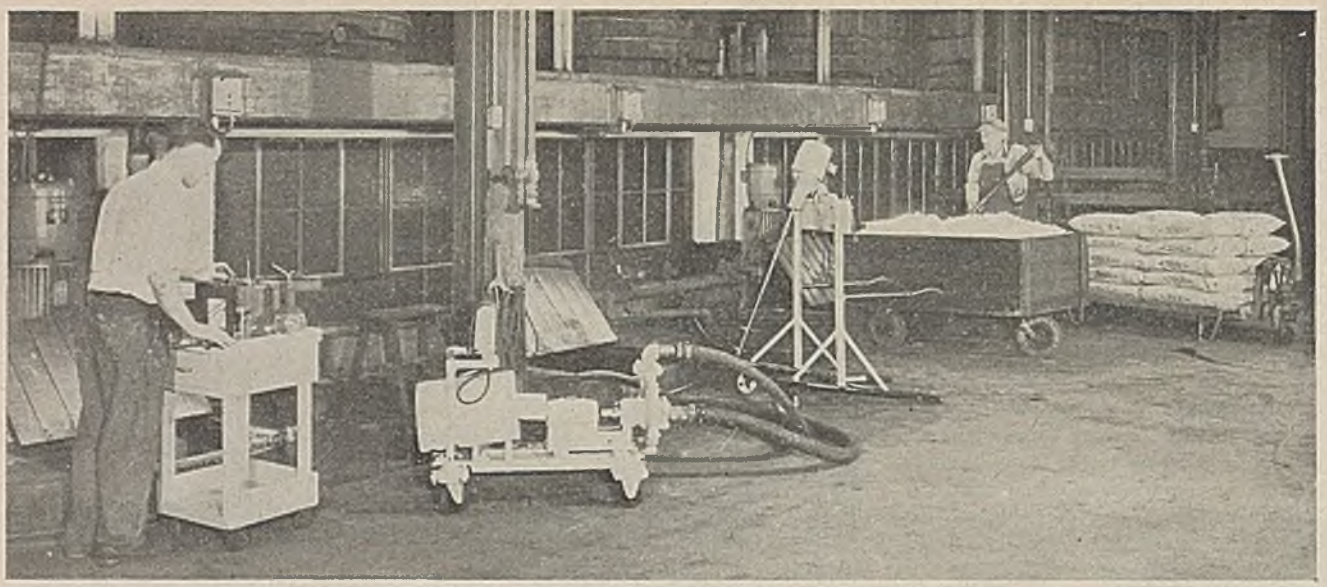
Portable closed delivery filter press connected for clarification of dissolved intermediates or diazo solutions prior to coupling



Pyrex heat exchanger with end guards removed is portable. Black wooden pipes near right wall are fume exhaust system



Portable gaseous phosgene and chlorine equipment. Steam jet is shown hanging on edge of vat and special valve is in use on mezzanine tub

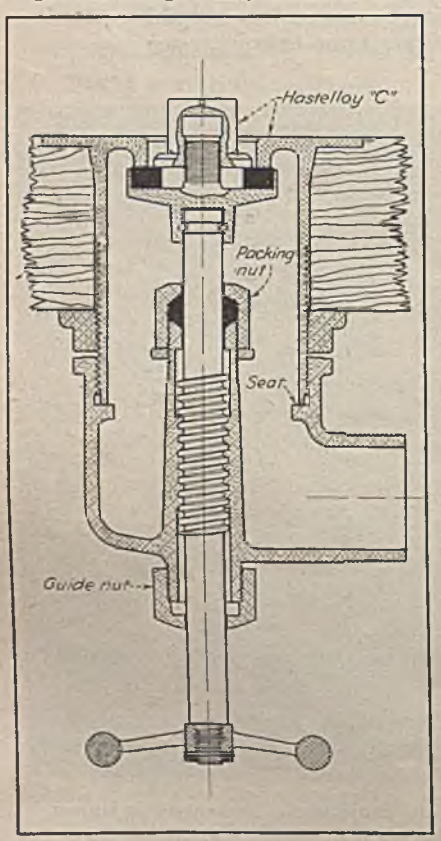


Table, corrosion-resistant pump, mixer, ice truck, and storage skids are all portable for ease in handling

bine blade. This was effectively countered by using a short rubber sleeve of ¼ in. thickness in the abraided area.

The steam jet is far more satisfactory than an open steam pipe. Higher temperatures can be reached, for the mixing action of the jet prevents local boiling. Near the boil, an open steam pipe hammers to a degree harmful to a wooden tub. This vibration is entirely eliminated when a jet is used. Hastelloy C jets and pipe have shown no signs of corrosion. The portable jets are made to hang over the edge of a tub and connect to a steam line with a steam hose. The length of the pipe is such that the jet is at least 12 in. from the floor and since the jet is pointed in the general direction of the center no erosion of the wood occurs. This necessitates at least one jet for a vat of each different height.

This chemical flush bottom valve designed by Althouse engineers has proven exceptionally satisfactory



The need for a flush bottom valve for a wooden vat was so great that one was designed and built which well serves the requirements and has proven exceptionally satisfactory. It is shown in an accompanying sketch. All portions exposed to the inside of the tub, that is, the inside flange with machined seat and a cap nut to hold the washer on the disk are made of Hastelloy C. The bonnet and stem which are exposed only during those times when the tub is being emptied are very satisfactory if made of Monel for the exposures are relatively short. The outlet is threaded for connection with a 1½ in. hose coupling. An unusual departure from regular valves is the packing nut on the inside. The lower nut is merely a bearing and is actually drilled to drain any liquid that might have seeped past the packing nut. It is believed that this valve could be advantageously used by anyone who is handling corrosive materials in wooden tubs or is troubled by the small stagnant space resulting from regular valve assemblies.

Transport of liquids throughout the plant is done in natural or synthetic rubber hoses of 1½ and 2 in. sizes. The variations of alkali and acids are most economically compromised in a good grade of wire wrapped hot water hose. The portion of the hose coupling to which the hose is clamped is made of Hastelloy C, the coupling nut which does not contact the liquid is brass. With Hastelloy C nipples machined square at both ends and with straight treads, hoses can be connected to one another by hand.

Pumps are all portable, with direct-drive motor and starter ready to plug in at any three-phase outlet. These are either Hastelloy C or hard rubber lined. Wooden filter presses of the plate and frame type are fitted with alloy feed pipes and valves. These presses are served by lead lined pressure tanks where compressed air furnishes the filtering force. Products which would settle in these blowcases filter rapidly and hence are pumped directly to the presses. Filter presses are dumped into wooden trucks built with the inside ply consisting of asphalt impregnated oak. They are more satisfactory in withstanding corrosion than alloy lined trucks which have been tried.

Portability has been made a factor in every piece of equipment that might handily be used on different floor levels and can be dimensionally accommodated by the elevators. One of the largest pieces that has been put on wheels is a 24 in. closed delivery filter press. This is most useful in clarifying diazo solutions just prior to coupling and for charcoal clarifications whenever and wherever needed. The press is merely placed in the hose line from the pump at a place where the filtrate runs by gravity into the vat or tub desired. The convenience of such an arrangement is evident from the accompanying picture.

When dilution by live steam or ice cannot be tolerated in heating and cooling operations heat exchange is necessary. Metal coils in a tub greatly limit its usage due to corrosion possibilities. The solution is a portable Pyrex glass heat exchanger through which is pumped the material to be heated or cooled. Any tub then has the equivalent of a coil. In order to

(Continued on page 103)

JOSEPH D. PARENT *Department of Chemical Engineering, Kansas State College, Manhattan, Kan.*

PREDICTING

Flow-Friction Data for Sludges

Data and curves presented in this article facilitate the correlation and prediction of friction data for sludges in plastic flow. Such a correlation has not previously been available although certain data have been determined by several investigators. Two correlation methods are described here, one of theoretical interest but of little utility for design; the other simple, but suitable only in the laminar range. For the turbulent range the author recommends that the method of Babbitt and Caldwell, which he describes, be employed.—*Editors.*

As is well known, all data for laminar flow of ordinary fluids in circular pipes fall on a single curve if the Fanning friction factor, f is plotted against the Reynolds group, Re. This behavior can be formulated mathematically as shown in Equation (1):

$$f = 16/\mathrm{Re} \qquad (1)$$

As used here, f will be defined as $sgD/2u^2$, although some authors use the 2 in the numerator. (As a matter of fact, no numerical constants need be included in any such dimensionless group in so far as they may be presented separately in the equation.)

It has been shown by various authors on theoretical grounds that the behavior of ordinary fluids in circular pipes in the range of laminar flow will follow the equation

$$s = \frac{32\,u\mu}{\rho g D^2} \qquad (2)$$

It follows that

$$f = \frac{gD}{2u^2}\left(\frac{32\,u\mu}{\rho g D^2}\right) = \frac{16}{\mathrm{Re}} \qquad (3)$$

Equation (1) is thus shown to have a basis in theoretical considerations.

In the range of turbulent flow, the roughness of the channel surface in contact with the fluid becomes significant, and friction losses due to eddies result. These losses are of the nature of kinetic energy effects, and should be correlated by a group containing the term u^2. The Fanning factor answers this requirement and therefore, although Equation (2) is no longer valid, the graph of f vs. Re is of use in this region also, although each surface of different roughness gives rise to a somewhat different line in so far as neither f nor Re contain a suitable roughness factor.

CORRELATION LACKING

Although a moderate quantity of data is now available for liquids containing suspended matter, no general correlation of friction data with flow variables and fluid properties has been presented. Many of the suspensions tested behave in a practical sense as ordinary fluids, but some of the more concentrated ones which have been tested exhibit plastic or semi-plastic flow characteristics at low values of the Reynolds number and turbulent flow at high values thereof. Several investigators have shown that the prediction of friction losses for viscous or quasi-viscous sludges should follow the usual procedure, and the same is true for turbulent flow of the plastic group.* However, the usual correlation breaks down for the latter group of materials when in laminar flow.

The viscosity of a fluid can be measured in any of the usual types of viscosimeters or it can be determined from the slope of the s vs. u curve. Inspection of Equation (2) reveals that this slope is $32\mu/\rho g D^2$ and since the curve for ordinary fluids in viscous flow is a straight line passing through the origin for fixed values of ρ and D, s/u and μ are independent of u. Materials exhibiting plastic flow possess characteristic yield points at any given temperature and composition, and the s vs. u curves can no longer pass through the origin, but must have positive intercepts on the s axis. As a consequence s/u and μ', the apparent viscosity, vary when u is altered, and this causes difficulty in predicting f values. Here

* Babbit and Caldwell perhaps have done the most direct and clear-cut work on this matter. They use the viscosity of water itself in estimating Re, and get values of f for aqueous sludges that agree within 5 percent with those of the usual friction factor curves.

LIST OF SYMBOLS

- a, b = Constants.
- f = Fanning friction factor.
- g = Acceleration due to gravity, feet per (sec. sec.).
- g_c = Conversion factor to change poundals to pounds force, or pounds mass to slugs.
- s = H/L.
- u = Average linear velocity across the pipe, feet per sec.
- x = $32\,u\eta/g\rho\,D^2$
- y = $s\,\rho\,g\,D/g_c\tau_w$
- D = Pipe diameter, feet.
- H = Friction loss, feet of fluid flowing.
- L = Length, measured along pipe, feet.
- P = Pressure drop due to friction in pounds force per sq. ft.
- Re = $D\,u\,\rho/\mu$, the ordinary Reynolds number.
- Re′ = $D\,u\,\rho/\mu'$, a modified Reynolds number.
- η = Coefficient of rigidity, pounds mass per (ft. sec.).
- μ = Coefficient of viscosity, pounds mass per (ft. sec.).
- μ' = Apparent coefficient of viscosity, pounds mass per (ft. sec.).
- ρ = Density, pounds mass per cu. ft.
- τ_y = Shearing stress at yield point of sludge, pounds force per sq. ft.
- τ_w = Shearing stress at pipe wall, pounds force per sq. ft.
- ϕ = Correction factor equal to $1-16/y^3$

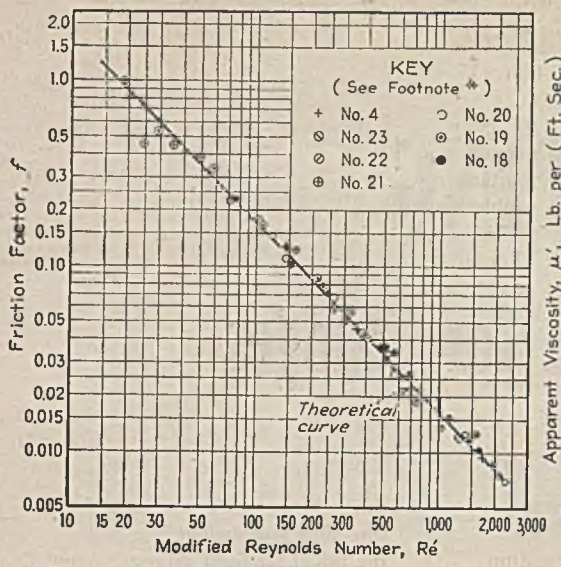


Fig. 1—Correlation of f and Ré for seven different plastic sludges in laminar flow

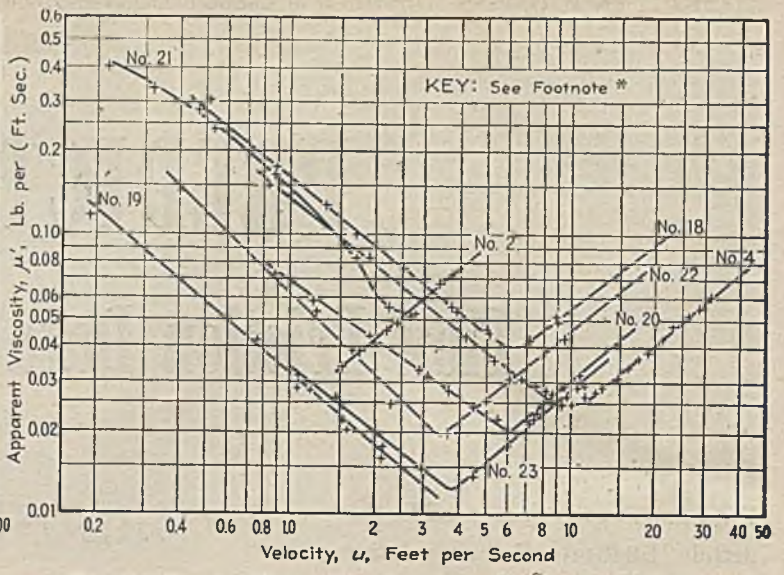


Fig. 2—Curves illustrating the dependence of the apparent coefficient of viscosity on the velocity, for several suspensions

μ' is defined by the following equation:

$$s = \frac{32\,u\mu'}{\rho g D^2} \qquad (4)$$

From this definition it follows that

$$\frac{16\mu'}{Du\rho} = \frac{16}{Du\rho}\left(\frac{sg\rho D^2}{32\,u}\right) = f \qquad (5)$$

From Equation (5) it may be seen that all data for plastic sludges in laminar flow may be expected to show the same correlation of f and Re′ as is shown for f and Re by ordinary liquids in viscous flow. Re′ is defined as $Du\rho/\mu'$. This principle was checked for seven different sludges reported in the literature, and the results are shown in Fig. 1. Values of μ' were computed by means of Equation (16).

The term μ' can be computed by means of Equations (4), (12) or (16), or it can be measured in laboratory devices the same as, or similar in design to the usual viscosimeters. The types of apparatus available and the theoretical mechanical considerations underlying their usage are learnedly discussed in two publications of the Academy of Sciences of Amsterdam.[1]

PREDICTING FRICTION

Where adequate test data have been reported, no trouble is experienced in checking both Equation (5) and the correlation pointed out. Unfortunately, when the problem is reversed to the practical one of predicting f or s for a given sludge at specified values of the significant variables, the solution is not simple, because μ', which must be known, varies whenever the velocity is altered. Until the exact nature of this relationship is known, the problem will remain difficult.

One method of attack is to provide tabulated data or graphs showing related values of μ' and u for specified sludges under stated flow conditions. Fig. 2 illustrates the manner of dependence of μ' on u for several suspensions. It will be noted that there are two separate sections for each curve, a falling one for the plastic range and a rising one for the turbulent range. Both sections are essentially linear in a log-log graph and the second is practically linear in an ordinary graph. Hatfield[2] has previously reported the first linear falling section of some sewage sludges. One may then express μ' as a function of u and substitute the resulting expression in Equation (4). Thus, an equation of the type

$$\mu' = au^b \qquad (6)$$

fits the data fairly satisfactorily in either flow range, and leads to

$$s = \frac{32\,u\,(au^b)}{g\rho D^2} = \frac{32\,au^{1+b}}{g\rho D^2} \qquad (7)$$

In fact, a general expression involving two terms covering both ranges can be found. If separate equations are used, the sign of b is different in the two ranges, and the magnitude also varies somewhat. The usage of this method is limited by the fact that it is necessary to have some μ', u data before s can be evaluated. Also it is necessary to know how a and b are influenced by the concentration, etc., before the data of one test can be used for another set of conditions.

A second method of attack is the theoretical one. It has been shown by Bingham[3] that

$$u = \frac{Dg_c\tau_y}{8\eta}\left[1 - \frac{4}{3}\left(\frac{\tau_y}{\tau_y}\right) + \frac{1}{3}\left(\frac{\tau_y}{\tau_y}\right)^4\right] \qquad (8)$$

for laminar flow of ideally† plastic materials in circular pipes. It may be shown by equating $\pi D^2P/4$, the driving force in flow in circular tubes, and the opposing force, $\pi D L \tau_y$, that

$$\tau_y = D\,P/4\,L \qquad (9)$$

Also it is well known that pressure readings can be expressed in terms of head of the fluid flowing by means of the following relation

$$P = H\,\rho\,g/g_c \qquad (10)$$

Combining Equations (8), (9), (10) one obtains

$$u = \frac{s\,g\,\rho\,D^2}{32\eta}\left[1 - \frac{16\,g_c\,\tau_y}{3\,g\,\rho\,s\,D} + \frac{256}{3}\left(\frac{g_c\,\tau_y}{g\,\rho\,s\,D}\right)^4\right] \qquad (11)$$

and comparing this with Equation (4) it is seen that

$$\mu' = \frac{\eta}{\left[1 - \frac{16\,g_c\,\tau_y}{3\,g\,\rho\,s\,D} + \frac{256}{3}\left(\frac{g_c\,\tau_y}{g\,\rho\,s\,D}\right)^4\right]} \qquad (12)$$

Using this value of μ' in Equation (4) leads to

$$s = \frac{32\,u\,\eta}{g\,\rho\,D^2\left[1 - \frac{16\,g_c\,\tau_y}{3\,g\,\rho\,s\,D} + \frac{256}{3}\left(\frac{g_c\,\tau_y}{g\,\rho\,s\,D}\right)^4\right]} \qquad (13)$$

It is not necessary to calculate s by means of Equation (13). This equation can be rearranged to the form

$$y + \frac{1}{3\,y^3} = x + \frac{16}{3} \qquad (14)$$

This new form shows that y data should be correlated with x data to give a single line for all plastic sludges in laminar flow in circular pipes. Fig. 3 shows this corre-

* Sludge Data Used: No. 2 and No. 4 refer to sludges No. 2 and No. 4 of Babbitt and Caldwell, reported in Engineering Experiment Station Bulletin, Series No. 323 of the University of Illinois. Numbers 18 to 23 refer to sludges of these same numbers reported by Wilhelm, Wroughton and Loeffel in Flow of Suspensions Through Pipes, *Ind. Eng. Chem.*, 31, 622 (1939).

† Settling, slip, seepage, thixotropy and other complicating factors must be absent. Thixotropy should cause no trouble if the suspension is well agitated before using, and is kept moving at a reasonable rate. Babbitt and Caldwell were very careful in their work in this and other respects.

lation and provides a graphical solution of Equation (13). Having once decided that the necessary restrictions obtain, i.e., laminar flow and circular pipe,* one may calculate x, and read off y from the graph, and from this value calculate s. For the sake of completeness it may be pointed out that this curve is double valued with respect to the ordinate, possessing its least value of 4 at an x value of zero. The lower branch is presumed to yield physically unacceptable solutions.

Approximate values of μ' may be calculated by means of a simplified form of Equation (12) which was suggested by Babbitt and Caldwell.[4]

$$\mu' \cong \eta + \frac{\tau_y g_c D}{6u} \qquad (15)$$

Actually, the full form of the rearranged Equation (12) should be:

$$\mu' = \eta + \frac{\tau_y g_c D \phi}{6u} \qquad (16)$$

where ϕ is a correction factor equal to $1 - 16/y^3$. Fig. 4 shows the manner in which ϕ varies with y. It is decidedly appreciable at lower values of y, and this indicates why the equations of Babbitt and Caldwell for calculating upper and lower critical velocities in the range of transition of flow type from laminar to turbulent give answers which, although fairly good, are not perfectly accurate. Their equations were based on Equation (15) for the sake of simplicity.

In conclusion, two methods of correlating plastic flow data have been pointed out. The first is of theoretical importance, but is of little utility in design problems; the second is simple to use, but is restricted to the laminar range. For the turbulent range, one should use the method of Babbitt and Caldwell.

* The guide for transition of flow type from laminar to turbulent is that the value of Ré be the same as that of Re for ordinary liquids undergoing this change. This will be about 2,200 to 2,500. Using extreme values of 2,000 and 3,000, Babbitt and Caldwell derive equations for upper and lower critical velocity values in terms of η, τ_y, D, ρ and g, which check fairly well.

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2. Hatfield. Viscosity or Pseudo-Plastic Properties of Sewage Sludges, *Sewage Works Jour.*, Vol. 10.
3. Bingham, "Fluidity and Plasticity," McGraw Hill Book Co. Inc., New York.
4. Babbitt and Caldwell. Their work in the laminar range is reported in Bulletin No. 319 of the Engineering Experiment Station of the University of Illinois; their work in the turbulent range is in Bulletin No. 323 of the same series. A single article covering both is "The Flow of Muds, Sludges, and Suspensions in Circular Pipe," *Trans. Am. Inst. Chem. Eng.*, 37, 237 (1939).

EQUIPMENT FLEXIBILITY

(*Continued from page 100*)

obtain the desired capacity within the dimensions permitted by the elevators a staggered cascade was made which will entirely drain by gravity. Counter-current circulations are used and the jacket is split near the middle in order that brine cooling, if desired, may follow regular water cooling in the first part of the exchanger. This equipment can be rolled up to a still and with a few extra Pyrex fittings serve admirably as a reflux or take-off condensor. It is truly quite versatile when it is on wheels.

It has been found to be expedient to make portable the equipment for dispensing gaseous chlorine and phosgene. This unit accommodates two cylinders so the emptying of one does not interrupt operations. With a low platform, one man can easily change cylinders. Heating is accomplished by three flat electric strip heaters which are clamped to the cylinder in use.

The most efficient heating results from keeping this heating unit just below the liquid level in the cylinder. This supplies heat to the area where heat of vaporization is needed. The gas is metered through a rotameter with a Hastelloy C float. Saran tubing with bronze flange fittings works satisfactorily.

Crushed ice for azo couplings and diazotizations is handled in wooden trucks each holding about 1,000 lb. The bottom of these trucks clears the top of all wooden vats. The truck is pushed to a vat, the end gate raised and the entire 1,000 lb. of ice can be pushed through the gate in 30 sec. They are constructed of two-ply wood, the inner ply being asphalt impregnated oak. This construction has shown excellent resistance to shovel wear and is quite impervious to moisture.

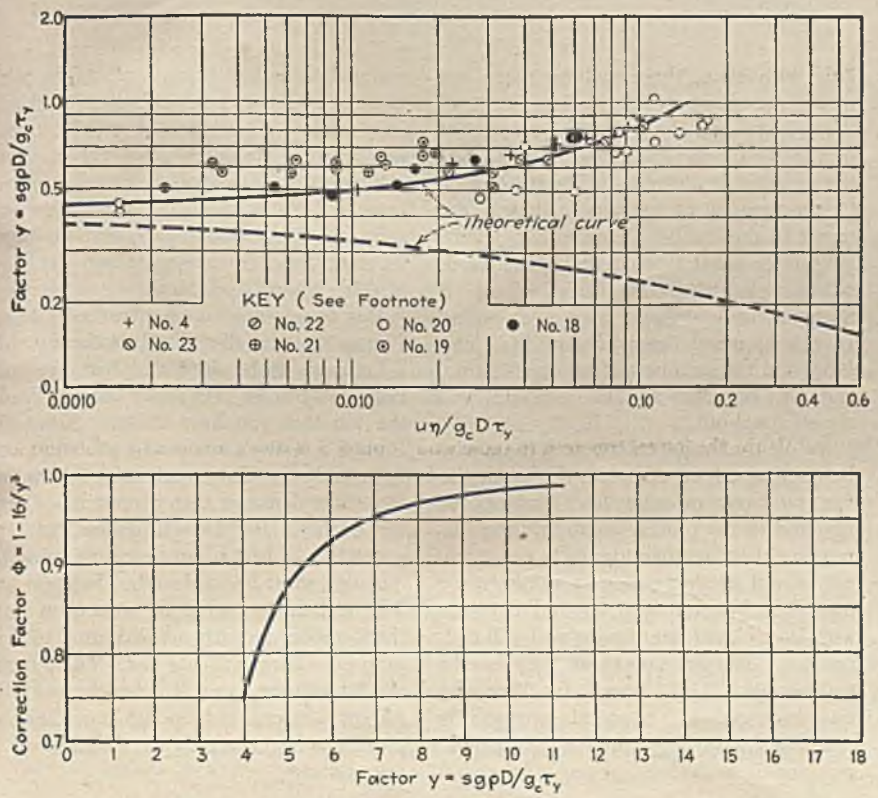
A portable mixer is fastened to a small truck in such a manner that it remains attached while dissolving drums of sodium nitrite or alkalis that may be needed. Workmen have dubbed it "The Mixmaster".

Bulk items of soda ash, bicarbonate, and salt are stored on skids. A minimum of effort is entailed in transporting these where desired. It is a matter of seconds only to pick up a ton load of one of these materials with a skid truck. A dial scale has been put on large wheels. Small tables on large casters serve throughout the plant as portable stands for pH meters and a convenient place to keep thermometers, test papers, hydrometers, and the like. Since belts which develop static electric charges are not used, a pH meter can be used anywhere a plant control chemist wishes.

A major part of this program relies on pneumatic tires. As an ironic and humorous consequence of all this portability, easy maintenance of properly inflated tires required us to make a small portable air compressor.

Fig. 3—Curve for solving Equation (13) by simplified Equation (14)

Fig. 4—Variation of correction factor for Equation (16), with y



ACHIEVEMENT

Award to Rubber Industry Brings Commendation and Challenge

When the Sixth Biennial Award for Chemical Engineering Achievement was presented to the American Synthetic Rubber Industry in New York on December 8, 1943, the former Rubber Director, William M. Jeffers, and his successor, Colonel Bradley Dewey, made some interesting comments about the work that had been accomplished and what remains to be done. Following are excerpts from a Soundscript recording of their remarks.

BRADLEY DEWEY *Rubber Director, Washington, D. C.*

Credit Where Credit Is Due

IT IS FITTING that you should honor those in the American synthetic rubber industry who have done such a monumental job for their country. In the hurly-burly of the war effort there is too often a tendency to forget industry. All too often industry is doing and has done its job despite rather than because of the efforts of others not so well informed.

Chemical & Metallurgical Engineering honors the technical men and women in this industry, and there is no more fitting place for me and my associates to say that we, too, admire and honor their accomplishments. The American synthetic rubber industry's achievement is one of the greatest of all time. Without it, this country could not fight the war on its present scale and its civilian economy would have faced disaster.

The past of the rubber program is checkered with debates, recriminations and investigations, but as history judges the effort, with a perspective that can come only with time, there will be more and more appreciation of the achievement of the industry and the wisdom and foresight of the men who stimulated and planned the program finally approved by the Baruch Committee and turned over in their classic report to the Rubber Director, Mr. Jeffers, for him to see it through, or in the words of the Baruch Committee, "bull it through" in accordance with a set policy. In this appraisal the names of Mr. Jesse Jones and the members of his organization, and Dr. Weidlein and his associates will always stand out.

While the formal tribute is to those who have designed or operated the plants in the program, or who have contributed significantly to process engineering or development of the main products and essential special products such as catalysts, we must not forget to pay tribute to others who have played, are playing and will continue to play an important part in the partnership. This group includes the manufacturers of chemical engineering equipment, the construction companies, and many who are making such vital materials as carbon black, accelerators, plasticizers, and last, but not least, the distillers, whose production of ethyl alcohol has proved absolutely essential in this achievement. Finally the rubber program owes a debt to the backing of the Congress and the favorable press that has been its since the Baruch Report and first day of Mr. Jeffers' leadership.

But in referring to what has been done I know that you all realize that there is still a lot more to be done and that you will keep going at an ever faster pace to finish the job that you have started. Although Buna S is doing a whale of a job and gives us a badly needed supply of rubber, the war effort demands that it must be of better quality. Its strength when hot, its generation of heat when flexed, its adhesive qualities, must be improved. They will be. The technical men in the American synthetic rubber industry are dedicated to this purpose. They will not fail. Their main effort has been and still is for the war but I know they cannot help but hope they are playing a large part in the building of a new industry.

Rubber Director Bradley Dewey (left) and his predecessor, William M. Jeffers, are cheerful commentators on the Chemical Engineering Award to the American Synthetic Rubber Industry

WILLIAM M. JEFFERS *President, Union Pacific Railroad*

A Long Way Yet to Go

I WANT to pay my respects to you men of the chemical industry. You've done a great job—the kind of a job, however, the American people expected you to do. But you've got a long way to go yet!

I am just a little disturbed about hearing so much of what is going to happen to the synthetic rubber after the war. Your job between now and that time is to improve the quality of synthetics. I should like to have it said that we are never again to be dependent upon any foreign country for our supply of rubber. Somewhere, some time, we Americans ought to begin talking and thinking about what's going to happen to *this* country. Of course, we are sympathetic with the desires of other nations, but we must remember that we owe something to the American people. Make no mistake about it, the American people are thinking too. They have a $750,000,000 stake in this synthetic rubber industry. They look upon the automobile as next to their Bill of Rights. They think of rubber in the manner in which it is used. They want tires. They are looking to you men in the chemical, petroleum and rubber industries to produce the materials and tires they want. They can be produced.

It was heartening the other day to hear Stalin give American industry, American production, the great credit he did in his recent statement. We know, of course, how American industry arose to meet the challenge of rubber. Let's treat this big giant of industry well. Let's see to it that taxation is proper. Let's see to it that it is not unnecessarily hampered, because the next time this big giant might not be able to rise. We must not have that condition develop in our country.

The next big job will be reconvert from war to peace, and fortunately for us, Bernard M. Baruch is still active, mentally and physicially. We have some outstanding men in this country who can think through on this problem. Baruch is one of them—in my book the Number One American citizen. Another is Jesse H. Jones, an outstanding man. So let's not worry too much about what is going to happen in this country's postwar. Let's support the people who are doing the thinking and have been given that job.

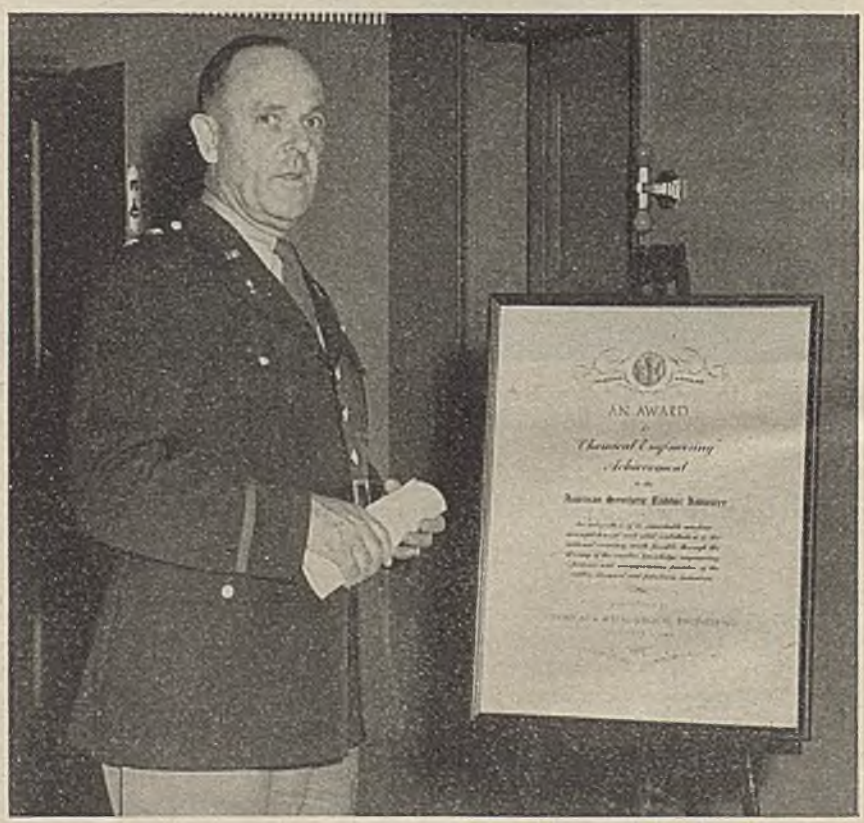
By the way, we hear entirely too much about the Baruch report. I for one, would like to hear more in the future about what Baruch says, what Baruch thinks. Let's never let that name Baruch become an adjective in this country. I never met the man until I came into the rubber program. You will recall the recommendation of that report, "to bull it through." I am not a chemist and I haven't even a speaking acquaintance with chemistry. I'm too old to take it up now. My job, as I saw it, was to run interference. Whether I did that job as well as I should have is for someone else to decide. I think I did pretty well, and what's more when I thought I had the job as far along as I could take it, I left Washington. Nor have I much further to say about by experiences there. But I was most thoroughly convinced of one thing and that is: after a year in Washington I am sure that no government, no era, no people is smarter than Main Street.

MAJOR-GENERAL L. H. CAMPBELL, JR. *Chief of Ordnance, United States Army*

SYNTHETIC RUBBER

Makes Vital Contribution Toward Winning the War

Today our biggest, most exacting customer for rubber products is the United States Army and no one speaks of its needs with greater authority than the hard-hitting, straight-thinking Chief of Ordnance. From a rich background of more than 20 years of experience in the arsenals, on the proving grounds, and in the various theatres of war, General Campbell addressed the following remarks to nearly 2,000 engineers and executives present at the Chemical Engineering Award Dinner in New York. (See *Chem. & Met.* Dec. 1943, pp. 96-101.)



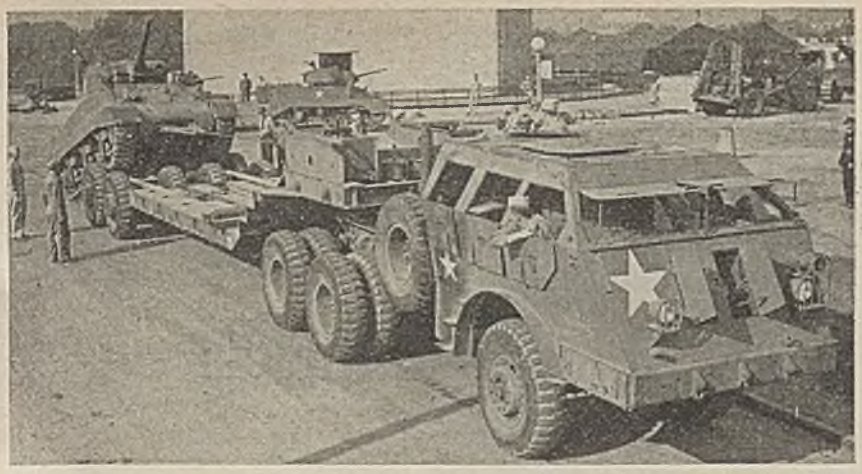
General Campbell stands beside the Scroll of Award to the American Synthetic Rubber Industry

THIS OCCASION is of historic importance. It is a milestone in our progress toward winning the war. It honors nearly a hundred companies that comprise the American synthetic rubber industry. It also affords me, as Chief of Ordnance of the United States Army, the opportunity to thank every member of that industry for helping to keep our guns rolling, our tanks moving, and our trucks, jeeps, combat cars and half-tracks on the road to victory! To the members of the Committee of Award representing the chemical engineering profession, to the publisher and editors of the technical journal that sponsors this award, and to the members of the American Synthetic Rubber Industry, I bring the hearty good wishes of every military and civilian member of the Ordnance Department at its arsenals, its plants, its depots, and in its maintenance companies on every battlefront throughout the world.

In this brief address, I would like to give you the background of our Army Ordnance problem so far as rubber is concerned. Then I would like to tell you what we are doing in cooperation with the rubber industry to assure the best product and adequate supply for our weapons.

In the years preceding Pearl Harbor, while the Army was on a peacetime basis, our principal contact with the automotive and rubber industries was through the Ordnance Advisory Committee of the Society of Automotive Engineers. This group was composed of representatives of the principal branches of the automotive industry, among which was a representative of the rubber industry. This committee, during the past quarter century, has been a valued adjunct of the Ordnance Department.

Rubber is an engineering material which is used in large quantities by the various branches of the Army. As our rearmament progressed, it became very evident that while to us this was only another raw material, yet its characteristics were more varied than any other item we were using. It is a material which is used both in a liquid and solid form. Products manufac-



This 45-ton tractor-trailer combination for recovering disabled tanks from the battlefield is a large user of heavy-duty tires

tured from rubber must work satisfactorily from temperatures as low as 65 deg. below zero, all the way up to those of superheated steam. Rubber can be compounded to have a hardness approaching that of steel. It can be so light and soft as to make hospital mattresses of the finest type. It can be used as an insulator on electric wiring. It can be used to eliminate the static electricity hazard in powder plants, and thus help make them the safest industrial plants in the land.

Material such as this obviously has many varied and sundry uses within the Ordnance Department. We found it desirable to establish a committee exclusively for the purpose of handling rubber products. Such a committee was established in August, 1937, and known as the Rubber Products Ordnance Advisory Sub-Committee. This committee was composed of representatives of all the major rubber companies as well as key personnel from the Ordnance Department. It became our central source of contact with the rubber industry.

The coordination of the problems of Ordnance and industry in this committee proved entirely adequate for our needs until it became apparent that rubber was to be one of the most strategic materials of the war. By the summer of 1942, our rubber problems had become so varied and so acute that it was essential to establish committees composed of specialists working within industry and Ordnance. At that time six special committees were set up to serve as Ordnance Advisory Groups. These groups covered such items as pneumatic tires, reconditioning of pneumatic tires, bogie rollers, half-tracks, tank track engineering and bullet-sealing fuel tanks. In addition to these recognized industry committees, we have several specialist groups working with the mechanical goods division of the Rubber Manufacturers Association. I cannot emphasize too strongly the importance of this work. Six ounces of rubber in a recoil mechanism can mean the success or failure of a military operation on which American lives may depend.

Paralleling our technical committee work with the rubber industry has been the establishment of test fleets. At present our test operations cover bicycles, trucks and half-tracks as well as the various types of fighting tanks. The rubber industry provides trained and skilled observers with these fleets in order that we may get the quickest exchange of information between the test fleet and the production line.

The Ordnance Desert Proving Ground at Camp Seeley, California, the Ordnance tire test fleet at Normoyle, Texas, and the Aberdeen Proving Ground in Maryland, are operating wheeled and track-laying vehicles around the clock, testing various items on the rubber program. These three test centers average 43,150 vehicle miles a day and they operate daily.

CONVERSION TO SYNTHETICS

The problem of conversion from natural to synthetic rubber in tires is more difficult as the tire size increases. This is due to the fact that the synthetic rubber builds more heat than natural rubber and this is, of course, more pronounced in the larger sizes. At the present time the small sizes are being produced of 100 percent synthetic-rubber construction. The 6.00–16 size which represents 20 percent of the total number of Ordnance tires is made entirely of synthetic rubber—a saving of 1,375,000 pounds of natural rubber a month—or 80,000 tons of natural rubber a year.

The medium size truck tires, 7.50–20 and 9.00–16 are now being produced in 70 percent synthetic-rubber construction—a saving of some 6,000,000 pounds of crude rubber a month. Development work is being carried out in an effort to extend the percentage of synthetic in these sizes.

The large size tires have presented an extremely difficult problem but it is felt that a satisfactory tire can be built with a high percentage of synthetic rubber.

All flaps have been made of synthetic rubber for some time and this item represents a natural rubber saving of about 394 tons a month. Some sizes of tubes are being produced from synthetic rubber and development work is progressing satisfactorily.

Ordnance material in the mechanical goods classification is more than 80 percent converted to synthetic rubber, saving approximately 800,000 pounds of natural rubber a month. Work is being continued to make this conversion 100 percent.

The Ordnance Department has made an overall conversion from natural to synthetic rubber of more than 50 percent, resulting in a saving of more than 10,000 tons of rubber a month. This conversion will be increased as rapidly as tests can be completed to prove that the conversions are sound, and as rapidly as industry can handle the change from natural to synthetic rubber.

The substitution of synthetic rubber for natural rubber has not been without its problems. The Rubber Director's office of the War Production Board, recognizing the strategic importance of synthetic rubber as an essential military material as well as a civilian necessity, has been quick to establish its own committees and test fleets to coordinate its work on this new material. The rubber industry has also set up a cooperative synthetic tire testing fleet. All these groups are working in full and complete harmony with the Ordnance Department of the Army.

The rapidly diminishing stockpile of natural rubber makes it imperative that we continue our efforts to convert all of our rubber products to synthetics. When we consider the scarcity of synthetic a year ago as compared with our production of today, it is indeed no small accomplishment. The chemical engineers of industry and those of the government, charged with this task, are indeed to be commended for a difficult job well done.

Thus it is that I can say with much pride that the American synthetic rubber industry has a vital part in the winning of the war. There can be no doubt but that when the history of this conflict is written, when the heroism and valor of our American soldiers and our Allies shall have defeated our ruthless enemies, then can you of the synthetic rubber industry and we of Army Ordnance view with added pride our cooperative endeavors. Due to our united efforts, our men will have kept the tanks, the guns, the airplanes, and the factories constantly operating for victory. Then will this Award for Chemical Engineering Achievement have added significance. It will symbolize that our Armies of World War II moved to the battlefield on rubber and that the American Synthetic Rubber Industry not only helped to defeat the enemy, but also, I am confident, to sustain the peace that will follow.

JAMES A. LEE *Managing Editor, Chemical & Metallurgical Engineering*

CRYPTOSTEGIA

Provides Limited Supply of Rubber

Under cultivation in Haiti are 35,000 acres of the cryptostegia vine. This is the first commercial attempt that has ever been made to cultivate this source of natural rubber. Problems dealing with means for collecting the latex and with its coagulation appear to have been overcome, but research is actively being pushed in an effort to improve both. The product compares favorably with rubber from the hevea tree. While at its present cost it could not compete for most purposes with other varieties of natural rubber in normal times, it offers certain advantages as a specialty material.—*Editors.*

HAITI'S CRYPTOSTEGIA offers the United States an opportunity to obtain a limited volume of natural rubber of high quality in the course of a year or two. The price of 62 cents per lb. (based on amortization of investment in five years) is high for rubber in normal years, but is not too much to pay for a strategic material during the present emergency. The United States government has spent approximately $5,000,000 in an effort to develop this project.

The cryptostegia operations in the West Indies were visited by the author in October when he and a group of newspaper representatives made a tour of the Haitian, Brazilian and Bolivian rubber producing areas under the auspices of the Rubber Development Corporation.

This plant is a native of Madagascar but is known to have been growing wild in Haiti for at least a quarter of a century. Its ability to produce high-quality rubber has been recognized for 50 years, but this is the first large scale effort to produce rubber from the cryptostegia bush.

The Societe Haitiano-Americaine de Developpement Agricole (Haitian-American Agricultural Development Corporation), better known as SHADA from the initials of its French name, is a Haitian organization, supported by credits from the Export-Import Bank of Washington and technical aid from the United States. It had begun work on the establishment of a rubber plantation industry, based mainly on hevea trees. And so when the war with Japan made it imperative to use every possible means to increase rubber production in the Western Hemisphere, SHADA undertook to grow cryptostegia, a bush or vine which grows much as does forsythia, and yields latex in a short time after planting. It is extremely rugged and grows with unbelievable rapidity. In fact, its growth is much faster than that of any other known rubber plant.

In October, 1942, a contract was signed with United States procurement agency, the Rubber Development Corporation, for the planting of up to 100,000 acres of the vine. The contract stipulated that all plantings must be made by Dec. 31, 1943. At the time of our visit in October, 30,000 acres had already been planted and by the end of the year the total acres in cryptostegia had been increased to 35,000. An extension of three months has been granted to permit planting of an additional 7,500. Unfortunately, one of the subdivisions of the St. Mare plantation had to be abandoned in November because of a very severe infestation of the grubs of the June beetle.

Before the end of 1944, the entire planted area should be in production. The cryptostegia bush can be tapped within eight months to a year after planting. The tapping is not injurious to the plant whose life is indefinite, with an expectancy of at least 25 years on plantations.

From one and a half to two acres of cryptostegia can be tapped in a single day by a Haitian worker. It is hoped that eventually this figure may be increased to three acres. The field tapping is done from six to ten o'clock in the morning and from two to six in the afternoon since the heat of mid-day slows the latex flow in the vine. The operation is accomplished by gathering the tappable tendril-like whips or long climbing branches into bunches of from six to fifteen each. Bunches are tied about 4 ft. above the ground and then tied again toward the end of the stems. The bunches remain tied until tapping cuts back past the tie. The worker places the bunched stems in a clamp at the top of the tapping stick and, using a sharp knife, cuts the stems about 1 in. above the ends. The cut ends are saved, for each end has a small plug of rubber, similar in shape to the rubber at the end of a pencil. After the stems are cut, latex drips for about three minutes through a small funnel in the tapping stick into a container. An average yield of latex is 13 to 15 drops per whip at each cutting.

A latex collector uses ten or twelve tapping sticks and taps from 800 to 1,600 bunches daily. Each plant is tapped every alternate day throughout the year, except during periods of extreme drought. Current production is approximately 300 lb. of rubber an acre a year from the young plants. After about 45 days the producing whips have been cut back sufficiently and so new adjacent whips are selected for tapping. "Bleeding" the cryptostegia plant for latex appears to increase its vigor. There is not yet any known limit to the productive age of the bush.

When the bottles on the tapping sticks are nearly full, the tapper transfers the latex into a pail and carries it to the coagulating building where it is placed in large storage tanks. There is one of these buildings on each division or plantation. The chemists and engineers have developed a very simple, low-cost coagulating and sheeting process. As required the latex is drawn from the storage tank which serves as a head box alternately into parallel shallow wooden coagulating troughs, where it is mixed with about six times its volume of clear water

and allowed to stand for a few minutes. The latex immediately coagulates. The soft coagulum is pressed into sheets on a work table, rolled, and then put through a marking roller which gives the sheets a waffle-like appearance. The sheets are soaked in water to remove impurities, dried and smoked for about seven days. They are then baled for shipment to rubber manufacturers in the United States.

SHADA's Cryptostegia Research Experimental Station at Gonaives, Haiti, has recently determined how to condense and to preserve the latex indefinitely in a liquid form—also how to coagulate the condensed latex and make it at will into good rubber. Cryptostegia latex is acid in its reaction so it may prove useful for processes not available to hevea latex.

Now, after a year, the project is beginning to show results. Thomas Fennell, president and general manager expects to get a yield of 1,500 long tons in 1944, 4,000 tons in 1945, and 4,500 the following year or later.

Cryptostegia rubber compares favorably with hevea. The resulting rubber from cryptostegia is slightly softer and has a longer flexing period than hevea rubber. Its tensile stretch is 10 percent greater. Abrasion is not quite as good. The tensile strength is 4,000 lb. per sq. in. In other qualities, it is the equal of hevea rubber.

How much can be done toward the goal of lower production costs remains to be seen. Much work is under way at the research station in an effort to develop higher yielding strains of the plant, better ways of tapping and conversion. Some authorities believe that it may be determined that higher production per acre can be obtained by permitting cryptostegia to develop into a tree and tapping the trunk. Already research efforts have uncovered plants which are three times as productive as the average. Unfortunately, this tendency toward higher production is not always carried through to the grafted progeny of the high yielding plant. Many varieties of fertilizer have been tried, but no positive results have been obtained.

When the emergency is past, Haiti's cryptostegia rubber may have difficulty competing with hevea on a straight price basis unless cheaper tapping methods and higher producing strains can be developed. Yet, all things considered, this rubber may become commercially valuable even in normal times. It has qualities which may prove useful for special purposes and thus command a premium in the rubber markets. Because of conditions of labor, soil and climate, Haiti appears to be about the only area in the Western Hemisphere where cryptostegia might be produced.

While it is doubtful that the Haitian cryptostegia crop will produce in the next few years the amount of rubber predicted by Fennell, the project seems fully justifiable under the circumstances.

Latex collector uses 12 sticks in tapping 800 to 16,000 bunches daily

President Lescot of Haiti standing beside cryptostegia plants a year old

Much work is being done to develop higher yielding strains of the plant

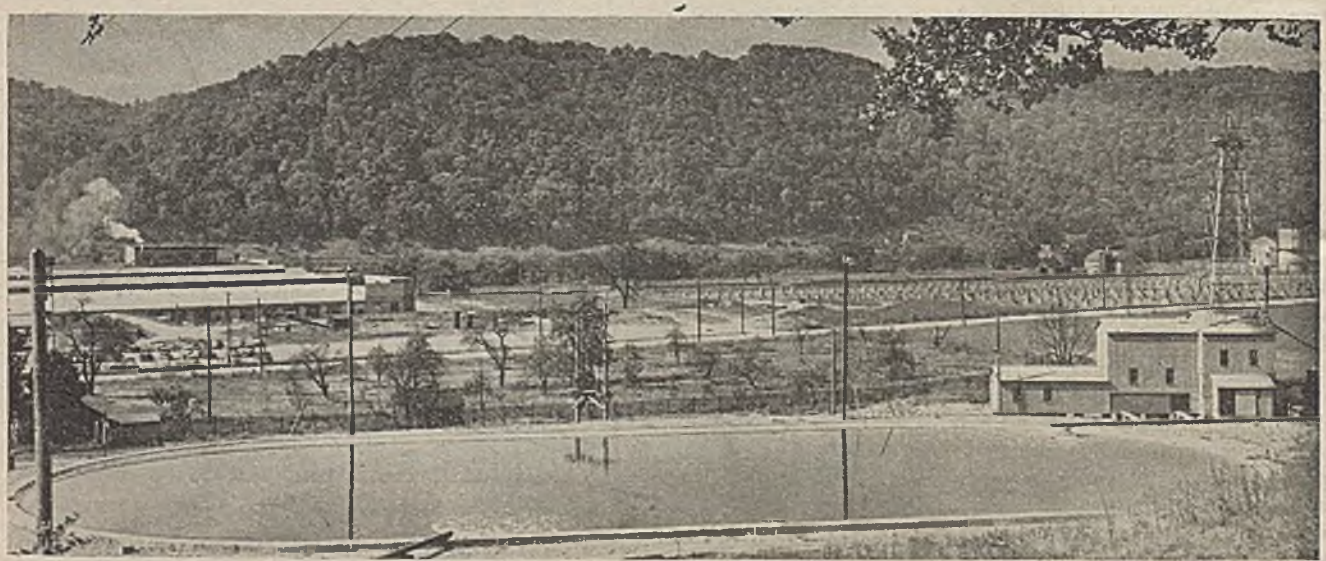
CHLORINE

From West Virginia Brine

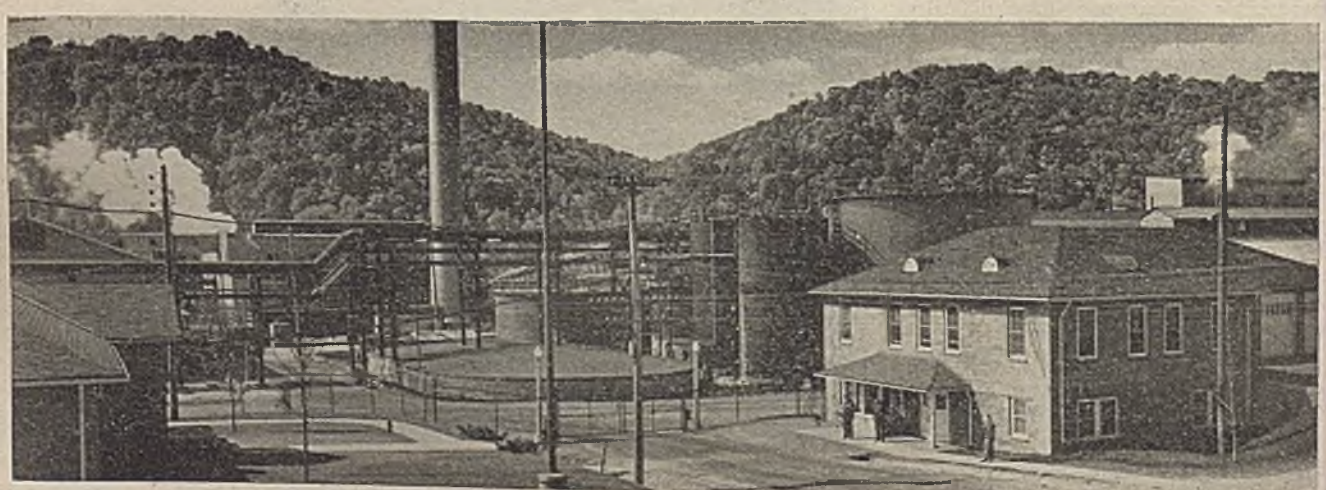
On the banks of the Ohio River at Natrium, W. Va., about 40 miles below Wheeling, a new electrolytic chlorine plant was recently placed in operation by the Columbia Chemical Division of the Pittsburgh Plate Glass Co. Financed by the Defense Plant Corp., and built by the H. K. Ferguson Co., the plant is one of the largest installations ever built as a unit and will provide a substantial increase in the nation's supply of chlorine. The six principal structures include a chlorine manufacturing building, machine shop, power house, caustic manufacturing building, administration building and combination employment office and gate house.

Adjacent to the site of the plant are rich veins of salt, coal supplies, and both water and rail transportation. Standard Hooker-type cells are used for electrolysis of the brine, and the chlorine formed in this reaction is piped to another building where it is dried and liquefied by an ammonia refrigeration system. Hydrogen, which is a co-product with the chlorine, is either used in other processes around the plant or marketed commercially. The caustic which is left in the cell solution is purified and evaporated, and finally shipped out in liquid form in tank cars.

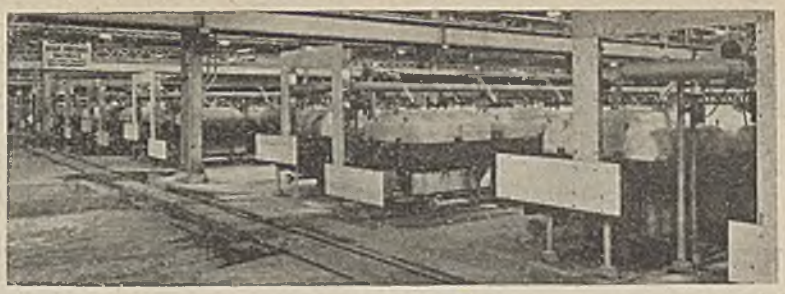
Several views of the new plant and the equipment installations are shown on this and the next page.



Above—Brine, the raw material for the process, is pumped into this million-gallon storage pool from four brine wells, each of which is about 6,800 ft. deep. One of the pump houses is shown at the right of the picture
Below—As the brine is required in the process, it is transferred about 750 yd. to tanks in the main plant area. At the left center is shown a covered temporary storage tank for the brine

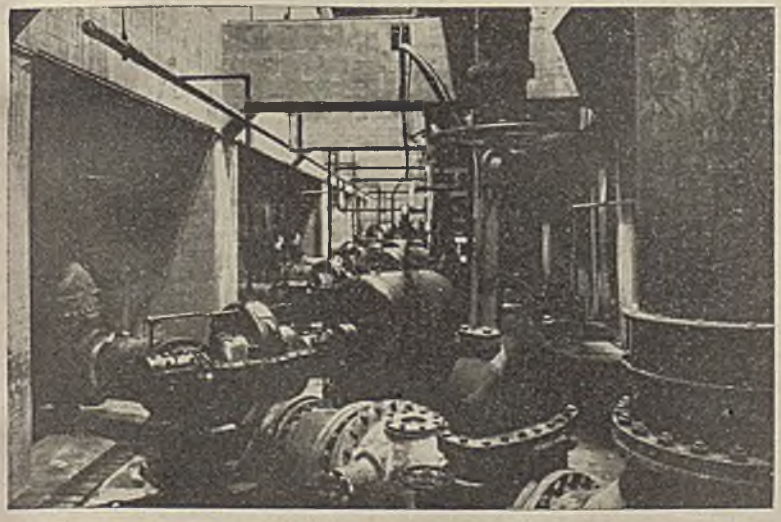


Above—Centrifugal filters are used to remove impurities from recovered salt before recycling it in the process. Approximately 50 percent of the original salt brine is unaffected by electrolysis and goes back into the process as a raw material

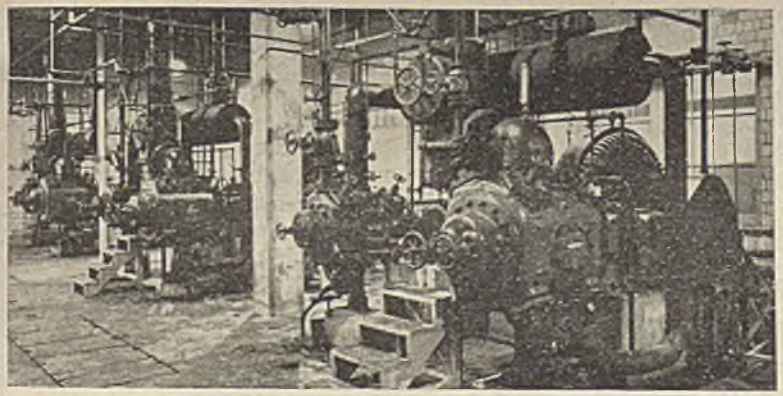


Above—Standard Hooker electrolytic cells form caustic and liberate chlorine and hydrogen from the salt solution

Below—Cell liquor containing salt and caustic is transferred to this large tank for crystallization of the salt. The caustic is then sent to evaporators, to make desired shipping strength



Below—Ammonia compressors and other refrigerating equipment used for liquefaction of the dry gaseous chlorine



Left—Water intake from the Ohio River for power and process requirements. Note large gate valves and centrifugal pumps which are needed to handle the enormous quantity of water used in this liquid process

Below—The finished product is packed out as liquid chlorine, this time in a tank car. At the start of the war, our chlorine supply was critical, but is now more plentiful and adequate for all military and essential civilian needs

FROM THE VIEWPOINT OF THE EDITORS——

S. D. KIRKPATRICK, Editor • JAMES A. LEE, Managing Editor • THEODORE R. OLIVE, Associate Editor • HENRY M. BATTERS, Market Editor
JOHN R. CALLAHAM, Assistant Editor • NORMAN G. FARQUHAR, Assistant Editor • LESTER B. POPE, Assistant Editor

WHEREIN WE WATCH WASHINGTON

WITH this issue we inaugurate a new departmental service in *Chem. & Met.* In the pages immediately ahead of the editorial foreword and article section there is a unique feature called "Watching Washington," which we feel can and should be of value to all engineers and executives in the chemical process industries.

That Washington needs watching is scarcely open to debate. Yet too often we must do that watching through the eyes of observers who lack the background of technical knowledge and industrial experience that is needed to relate their observations to our particular problems. Sometimes interpretations, as well as facts, are needed to give a news event its real meaning. Statements of opinion, when duly credited to responsible sources, are frequently useful provided proper care is exercised to prevent unfair "coloring" of the news.

Recognizing these prime responsibilities to its readers, *Chem. & Met.* will endeavor in this new department to present authoritative subject matter in a manner that will be most useful and convenient. Fortunately it can draw heavily on the large and experienced McGraw-Hill Washington Bureau under Paul Wooton, as directly represented by Malcolm Burton, a news correspondent with chemical engineering training. Russell S. McBride, editorial consultant to *Chem. & Met.* for almost a quarter of a century, continues to serve as an on-the-job technical adviser giving special attention to economics, professional and industrial trends affecting chemical engineers. These, then, are your *Chem. & Met.* eyes for "Watching Washington." Tell us how they can serve you better.

START SOME REAL SELLING

IN SOME chemical companies, sales development work has been taking an enforced vacation during the past few years. With Uncle Sam as their sole customer and with shortages developing all along the line there seemed to be little need to look for new outlets or new products to manufacture. Now that situation is begining to change. We see prospects of great surpluses requiring the aggressive development of sales in order to prevent idle plant capacity from becoming a burden on some of our industries after the war. There is both time and need for resuming the job of really selling chemicals.

One way in which that sort of sales development can be started is to begin talking about the properties of some of the new products that can soon be made available for non-military uses. In many cases it is no longer necessary, for security reasons, to deny a prospective customer the opportunity to learn more about these new materials. Samples should soon be available in suitable qualities and quantities in order to stimulate the development of new uses. Promising leads must be followed up promptly by field studies and plant conferences with prospective purchasers.

Chemical engineers and research man who are on the receiving end of such conferences may have some pleasant surprises in store for themselves. If they are frank in telling how much of a new commodity might be used at a certain price level, they may find a very receptive attitude on the part of the producers. It is to their interest to work out prices as well as technical specifications that will make the new products most attractive to their most important customers.

This sort of cooperation, backed up by real chemical salesmanship, may amaze us all by the magnitude of the resulting developments.

PAPER STILL IN THE RED

A YEAR ago this country had a shortage of steel, aluminum, magnesium, chlorine, and a great many other materials including paper, all badly needed for prosecuting the war. Shortages of most of these materials now have been converted into surpluses. Paper is the exception. Production in 1943 was considerably under the 1942 and 1941 figures, and it is estimated that 1944 production of paper will run even lower.

Little can be done by the pulp and paper industry to increase output. It has the timber and the manufacturing facilities, but it lacks the manpower to cut the trees. The woods laborers have been drafted by the army. Only a convincing conservation effort by everyone who uses paper can interest the army in regarding paper production as an essential war activity and releasing wood choppers.

A real paper shortage, a truly drastic squeeze of your paper needs, would hit you and hit you hard. Surely, anything which you can do to prevent a national paper crisis is to your personal advantage.

EXIT BRITISH BUREAUCRACY?

RECENT correspondence with British friends reveals a threatened revival of a plan for postwar controls of industry that is strangely reminiscent of N.R.A. days over here. Fortunately British industry, irked by the petty bureaucracy of wartime controls, is so thoroughly sick of such measures that it has not hesitated to say so. Let us quote from a personal communication from a well qualified observer of the industrial scene in Great Britain:

"You probably know that there has been a certain amount of talk about making membership in trade associations, like the Association of British Chemical Manufacturers, compulsory on everybody in the industry. But that has now been squashed. Industry was very emphatic when a questionnaire was sent round a few months ago that it did not want compulsory membership of trade organisations and it did not want trade associations to have compulsory powers even if they were not used. This, I think, is very much to the good. We here have got so heartily sick of control, because control means bureaucracy at large, and the type of man who goes into that sort of organisation is usually what we call the "chuck-outs" of industry. With notable exceptions of some high calibre men at the top, the average rank and file of most of the controls here consist of people who have been from pillar to post throughout industry in peacetime, and in the ordinary way most firms do not want them. Yet these men are put in to run the most far-reaching controls with the result that things are

not run as they should be and, of course, efficient chemical firms are fed up with the whole scheme."

Let us hope that we have already learned these lessons but if not then British experience should serve as a warning against unnecessary postwar controls by incompetent bureaucrats.

ALLOCATIONS MAY AID REVERSIONS

Postwar manufacturing, as well as manufacturing for civilians in wartime, is restricted by shortage of materials more often than by any other single cause. It now appears that this restraint on return to peace business may be rather simply set aside. Certainly WPB has the power to do so, and fortunately, the chemical division has also the disposition to do this.

Many "scarce" chemicals are now relatively abundant. Some which were very scarce a year or more ago are now available in burdensome surpluses. No one is more anxious than the WPB executives to put these materials to work in the public interest. It is only necessary for prospective users of these chemicals to ask for them in such manner as to permit prompt and generous allocations.

No longer is it feasible for the executive to hide behind the excuse "We would like to make it but we can't get the raw material." It is now feasible for sales managers, research directors, and other executives of process industry to prepare plans for renewed service for civilians, and expect to get the chemicals essential to that job. And all of this can be done, if thoughtfully planned, without detriment to the war effort which, of course, is essential.

RESEARCH BUDGETING REQUIRES CAUTION

It is almost impossible today to plan a thoroughly desirable research program for 1944. Far too many uncertainties as to personnel and proper projects remain. But the habits of American enterprise have made it necessary for the research director of most companies to prepare such a budget under which he is now beginning to function for this calendar year.

Because of current acceptance of research as a normal part of all business, it has probably been easy to get an allocation of funds for this year's experimental program. In one way that is a pleasant and good thing. In another way it is in itself a warning. "Easy come, easy go" is a dangerous motto for the research executive.

One smart executive remarked recently, "I don't know whether I will spend all of my research money this year or not." He is not timid. Nor did he lack ideas on which it would probably be profitable to carry out work. His conservative attitude sprang from a recognition of a more important principle. It was based on the thought that research done today might have to be carried out with men of only mediocre talent and might result in findings that were relatively of little usefulness. This man knew that he could do more for the permanent research program of his company by going forward slowly and surely than by attempting a big showing at a time when radical changes in the economic structure confronted every new project.

There is the danger that over optimism during the next few months will give research too many black eyes. On the other hand there is the possible danger of following a policy of undue conservatism or just plain "scared to take a chance."

PROCUREMENT RITUAL GROWS

Now that the maximum speed of government procurement is no longer necessary, it is evident that government purchasing officers are adding more and more to the ritual of buying. This makes Uncle Sam even less desirable as a customer than heretofore, if such a thing were possible.

No one can properly suggest that chemical enterprise, or any other for that matter, should fail to do its utmost in supplying essential materials for the war effort. But it is proper to suggest that management of chemical enterprise resist the present tendency to make a simple purchase transaction of the government into a bookkeeping and report-making nightmare.

Some of the procurement officers have announced that they will seize needed goods and make no effort to pay for them if they do not get "cooperation." Any company receiving such a threatening statement should undertake to get it before witnesses. Then all of the facts, authenticated beyond question, should be presented to a high official of the department concerned. If necessary, such communications can go as high up as the Secretary of War or Secretary of the Navy. And it is not amiss to send copies of such protests to the appropriate members of the military committees of the two Houses of Congress.

If these procurement offices have nothing better to do than make socializing investigations as a part of their buying program, it is time that the legislators found out this fact. Presumably, the high executives of the government do not realize what is going on. If they are too lenient or too ignorant, they must be set right by those whose authority they will recognize.

But it is most important of all that protests do not delay delivery of essential goods. Military effort is more important at the moment than even the protection of much restricted rights of private enterprise.

A POSTWAR PRIMER

Good chemical engineering based on sound economic principles is the only safe basis for postwar planning. When we revert to peacetime production and distribution of chemicals, there will be three cardinal considerations that that will define the work of research and development departments. They are not new but they are worth repeating often. (1) We must seek lower costs. (2) We must seek to make better products. (3) We must seek to make new products at a profit. These are more important than all the diverting details that characterize so many of our postwar discussions.

Volume 51—Chemical & Metallurgical Engineering—Number 1

Chemical & Metallurgical Engineering is the successor to *Metallurgical & Chemical Engineering*, which in turn was a consolidation of *Electrochemical & Metallurgical Industry* and *Iron & Steel Magazine*, effected in July, 1906.

The magazine was originally founded as *Electrochemical Industry*, in September, 1902, and was published monthly under the editorial direction of Dr. E. F. Roeber. It continued under that title until January, 1905, when it was changed to *Electrochemical & Metallurgical Industry*. In July, 1906, the consolidation was made with *Iron & Steel Magazine*, which had been founded eight years previously by Dr. Albert Sauveur. In January, 1910, the title was changed to *Metallurgical & Chemical Engineering*, and semi-monthly publication was begun Sept. 1, 1915. On July 1, 1918, the present title was assumed and weekly publication was begun Oct. 1, 1919. Monthly publication was resumed in March, 1925.

Dr. E. F. Roeber was editor of the paper from the time it was founded until his death Oct. 17, 1917. After a brief interim he was succeeded by H. C. Parmelee. Ten years later, Nov. 1, 1928, Mr. Parmelee assumed other responsibilities in the McGraw-Hill Publishing Company and Sidney D. Kirkpatrick was appointed editor.

The present editorial staff of the magazine comprises, in addition to Mr. Kirkpatrick: James A. Lee, managing editor; H. M. Batters, market editor; T. R. Olive, associate editor; J. R. Callaham, N. G. Farquhar and L. B. Pope, assistant editors. R. S. McBride, E. S. Stateler and Earle Mauldin are editorial representatives in Washington, Chicago and Atlanta, respectively.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

War Bond Awarded Each Month

Until further notice the contest which was first announced in our November 1943 issue will be continued. For the best short article received each month and accepted for publication in the "*Chem. & Met.* Plant Notebook," a $25 Series E War Bond will be awarded, in addition to payment at our usual space rate for this department. The award for each month will be announced in the issue of the following month. The judges will be the editors of *Chem. & Met.* Any item submitted may be published in this department, but all items so published will be paid for at our usual space rate for such material.

The contest is open to all readers of *Chem. & Met.*, other than employees of the McGraw-Hill Publishing Co., Inc.

Any number of entries, without limit, may be submitted by one person. Articles must be previously unpublished, and should be short, preferably less than 300 words, but should include one or more illustrations if possible. Finished drawings are not required and literary excellence will not be a factor in the judging. Winning articles will be selected on the basis of appropriateness, novelty and the usefulness of the ideas described.

Articles may deal with any sort of plant or production "kink" or shortcut which in the opinion of the judges will be interesting to chemical engineers, in process industries, as well as with cost reducing ideas, and novel means of presenting useful data. Material to be entered in this contest should be addressed to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

November Contest Prize Winner

SIMPLE METHOD OF CONTROLLING COMPOSITION OF THREE-COMPONENT PLANT SOLUTIONS

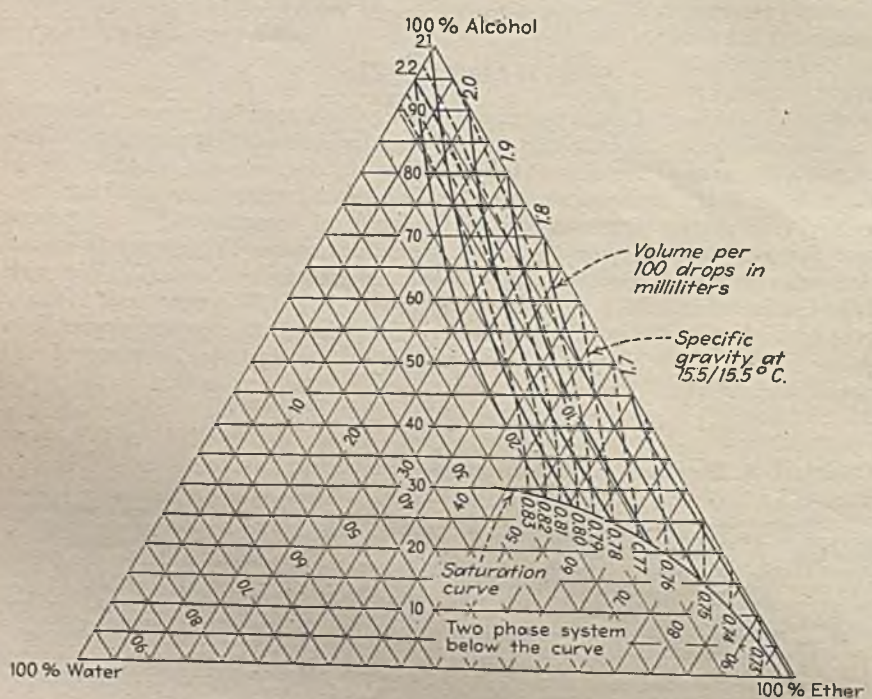
GERALD M. ANDRESS

Supervising Chemist, Defence Industries Ltd.
Valleyfield, Quebec, Canada

COMPOSITION of many three-component plant solutions, such as the mixtures of ether, alcohol and water, or nitric and sulphuric acids and water used in the explosives industry, can be determined by plant operators without laboratory analysis, by the simple measurement of any two suitable physical properties of the mixture. The use of specific gravity and a quantity which is proportional to the surface tension, as described here, can be applied to many ternary systems of miscible liquids, and it is probable that other pairs of physical properties (such as refractive index, viscosity or electrical conductivity) can be chosen in cases where the lines of specific gravity and surface tension are too nearly parallel.

Applied to mixtures of diethyl ether, ethyl alcohol and water, the test has not yet been rigorously proven, but appears to be accurate to about 1 percent, except that it must be used with care at alcohol concentrations above 50 percent where, as the accompanying graph shows, the gravity and surface tension lines change direction.

Trilinear plot of constant gravity and constant surface tension lines for mixtures of ether, alcohol and water (basis, volume percentages)



The graph presented here was worked out for the necessary range of compositions on a volume percentage basis since the flow of the several components in the plant is measured volumetrically by means of rotameters. It was derived by measuring and plotting the specific gravity and surface tension of a series of mixtures of ether, alcohol and water, of known compositions. Specific gravities were measured with a 60 deg. F. hydrometer and corrected from the actual observed temperature to the standard of 15.5/15.5 deg. C.* The surface tension was not measured directly, since this is difficult to do under plant conditions. Instead, it was decided to measure a property proportional to the surface tension, namely, the volume of a certain number of drops. For this purpose a 50 ml. glass-tap burette was found to be satisfactory. The burette was filled to the zero point with each of the mixtures for which the specific gravity

* For the following observed temperatures of the solution the corrections were: At 17 deg. C., add 0.001; 19 deg. C., add 0.003; 21 deg. C., add 0.005; 23 deg. C., add 0.007; 25 deg. C., add 0.009; 27 deg. C., add 0.011.

DECEMBER WINNER!

A $25 Series E War Bond will be issued in the name of

JAMES H. WIEGAND
Chemical Engineer
Traverse City, Mich.

For an article dealing with a simplified method for the rapid calibration of thermometers which has been adjudged the winner of our December contest.

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

had been obtained, and 100 drops were allowed to dribble out at about one per second. The volume for 100 drops was recorded in each case, and was the quantity plotted. It was found that the average volume for three trials on each composition was adequate. The trilinear plot resulting from these measurements shows a family of constant specific-gravity curves, intersecting another family of curves of constant volume per 100 drops.

A chart of this type is peculiar to the particular burette used in its determination, since the weight of the drops depends on the burette characteristics as well as on the surface tension. Hence, a check run with water must be made to correct for a different burette. The burette used in obtaining the data for the accompanying graph gave 5.00 ml. for 100 drops of water. If a second burette of different length and tip were to give 4.90 ml. per 100 drops, then all observed readings from the second would have to be corrected in the ratio of 5.00/4.90. Similarly, if the solution originally used differed in temperature from the test temperature, the discrepancy would have to be corrected by means of a water run at the test temperature. Or, correction factors can be determined once and for all, for several water temperatures in the range of likely test temperatures, and recorded for use in correcting subsequent tests.

The method described here is simple and rapid and can readily be taught to the average plant operator. It is evidently susceptible of use in a wide variety of applications.

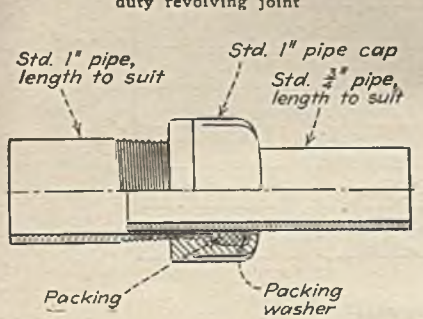
REVOLVING JOINT FROM PIPE AND FITTINGS

WILLIAM L. BULKLEY
Evansville, Ind.

A REVOLVING JOINT which permits piping to be connected to rolls, dryers or other rotating equipment is frequently required in pilot plant operations. While commercial joints are available, time and cost consideration often require one to be made with facilities at hand. A joint which can be fabricated easily from standard pipe and fittings is shown in the accompanying sketch. It is suitable only for moderate pressure or vacuum and moderate speeds, but its low cost and simple construction give it considerable utility. It has the additional advantage of acting as an expansion joint.

As shown in the sketch the joint consists of a length of ¾-in. standard pipe within a piece of 1-in. standard pipe. A 1-in. pipe cap drilled for the ¾-in. pipe forms a packing nut. A sheet metal washer may be used as a packing gland as shown. The outside surface of the smaller pipe should be given a light cut in a lathe or dressed with emery paper to permit its easy entry into the larger pipe and provide a smooth surface for the packing. The larger pipe is threaded to a sufficient length to prevent the pipe cap from tightening on the pipe before compressing the packing. Other pipe sizes may be used in the same manner wherever the inside diameter of the larger is only slightly larger than the outside diameter of the smaller. Packing can be as desired although lubricated packing works best.

Pipe, a pipe cap and packing make a light-duty revolving joint



A joint similar to the one described, having graphite-impregnated braided asbestos packing has been used successfully at 2.5 r.p.m. to handle hot coal distillation products with a vacuum of 5 to 10 in. of water and temperatures up to 360 deg. C.

GLASS TUBE PROTECTS ACIDPROOF HEATER

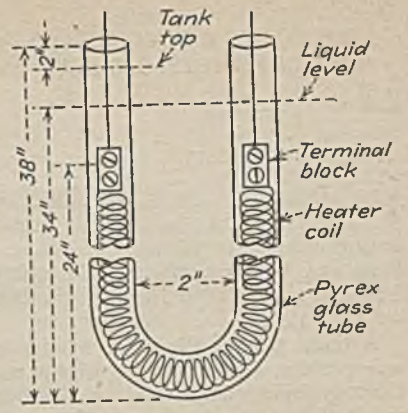
SIDNEY FISHBERG
Chief Engineer
Cosmic Radio Corp.
New York, N. Y.

IN THE COURSE of designing aluminum anodizing equipment, it was necessary to provide for a tank containing activated HCl at 10 percent concentration and 95 deg. C. To facilitate automatic preheating and thermostatic control of temperature, electric immersion heaters were chosen as the heating means, and metal-clad heaters of a conventional type were used. In the space of two months, the metal sheaths were destroyed by the combined corrosive action of the hot HCl and the activating current. Other types of metal sheaths were tried, including various acid-resistant alloys and even a combination of resistant alloy with acidproof paint baked on. All failed in a comparatively short time.

A radically different heater was then fabricated in our own plant and was found to be absolutely acidproof. This heater consists essentially of a coil of resistance wire operating within a tube of Pyrex glass, and provided with heat-dissipating connection lugs between resistance wire and terminal leads.

The heater coil is wound to such a length and diameter that the wattage density, calculated with respect to the outer surface of the Pyrex tube, is approximately 30 watts per square inch. The wire size and spacing are such that the heater coil operates at a dull red heat. The inside diameter of the Pyrex tube is $\frac{1}{16}$ to $\frac{1}{8}$ in. greater than the outside diameter of the heater coil. Close contact between the coil and tube is not necessary; the clearance given allows adequate convection of heat from the coil to the tube wall, and greatly facilitates the positioning of the coil in the tube.

If it is necessary to provide coils and tubes longer than 4 ft. (the standard length of Pyrex tubing) a glass blower can join two or more tubes together with-



Acidproof immersion heater of resistance wire in Pyrex tube

out difficulty. In making bends in the tubing, a minimum radius of three times the outside tube diameter should be allowed to facilitate the drawing of the coil through the tube. After the tubing has been bent to the desired shape, it should be annealed to prevent cracking when the heater is first operated.

The heater wire and the terminal wire are connected together through a copper terminal block which serves to dissipate heat from the end of the heater wire. Brazed joints between heater and terminal wires invariably burned out. The two wires may be brazed to the copper block, or copper machine screws equipped with pressure washers may be used with a block which has been tapped to receive them. Construction is indicated in the sketch.

In order to draw the heater coil through the tube, a snake of some kind is desirable. The writer has found light ladder chain, like Boston No. 1, to be extremely efficacious. This chain can be shaken completely through a multi-bend tube with very little difficulty. Then it is fastened to one end of the terminal wire, and with a judicious combination of pushing the coil and pulling the snake, the coil can be moved into place.

The completed heater should be positioned in the tank in such a way that no mechanical strain is placed upon the glass tube. The ends of the tube should not be exposed to liquid or spray. In some cases it may be desirable to plug the ends of the tube lightly with cotton wadding to keep out liquids. The heater coil itself, including the terminal blocks, should always be kept below the liquid level (see sketch) to avoid strains which might crack the glass.

The writer has made heaters of the type described which have been in continuous operation for 100 hours per week for a period of two years without failure. Contrary to expectation, these heaters are not at all fragile, and will withstand considerable mechanical and thermal shock without failure. A typical 2-kw., 208-v. heater, shown in sketch, was made with a resistance coil of No. 17 Nichrome wire wound to an outside diameter of $\frac{1}{16}$ in. and stretched out to a length of 4 ft. The Pyrex tube had an inside diameter of 13 mm. The copper terminal blocks were ¾ in. long, ¼ in. wide, and $\frac{1}{16}$ in. thick.

TOTAL HEAT FEATURED IN PSYCHROMETRIC CHART

EDWARD LEDOUX
Consulting Engineer
Dorr Co., New York, N. Y.

PSYCHROMETRIC charts will differ in aspect according to the two characteristics chosen for the main coordinates: these may be Temperature vs. Humidity, Temperature vs. Total Heat or Humidity vs. Total Heat.

A linear plot of the main coordinates will produce a chart which will permit direct graphical computation of conditioning problems. Such a graphical method saves considerable time, particularly when heat losses are to be accounted for, and eliminates chance errors. It is not possible with a logarithmic plot.

Furthermore, there is advantage in selecting for the main coordinates the two most important variables. These are Total Heat and Absolute Humidity because, by differences, they measure directly the amount of heating or cooling and the amount of humidification or dehumidification to be performed; in other words they express directly the conditioning job to be done.

The design of the chart presented below is based on these considerations. Total Heats have been calculated from the following expressions which do not include the heat of the liquid:

For dry air, $Q = C\ t$

For saturated mixtures, $Q = C\ t + L, w,$.

For unsaturated mixtures, $Q = C\ t + L'\ w + c_{p,}\ (t - t')w$.

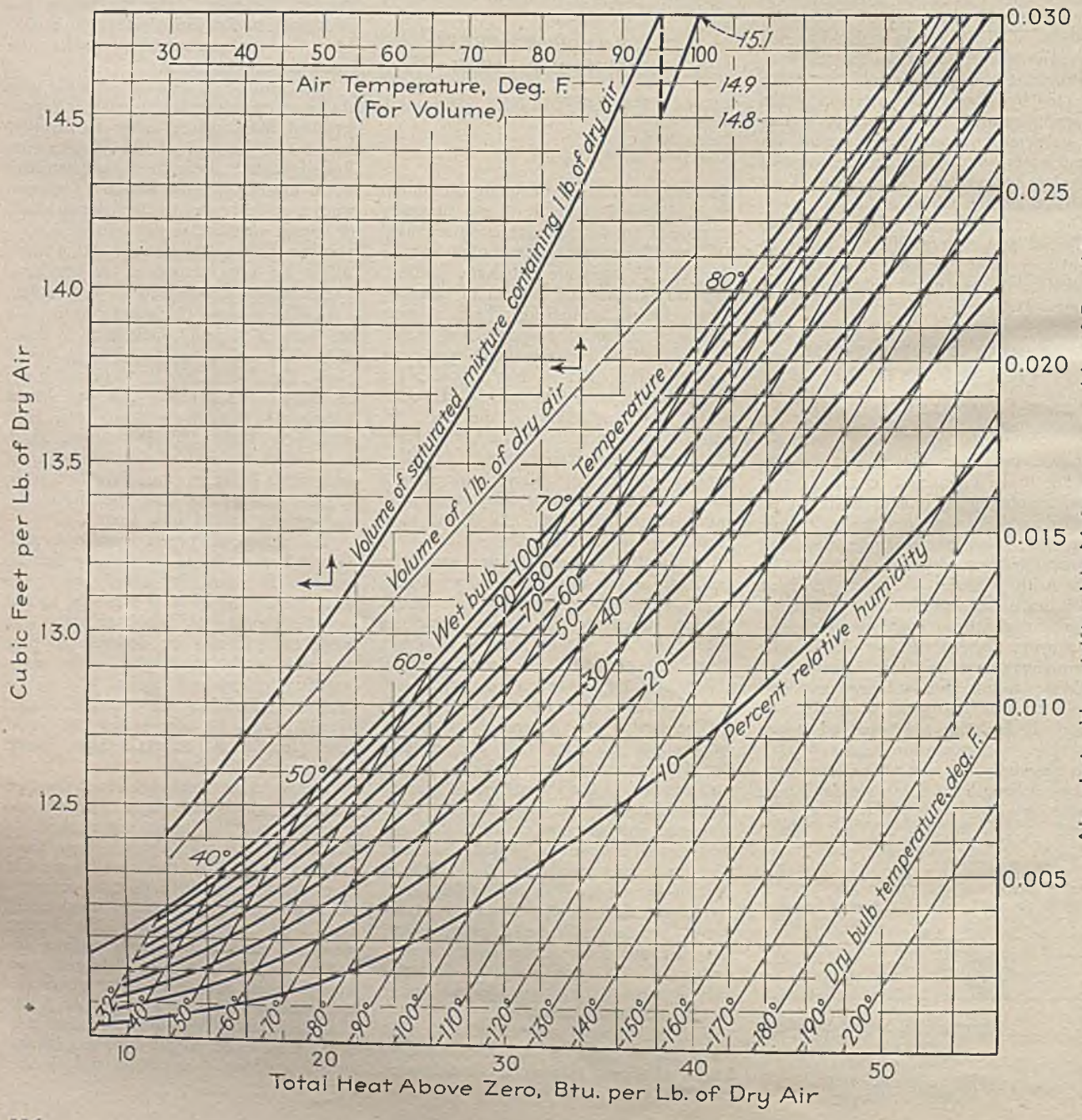
In these, L' and $L,$ are respectively the latent heats of vaporization at the dew-point t' and at the saturation temperature $t,$; w and $w,$ are the absolute humidities in pounds per pound in the unsaturated mixture and at saturation respectively; C and $c_{p,}$ are respectively the specific heats at constant pressure for air and water vapor. The Relative Humidity or partial pressure curves are determined by

$$\frac{w}{w,} = \frac{0.623\ K}{0.623 + (1 - K)\ w,}$$

in which K is the Relative Humidity and 0.623 the constant density ratio between water vapor and air.

The constant Total Heat or Wet Bulb lines are vertical and rectilinear so that the Dry Bulb Temperature lines are sloped and concave upward.

Psychrometric chart with Total Heat—Absolute Humidity grid facilitates air conditioning computations



REPORT ON.....

FILTRATION

In the Chemical Process Industries

Mechanical separation generally follows chemical combination so that somewhere along the line of production in nearly every chemical processing plant, filtration equipment takes its place. Often the chemical reaction is predicted and controlled by accurate mathematical calculations, whereas in filtering the product, physical complications probably necessitate engineering of a somewhat empirical nature.

It is not the purpose of this report to put practical filtration problems on a theoretical basis, but we shall attempt to evaluate some of the factors affecting filtration rates, product quality and related matters. To define the scope of the report, the meaning of filtration will be limited to the separation of solids from a liquid by passing the liquid through a porous medium, either by vacuum, gravity or pressure. (Centrifugal filtration was covered in the *Chem. & Met.* report for July, 1943.)

Filtration, although a universally used chemical process, has not been developed along engineering lines as have most of the other chemical engineering unit operations. At least, filtration theories have not yet reached the point where they can be applied by the chemical engineer faced with a practical problem in a chemical processing plant. There are good reasons, however, why development of the theory of filtration has not progressed to the same extent as, for instance, the theory of distillation, and perhaps the greatest reason is the difficulty of duplicating filtration conditions on a plant scale. In the filtration of slurries where the filter cake is the desired product, there is a fair chance that the size and porosity of the cake, as well as the condition of the filtrate, will be duplicated in consecutive operations. On the other hand, if the filtration is a method of clarifying a liquid product, the solid content will probably be small and non-uniform, thus making it practically impossible to duplicate the filtering rate.

In view of the foregoing, the theory of filtration will be discussed here in general terms only, and for further details the reader is referred to standard texts on the subject such as "Elements of Chemical Engineering," by Badger and McCabe, "Principles of Chemical Engineering," by Walker, Lewis, McAdams, and Gilliland, and Perry's "Chemical Engineer's Handbook."

Since the main object in filtration is to secure a balance between speed of separation and quality of product, theoretical considerations usually begin by relating the liquor flow to filtering conditions. In simple form it is stated that the instantaneous rate of flow of liquor through a filtering medium is directly proportional to the pressure drop across the medium and inversely proportional to filtrate viscosity and resistance to flow offered by the medium, plus the cake which may have been built up. This relation can be expressed by a form of Poiseuille's equation as follows:

$$\frac{dV}{A\,d\theta} = \frac{P}{\mu \times \alpha\,(W/A + r)}$$

This equation is written on the basis that cake formation results in capillary flow of the filtrate. V is the volume of filtrate, θ the time, A the area of filtering surface, P the total pressure drop across the filter medium and cake, μ the viscosity of the filtrate, α the average specific cake resistance, W the weight of dry cake solid and r the resistance of a unit area of filter medium plus pressure drop in pipe lines and other minor resistances.

The average specific cake resistance, α, is a constant depending on the type and condition of slurry filtered, and is directly proportional to the total pressure P raised to the s power times another constant, α', where s is the cake compressibility. This

may be written as follows:

$$\alpha = \alpha' P^s$$

The exponent s may vary from 0 in the case of incompressible cakes, to 1 for highly compressible cakes, but is usually between 0.1 and 0.8 for slurries met in industrial filtration.

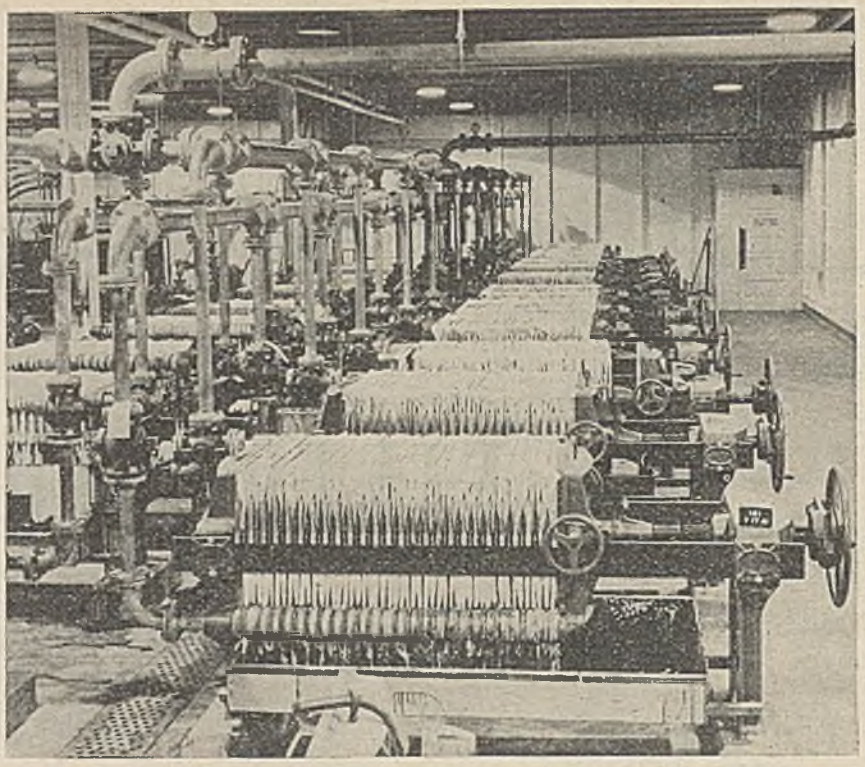
Filtration Variables

Without integrating for specific operating conditions or going any farther into the theory, several interesting and important facts can be learned through analysis of the differential formula. For instance, if we neglect the resistance of the filter medium, in the case of a cake made up of sandy granular particles or fine crystals packed hard, the compressibility, s, will approach 0 which would make α' equal to unity and the rate of filtration directly proportional to the pressure. This is borne out in industrial filtration where increasing the pressure through a highly incompressible cake causes an approximately equal increase in flow rate. However, there are limits to the amount of pressure which may be applied in this way. It is possible to apply so much pressure that the filter cake collapses, thus losing its porosity and stopping the flow of liquor. Even if the cake does remain porous, there is always the danger of forcing some of the finer particles in the slurry through to the filter cloth and stopping the flow at that point. Conversely, it is seen that if the compressibility of the cake is high, s approaches the value of 1, which would make the rate of flow independent of pressure. In plant practice it is found best in almost every case to build up filter cakes starting with a low pressure and increasing the pressure gradually to maintain a more or less constant rate of flow.

Cake Thickness

The question of how much cake thickness should be allowed to build up is dependent on the relative resistance of cake and filter medium as well as the time required to discharge the cake in the case of batch filtration. Since rate of flow varies inversely with the amount of cake formed, it would be desirable to use thin cakes, except when the filter medium resistance is large compared to the cake resistance. In that case, the cake thickness could be increased until its resistance became appreciable. More will be said about cake thickness in connection with the use of filter aids later in this report.

If W, the weight of dried solids in the above equation, is expressed in terms of weight of solid per volume of filtrate, it is seen that the more concentrated the slurry, the slower will be the volume rate of filtrate flow since the two are inversely proportional, again neglecting medium resistance. But the rate of cake formation is directly proportional to the solid concentration, thus indicating that there may be an economic optimum between the slurry concentration step and actual filtration.



A battery of plate-and-frame filter presses used for filtering viscose rayon solution in a rayon plant

Particle Size

Large changes in particle size will, of course, reflect in increased or decreased cake compressibility, while even small differences will cause considerable change in the constant α'. Dense cakes formed of very small particles tend to decrease the flow rate and maintain a high percentage of moisture. Often it is advantageous to use a coagulating agent in controlling the size of particles being fed to the filter.

Barring chemical changes in the cake, the main effect of temperature variation is in the viscosity of the filtrate, higher temperatures tending to decrease viscosity and increase flow rate.

In selecting a filtering medium, there must be a balance between quality of filtrate and rate of filtration. On the one extreme is a fine woven medium which gives a clear filtrate but tends to plug, while at the other extreme there is open fabric which allows rapid filtration but "bleeds" the finer particles. In the latter case, the initial filtrate is frequently recycled until a cake has been formed which becomes the filter medium, the fabric acting only as a holder.

FILTER TYPES

Before passing from this brief discussion of the factors affecting filtration to a description of specific equipment now in use in the process industries, filters can be classified in the following way:

Gravity filtration is for the most part limited to liquids having only a small percentage of solids and usually employs a bed such as sand, gravel or charcoal as the filter medium. However, there is some use of gravity filtration in the fine chemical industries, or where excessive corrosion precludes the use of other types of equipment. Normally only small batch operations are involved and filter paper in a funnel or crock can be used.

Pressure filters of all kinds utilize the same fundamental principle of operation by forcing the material to be filtered through a medium into a filtrate chamber or housing. They are of two general types: (1) the plate-and-frame press, and (2) the shell-and-leaves press, the latter permitting higher working pressures. With few exceptions, all pressure filters are intermittent in operation. The more common filters in use will be discussed in detail later in this report.

Vacuum filters are usually classified as intermittent or continuous. In the intermittent, or batch type, application of the vacuum forms a cake and pulls the filtrate through until the resistance builds up to a point where the cake must be removed. Continuous vacuum filters have revolving filter media on which the cake is initially formed, filtered and dried, prior to discharge by some mechanical means. Large volumes of slurry are thus handled quickly and economically.

PLATE-AND-FRAME PRESSES

The plate-and-frame filter press is in such universal use that there is little that is new to be said about its operation. Its simplicity is one of its important features. The filter is made up either by a series of plates and frames or of recessed plates with a filter medium to hold the solids while the liquids pass through.

Three advantages of the recessed plate are lower first cost because of fewer pieces to provide a given filter area, a lesser number of joints to keep tight, and the large center feed channel which prevents plugging by even the thickest of materials. Recesses vary up to ½ in. or even ¾ in. which forms a cake of about 1 to 1½ in. thick. However, they have certain disadvantages and are not recommended except in specific cases as for thick or lumpy material. They do not provide a uniformly thick or solid cake, nor is it possible to give the cake efficient, thorough washing because of this unevenness which allows wash water to short circuit through the thinner sections of the cake. In addition, the filter medium must be fastened at the feed opening. Then, too, there is considerable strain on the medium at the edge of the recess plate joint, making it impossible to use filter paper or wire mesh and reducing the life of woven fabric.

Feed

Flush plate-and-frame presses are classified by whether they employ side feed or corner feed. In the side feed type, the chambers are fed through channels formed by holes located outside the joint surfaces of the plates and frames, while in the corner feed type the chambers are fed through channels formed by holes in the joint surfaces. In both cases, the material to be filtered reaches the filter chamber through feed ports in the frame connecting the channel with the chamber. The side feed type requires no holes in the cloth, this saving offsetting the added cost of rubber collars or cloth pockets to make the joints tight. The corner feed type, on the other hand, requires holes in the cloth, frequently necessitating use of preshrunken cloth and excessive care in clothing the press.

When a press delivers the filtrate through outlets in each plate, it is known as open delivery as compared to closed delivery where the filtrate is discharged in channels either in the joint surface or outside it. Open delivery types are frequently installed where maximum clarity of the filtrate is important. If the filtrate from any chamber runs cloudy, it is a simple matter to cut it out of operation by closing the discharge cock. This is possible on closed delivery types only through the use of visible discharge fittings with control cocks. Open delivery types cannot be used where the filtrate must be delivered to a level above the filter, unless an additional pump is installed. Closed delivery types are cleaner and more applicable to filtration of easily contaminated liquids such as highly volatile or easily oxidized liquids.

There are several refinements available such as hollow plates for temperature control by circulating steam, hot water, oil, brine, etc. There are also special plates and frames for pressures reaching up as high as 1,000 lb. per sq.in. Electric hydraulic devices are available for opening and closing the press, thus reducing operating effort.

Operation

In operation of the plate-and-frame press, the time taken to form the filter cake depends, as was previously shown, on the slurry concentration, filtrate viscosity, pressure and thickness of press- frames. Cakes up to 8 in. or more may be formed, but 2 in. thickness is seldom exceeded if washing is to be performed. At the start of the filtration, the pressure should be only about 5 lb. or less and then gradually increased to possibly 60 lb. at the end of the filtration. Before washing, when required, it is common plant practice to apply 30 lb. air pressure to drive out the remaining filtrate. Steam may also be used in certain cases, but is too expensive for general plant use. Removing the cake from a plate-and-frame press involves a considerable amount of time and labor and is the chief disadvantage of this type filter. However, unskilled labor can be used for cake removal and press cleaning. Depending on the final disposal of the cake, the cake may be dumped directly into carts, handled by a conveyor or slurried up and pumped away.

Of the operating difficulties experienced, pressure fluctuation is one of the most common and may result in cloudy filtrate. This is particularly true if the cake is uneven due to low pressure or settling in the frame. The tendency to settle can often be overcome by use of a top discharge plate and should be corrected, especially if satisfactory washing is to be accomplished.

Continuous thickness

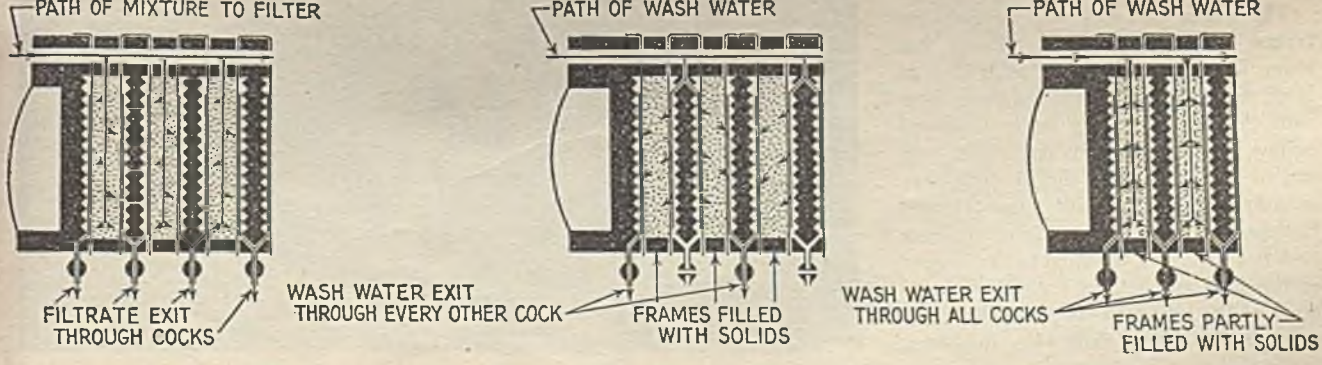
A recent variation of the standard plate-and-frame press is the Shriver continuous thickener. Thickener plates and frames have spiral ribs and grooves (baffles when made of wood) which guide the slurry to the discharge ports, generally a closed delivery system. Filtrate is run off from the plate as in a regular filtration but there is no cake formed if the slurry is pumped through with sufficient velocity. This development may have interesting applications such as thickening for direct feed to dryers, mixers, reaction vessels, etc. It is also expected to find use for continuous catalysis where the finished product could flow through the plate discharge while the catalyst slurry was returned to the reaction vessel.

KELLY FILTER

For higher pressures of 60 to 250 lb. and for special uses, the Kelly pressure filter has fairly wide use. One important feature of this filter is the fact that it can be easily insulated or jacketed to hold any desired temperature throughout the filtration. The Kelly filter consists of a fixed cylindrical steel shell inclosing a removable carriage on which rectangular filter frames or leaves are suspended. Each frame consists of a heavy wire screen bound with a steel shape through which the filtrate runs. The outlet can be made in either an upper or lower corner of the leaf and any suitable type of cloth can be used as a filtering medium.

In operation, the shell is tightly closed by a locking device and the slurry run into the shell. As the cake fills up, the filtrate passes through separate discharge pipes to

Material flow in plate-and-frame press for filtration (left), thorough washing (center) and simple washing (right)



a common manifold. When the filtration rate decreases, a slight air pressure (approximately 5 lb.) is applied to hold the cake on the leaf while the excess slurry is dropped through the bottom opening of the shell. The cake may then be washed, the wash liquor following the same path as the filtrate. Excess wash is drained off and air applied if a dry cake is desired. To discharge, the shell is opened, the carriage rolled back by a small motor and the cake either blown off by air in the case of a dry cake or sluiced off with water for wet discharge.

Allowable cake thickness depends on the leaf spacing which is determined by experience, and filtration should always be stopped before the surfaces of adjacent cakes come in contact. For very large capacities the Twin Kelly filter consisting of two units utilizing a single runway may be used. Thus, one unit is filtering while the other is being discharged and cleaned. The main advantage of the Kelly press is the speed of dumping the cake, low hand labor and short cycle which permits high capacity.

SWEETLAND FILTER

Among the pressure filters, the Sweetland finds wide use in chemical industries such as the sugar, dyestuffs and organic chemicals. It consists of a split pressure shell with hinged bottom, inside of which is suspended a series of circular filter leaves which drain through individual sight-glass outlets into a common discharge manifold. Top drainage leaves are in use for most filtrations, but the bottom drainage types are used where thorough washing and drying of the cake are desired. Sweetland filters operate up to a maximum pressure of 50 lb. and have as much as 1000 sq.ft. capacity. Cotton or wool cloth filtering mediums are applied either by slipping a bag over the smooth rim leaf and sewing it tight, or by cutting it into disks and calking it into the grooved rim leaf. Metal cloth is installed by the latter method.

Filter cake is removed either by dropping the bottom of the shell or by sluicing through the bottom drain. If there is any difficulty in discharging the cake, a slight blow-back of air will release it.

VALLEZ FILTER

The Vallez filter originally designed for certain operations in sugar refining, has found limited uses in other fields such as in oil refining. It is a shell-and-leaves filter with the leaves rotating on a horizontal hollow shaft supported by bearings at each end of the shell. The shell is split horizontally with the top half removable and equipped with inspection doors opposite each leaf. Slurry is admitted to the bottom of the shell and filtered through the medium of the leaves, the filtrate passing out through the hollow shaft. For discharge, there is a pipe installed which directs jets of water on each leaf, thus sluicing the cake through the bottom outlet aided by a revolving scroll.

The same principle is used in the Swenson rotating leaf filter which has been used for sugar liquor and syrup, oils and volatile solvents, 50 percent caustic soda, etc.

VACUUM FILTERS

The simplest form of vacuum filter is the stationary vacuum filter, often referred to as a Nutsch. It consists of a box, usually circular, but sometimes rectangular with a horizontal perforated plate which separates upper and lower compartments into approximately equal volumes. Vacuum applied to the top section of the lower compartment pulls the filtrate through a filter medium supported on the perforated plate, while discharge of the filtrate is accomplished through a bottom outlet. Some of these filters currently in use are made with a mechanical device to facilitate dumping the cake by tilting the entire box.

OLIVER FILTER

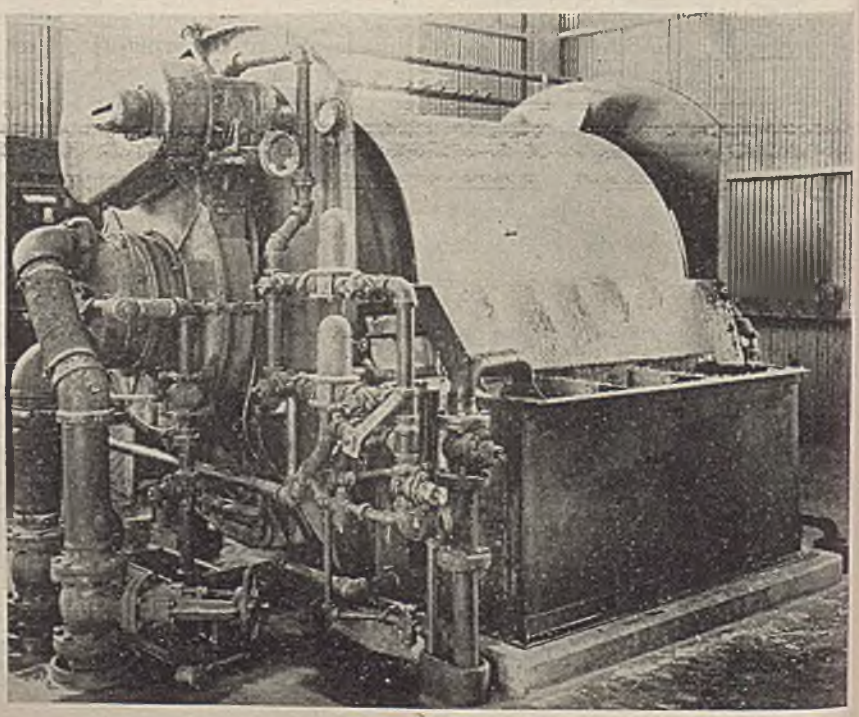
Intermittent vacuum filters such as the Moore and Butters filters have been largely superseded by continuous types of filters such as the Oliver. The Oliver filter consists essentially of a drum supported on trunnions and partially immersed in and revolved through a slurry in an open tank. The drum surface is divided into shallow compartments supporting the filter medium and individually connected by pipes or passages to an automatic valve mounted on one of the trunnions. Each compartment as it passes through the slurry is subjected to a vacuum controlled by the automatic valve, and a cake of solid is formed on the filter medium. The filtrate passes through the valve to the discharge pipe while the cake is held on the drum and dried by rotating in the air. Normally, the vacuum is maintained on the cake during the drying period. The cake may be washed while rotating and the wash water discharged separately from the filtrate. One type of washer utilizes a woven mesh material which rests on the rising cake and distributes the wash over its entire width. Just before each compartment re-enters the slurry tank, the vacuum is cut off and the dried cake discharged by a slight application of air pressure.

Discharge is now normally accomplished well below the center line of the drum so that the effect of gravity is practically sufficient to discharge the cake. This low discharge also allows more room for washing and drying, higher speed and a thinner cake. When a cake tends to retain moisture during the drying period, it may be subjected to compression by heavy rolls which literally squeeze out the water. This compression, in flattening the cake, also closes any cracks that may have formed, thus insuring uniform drying and reducing the vacuum load.

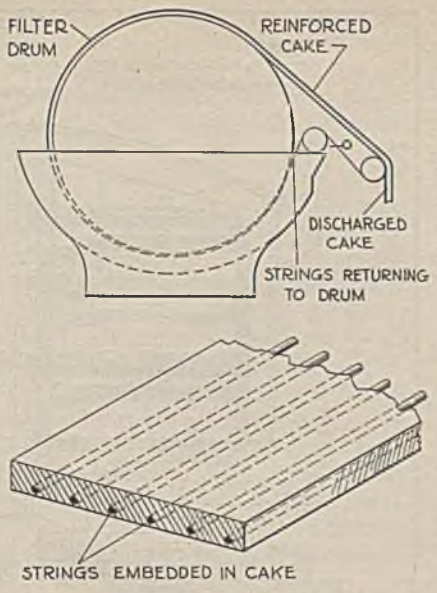
TOP FEED FILTER

The top feed filter is a variation of the rotary vacuum filter for handling salt and other quick drainage products which require washing and drying. This type should not be used if a turbid filtrate is objectionable. In the Swenson top feed filter, wire cloth or perforated plate is used

Oliver continuous vacuum filter handling potash



as the filter medium, the size of openings depending on the size of particles in the magma. Coarse crystalline solids form a porous cake permitting comparatively large volumes of air to be drawn through the material and yet maintain a reasonably good vacuum. For instance, with an exhauster capacity of 150 c.f.m. of air at 70 deg. F. per square foot of filter area, it is possible to maintain a vacuum of 2-2½ in. of mercury. If the air is preheated, the material may be discharged in a bone dry condition. (For a complete description of this type of filter, see *Chem. & Met.* for July 1941, pp. 80-84.) Problems other than simple filtration enter the picture with this type of equipment. Cake thickness normally ranges from ½ to 1½ in. and the drum speed may vary up to 2 r.p.m. Depending on the condition of drying, final cake moisture may range between 0.5 and 2 percent. Washing is restricted to approximately 45 deg. of the surface, which is sufficient in many cases, but does not allow for thorough washing.



Above—FEinc string discharge
Below—Detail of cake

OLIVER PRECOAT FILTER

The Oliver precoat filter has proven profitable in the filtration of colloidal matter, sticky or gummy substances or small amounts of finely divided particles in suspension. The tank of the precoat filter is filled with a slurry of filter aid and the drum rotated until it has a cake of about 1 to 2 in. The filter aid slurry is then replaced by the material to be clarified, and the vacuum being maintained holds the precoat until filtration begins.

Drying and washing are similar to general filter practice, but a special method is used to discharge the cake. A traveling knife-edge with micrometer feed shaves off the film of solids together with just a trace of the precoat material, thus presenting a fresh surface of precoat at all times for further clarification. Forward travel of the scraper may be varied from 0.0005 in. to 0.002 in. per revolution. In cases where it is desirable to remove the solid absolutely free from precoat, two scrapers, one leading the other, can be used.

FEINC CONTINUOUS FILTER

The principal feature of the FEinc continuous filter is a string discharge mechanism consisting of a series of individual strings which are tied to make them endless, and arranged so as to pass around the drum and down over a discharge roll where they make an abrupt bend in order to dislodge the cake from the string. They then pass through an aligning comb and are guided back onto the drum by means of a return roller. The cake is built up over the strings and reinforced by them so that at the point of discharge from the drum, the strings actually lift the cake in a continuous sheet. When this method of discharge can be used, it obviates the need for compressed air blow-back, and eliminates the necessity of a wire winding to hold the filter medium on the drum against the air pressure or to protect it from a scraper mechanism. Changing of the filter cloth is thus facilitated, and does not require removal of the strings. One result of the string discharge is that the filtered material is taken away from the filter at a steady rate which may be important if subsequent drying or processing operations are required. Cake thickness may range anywhere from ⅛ in. up to 12 in., with the majority of applications falling between ¼ in. and 4 in. The strings may be made of cotton, linen, silk, rubber covered cotton and various other synthetic fibers.

There is a wash mechanism available for this filter which is comprised essentially of a highly absorbent belt that rests on the cake and is driven by contact with it. As the cake is built up on the drum and emerges from the slurry, it is allowed to dewater for a short time to become firm and is then engaged with the wash belt by means of a floating roll. Non-atomizing distributors apply water uniformly to the belt and create a condition comparable to submergence.

DORRCO FILTER

The Dorrco filter is a drum filter in that the filter medium is placed around a cylindrical drum rotating on a horizontal axis, but it differs from the Oliver filter in that the filtering surface is on the inside of the drum. The drum acts as its own container and any settling is in the direction of the filter medium. The cake formed in the slurry passes through a washing and drying zone to the zenith or top position, where the vacuum is cut off and a slight air pressure applied to dislodge it onto a chute or conveyor belt. Filtrate passes out through the trunnion via a valve similar to the Oliver valve. The advantages of this type filter are that it will handle large volumes of fast settling solids, it requires no extra hood and it can be insulated completely for abnormal temperature filtration.

AMERICAN FILTER

Still another member of the continuous vacuum filter family is the American, which is a typical rotating disk filter. The filtering medium is attached to disks built up of wedge shaped sectors carried on a hollow shaft. A valve similar to the Oliver valve is used to discharge the filtrate as it flows through the drainage channel and hollow shaft. If the tank is partitioned, different feeds can be handled separately and simultaneously on a single filter. Discharge of the cake is accomplished by air pressure and scrapers or discharge rolls. Each sector of the disk can be easily replaced while the filter is in operation, and filter bags can likewise be changed rapidly.

ALLUVIAL FILTERS

These filters typified by the Republic and Sparkler filters are generally used for clarifying or polishing liquids containing small quantities of solids. Shown in the illustration on page 122 is a horizontal plate filter especially acceptable where filter aids are used. Among other applications it has found fairly extensive use in chemical plants where activated carbons are required for clarification. Any kind of filter medium can be used since the plates or leaves are made to carry the weight of the cake and filtrate. Although the operation is intermittent, it is possible to keep an extra set of plates on hand and thus maintain nearly continuous filtration. One advantage of this type filter is that it can be readily jacketed and insulated. It can be obtained in capacities up to 1500 sq.ft. of surface.

SELECTION OF FILTERS

Close study of these filters and others not mentioned here reveal that each one was developed to meet certain conditions, and therefore selection of the type of filter depends on the specific conditions of each case.

Plate and frame presses are lowest in first cost, but among the highest in operating cost. Still, they are the most economical device if only infrequent openings must be made, provided, of course, that they are otherwise suitable. For rapid handling, and for sludges which are difficult to filter, the Kelly or Sweetland type filters give good economy and efficiency. If there is much washing to be done, one of the continuous rotary drum or disk type filters would probably be the best to use. Shell and leaf filters do allow for as much washing as may be desired, even with water temperatures above the boiling point at atmospheric pressure, but there is always the danger that the cake will fall

away from the leaves. This is particularly true if there is much "rotting" of the cake due to soluble material being washed away.

If filtrate clarity is important, the plate and frame, Sweetland and Kelly types will permit inspection and close control of the filtrate. On the other hand, the continuous vacuum filters do not always give a clear filtrate.

If a large filtering area is required and only a small floor space is available, the choice of a rotating disk type filter may be indicated.

For handling particularly corrosive materials, the inclosed pressure type filter is often superior in reducing corrosion effect by preventing the material from being exposed. If a rotating vacuum filter is used for corrosive materials, great care must be taken to see that the proper corrosion resistant materials are provided, especially in the vacuum system where there is a considerable flow of air.

The power cost for rotating filters cannot be generalized, but most manufacturers have data available for the various types of materials handled by their equipment. The cost of actually rotating the filter is low, but other power costs for air and vacuum may be considerable. In general, the cost of running a continuous vacuum filter is lower than for a plate-and-frame filter. The power cost on a pressure filter is high but is generally justified on the basis that it does a better job than any other type for the particular material handled.

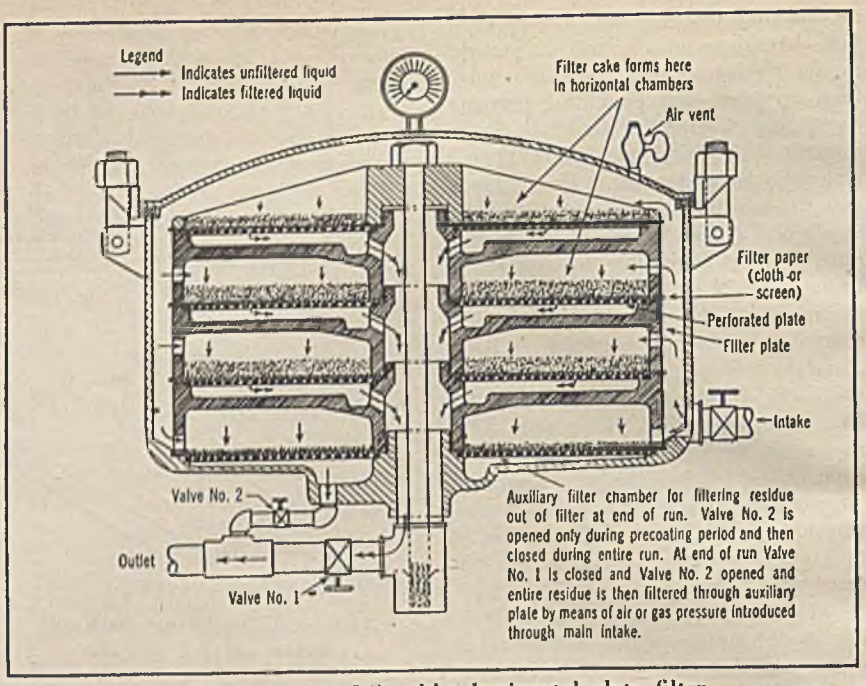
FILTER MEDIA

A wide variety of filter media are available from the cotton fabric to wool, rubber, glass, synthetic fibers, asbestos fabric, and metal. Because of their mechanical strength and relatively moderate initial cost, cotton filter media are employed in the widest variety of filtration operations and are available in practically any weave of fabrics ranging from 5 oz. to 50 oz. per sq. yd. Porous ceramic materials are used to some extent as a filter medium where certain bad corrosive conditions are met. They provide the advantage of easy cleaning plus constant pore size.

Woven Glass

Where high temperature, strong acid solutions or combinations of both are present, woven glass provides a satisfactory filter medium. It lends itself to successful installation on flat type plate-and-frame filter presses, rotary vacuum drum filters, Nutsch filters, etc. However, it is not so well suited to recess type plates. For installation in plate-and-frame presses, the individual filter cloths should be latexed to a distance of ½ in. inside of where they come into contact with plate and frame bearing surfaces and around all feed, wash and filtrate discharge ports. This helps to prevent damage to the glass fibers from compression, unraveling and liquid flow through the ports. For rotary vacuum filter covers the medium is made up by sewing glass cloth together in panels with flat seams having two rows of glass thread stitches. The seams run circumferentially around the filter drum.

For removal of the cake, excessive scraping should be avoided. Also, if sluicing is the method used for discharge, high pressure water streams should be avoided. Similarly, in the reverse air flow method, the pressure should be adjusted to the minimum necessary to lift the cake from the medium. In order to give longer life to the woven glass medium, pressure fluctuation caused by the pumping equipment should be kept at a minimum. When glass media are applied to rotary vacuum filters, Nutsch filters, etc., a wire screen under the cover improves drainage and increases cloth life.



Cross-section of Sparkler horizontal plate filter

Wool

Wool, being an animal fiber, can withstand higher temperatures than cotton and also is less rapidly attacked where acid solutions are encountered. The effect of acid solutions on wool is much greater at elevated temperatures than in cases where filtration is carried on at room temperature. Even relatively low acid concentrations become progressively more harmful to wool as temperatures increase. As a consequence, in acid filtration where wool is to be used, the maintenance of the solution at room temperature or as near as possible is most important. Otherwise, it is more desirable to go to glass or rubber or some other type of medium.

Rubber Media

This medium consists of porous rubber sheeting formed as it is being produced from the liquid latex, or by mechanically perforating the sheet, the former method being a patented process with certain advantages. Rubber filter media are produced as standards in varying thicknesses and number of pores per square inch. As produced by the Filter Media Corporation, the maximum width without seams is 42 in. and the maximum length 38 yd. The thickness of the material varies from 0.5 in. to 0.9 in., the diameter of pores from 0.004 to 0.012 in., the pores per square inch from 1,100 to 6,400, and the percent of voids from 6 to 13 percent. To improve the strength of the rubber and to reduce its tendency to stretch, a coarse mesh rubber covered cotton backing is frequently employed.

Synthetic Yarns

During recent years, considerable use has been made of yarns produced from vinyl polymers. They are particularly valuable wherever strongly acid or alkaline solutions must be filtered. Except for a few little-used substances, cloths of this nature are immune to chemical attack, even by aqua regia and hydrofluoric acid. These synthetic filter media are available in all weights, thicknesses and porosities, and can be made in various twill weaves and chain cloth construction as well as ducks. However, there is one disadvantage to these fibers in that they cannot be used at temperatures much above 60° to 70° C.

Metallic Media

Metallic filter media are woven of iron, copper, brass wire, and other corrosion resistant alloys. Their resistance to corrosion as well as their mechanical strength results in such a long period of service that the higher first cost is justified in practically every case where they can be used. In

some cases, perforated metal plates have been used successfully. Perforated sheet copper or stainless steel are sometimes used on the rotary vacuum filter for handling excessively corrosive muds.

FILTER AIDS

In general it can be said that the purpose of a filter aid, or a filter powder, is threefold. It must form a screen which will retain the smallest suspended particles in the slurry, it must prevent the slurry from plugging the filter medium and must also insure a reasonably high rate of flow through the filter. They are particularly beneficial in filtration when particles to be removed are small, non-rigid, slimy or colloidal. In such cases it is often practically impossible to do a good job of filtration without the use of a proper filter aid. Most common among the filter aids used in the chemical process industries is diatomaceous silica, the fossil remains of tiny marine plants called diatoms.

There is no chemical action involved in the use of the ordinary filter aid. Capable of being used in any type of filter, the filter aid is mixed in with the impurities to be removed and collects with them on the filter medium. One purpose of the filter aid is to keep the cake porous as it builds up and prevent the impurities from forming a layer impervious to the flow of liquid. Selection of the proper filter aid for this depends on the desired rate of flow and the required clarification. In practice, the coarsest filter aid giving a filtrate of satisfactory clarity is the one to use, since the best possible flow is then obtained. The finest filter aids (those with the smallest size pore faces) will remove slimy or colloidal material of about 0.1 micron size. The proper quantity of filter aid depends more on the nature than the quantity of suspended impurities. A sufficient amount usually involves having enough present to envelop and surround completely the suspended substances. The percentage of filter aid necessary to provide for perfect clarification, protection of the cloths, proper cake formation, etc., is generally from one-tenth to one-half of 1 percent of the weight of the liquid.

Precoating

Precoating is the depositing on the filter cloth of an initial film of clean filter aid at the beginning of the filter cycle. This is accomplished by pumping a suspension of the filter aid in water or some other liquid through the filter. For batch filtration, the amount of filter aid necessary for precoating is about 10 lb. per 100 sq.ft. of filter area which gives a film approximately $\frac{1}{16}$ in. thick on the filter cloth. The first of the precoat charge flowing from the filter is generally recirculated until clarity of filtrate is obtained, which normally takes but a few minutes. This is necessary because the cloth pores are chosen relatively large to give a good flow rate, and the filtrate will not be clear until they are latticed over. When precoating is employed on vertical plates or leaves, there must be no cessation of flow between the slurry of filter aid and the slurry to be filtered. Otherwise there will be a period of no pressure upon the film and it may slide from the cloth. It would be possible, of course, to maintain sufficient pressure for this by use of air pressure in some cases.

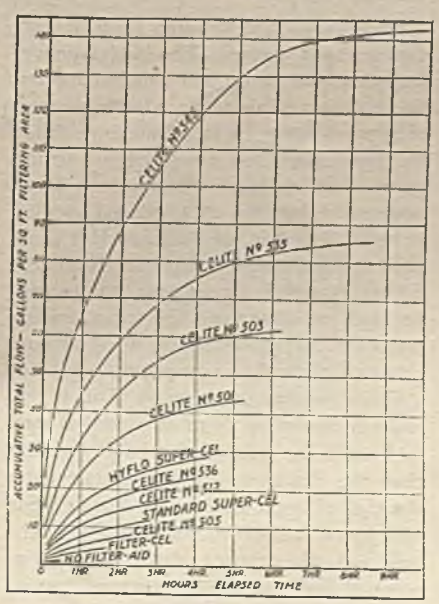
Precoating is necessary when the material to be filtered is so slimy that even though it were diluted with filter aid it might yet slime the filter medium before the filtration could get under way. It is commonly done on large scale work where continuous operation of the filter presses is an absolute necessity. On leaf type filters particularly, precoating is employed because the cloths are sewed onto the frames and cannot be easily removed for cleaning.

Since the use of filter aids actually transfers the filtering surface from the filter medium to the filter aid itself, it is not so essential that expensive weaves and heavy weight filter cloth be used.

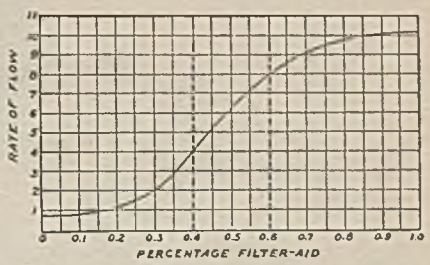
When using filter aids in leaf filters, a light 200 cotton drill is satisfactory. For plate filters, a 10 to 14 ounce loose-weave duck is best, as the cloth also serves as the plate gasket. In very large plate filters, 36 in. and larger, two layers are better, the lower a 14 or 16 ounce type burlap and over this a 12 or 14 ounce duck. Only the duck, which holds the cake, requires cleaning. In cases where metal cloth is used, the mesh must be close enough to hold the filter aid. Satisfactory meshes include 70x80 (0.007 in. wire), 60x60 (0.011 in. wire), both twilled, 24x110, 20x150, and 16x200.

Other filter aids which are sometimes used include paper pulp, fuller's earth,

These curves show the increase in flow rate as larger size particles are used for filter aids



asbestos, sawdust, magnesia, salt and gypsum. Most paper pulps and kieselguhrs can be washed and revivified so that they may be reused several times.



Rate of filtration varies with amount of filter aid used. Usually there is an economic optimum as in this typical case

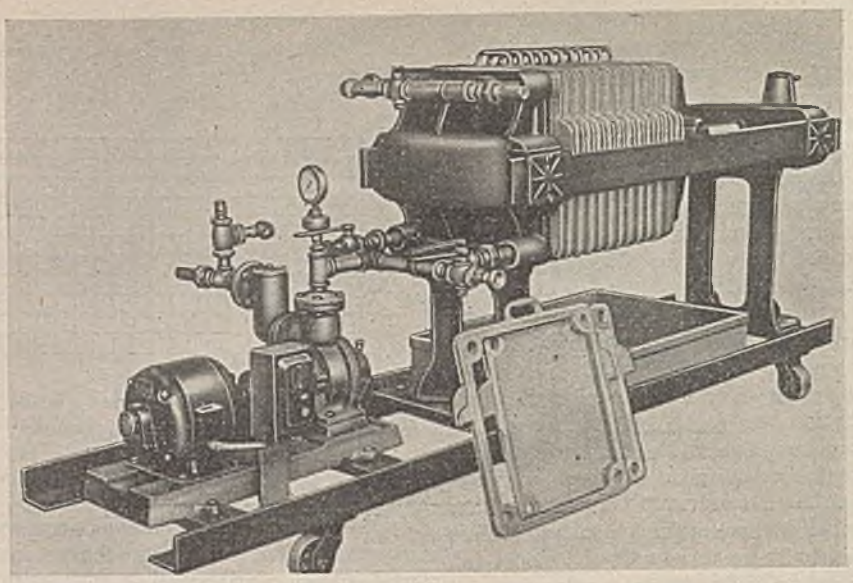
It is very seldom that filter aids can be recovered for further use. Since the amount used is small, and removal of the impurities is difficult in most cases, it is not economical. Filter aids in general are not used where the filter cake is of particular value, unless the cake can be dissolved and separated from the filter aid without too much difficulty, such as is the case in the removal of wax from lubricating oil.

MATERIALS OF CONSTRUCTION

As might be expected with such a universal piece of equipment as a filter, it is made of almost every material of construction available to the chemical industry. More filter presses are made of cast iron rather than any other material due to the cheapness of the metal and its durability and strength. However, they are also made in lead, bronze, wood, aluminum, rubber, stainless steel or special alloys. Cast iron plates and frames may also be galvanized, enameled or rubber coated, and plates of any metal can be electroplated.

Many food products and pharmaceuticals are satisfactorily filtered in aluminum presses, while hard lead and special alloy filter presses are used for cases where corrosion or contamination must be avoided. Wood or rubber presses are used where acid conditions must be met, but a larger size press is required in these cases since a wider joint surface is required between plates and frames. Common practice in chemical plants where severe corrosion is met and there is a considerable amount of filtering to be done, is to use wood plates and frames despite the fact that they are not permanent, are harder to keep tight and use a larger size of filter cloth than metallic plates of the same area. In some cases, the wood is impregnated with paraffin or other wood coating such as bakelite. Wood plates and frames should never be allowed to dry out but should be kept under water at all times when not in service.

The Sweetland pressure filter is often supplied completely fitted out for handling corrosive materials. The shell can be made either of cast bronze, stainless steel, etc., or lined with some metal, and equipped



Portable filtration unit with stainless steel filter press, pump and piping

with filter cloth and leaves of the same material. Most of the shell-and-leaves type filters are provided in the various alloys and chemically resistant materials which are common to the chemical process industries. Many of them are of welded construction.

For some corrosion problems, which involve vacuum or gravity filtration and occasionally even pressure filtration, filters are made of ceramic materials.

The continuous vacuum filters such as the Oliver are fabricated from mild and alloy steels, including stainless; cast iron and Niresist copper, bronze, Everdur, Monel and other corrosion resistant alloys as well as lead, rubber and wood used alone or in combination.

ACCESSORY EQUIPMENT

A very essential and frequently overlooked or neglected phase of filtration is the necessity to provide suitable accessory equipment. The success of a filter installation may depend upon the choice of accessories and great care should be given to selection of filter drives, agitator drives, vacuum displacement, filtrate disposal, cake or sheet removal, separation of air and liquid in the filtrate, and other incidental problems which arise in connection with the operation of a filter. In short, it is wise to remember that filtration is an integral part of modern processing and reaches beyond just the filter itself.

Slurry Pumps

One of the most important items of equipment in connection with filtration is the pump which feeds the slurry to the filters. The open impeller centrifugal pump is the best general pump for this service since it starts with a low pressure, then builds up the pressure as the cake becomes thicker and resistance to flow increases. If constant rate flow is desired and an initial high pressure is not detrimental, the plunger type pump may be used. The montejus, or blow-case, is still used in special cases.

For handling lumpy materials or materials which are excessively corrosive, the diaphragm slurry pump may be used satisfactorily. In this pump, all the parts which come in contact with the material being handled are protected by rubber which makes the pump resistant to both corrosion and abrasion. Diaphragm pumps operate up to about 50 lb. pressure and do eliminate the tendency in centrifugal pumps to churn and break up the flocs. However, for filtering operations the pulsating flow of a diaphragm pump is not good, but can be overcome somewhat by use of an air chamber on the discharge line, or, better still, by using two or more pumps actuated by a single timer but with pulsations staggered.

Vacuum Pumps

For vacuum filters, some form of vacuum pump is required. The Nash-type wet rotary vacuum pump will handle considerable volumes of air at a moderate vacuum of approximately 16 in. of mercury, while the Roots-type, also a wet rotary vacuum pump, handles large volumes at a lower power cost but also at a reduced vacuum of about 2 to 6 in. of mercury. If it is desired to handle the air separately from the filtrate, standard dry vacuum pumps may be used including both the rotary and reciprocating types. However, if dry vacuum pumps are used, it is necessary to provide a filtrate receiver or separator. This is generally made in the form of a vertical steel tank with the height considerably greater than the diameter. Air and filtrate enter the tank through a side inlet, the air being withdrawn through the vacuum line at the top and the filtrate drained away or pumped out through the bottom connection. A moisture trap or condenser or possibly both are also required to prevent any of the filtrate or condensed moisture from entering the pump. If the filtration is carried out at normal room temperature, the trap will probably be sufficient, but at higher temperatures near the flash point of the filtrate, it is necessary to condense the water vapor in the air before feeding the air to the pump. The trap is merely a small tangential inlet receiver with bottom outlet connected either to the suction of a filtrate pump or to a seal pit at least 30 ft. vertically below the bottom of the trap. The condenser is similar to a trap but is equipped with showers or weirs and baffles for washing the gas with cold water.

The standard filtrate pump is the closed impeller centrifugal pump. However, they are generally required to handle both water and air under vacuum, and discharge against a positive head so that special design is necessary or at least advisable in most cases.

Most processing plants which use filters requiring air pressure have adequate air pressure available in the regular service lines. If the air pressure is not available, a small air compressor or a rotary blower may be employed. Rotary blowers are probably better for providing the blast which helps to discharge the cake since they operate efficiently under 3 lb. per sq.in. pressure.

Mechanical Drives

For rotating filters, electric motors and standard drives are general practice. The Vallez pressure filter utilizes a worm gear reducer for driving the hollow shaft. In the case of the Oliver continuous vacuum filter, speed reduction is obtained first in a worm gear reducer which is connected to the worm shaft of the rotary drum by V-belt and sheaves. There is also a considerable use of roller chain and sprocket drives. Various speed changing devices are used such as the Reeves, Link-Belt, hydraulic coupling, etc. The Dorrco filter uses a chain and sprocket drive speed reducer. The type of drive decided upon is sometimes dependent on plant conditions and plant standards.

Acknowledgment is made to the following companies who aided in the preparation of this material and provided illustrations: The Dicalite Co., Filter Media Corp., Filtration Engineers, Inc., Johns-Manville, Maurice A. Knight, T. Shriver & Co., Sparkler Manufacturing Co., D. R. Sperry & Co., Swenson Evaporator Div. of the Whiting Corp., United Oliver Filters, Inc., and The United States Stoneware Co.

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PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

SOLIDS LEVEL INDICATOR

A BIN-LEVEL indicator for dry materials which operates entirely on the electronic principle is now being supplied by Mosher Electronic Control Systems, 130 West 42nd St., New York 18, N. Y. The device operates without moving parts and is said to be effective in measuring all types of materials, whether fine or coarse. The device includes two parts: a detector box which is attached to a probe extending into the bin, and a second box containing the signal control which is provided with a series of colored lights to show the condition of the bin level. The latter may be hooked up with valve control devices, sound signals or remote signal devices. Using an electronic amplifier, the device measures differences in electrical capacity between a bin that is empty and one that is full.

PORTABLE MIXER

UNIQUE in design among portable mixers is a new belt-driven industrial mixer recently announced by United Electric Motor Co., 178 Centre St., New York, N. Y. In this design the motor hangs outside the tank and out of the path of spray or fumes from the equipment. The balanced hanger carries the weight of the equipment below the center of gravity so that tension on the clamp is not needed to hold the mixer in place. Either an a.c. or d.c. motor of low cost may be used, while precisely defined mixing speeds may be secured readily by simple pulley changes. Belt and pulleys are of the V-type and are readily interchangeable. The mixer employs large low-speed propellers carried on a heavy shaft mounted on combination radial and thrust bearings. Propellers are held on the shaft only by set screws to facilitate cleaning, removal or replacement.

SELF-PRIMING PUMP

AN IMPROVED automatically controlled valve is one of the important features of the new type AO self-priming centrifugal pump recently put on the market by Allis-Chalmers Mfg. Co., Milwaukee, Wis. Priming of the new pump is accomplished as the motion of the water through the pump runner and the volute passage carries behind it a slug of air, drawing air into the suction passage through the impeller and out through the priming chamber. This hydraulic action lifts the column of water in the suction line and achieves the same result as with a separate vacuum pump. The priming valve closes slowly during this process, acting against a spring tension which governs the rate of priming and the static height of the priming suction lift. The automatic closing of the valve after complete priming prevents water from bypassing the suction chamber, with resulting loss of power.

The impeller of the pump has an unusually thick vane with rounded inlet edges to permit the passage of stringy materials and fairly large solids. The company plans to produce a complete line of these new self-priming pumps in sizes from 1 to 6 in., although 2- and 3-in. sizes are presently available. The entire line will range from very small capacity to 1,400 g.p.m., with heads of 100 ft. or more. The new self-priming device is also adaptable to use with other pumps, particularly the single-suction type.

MOTOR INCHER

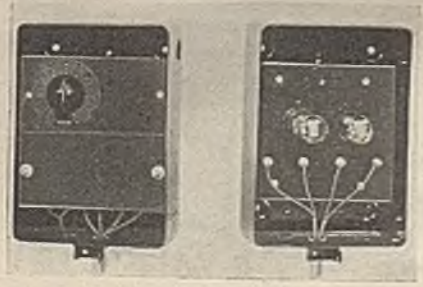
AWKWARD and time-consuming operations in the spotting of heavy rotating equipment, such as cement grinding mills, by "nudging" the motor with the starter, are avoided through the use of the new slow-motion, high-torque Incher recently announced by Electric Machinery Mfg. Co., Minneapolis 13, Minn. The new device is applied to three-phase synchronous motors and split-ring induction motors, using commutated direct current to supply a slowly revolving three-phase inching current to the motor. The ordinary method of "nudging" with the starter is destructive to the starter switch, while turning the motor with an overhead crane or other mechanical device is clumsy and slow. The new method is said to be precise and quick and to cause no damage to the equipment. Furthermore, since the Incher can revolve the motor in either direction, a reversing switch may be saved when reverse inching would otherwise be accomplished by "jabbing" a reversing switch.

The speed rating of the Incher will depend on the speed rating of the motor to be inched, usually being 1 or 2 percent of the normal speed of the motor for low-speed, direct-connected cement mill motors. The equipment consists of a small motor driving a six-cam commutator, the cams of which are set at 30 deg. intervals. These cams during their rotation close contacts in appropriate sequence and duration to provide approximately a 3-phase inching current. Power for inching is provided by a d.c. generator, such as a welding generator. Through operation of the contactors, the successive amplitudes of current supplied to the synchronous motor in a given phase are 0, 50 percent, 75 percent, 100 percent, 75 percent, 50 percent and 0, then repeating in a reverse direction. The effect of this stepped regulation of current is to provide an approximate alternating cycle at the desired frequency for inching. The field winding of the synchronous motor is supplied with normal excitation. When the inching current is supplied to the stator the polarities in the stator shift forward by 30 electrical degrees for the operation of each successive cam and hence as the commutator rotates, the poles of the stator follow its rotation and the rotor follows the poles. Reversing is accomplished simply by reversing the direction of rotation of the commutator.

PHOTOELECTRIC FUEL CUTOFF

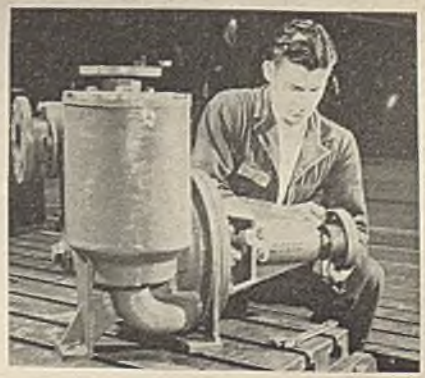
TO PROVIDE an instantaneous fuel cutoff in any pressure-fed burner, in the event of flame failure, Combustion Control Corp., Cambridge 42, Mass., has developed the Fireye Type F28C which is said to be capable of monitoring flames of any intensity in furnaces burning oil, gas or pulverized coal. Since the device operates by

Electronic bin level indicator



New belt-driven portable mixer

New self-priming pump



the actual presence or absence of flame, it operates immediately and therefore eliminates any possible explosion hazard which might be caused by a few seconds' lapse of time before fuel cutoff. The device may be used with manually ignited burners to cut off fuel and sound an alarm, or when the burner is automatically fired, it can be provided with a program type relay to program fuel pump and valve operation, intermittent ignition system, purging period, and recycling. In use, the instrument is sighted directly on the flame so that its field of vision is limited to the flame itself and any extraneous light is rejected.

INDUSTRIAL FLUID COOLER

Model 400 is the designation of a new portable refrigerating device for industrial fluids recently announced by Gray-Mills Co., Chicago, Ill. This device not only mechanically refrigerates whatever process liquid may be circulated through it, but also settles and screens out foreign material and provides its own pump pressure for circulation. The device is compact, occupying 28½x33 in. floor space, standing 44 in. high. Its condenser is air cooled so that a water connection is not required. It is equipped with a 1-hp. compressor rated at 11,800 B.t.u. It can be provided with either a centrifugal or gear type pump operated by a ½-hp. motor. The first type has a rated capacity of 3,000 g.p.h. at 7 lb. pressure, and the gear pump, a capacity of 180 g.p.h. at 50 lb. pressure.

DRUM-OPENING TOOL

Usual risks involved in the opening and handling of medium weight and light metal drums are avoided through the use of a new drum opening tool operating on the principle of a household can opener, which has been announced by Merrill Bros., 36 Caspian St., Maspeth, Brooklyn, N. Y. The new tool grips the outside of the barrel and cuts smoothly and evenly, folding the edges in close to the barrel to permit reuse without danger. Made of drop-forged steel, the opener may be resharpened when necessary.

PORTABLE OIL TESTER

Convenient and rapid testing of insulating liquids such as oil and Pyranol is possible with an improved 30,000-volt portable test set developed by the General Electric Co., Schenectady, N. Y. The set, designed for indoor service, maintains smoothly variable test voltages from 0 to 30,000 volts on single-phase 115- or 230-volt, 25- or 60-cycle circuits. The tester is claimed to be used advantageously in industrial plants, saving both time and expense in checking the proper dielectric strength of insulating liquids. The device combines in a single unit a step-up transformer, a potentiometer which gradually raises the test voltage, a voltmeter to measure breakdown values, an automatic circuit breaker, and an oil testing receptacle. As soon as the test sample breaks down, the low-voltage breaker automatically opens the circuit, preventing continuation of the arc and burning of the electrodes. Complete instructions for operation are given on the control panel. The oil testing receptacle is located at the rear of the control panel under a hinged safety guard with a glass window.

CORROSION RESISTANT MATERIALS

Two new products for covering plating racks, made from Koroseal plasticized polyvinyl chloride thermoplastic, have been announced by B. F. Goodrich Co., Akron, Ohio. One type known as Koroseal Tape RX comes in tape form, while the second, Koralac RX, is a solution of Koroseal. In some applications both types are used together while in other cases they may be used separately. The tape is said to have good resistance to wear and abrasion, excellent insulating properties and a high degree of resistance to all types of plating solutions.

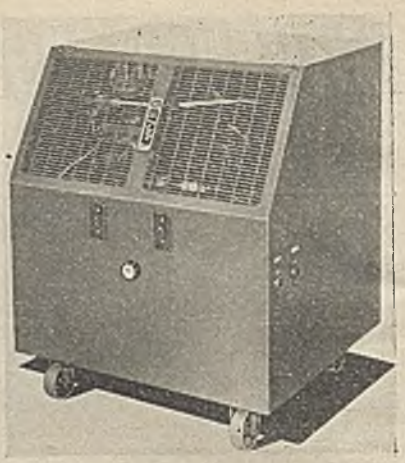
The tape is supplied in glossy black 1-lb. rolls containing approximately 170 lin.ft., ¾ in. wide by 0.14 in. thick. No special equipment is needed in applying the tape in conjunction with the solution. The rack is first coated with two or three coats of solution and the tape is then wrapped under firm tension, after which one or two more coats of solution are applied. If the tape is to be used alone, the rack must be placed in an air oven with a minimum temperature of 300 deg. F. for two hours after application of the tape to fuse the overlapping edges together. The solution can also be used alone and is said to be satisfactory for nearly all kinds of plating rack service. Liquid at room temperature, the solution holds its position on the rack after application because of shrinkage as the solvent exaporates. The solution is said to be highly resistant to all types of plating solutions including acid and alkali dips.

VERSATILE BAG CLOSER

Accommodating all types of Union Special sewing heads, and capable of use with any type of conveyor is a new column-type, high-speed bag closer designated as Style 20-100P, which has been announced by Union Special Machine Co., 400 North Franklin St., Chicago, Ill. Depending on the kind of sewing head used, this bag closer produces three different closure types including: (1) Bound-over tape closure for all sizes of multi-wall paper bags; (2) Straight sewed closure for all sizes of cloth or paper bags; (3) "Dubl-Tape" sewed closure for paper bags up to 10 lb. in size. The machines use either a single-thread chain stitch for easy raveling, or a two-thread double lock stitch for extra strong closures.

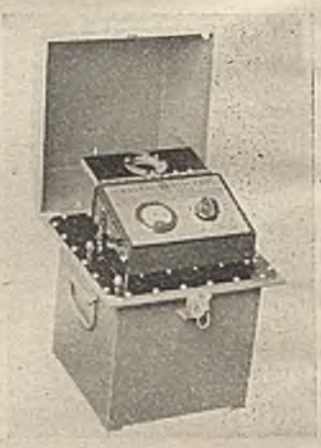
INDUSTRIAL MITT

Jumbo-sized, all-leather, wool-lined, one-fingered mitts have been designed by Industrial Gloves Co., of Danville, Ill., for industrial uses where asbestos was formerly used. The construction is said to assure ventilation and coolness in handling extra hot materials. Made with a 4-in. gauntlet with extra protection at the wrist and the thumb reinforced with a leather strap, the glove can also be had with a 2-in. band and 6-in. gauntlet, if desired.



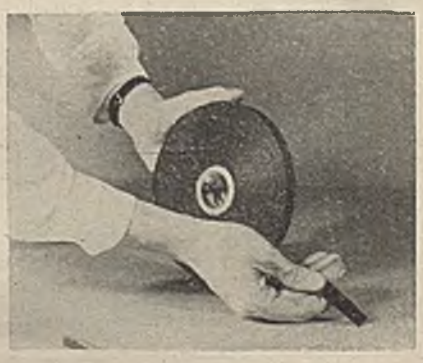
Model 400 fluid cooler

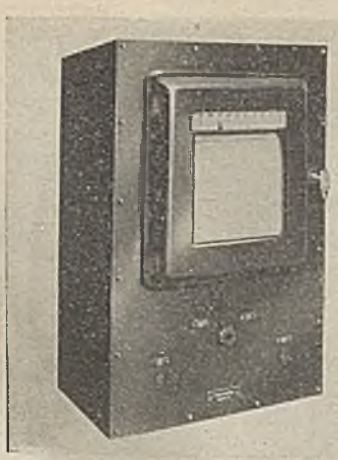
Drum opener in use



Portable tester for insulating oil

Polyvinyl chloride tape



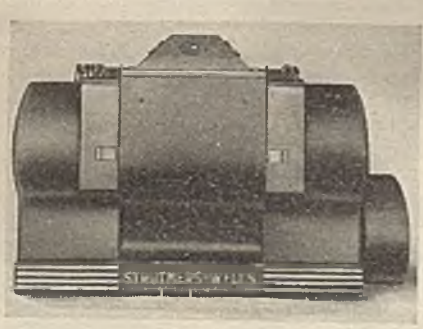


New Televac vacuum recorder

New spray nozzle

New wind-up machine

Heavy-duty kneading machine



RECORDING HIGH VACUUM GAUGE

FOR USE in the indicating and recording of extreme low pressures, down to 10^{-6} mm. of mercury, the Televac indicating and recording unit has been developed and announced by George E. Fredericks, Bethayres, Pa. This device is operated by means of a thermal conductivity gage in the upper part of its range, and an ionization gage in the lower range. To obtain the record of an evacuation, the operator turns on the thermal gage after the forepumps have been started. This gage cannot be harmed if turned on at atmospheric pressure. The recorder then draws a curve of the preliminary evacuation. When a pressure of 10^{-2} mm. has been reached, the operator turns on the ionization gage and the record is continued during the high-vacuum portion of the cycle. Owing to safety devices which have been incorporated in the unit, it is impossible to turn on the ionization gage until the pressure has been lowered to 10^{-3} mm. This feature is provided to avoid damage to the latter gage. If pressure should rise above 10^{-3} mm. during operation, the filament current instantly and automatically shuts off, thus avoiding the possibility of a burned out gage.

According to the manufacturer, ionization gages used with this instrument avoid most disadvantages ordinarily associated with this type of gage. The new gages are guaranteed for 2,000 hours' operation unless used with contaminating vapors. They do not require outgassing when used with a moderately high speed pumping system. External and interior leakage between collector and tube elements have been entirely eliminated and recalibration is never required. Should a gage be broken, another can be installed without recalibration.

INJECTOR TYPE NOZZLE

OF THE injector type, the Fulljet spray nozzle manufactured by Spraying Systems Co., Chicago, Ill., is built in a wide range of sizes to give any desired performance characteristics. This nozzle, designed primarily for use in gas washers and related process applications, is made in brass, steel, Monel metal and stainless steel and handles water and other liquids of similar viscosity. The pattern produced is a concentrated narrow cone.

IMPROVED KNEADING MACHINE

FOR THE PROCESSING of heat-sensitive materials and other difficult materials requiring accurately controlled treatment, Struthers Wells Corp., Titusville, Pa., has announced a new kneading machine which features improved blade elements carried on widely spaced anti-friction bearings to insure maximum rigidity under severe operating conditions. Especially close blade clearance is obtainable with this construction, according to the manufacturer. All gears, bearings and other rotating parts are totally inclosed and automatically lubricated. The mixing chamber is provided with a quick-acting cover and, in tiltable machines, motor or hydraulically operated dumping mechanisms are provided. For vacuum service a single outside stuffing box arrangement is used which, according to the manufacturer, is designed to prevent contamination and to require minimum attention for proper adjustment. Heavy duty units use an improved stabilized-torque type of drive to balance uneven loading conditions. Known as the Northmaster, the new machines are available in extra large sizes in various types of construction for processing a wide variety of materials.

WIND-UP MACHINE

BUILT for a variety of coating operations, a new wind-up machine for wire, cable, cord, rope, paper, tapes of various kinds, textiles and coated fabrics has been developed by Industrial Oven Engineering Co., 11621 Detroit Ave., Cleveland, Ohio. The device is a self-contained unit with combination variable speed and hydraulic synchronizing equipment, designed to provide constant speed at constant tension within a variable production range. By means of adjustable counterweights, the tension can be varied from a few ounces to hundreds of pounds. The equipment comprises a dismountable reel stand, multi-wrap large-diameter capstans, variable tension mechanism and an adjustable level winder. The equipment is motor driven and requires no outside source of power or synchronization.

LEVEL CONTROLLER

A BUOYANCY-TYPE liquid level controller and indicator known as the Level-Buoy has recently been added to its line by the Taylor Instrument Cos., Rochester 1, N. Y. The new instrument employs this company's Fulscope control mechanism with either completely adjustable sensitivity for smooth throttling level control, or automatic reset for averaging of liquid level with a minimum of disturbance to the process. The instrument requires no stuffing box, using a torque tube to transmit the level changes to the instrument mechanism. The torque tube is interchangeable with those used in this company's aneroid manometers, which assists instrument users in minimizing inventories of spare parts. The instrument handles liquids with specific gravities between 0.2 and 2.0. It is available in standard ranges of 14, 32, 60, 72 and 120 in.

TEMPERATURE-RISE WARNING

DEVELOPED primarily for use in aircraft, but also suitable for warning of temperature rise in industrial applications, is the new Vapor Immersion Thermostat recently developed by Vapor Car Heating Co., 80 East Jackson Boulevard, Chicago, Ill. The device employs a mercury thermostat sealed against dirt or moisture, with a sensitive bulb protected against breakage. The bulb housing is provided with a $\frac{3}{8}$-in. pipe or other standard thread for screwing direct into the equipment. The device is available for any temperature range from −60 to + 500 deg. F., for use in contact with oil and a variety of chemicals and gases. The thermostat is equipped with signal lights or other warning devices as required. For example, one arrangement is to use a green light indicating that the temperature is below a certain point. Should the temperature increase, a red light will flash. Should

New electronic-pneumatic controller

the increase continue, the red light will light continuously. The device is said to be accurate to within less than 1 deg. F.

ELECTRONIC CONTROLLER

What is said to be the first electronic controller of its type, which does not employ a motor or other continuously moving part, is the new Celectray pneumatic indicating controller recently announced by C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y. The new instrument combines the principle of the original Celectray controller, with its mirror galvanometer and photo-electric amplifier, with a pneumatic follow-up. The instrument is claimed to provide continuous action without measurable dead-zone. The measuring circuit in this instrument is similar to the standard Celectray controller except that in place of the relay ordinarily used, there is substituted a magnetic air valve which acts as an amplifier and converter from electric to pneumatic operation. The light beam follow-up flag is moved back and forth by changes of the air pressure in the bellows of the follow-up assembly, unless the sensitivity-adjusting arm is turned to the highest sensitivity on its scale at which point the throttling range is zero. In this event, the flag stands still as the control pressure varies and the controller acts as an on-and-off controller. As the temperature varies, the light image moves across the controlling edge of the flag and more or less of the light reaches the phototube, in turn causing more or less air to flow through the magnetic air valve and thus raising or lowering the controlled air pressure.

WATER TESTING EQUIPMENT

All necessary apparatus and chemicals for the determination of hardness, alkalinity, chlorides, sulphites and phosphates is included in a new test set for boiler water control analyses announced by W. H. & L. D. Betz, Gillingham and Worth Sts., Frankford, Philadelphia, Pa. The apparatus and all chemicals are housed in a special cabinet designed for use on a table or wall. A portion of the opened cabinet forms a convenient acid-resistant laboratory work table and a fluorescent light provides correct illumination for the test.

EXPLOSIVE MATERIAL MIXER

An accompanying illustration shows a new mixer intended primarily for the mixing of explosive materials which has been developed by Paul O. Abbé, Inc., Little Falls, N. J. All supports, gears and power units are placed in a separate room from

Boiler water testing kit

the mixing chamber of the machine, a long shaft extending through the wall to solve the problem of safe, efficient operation.

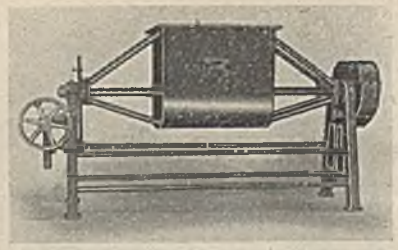
CLOSED-IMPELLER PUMP

A new line of paper stock pumps with closed impellers has been added by Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago, Ill. The company, therefore, is now prepared to supply paper stock pumps in 4, 5, and 6 in. sizes with both open and closed impellers. Each type has a definite field of application in paper stock handling. The open impeller was developed primarily for handling clean, homogeneous paper stock devoid of long fibrous stock. The new closed impeller design utilizes this company's two-vane streamlined trash pump impeller and is recommended by the manufacturer for use whenever long fibrous stock or dirty stock containing large solids is to be pumped. Like the open-impeller type, the new pump is provided with a volute casing which is split diagonally along the center line of the shaft to permit easy access and quick removal, if desired, of the entire rotating element without disturbing either the suction or discharge piping. Owing to the use of diagonally split bearing caps, removal of the rotating element does not require exposing the bearings.

EQUIPMENT BRIEFS

Industrial So-Lo, manufactured by the So-Lo Works, Loveland, Ohio, is a new product for repairing breaks, burned or worn spots, and for filling holes and resurfacing industrial belts of all types including rubber, rubber composition, synthetic rubber, leather and cotton. The manufacturer claims the new material will greatly lengthen the life of belts and permit continued use of many belts which otherwise might be discarded. It is easily applied and dries overnight. One quart covers approximately 14 sq.ft. The material is said to be resistant to oils and greases, to spread easily and to dry smoothly. The product is in two parts, consisting of a primer and a mastic, which are applied in that order.

According to the B. F. Goodrich Co., Akron, Ohio, restrictions on its Vulcalock cement have now been lifted so that anyone who can qualify under Rubber Restriction Order R-1 can purchase and use this product. The same company has now announced manufacture of a general purpose synthetic rubber sponge made in three densities, soft, medium and firm. Slabs 24x20 in. can be made in thicknesses ranging from $\frac{1}{8}$ to $\frac{1}{2}$ in., with smaller slabs in greater thicknesses.



Mixer for explosive material

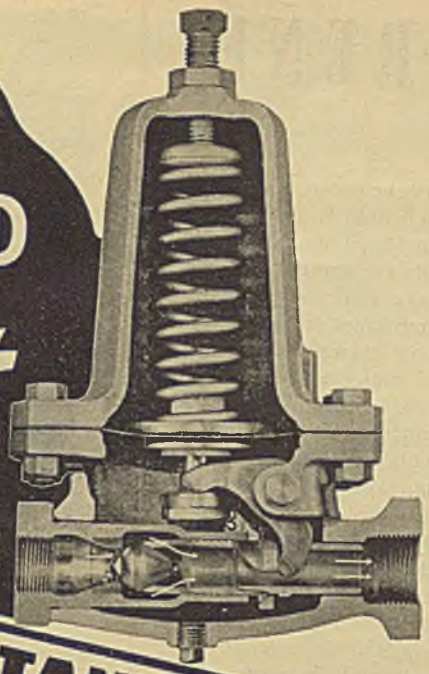
Improved paper stock pump

A multiple-unit, electrically heated combustion furnace is being offered by the Precision Scientific Co., 1750 North Springfield Ave., Chicago, Ill., for the developers, the Universal Oil Products Co. Designed specifically for determination of carbon on cracking catalysts, the equipment is modifiable to handle a variety of organic combustions within the temperature limit of 540 deg. C. The unit comprises an oxygen purification system; oxygen pressure regulating column; and an electrically heated furnace with four combustion tubes, each equipped with an indicating pyrometer; and conventional absorption trains.

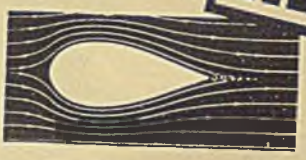
SIGNALLING TIMER

Designed to command visual and audible attention the instant a time interval is completed, the new Series S signalling timer announced by Industrial Timer Corp., 117 Edison Place, Newark, N. J., is available in eight different models for maximum timing intervals ranging from one minute to three hours. When the pointer on the timer is manually set to the required interval, as shown on the dial, a circuit is closed, operating the pilot light to indicate that the time interval has started. The moving pointer revolves counter-clockwise towards zero, with the exact time elapsed shown on the dial. When the interval is completed an audible alarm sounds and the pilot light goes out. The alarm continues to sound until the toggle switch on the timer is snapped to "off" position, or the timing interval is again started. A socket on the side of the timer case provides for connection of additional lights or alarms. Rapid setting of the pointer knob, when the same time interval is to be repeated indefinitely, is afforded by a quickly adjustable backstop. The timer comes in a black metal case for wall or panel mounting and operates from any 115- or 230-volt a.c. line.

PUT IT ON THE LINE AND *forget it*



CASH STANDARD *Streamlined* PRESSURE REDUCING VALVE TYPE 1000



Streamlined
FOR SMOOTH EVEN FLOW
of Steam, Water, Air, Oil, Etc.

● That is the Streamline story in a nutshell. The way it works is the answer—from inlet to outlet the fluid flows through this valve in a straight line—a streamline. There is no detour around a dividing wall—the direction of the flow is not changed at right angles because of a seat wall AND the flow is not broken up by valve stems, springs, or other parts. Forget it once it's installed like others do. PROOF: "We have a large number of buildings scattered over about 100 acres of land. Just where we installed these Streamlined Valves I dont know. But I do know that I haven't seen or heard of them since they were installed."—Case No. 343. PROOF: "We installed four or five of your Streamlined Regulators. The last I heard of them they were holding pressure the same as when we first installed them. And as far as I know no one has ever touched them."—Case No. 345.

Bulletin 1000 will give you full details.

YOU GET MAXIMUM CAPACITY WHEN IT IS NEEDED MOST

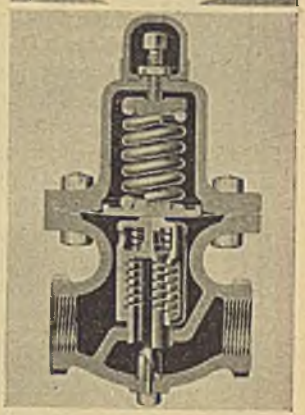
TROUBLE-FREE SERVICE	CONSTANT DELIVERY PRESSURE
SMOOTH OPERATION	PRACTICALLY ZERO IN MAINTENANCE COST
TIGHT CLOSURE	SPEEDIER PRODUCTION RESULTS
NO SPOILAGE	COST-SAVING OPERATION

ACCURATE PRESSURE CONTROL AT ALL TIMES

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

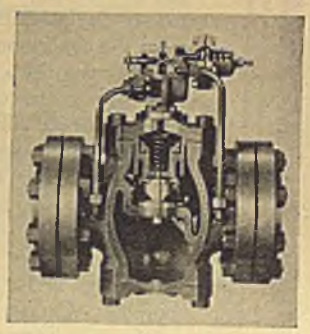
OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 4190 Valve; holds constant back pressure on inlet side regardless of variation in outlet pressure or changes in load. A multiport, large capacity valve. Used on suction line in refrigeration practice. Also as bypass valve for oil pumps.

Iron or bronze bodies; iron trim. Screwed ends ½" to 2"; flanged ends 2" to 6".

In automatic liquid level work, Cash Standard controls: (1) to hold the level within the closest kind of limits; (2) to do it dependably. In the cut above, a Type 100-L Controller operates a 12" Balanced Valve regulating liquid supply to a large tank. It is pilot actuated for sensitivity. It has operating power to spare—for any size Valve, however large.



Cash Standard Type 10 Pressure Reducing and Regulating Valve—self-contained, pilot operated. For holding reduced pressure within extremely close limits.

Sizes: 2" to 12" inclusive. Highest initial pressure 600 lbs.; highest reduced pressure 250 lbs. For use with water, air, Freon, ammonia; or with any non-corrosive gas or oil. Valve operating fluid not wasted; it discharges to outlet pipe. Bodies: iron, bronze, steel. Trims: iron, bronze, stainless steel, monel.

NEOPRENE

THE WORLD'S first neoprene synthetic rubber plant was built by E. I. du Pont de Nemours & Co. at Deepwater, N. J., in 1931. Later a plant was constructed in Kentucky. The process comprises generation of acetylene; conversion of the purified acetylene to monovinyl acetylene with the aid of a catalyst consisting mainly of cuprous chloride; addition of hydrogen chloride to monovinyl acetylene to produce chloroprene, utilizing a similar catalyst; and finally, emulsion polymerization of the chloroprene. Conversion of acetylene to monovinyl acetylene is carried only partially to completion during a single pass through the reactor. The partially converted gases are dehydrated and monovinyl acetylene with associated impurities (largely divinyl acetylene) is separated from unconverted acetylene by condensation at very low temperatures, followed by fractional distillation to remove acetylene, divinyl acetylene and other higher boiling impurities. The unconverted acetylene is recycled, and the other impurities are burned. The reaction between monovinyl acetylene and hydrogen chloride to produce chloroprene is also carried only partially to completion during a single pass through the reactor. Chloroprene is separated from unconverted monovinyl acetylene and hydrogen chloride by condensation and distillation and unchanged monovinyl acetylene and hydrogen chloride are recycled for further conversion. Resultant crude chloroprene is purified by distillation and stored in refrigerated tanks.

Purified chloroprene is polymerized by emulsifying in water containing suitable catalysts and modifying agents to control the rate of polymerization and the structure of the polymer. The finished product from the continuous film washer and dryer emerges as a thin, transparent, pale yellow film having the characteristic rubber-like property of self-adhesion, or tackiness. The film is folded into a rope about one-half inch in diameter and cut into convenient lengths for shipment.

Neoprene latex is made by arresting the polymerization of the emulsion at the desired stage and stabilizing it for shipping purposes. Certain types of neoprene are made by interpolymerizing chloroprene with other polymerizable materials, but the bulk of the production is made by polymerizing chloroprene alone without the addition of any other polymerizable component.

CHEMICAL & METALLURGICAL ENGINEERING
January, 1944
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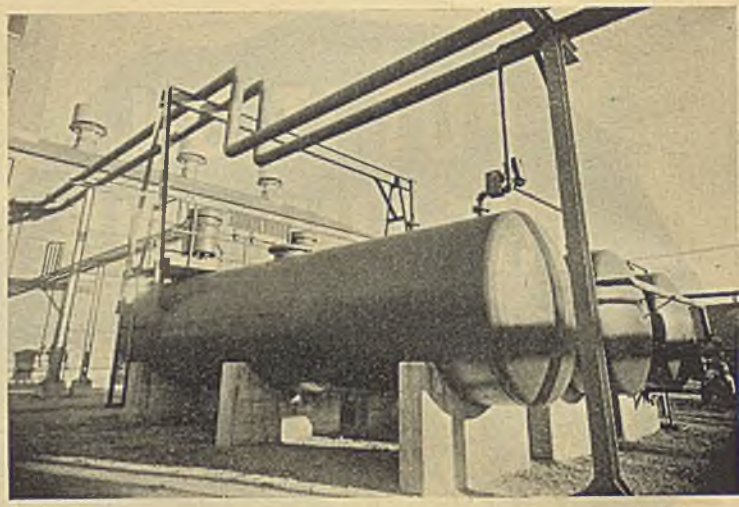
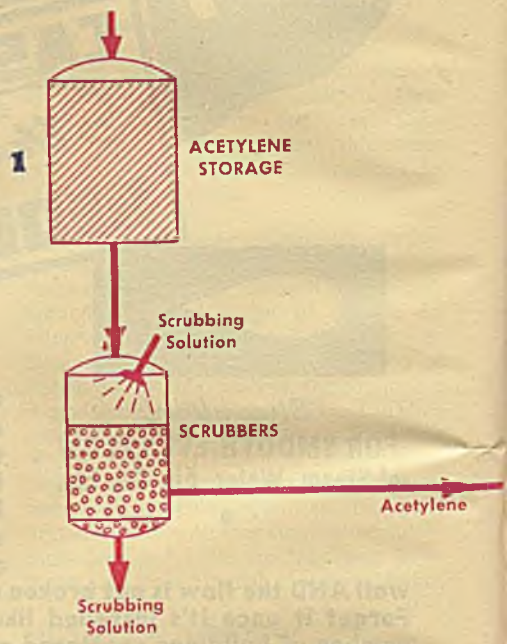
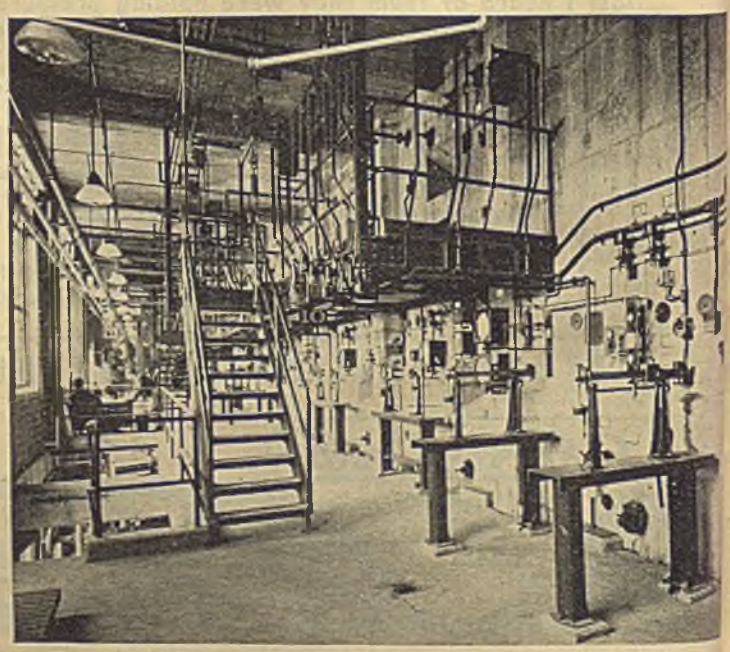


1 The principal raw material is acetylene which is stored in these several horizontal tanks outside the building



2 Hundreds of recording instruments are required to maintain control of the numerous reactions throughout the process



NEW TRAINING FILM FOR MAINTENANCE WORKERS

"PIPING POINTERS"
16 mm. Sound Movie

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Approx. Length, 30 Min.

TEACHES PROPER HANDLING OF VALVES, FITTINGS AND PIPE

TRAINING new workers in the fundamentals of piping maintenance becomes an easier task with this "Piping Pointers" sound film. It quickly familiarizes trainees with various types of valves and fittings and explains how to choose the most practical equipment for each use. It shows what to do when valves leak—how to handle many other maintenance problems—how to conserve time and critical materials. One complete section is devoted to the "*Language of Piping.*"

Manual Makes This Film More Valuable

Making this film doubly effective is the new 32-page Crane "Piping Pointers" manual which takes up in greater detail each subject covered in the film. This is the most complete manual of its kind ever compiled by Crane—it's full of valuable "know-how" data for every piping man. And all the information given in both film and manual is fully dependable because it's based on Crane's own 88-year experience as the world's leading maker of valves and fittings.

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CHEMICAL ENGINEERS AND CONSTRUCTORS

NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

CONTENTS

ANTI-FOG

For the purpose of removing fog, mist and steam from eye glasses and goggles, Anti-Fog has been developed by the Merix Photo Co., Chicago, Ill. It is said to assure clear lenses, windows, mirrors and windshields under all weather and temperature conditions. It is simply applied with a soft cloth or cotton batting. The preparation is non-flammable and non-explosive.

PLASTIC FLOOR WAX

Development of a new type of emulsion floor wax has been announced by Twi-Laq Chemical Co., Brooklyn, N. Y. In combination with carnauba wax, the sponsors contend that a plastic material melting at 283 deg. F. is used, resulting in a tougher and longer wearing wax film on the floor. The new wax is also said to be more highly resistant to water, and is less slippery. It gives a higher gloss than a straight carnauba base water wax.

PHENOLIC MOLDING COMPOUND

Physical properties of Kys-Ite include good machinability, no odor or taste, an imperviousness to effects of age or 24-hr. immersion in boiling water. Tensile strength ranges from 4,500 to 9,000 lb. per sq.in. It will resist most chemicals, but is decomposed by strong oxidizing acids and strong alkalis. It may be made in any color from medium to dark shades. It is a product of the Keyes Fibre Co., Waterville, Me. It combines strong fibered wood pulp with a fast curing phenolic resin. Kys-Ite is made in a two-stage process.

SYNTHETIC RUBBER

One of the new products recently announced by the United States Rubber Co. New York, N. Y., is Uskol, a synthetic rubber that is said to be superior to other rubber compounds for solvent resistance. At the present time the United States government's armed forces are taking the entire output of this material, but it will be available for post-war uses by civilians.

PLASTIC COATING

Another protective coating is available for civilian use. It is said to protect metal surfaces from salt spray corrosion and it is claimed to be five times as resistant as galvanizing. This new material is known as Plast-Anneal, and is made by the Allen Corp., Detroit, Mich.

ANTI-RUST COMPOUND

Improved protection for radiators and other cooling system surfaces is made possible by an anti-rust compound in powder form recently developed by U. S. Industrial Chemicals, Inc., New York, N. Y. Orange in color, the powder works equally well with water or any type of anti-freeze solution. Two ounces will protect a 5-gal. capacity automobile cooling system. Extensive tests have shown that the inhibitor will protect surfaces of a wide range of metals, including aluminum, steel, cast iron, copper, brass, and solder. It has no effect on rubber, and therefore cannot cause trouble with radiator hoses or other rubber appliances in a cooling system. It is entirely odorless.

PUTTY SUBSTITUTE

Glass instrument windows have long been puttied in—like panes in a sash—a laborious hand operation. Much time is consumed in removing the putty smears from the glass. After extensive research, Westinghouse Electric and Manufacturing Co. chemists have found a synthetic cement that seals the glass to the plastic instrument case far tighter than any putty. A simple, automatic machine applies a narrow band of the cement and the glass is pressed into place. Cement sets quickly in a low-temperature oven and glass cleaning is no longer necessary.

PESTICIDES

Ferric dimethyl dithiocarbamate, known as Fermate fungicide, a new organic compound, was discussed recently by Dr. Harry F. Dietz, entomologist, of Du Pont Pest Control Research Laboratory at Wilmington, Del. Dr. Dietz emphasized a definite trend in the development of new pesticides. He said that with the exception of the low-solubility copper compounds, all of the newer developments of the last decade have been synthetic organic compounds.

PAINTBRUSH RESTORER

Old paint brushes with natural bristles that have become caked with dried paint and rendered useless by neglect promise to be given new leases on life through the use of Prestorer, a new liquid cleaner formulated by the Technical Development Laboratories, Tenafly, N. J. It is said to be almost entirely mechanical in its work, since it is absorbed into the bristles by capillary action, causing them to swell and thus to crack off the surrounding hard paint pigment. The swelling disappears after drying and the bristles return to normal size without injury.

GLASS CONTAINER

The Hartford-Empire Co., Hartford, Conn., has given the name Glascan to its new and practically all-glass container. The only non-glass part is the sealing gasket between cap and base, and that is not rubber but a synthetic substance developed after many tests.

NYLON MOLDING POWDER

The plastics department of E. I. du Pont de Nemours & Co., Wilmington, Del., has announced that it has developed a new nylon molding powder designated as FM-1 having characteristics suggesting numerous postwar applications in the molding field. Slide fasteners are mentioned as among the articles for which this new plastic material is especially well suited because of its ability to withstand laundering conditions, including the solvents encountered in dry-cleaning, and ironing temperatures. The plastic lends itself to production by the injection molding process, which means high speed production and low unit costs for the finished piece. Its flow properties also permit molding around complicated inserts. Pieces having thin wall sections may be readily produced. One of the great advantages offered by nylon as a molding composition is the fact that it will withstand much higher temperature than other thermoplastics, being serviceable at temperatures up to 275 deg. F.

SYNTHETIC SHELLAC

A synthetic shellac has been developed by the Arthur D. Little Laboratories at Cambridge, Mass., for the William Zinsser & Co., New York, N. Y., to relieve the serious shortage of natural shellac, normally imported from India. According to the chemist, C. G. Harford, who is given credit

for the development work, the new shellac is essentially a duplicate of the natural product, but surpasses it in adhesion to metal and wood and in resistance to water, for which reason it is being used in ships, life rafts, communication, gas masks, fuses and other military purposes. Zinlac, because of its war uses, was soon put on priority, to take the place of and supplement the nation's comparatively small stockpile of shellac. It is not as yet available for non-war use, but after the war will take its place among standard articles of trade.

VARNISH RESINS

A RESIN of the modified phenolic type, Amberol F-77, is introduced as an improved Amberol F-7 by the Resinous Products & Chemical Co., Philadelphia, Pa. The company hopes that it will prove to be a resin of increased value to the varnish industry for use with a variety of oils. It is considered that Amberol F-77 embodies to a greater degree than any resin previously obtainable the properties considered to be most essential for the manufacture of soft oil varnishes of the highest quality.

Physical Properties
Melting Point, 122-132 deg. C. (Capillary method)
Acid number, Under 20
Color, Light (M-minimum)
Specific gravity, 1.11
Viscosity, A-F (46% in toluol) (0.5-1.5 poises)

This new varnish resin is said to represent a desirable combination of hardness, high viscosity, excellent solubility in all drying oils, good color and color retention. It is intended for use in clear oleoresinous varnishes of all types and all oil lengths, and in the preparation of enamels. It is suggested for consideration in all applications where Amberol F-7 has been used previously and should prove to be an even more versatile resin on the strength of the following points of its superiority:

1. Better solubility in bodied oils.
2. Imparts higher viscosity to varnishes.
3. Slightly faster surface-dry and considerably harder through-dry in 24 hr.
4. Improved water and alkali resistance.

SOYBEAN FIBER

RECENTLY a plant was completed by the Drackett Co. for the production of soybean fiber. It is said to be as warm as wool; it is resilient, strong and durable, and can be made either moisture absorbent or moisture resistant. It is not a competitor of any other fiber, Mr. H. R. Drackett, president of the company, pointed out, but is an entirely new raw material. It may be blended with either cotton or wool or it may be woven or spun into fabrics. It has already been made experimentally into such products as blankets, felt hats, underwear, hosiery, suitings and upholstery fabrics. The product is a fiber which resembles wool in appearance.

INSECTICIDE

ANNOUNCEMENT has recently been made of Neville "V" insecticide which is said to be basically different from other insecticide materials in common use. It is a polycyclic hydrocarbon oil of petroleum origin, with speed of evaporation slightly slower than that of kerosene. It can be sprayed readily with all types of atomizing apparatus. It has no injurious effects toward humans and warm-blooded animals with which it might come in contact. It is said to be a stable mixture and can thus be carried in stock or storage for extended periods without noticeable deterioration in insecticidal activity. It has a clean characteristic odor well adapted for sprays intended for household and commercial use. Its odor can be masked by any of a number of inexpensive perfumes. Numerous tests indicate that it leaves no lasting mark on most fabrics or paper ordinarily encountered in household or commercial use.

FLUOSULPHONIC ACID

NUMEROUS future uses are suggested for fluosulphonic acid that is now produced by General Chemical Co., New York, N. Y. Among the more important possible applications for HSO_3F are (1) alkylating agent in manufacture of high-octane fuel for the post-war "plane-mobile"; (2) reagent in production of synthetic polymers with dielectric properties; (3) superior high-pressure lubricants. This new acid may also be useful in the manufacture of dye intermediates, insecticides and cutting oils.

Physical Characteristics:
Mobile, nearly colorless liquid.
Boils without decomposition at 330 deg. F. (165.5 deg. C.)
Freezes at −125 deg. F. (−87.3 deg. C.)
Specific gravity: 1.74 at 60 deg. F. (15.6 deg. C.)
Vapor pressure: 3mm Hg at 80 deg. F. (26.7 deg. C.)
Most salts soluble in water.

BENZYLTRIMETHYLAMMONIUM CHLORIDE

THE quaternary ammonium salt anhydrous benzyltrimethylammonium chloride is now available in moderate drum quantities for special uses from Commercial Solvents Corp., New York, N. Y. It is stable up to approximately 137 deg. C., but on further heating it decomposes to form benzyl chloride and trimethylamine. The anhydrous salt is extremely hygroscopic, hence benzyltrimethylammonium chloride is sold as a 60–62 percent aqueous solution.

In Pure Anhydrous Form:

Molecular weight	185.7
Color	White
Melting point	137.0° C. d
pH of 0.1 M aqueous solution, 25° C.	5.4

In 62% Aqueous Solution:

Specific gravity, 20° C./20° C.	1.07
Refractive index at 20° C.	1.472
Freezing point, ° C.	<—50
Viscosity, 25° C.	6.36 centipoises

Table of Solubilities:
(g. solute per 100 g. solvent)

Water	411
Ethanol, 95%	103.5
Butanol, C. S. C.	32.7
Dibutyl phthalate	0.1
Tributyl phosphate	0.1
Butyl lactate	20.0
Ethyl ether	Insoluble
Petroleum ether	Insoluble
Benzene	Insoluble
Ethyl acetate	Insoluble

STENCIL INK

A COMPLETELY new formula has been devised for stencil ink according to the Diagraph-Bradley Stencil Machine Corp., St. Louis, 8, Mo. Formerly, lamp black and coal oil have been almost from the dawn of shipping the traditional ingredients of stencil ink for marking shipping containers. D-B stencil ink, according to the manufacturers, does not settle and does not require shaking each time it is used. It dries instantly and requires little pressure in applying to the stencil. There is no building up of ink on the brush.

VARNISH RESIN

A MALEIC type resin designed primarily for use in the manufacture of very pale oleoresinous varnishes and white enamels is known as Amberol 808. It can be used to good advantage with all types of varnish oils, and should prove to be especially useful in vehicles containing all or preponderant volumes of the soft oils. It is made by the Resinous Products & Chemical Co., Philadelphia, Pa. In developing the new Amberol 808, the laboratory is said to have retained to a high degree the advantages of Amberol 806-P and has simultaneously effected significant improvements in those properties that are most important in the manufacture of soft oil varnishes and enamels of the highest quality. It should prove to be useful in a variety of finishes of both the air-drying and baking types.

Physical Properties
Melting Point, 120-132 deg. C (Capillary method)
Acid number, Under 20
Color, Extra light (M-minimum)
Specific gravity, 1.11
Viscosity, G-R (50% in toluol) (1.6-4.8 poises)

It is especially significant that the high viscosity of Amberol 808 is combined with good solubility in bodied oils and good petroleum tolerance. The resin is said to be well suited to the simplified cooking procedures that are now standard in the industry, and its varnishes are characterized by the pale color, good color retention, high viscosity, good drying properties, and adequate resistance to water and alkali.

Amberol 808 is suggested for consideration in all applications where Amberol 806-P has been used previously, and exhibits the following points of superiority over the old resin:

1. Better solubility in bodied varnish oils. (Increased ease in handling and reduced cooking time.)
2. Greater petroleum tolerance.
3. Improved drying properties. (Faster surface dry and harder through dry overnight.)
4. Better alkali resistance.
5. Better pigment stability.
6. Better drier retention.

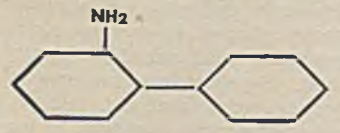
PLASTIC DYE

THE PLASTIC industry requires colors that will remain full toned and permanent without wearing or rubbing away and that will preserve the plastic's original gloss and hardness. The Technical Color Division of the Krieger Color & Chemical Co., Hollywood, Cal., developed the dye known as Lucidip. It is being used now for dyeing acrylic plastic by the dipping process. The same company has developed a special acetate liquid dye for use with several acetate plastics. Dyeing time is set for rapid production; it takes but ten seconds to effectively dye sheets of this material. Pastel shades take only two seconds. The special acetate dyes are also being used in

YES, we'll gladly send samples of these available, low-priced MONSANTO CHEMICALS!

In addition to their long-established uses, these two low-cost Monsanto Chemicals have vast potential value in new applications and as replacements for materials made scarce by the war. If your company wishes sample quantities of these chemicals, they will be sent promptly upon request by wire or on your company letterhead. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

ortho-AMINODIPHENYL
(TECHNICAL)



Mol. Wt. 169.10

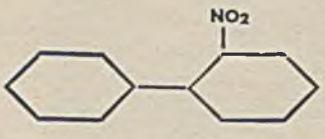
Standard Form: Fused solid.

Specifications: Purplish crystalline mass; crystallizing point 47.0°C. min.; assay 94.5% min. Distillation range: first drop, 295.0°C. min.; 95% (1-96 ml), 8.0°C. max.; dry point, 310.0°C. max.

Where ortho-AMINODIPHENYL may be used

1. Intermediate for chemical synthesis.
2. Intermediate in synthesis of dyestuffs such as quinoline yellows, lithol reds and hydron blues.
3. As a constituent of Phenol Formaldehyde resins.
4. A solvent, where a high molecular weight amine is advantageous.

ortho-NITRODIPHENYL
(TECHNICAL)



Mol. Wt. 199

Specifications: Light yellow to reddish crystalline mass. Crystallizing point 34.5°C. min

Where ortho-NITRODIPHENYL may be used

1. Intermediate for chemical synthesis.
2. In the manufacture of dyestuff intermediates such as 2,2′ Diphenyl Benzidine and its derivatives.
3. Plasticizer and component in resin compositions.
4. As a component and intermediate in insecticides.

MONSANTO CHEMICALS

SERVING INDUSTRY... WHICH SERVES MANKIND

war industries, but, like Lucidip, they are available to the manufacture of civilian goods in small quantities. Lucidip and special acetate dyes come in twelve colors: blue, yellow, red, green, amber, chartreuse, aqua, gold, black, orange, blue green, old rose. The various Lucidip colors may be intermixed to form other special colors or blends especially desired. The same rule applies to the special acetate dyes, but the two types should never be intermixed.

TRANSLUCENT WRAPPER

A NEW translucent "skin" for protecting machine parts in shipment has been announced by the Dow Chemical Co., Midland, Mich. The product, which has an ethyl cellulose base, is a plastic-like substance which is applied by a simple hot dip process; sets into a tough, skin-tight coat in a few seconds that fully protects the metal from rust, corrosion and dirt during shipment. Assembly crews find it strips off quickly and easily with no more equipment than an ordinary pocket knife. Although the material used is not yet available for general distribution, being under rigid government control, production experts believe it will eventually revolutionize this entire phase of packaging procedure for civilian as well as military equipment. Actual production costs indicate packaging time reductions up to 80 percent. So effective is the material in protecting metal from dirt, salt air and salt water, that parts may even be tossed overboard at high tide near invasion points to be recovered later by repair crews when the tide and the fortunes of war permit.

CORK SUBSTITUTE

DOWN in Atlanta, Ga., Herman M. Kulman has been experimenting for some time with a cork-like material made from peanut hulls. He grinds 20 to 50 percent of peanut hull fibers into a fine meal which he mixes with a liquid. The Holfast Rubber Co. of Atlanta is preparing to manufacture items under Kulman's patent. Dr. T. G. Woodroof, food technologist at Georgia's state experiment station, reports that bottled tomato juice and grape juice put up with this cork crown has survived tests of time, water, citric acid, turpentine, vinegar, peanut oil, and other oils.

BONDING AGENT FOR LEAD FOIL OR SHEET

A METHOD of bonding lead foil or lead sheet together metallurgically is revealed by Reynolds Metals Co., Richmond, Va. The new, lead-based material forms a hermetical seal without mounting or heat-seal coating. The heat seal ingredients are contained in the metal itself, a low melting point solder casing. Temperature of 300 deg. F. melts the surface metal without affecting its lead core, the heat seal flowing the two surfaces permanently into a solid piece of metal. The new material is currently available for war uses only, since strategic materials are involved.

PHOSPHORUS COMPOUNDS

Two new phosphorus compounds, diphenyl phenylphosphonate, and diphenyl phenylphosphinate, have been developed experimentally by the Victor Chemical Works, Chicago. The former is white

crystals soluble in alcohol, ether, benzene; but insoluble in water. It has a molecular weight of 310, a melting point of 63.5 deg. C. It is stable to hydrolysis by aqueous caustic. It is hydrolyzed by alcoholic caustic. Potential applications are plasticizer, lubricating oil additive, additive for cellulose plastics as a fire retardant. The other compound, diphenyl phenylphosphinate, is a colorless to straw-colored liquid, soluble in alcohol and common organic solvents; it is insoluble in water. Its molecular weight is 294. Specific gravity, 1.166 at 26 deg. C. and its boiling point 208 deg. C. (5 mm.). This compound hydrolyzes very slowly in water; it contains trivalent phosphorus. Its sponsors suggest that it may be useful as a lubricating oil additive, soap preservative, anti-oxidant or plasticizer.

FILM-FORMING MATERIALS

THE Lewisols are hard resins made by modifying rosin esters with maleic alkyd compounds in common with other hard resins of the rosin ester group. They are primarily intended for compounding with film-forming materials such as the cellulose derivatives, or with drying oils to achieve gloss and hardness, and in most cases to improve adhesion. In addition to these basic resin functions, the Lewisols serve special purposes, most important of which are (1) control of viscosity of varnish and other compositions; (2) control of speed of solvent release, especially from lacquers; and (3) control of after-yellowing in white oleoresinous and lacquer enamels. They are products of the Hercules Powder Co., Wilmington, Del. Lewisol 2L is a pale resin well suited to light colored varnishes for tin-decorative finishes, overprint varnishes, and for vehicles for 4-hour white enamels. Lewisol 33 is an especially hard maleic-modified resin, indicated for use in soft-oil varnishes which must be cooked to adequate viscosities in the shortest possible time. In this case, as may be inferred, the resin contributes notably to the resultant viscosity of the oil-resin-mineral spirits system which composes such varnishes.

GRAMACIDIN: WONDER DRUG

UNIVERSITY of California Medical School disclosed that another wonder drug, gramacidin is competing with penicillin in dramatic cures. Dr. Henry Brainerd, a member of the faculty, stated that this new medicine, prepared from soil bacteria by a relatively simple process, owes its healing power to the same general principle as penicillin. Dr. Brainerd stated that gramacidin is more than 1,000 times as active in germ killing as the sulfanamide drugs. The new drug has been used successfully in cases of impetigo, boils, infected wounds, burns, and various types of ulcers with "variable and sometimes very dramatic results".

POLYCHLORPROPANE LIQUID

CHEMICAL ENGINEERS and chemists may be interested in this new chemical whose composition is as follows: pentachlorpropane, 0–5 percent; heptachlorpropane, 40–50 percent; and octachlorpropane, 0–5 percent. It is known as Chlorpropane Liquid 170 by Hooker Electrochemical Co., Niagara Falls, N. Y., who is offering experimental quantities. This new chemical is a

clear, colorless liquid with a mild characteristic odor, insoluble in water, infinitely soluble in alcohol, ether, and most chlorinated solvents. It becomes quite viscous at temperatures below 50 deg. C.

Molecular weight (aver.)	268
Boiling range 760 mm., deg. C.	160 to 260
Refractive index N 20/D	1.520 to 1.523
Flash point	None
Fire point	None
Specific gravity 15.5/15.5 deg. C.	1.70 to 1.75
Weight—lb. per gal. at 15.5 deg. C. (aver.)	14.40
Specific heat at 15 deg. C.	0.403
Cubical expansion Mean coefficient 15–80 deg. C.	0.00125
Vapor pressure	760 mm. at 168
Voltage resistance at 0.1 in. gap at 20 deg. C.	24,000 V
Hydraulic stability test* mg Cl_2/ml of sample (aver.)	100
Compatibility, parts of product as plasticizer with 100 parts of†:	
Cellulose acetate	0 to 20
Ethyl cellulose	90
Polyvinyl chloride	25–50–90
Vinylite	25–90
Styrene	25–50–90
Urea formaldehyde	25–50–90
Piccolyte	25–50–90
Piccaroun	25–50–90
Phenol formaldehyde	25–50–90
Methyl methacrylate	25–50–90
Inter polymer methacrylate	25–50–90
Natural rubber	25–50–90
Korolac	25–50
Hycar	25

*4 hr. at 90–100 deg. C., 1% Na_2CO_3 solution, violent mixing. †Other proportions may be compatible also.

BENZYL CELLULOSE

BENZYL CELLULOSE, the benzyl ether of cellulose, is being studied by Hercules Powder Co. with an eye to possible commercial production. Among the characteristics of this material, Hercules reports, are extremely low moisture absorption, resistance to chemicals, and useful electrical properties, including high arc resistance. Having a lower melting point than any of the more familiar cellulose derivatives, benzyl cellulose can be compounded, injected, or extruded with little or no plasticizer.

Tests being conducted in the Hercules laboratories on the wide solubility and compatibility of benzyl cellulose indicate both the ease and range of possible formulations, and also the possibility of using low-cost solvents, resins, and plasticizers. It is soluble in all hydrocarbons except the straight-chain aliphatics, in esters, in the higher aliphatic and cyclic ketones, and chlorinated hydrocarbons, but insoluble in straight alcohols, ethers, and terpenes. It has wide compatability with resins and with most common plasticizers, including raw castor oil.

HEXACHLORPROPYLENE

PERHAPS the most interesting property of this entirely new chemical is that it is liquid over a temperature range of some 300 deg. C., boiling at 210 and becoming a glass-like solid with a definite freezing point at about 100 deg. C. Hexachlorpropylene is a clear, colorless liquid with a mild characteristic odor. It is insoluble in water, infinitely soluble in alcohol, ether, and most chlorinated solvents. This chemical may prove useful as a solvent and plasti-

cizer for rubber and other polymeric materials, and also as a non-flammable fluid. Hooker Electrochemical Co., Niagara Falls, N. Y., is offering it in experimental quantities. Its production in larger amounts will be undertaken when circumstances warrant.

Synonym	Perchlorpropylene
Molecular weight	248.8
Last crystal point, deg. C.*	Below 150
Boiling range 760 mm., deg. C.	205 to 215
Refractive index N 20/D	1.545 to 1.547
Flash point	None
Fire point	None
Specific gravity 15.5/15.5 deg. C.	1.76 to 1.78
Weight-lb. per gal. at 15.5 deg. C. (Aver.)	14.75
Specific heat at 15 deg. C.	0.491
Cubical expansion, mean coefficient 15-80 deg. C.	0.00125
Vapor pressure	760 mm. at 209 deg. C.
Voltage resistance at 0.1 in. gap at 20 deg. C.	Over 30,000 V
Compatibility, parts of product as plasticizer with 100 parts of: Hycar†	25

*Highest temperature at which solid phase exists in contact with liquid. †Other proportions may be compatible also

TOUGH WHITE CRYSTALLINE WAX

From the development laboratories of Hooker Electrochemical Co., Niagara Falls, N. Y., has come a tough white crystalline wax, possessing a mild camphor-like odor. It is a very highly chlorinated propane derivative and therefore completely saturated. Chlorpropane Wax 130 is insoluble in water, soluble in alcohol, ether, and most chlorinated solvents. Interest is due mainly to its inertness and wax-like properties.

It has been suggested that this new wax might be useful as a plasticizer, dielectric wax, ingredient of pyrotechnic compositions, chemically resistant lubricant. This product is available at present in experimental quantities. Its production in larger amounts will be undertaken when circumstances warrant.

Molecular weight (aver.)	311
Analysis (typical)	Octachlorpropane 85% Heptachlorpropane (1, 1, 1, 2, 2, 3, 3) 15%
Last crystal point deg. C.[1]	130 to 135
Melting range deg.[2]	110 to 135
Boiling range, 760 mm., deg. C.	210 to 270
Flash point	None
Fire point	None
Hydraulic stability test[3] mg Cl_2/ml of sample, aver.	0.5
Compatibility, parts of product as plasticizer with 100 parts of:[4]	
Polyvinyl	25
Vinylite	25
Styrene	25–50
Urea formaldehyde	25–50
Piccolyte	25–50
Piccarcun	25–50
Phenol formaldehyde	25–50
Methyl methacrylate	25–50
Inter polymer methacrylate	25–50
Natural rubber	25–50
Koralac	25–50
Hycar	25

[1] Highest temperature at which solid phase exists in contact with liquid. [2] Temperature range within which both solid and liquid coexist. [3] 4 hr. at 90–100 deg. C, 1% Na_2CO_3 solution, violent mixing. [4] Other proportions may be compatible also.

ALKALI STEEL CLEANER

HERE IS AN alkaline cleaner for steel known as Cleaner 100. This product is used in a concentration from 4-8 oz. per gal. in the temperature range from 180-212 deg. F. It is said to have high detergency. The cleaner is best used anodically, but it is also claimed to be an effective immersion cleaner. Advantages claimed for the product include excellent rinsability, long life due to buffering and selection of surface active materials.

The compound contains no soap such as rosin soap, but has complex phosphates to solubilize any fatty acid soap that may form from greases and oils being cleaner. It is effective in soft and very hard water and does not form insoluble residues due to reaction with acids. This cleaner is a development of the Enthone Co., New Haven, Conn.

ORGANIC CHEMICALS

HEXACHLORBENZENE is now available as a sublimed fine white crystalline product. It is available from Hooker Electrochemical Co., Niagara Falls, N. Y. Among the other new chemicals offered by this company are: tetra hydro furfuryl oleate, methyl pentachlor stearate and pelargonyl chloride.

Sodium tetrasulphide has been added to Hooker's line of products. Their material differs from the product of other producers in being of different composition and it is believed to be of superior properties by the manufacturer. Leather tanners are finding it useful in soaking of hides prior to unhairing, according to Hooker.

HEXACHLOR BUTADIENE

THIS ENTIRELY NEW COMPOUND is a clear colorless liquid with a mild, characteristic odor. It is typically 98 percent mimimum pure material, insoluble in water and will itself dissolve only 0.007 g. water per 100 g., infinitely soluble in alcohol, ether and most chlorinated solvents. It is highly stable, is not easily hydrolyzed by water or mild alkalics.

Among the uses suggested so far: solvent for natural rubber, synthetic rubber and other polymeric substances, high boiling non-flammable heat transfer liquid, transformer fluid and hydraulic fluid. This material is available at present in experimental quantities from Hooker Electrochemical Co., Niagara Falls, N. Y.

Molecular weight	260.7
Last crystal point, deg. C(1)	−19
Melting range, deg. C(2)	−19 to −22
Pour point, deg. C(3)	−21
Boiling range, deg. C.	210 to 220
Refractive index N 20/D	1.551 to 1.554
Flash point	None
Fire point	None
Specific gravity 15.5/15.5°deg. C.	1.65 to 1.70
Weight-lb. per gal. at 15.5 deg. C.	13.95
Specific heat at 15 deg. C.	0.519
Cubical expansion Mean coefficient 15–80 deg. C.	0.00125
Vapor pressure	760 mm. at 215°deg. C
Voltage resistance at 0.1 in. gap at 20 deg. C.	Over 30,000 V
Hydraulic stability test(4) mg Cl/ml of sample, aver.	0.2
Compatibility, parts of product as plasticiser with 100 parts of: Hycar(5)	25

Notes

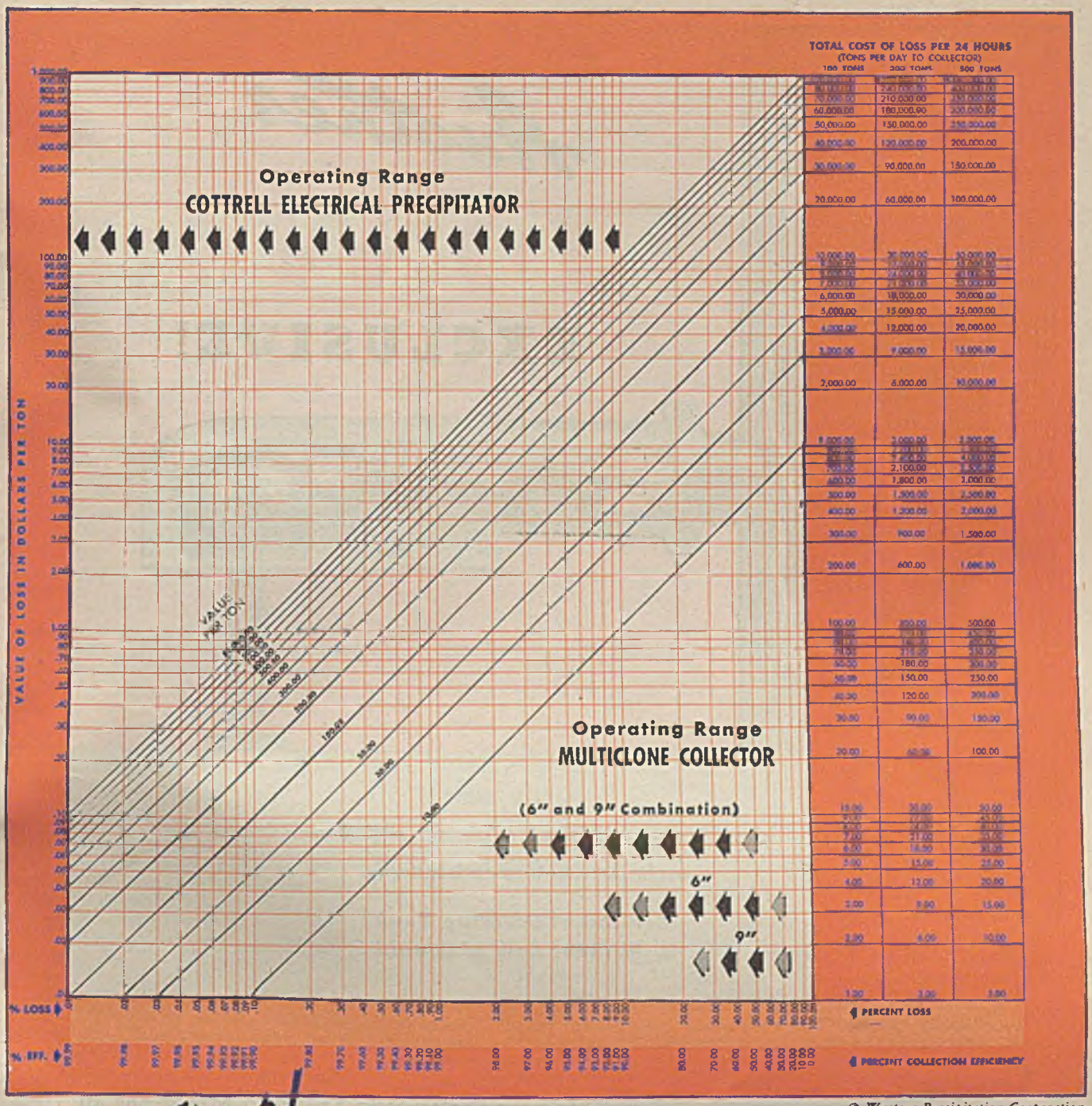
(1) Highest temperature at which solid phase exists in contact with liquid.

(2) Temperature range within which both solid and liquid coexist.

(3) Temperature at which product fails to flow in a horizontal tube within 5 sec.

(4) 4 hr. at 90–100 deg. C, 1% Na_2CO_3 solution, violent mixing.

(5) Other proportions may be compatible also.



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CHEMICAL ENGINEERING NEWS

EXPERTS ORGANIZED FOR POSTWAR PLANNING

THE National office of the Committee for Economic Development was recently moved from Washington to 285 Madison Ave., New York. Marion B. Folsom, treasurer of the Eastman Kodak Co. and chairman of the field development division of the Committee states that outstanding experts in manufacturing, marketing, sales, finance, management and engineering will make available to American business this year, the latest practical knowledge to help in effecting an expansion of postwar production and employment to unprecedented peacetime levels. Mr. Folsom said the job of the Committee last year was to organize businessmen to study conditions in their own localities and in their own businesses and to take responsibility for devising plans for reducing postwar unemployment to bedrock minimum. In his opinion the urgent task for this year will be to make available to the nation's 2,000,000 employers the best managerial science, imagination and know-how, in such practical form that it can be applied effectively to their own postwar planning.

Included in the work which is being done through action and advisory committees is a consulting management engineers committee which is preparing a handbook for distribution late this month entitled "Planning the Future of Your Business" covering the six fundamental functions of planning for peacetime jobs and higher production. This will be available only through community committees of CED. Edwin Booz of Booz, Allen & Hamilton is chairman. Serving with him are six past presidents of the Association of Consulting Management Engineers.

The marketing committee is preparing a detailed analysis of postwar markets for 400 to 600 different commodities, based on a national level of production up to $142 billion. T. G. MacGowan, manager of the marketing research department of Firestone Tire & Rubber Co., is chairman. Serving with him are 35 of the country's top marketing and merchandising experts.

New materials, processes and designs committee is preparing important facts about new materials and processes to stimulate manufacturers to make goods that will look better, work better, and sell for less. G. F. Nordenholt, editor of *Product Engineering* is chairman. The board of review is composed of the country's outstanding industrial designers including Egmont Arens, Donald Dohner, Henry Dreyfuss, Raymond Loewy, John Morgan and Walter Dorwin Teague. This material will be presented in a booklet and some of it in sound slidefilm and will be available early this year through local committees.

Postwar sales personnel committee has completed an outline for a sales training program to prepare business for the job of distributing substantially expanded postwar production. Henry L. Porter of the Standard Oil Co. of Indiana is chairman. The outline will be published in five booklets and will be available only through a course of sales training programs being conducted with local committees.

The trade association committee is undertaking a national action program to assist all trade associations to tie in their plans with CED for stimulating planning for expanded producion and employment on an industry-by-industry basis. Pyke Johnson, chairman of the Automotive Safety Foundation is chairman.

WASHINGTON NEWS

News from Washington which, hitherto, has been found in this section, appears in this issue beginning on Page 82.

DR. CARL S. MARVEL SELECTED TO HEAD ACS IN 1945

Dr. Carl Shipp Marvel, professor of organic chemistry in the University of Illinois, has been elected president of the American Chemical Society for 1945. Dr. Marvel will take office as president-elect on Jan. 1, 1944, when Dr. Thomas Midgley, Jr., vice-president of Ethyl Corp., and internationally known for his discovery of tetraethyl lead, becomes president, succeeding Dr. Per K. Frolich, director of the chemical division, Esso Laboratories, Standard Oil Development Co., Elizabeth, N. J.

Dr. Robert E. Wilson of New York, president of the Pan American Petroleum & Transport Co., and Professor Roger Adams, head of the department of chemistry in the University of Illinois, were chosen directors of the Socicty. Dr. Ernest H. Volwiler of Abbott Laboratories, Chicago, was named director at large.

The following councillors at large were chosen: Dr. Henry B. Hass, Purdue University; Dr. Joel H. Hildebrand, University of California; Dr. Gustav E. F. Lundell, National Bureau of Standards, Washington, D. C.; Dr. Linus C. Pauling, California Institute of Technology.

Dr. Marvel was recently awarded the 1944 William H. Nichols Medal of the New York Section of the American Chemical Society, one of the highest distinctions in chemical science. The presentation to Dr. Marvel will be made at a meeting of the New York Section on March 10.

AMERICAN GAS ASSOCIATION TO HOLD CONFERENCE

ANNOUNCEMENT is made by Charles G. Young, Chairman of the Industrial and Commercial Gas Section, that the American Gas Association will hold a "War Conference on Industrial and Commercial Gas" at the Hotel Seneca, Rochester, N. Y. on March 30–31. The handling of many problems that have arisen in applying industrial gas to higher speed, higher quality and greater quantity production is teaching gas men many lessons. Many of these problems will be discussed at the conference and interpreted in terms of better industrial gas utilization in the future. The managing committee will hold its next meeting in Rochester on March 29.

The Aluminum Company of America's Aluminum Research Laboratories, New Kensington, Pa., celebrated its 25th anniversary on December 16. A dinner was held at the University Club in Pittsburgh in the evening, at which time Dr. Francis C. Frary was presented with a 25-year award by President Roy A. Hunt. Assembled in the conference room at the Research Laboratories is the administrative staff. Left to right, E. H. Dix, Jr., assistant director of research and chief metallurgist; J. D. Edwards, assistant director of research; Dr. Francis C. Frary, director of research; H. E. Bakken, associate director of research; R. L. Templin, assistant director of research and chief engineer of tests.

DOLAN ELECTED PRESIDENT OF MATHIESON ALKALI

EFFECTIVE as of January 1, announcement was made that E. M. Allen had relinquished his duties as president of Mathieson Alkali Works, Inc. and George W. Dolan had succeeded to the office. Mr.

George W. Dolan

Dolan joined the Mathieson organization in 1930 and was elected executive vice-president in 1941. Mr. Allen will continue to serve the company as chairman of the board which position he has filled since 1938.

DCAT ELECTS OFFICERS FOR COMING YEAR

THE organization meeting of the newly elected executive committee of the Drug, Chemical and Allied Trades Section of the New York Board of Trade was held last month at the Drug and Chemical Club. The primary purpose of this meeting was the election of officers to serve for the next fiscal year, the results of which are as follows: chairman, E. T. T. Williams, chairman of the executive committee, Becton, Dickinson and Co.; vice-chairman, Guy L. Marsters, vice-president, The Norwich Pharmacal Co.; treasurer, Robert B. Magnus, vice-president of Magnus, Mabee & Reynard, Inc. Carl M. Anderson, assistant to the president, Merck & Co., Inc., was reelected counsel. John C. Ostrom was formally reelected secretary of the Section and granted a continued leave of absence for the duration to serve as Lieutenant in the U. S. Navy. Miss Helen L. Booth was reelected acting secretary to serve in his stead.

The retiring chairman, Victor E. Williams, eastern district sales manager Monsato Chemical Vo., automatically becomes a member of the Section's advisory council, to succeed Philip M. Dinkins, vice-president of American Cyanamid & Chemical Corp., who has finished his five year term.

C. S. MUNSON TO HEAD WAR LOAN DRIVE IN CHEMICAL FIELD

JOHN A. BROWN, president of the Socony-Vacuum Oil Co. and chairman of the industrial section of the War Finance Committee for New York State, has announced that Charles S. Munson, president of Air Reduction Co. has accepted the chairmanship of the chemicals division for the Fourth War Loan. Mr. Munson will ask each of the more than 350 concerns in the chemicals division to cooperate with the Treasury Department by having a company representative appointed. Bond sales will begin on Jan. 18 and will continue through Feb. 15.

PAPER AND PAPERBOARD OUTPUT FIXED FOR FIRST QUARTER

LAST MONTH WPB announced through its Requirements Committee that a program had been adopted limiting production of paper and paperboard during the first quarter of this year. The program resulted from considerations by the Forest Products Bureau, the various claimant agencies including the Army, Navy, War Food Administration and Office of Civilian Requirements, and the Industry Advisory Committees made up of members of the paper and paperboard industry. Allocation of wood pulp for the quarter is designed to check declining inventories of pulp and pulpwood. Mills will be requested to produce from quantities of pulp not to exceed the determined minimum for each grade, the maximum

Convention Calendar

Technical Association of the Pulp & Paper Industry, annual meeting, Commodore Hotel, New York, N. Y., Feb. 14–17.

American Institute of Mining and Metallurgical Engineers, annual meeting, Waldorf-Astoria, Feb. 20–24.

American Society for Testing Materials, spring meeting, Netherland Plaza, Cincinnati, Feb. 28–Mar 3. Annual meeting, Waldorf-Astoria, New York, N. Y., June 26–30.

American Gas Association, war conference on industrial and commercial gas, Hotel Seneca, Rochester, N. Y., March 30–31.

American Society of Mechanical Engineers, spring meeting, Birmingham, Ala., April 1–3.

American Chemical Society, 107th meeting, Cleveland, Ohio, April 3–7.

The Electrochemical Society, spring meeting, Milwaukee, Wis., April 12–15.

American Institute of Chemical Engineers, semi-annual meeting, Hotel Cleveland, Cleveland, Ohio, May 14–16.

amounts of the various grades of paper and paperboard. It is proposed that this be done through the use of waste materials and fillers and by encouraging and directing wherever possible, the production and use of lighter weights of paper.

The allocation of pulp was determined after statements of requirements were requested from the claimant agencies and application forms from producers required that the applicant show proposed consumption of pulp in terms of major end-uses. From these data was established the relative essentiality of the various classifications of paper and paperboard products.

During the quarter, the program calls for production of a minimum of 1,398,837 short tons of the following types of paper and paperboard to be produced each month from 837,060 short tons of pulp:

Paper	Minimum To Be Produced in tons	Wood Pulp Allocated tons	Ratio of Pulp to Product
Coarse	157,190	155,618	99.0
Book	114,732	78,707	68.6
Building papers	77,137	12,573	16.3
Fine	74,178	62,755	84.6
Special industrial .	21,770	13,998	64.3
Newsprint ...	60,000	60,780	101.3
Groundwood .	44,784	45,232	101.0
Multi-wall ..	29,000	30,247	104.3
Sanitary	66,434	65,437	98.5
Tissue	13,428	13,334	99.3
Absorbent ...	7,616	4,973	65.3
Paperboard			
Container board	363,447	199,096	54.8
Folding boxboard ..	167,801	40,104	23.9
Building	76,585	36,788	48.0
Set-up boxboard .	63,016	592	.9
Cardboard ..	4,438	1,741	39.2
Other paperboard.	357,281	15,085	26.3

The Forest Products Bureau is authorized to transfer not more than 50,000 tons of pulp during the first quarter from the amount assigned to make container board, to mills making coarse paper products, including wrapping and bag paper, if it appears an adjustment is warranted.

A maximum reserve supply of pulp approximating 69,000 tons per month for the first quarter, has been established for export and non-paper uses, in addition to the amounts specifically allocated.

NEW CHAPTER OF SIGMA Xi AT WAYNE UNIVERSITY

A NEW chapter of Sigma Xi, national honorary scientific society, will be established at Wayne University following approval of Wayne's charter application by delegates to the Sigma Xi national convention, held in Chicago last month.

An outgrowth of the Sigma Xi Club founded at Wayne three years ago ,the new organization will bring to 89 the number of Sigma Xi chapters now active in the United States. Only two other chapters exist in Michigan—one at Michigan State College, East Lansing, the other at the University of Michigan, Ann Arbor. There are more than 185 members of the society in the Detroit area, of whom 85 now belong to the Wayne Club. President of the organization this year is Dr. Arthur H. Smith, professor of physiological chemistry at the Wayne University College of Medicine.

HERCULES PRESIDENT PREDICTS HIGH PEACETIME EMPLOYMENT

In the review of his company's activities last year, Charles A. Higgins, president of Hercules Powder Co. stated that the postwar American chemical industry will employ considerably more workers than in prewar years and chemical plants are ready to swing over to peacetime production the day the war ends. Based both upon a survey of the chemical industry and upon Hercules' own postwar blueprints, his statement emphasized that the wartime accomplishments of the chemical industry would stand up after the war. The war has simply accelerated the development of the industry.

Referring to new products, Mr. Higgins said that some of the so-called substitutes are better than what they have replaced. Under the impetus of war, these materials have been moved from the research laboratory into actual use much faster than would have been possible under a peacetime economy but they are here to stay and will play a prominent part in raising the postwar standard of living.

MEETING OF AMERICAN COUNCIL OF COMMERCIAL LABORATORIES

The annual meeting of the American Council of Commercial Laboratories was held in Chicago on Dec. 13-14. The following officers for 1944 were selected: W. P. Putnam, president and technical director, The Detroit Testing Laboratory, president; H. L. Sherman, treasurer, Skinner & Sherman, Inc., Boston, vice-president; T. A. Wright, president and general manager, Lucius Pitkin, Inc., New York, treasurer; and B. L. Oser, vice-president and director of Food Research Laboratories, Inc., New York, secretary.

Following will constitute the executive committee for the ensuing year: A. R. Ellis, president, Pittsburgh Testing Laboratory; D. E. Douty, president, United States Testing Co., Inc., Hoboken; R. W. Truesdail, president, Truesdail Laboratories, Inc., Los Angeles; J. H. Herron, president, The James H. Herron Co., Cleveland; and A. C. Purdy, Bull & Roberts, New York.

STUDENT DEFERMENTS WILL BE SHARPLY REDUCED

A new ruling of Selective Service will restrict the number of college students deferred for educational reasons to 10,000. This number will include only chemists, engineers, physicists, geologists, and geophysicists. The selection of those to be deferred will be made in accordance with rules being formulated by the National Roster.

Those to be placed in this group must meet certain requirements. They must be studying in an approved curriculum for one of the five named professions; they must be between 18 and 22 years of age and physically fit to be classified as 1-A for military service. It is probable that all of them must be far enough along in their courses that they are expected to be graduated by July 1, 1945.

LOUISVILLE DRYING MACHINE CO. FIGURES IN SALE

The Louisville Drying Machine Co., Louisville, manufacturers of drying equipment used chiefly in recovery of grains from brewery and distillery operation, but also largely in chemicals, and various other products, has been merged with the General American Transportation Corp., New York and Chicago, through interchange of stock, in which A. W. Lissauer, president of the Louisville company, which he has headed since 1923, receives 7,667 shares of General American Transportation stock for his 50,040 shares of Louisville Drying, of which he was sole owner, the deal involving something more than $300,000, in that General American Transportation common is trading at $40 a share in the market.

It is reported that General American Transportation plans to enlarge the scope and activities of the local company, and to add some new lines, and acquire other companies. A. W. Lissauer will continue in charge of the Louisville division, as the company will be operated as a subsidiary of the new owners.

ALLIED NATIONS STANDARDS BODY ADVOCATED

The American Standards Association held a meeting on Dec. 10 at the Hotel Roosevelt, New York, celebrating a quarter century of service to industry and the government in the field of standards.

It was announced that the board of directors of the association had authorized participation in an allied nations standards body. The organization of such a body has been discussed informally for a number of weeks between the British Standards Institution, the Canadian Engineering Standards Association, the American Standards Association and also with key governmental agencies in three countries.

The function of the organization is to spur cooperation between the allied belligerant countries in standarization matters as an aid to production and use.

HIGGINS HEADS PITTSBURGH PLATE GLASS CO.

At a meeting of the Board of Directors of the Pittsburgh Plate Glass Company in New York, December 15, the following changes in executive personnel were approved, to become effective as of January 1, 1944: Clarence M. Brown has resigned as chairman of the board of directors, but will remain active on the executive committee, on the board, and as chairman of the finance committee. Harry S. Wherrett, now vice-chairman, will become chairman of the board. Robert L. Clause, formerly president, will become vice-chairman of the board, and Harry B. Higgins, formerly executive vice-president, will become president.

SOCMA MOVES HEADQUARTERS

The office of the Synthetic Organic Chemical Manufacturers Association is now located at 6 East 45th Street, New York 17, N. Y. The new telephone numbers are Murray Hill 2-8128-9.

WESTERN COMPANY HONORED FOR ENGINEERING SKILL

Bechtel-McCone-Parsons Corp., engineers and constructors of Los Angeles has been added to the list of companies honored for their contributions to the American synthetic rubber industry. (See *Chem. & Met.* Nov. 1943, pp. 115–118.) This action was taken by the Committee of Award for Chemical Engineering Achievement on recommendations of both the Office of Rubber Director and the Rubber Reserve Co. It recognizes the responsibility for process engineering and design as well as the construction of the 15,000 ton butadiene plant for Standard Oil Co. of Calif. at El Segundo refinery.

QUARTERMASTER DEPOT HOLDS LABORATORY SEMINARS

The Engineering Division of the Jeffersonville Quartermaster Depot, Jeffersonville, Ind., has recently completed a laboratory training program for personnel in the form of a series of seminars.

Two sessions of two hours each were devoted to each topic. In the first session subject matter was presented by one of the personnel. The second session was devoted to group participation in discussions of questions about the experience of the laboratory with the subject matter.

CALCO ACQUIRES UNITED COLOR AND PIGMENT DIVISION

Calco Chemical Division, American Cyanamid Co., has purchased from Interchemical Corp. its United Color and Pigment Co. Division located in Newark. United, with manufacturing facilities covering eight acres and employing some 500 people has been a major factor in the production of organic and inorganic chemical colors. The Calco Chemical Division manufactures organic intermediates and dyes many of which are raw materials for the production of organic chemical colors. The combined production as well as research and technical service facilities is expected to make possible greater contributions to the pigment consuming industries.

According to the Calco statement the new unit will be known as United Color and Pigment Department, Calco Chemical Division, with "no change of management, personnel or policies contemplated".

LAVA TALC NOW BEING MINED IN BRITISH COLUMBIA

Lava talc, a valuable war material, unobtainable now from former supply sources, is being mined in Kootenay National Park, British Columbia, and production of 40 tons monthly is expected. It is the only known source of lava talc in Canada and is chiefly used in the manufacture of radio equipment.

The deposit was discovered in the area some 20 years ago, and, although a company was then formed to mine it, operations were not undertaken until a short time ago. The property belongs to the government as it is within a national park area, and mining is carried on under direction of the metals controller.

Reconversion *and* Contract Termination

American industry is dedicated to an all-out effort to achieve victory, and its good faith in this direction is amply demonstrated by the results.

American industry also is dedicated to making democracy work effectively after the victory. And it is toward this objective that industry must prepare itself to guide the processes of demobilization and reconversion in order to minimize the dislocations and chaos which too easily can result from so tremendous a task.

We exercised foresight from the very beginning of the war mobilization program. Let us now exercise foresight in the approaching changeover from a wartime to a peacetime economy.

The first step in converting American industry from military to civilian production is the termination of contracts between the government procurement agencies and the producers. There are now in force war contracts amounting to tens upon tens of billions of dollars. As the demand for weapons of war decreases, the Armed Services will undertake to cancel contracts. With the emphasis shifting from weapons of one category to weapons of another category, many billion dollars worth of contracts already have been terminated. It is hoped that the experience now being gained in this work will provide the basis for effective and sound procedures when an avalanche of cancellations comes later.

Many complex problems involved in the termination of contracts will materially influence the success of the entire reconversion program. Once war demands fall off sufficiently to permit the renewal of civilian production, we will have to act with great speed if we are to avoid large-scale unemployment. Prompt financial settlements of contracts and the rapid clearance of plants are of immediate and great significance. In many cases the removal of equipment and raw materials will be more important than money payments. The allocation of raw material for civilian production will be of paramount importance.

Government agencies obviously must exercise great care in spending the people's money and in protecting the interest of the public against excessive payments. Unjust enrichment at the expense of the people will not be condoned nor will it reflect favorably upon management to present inflated claims. But long-delayed negotiations, which will retard the initiation of civilian production, likewise must be avoided.

The contracting agencies and the manufacturers both know that the greatest losses in the reconversion period will result from delays in getting peacetime production under way. The

greatest potential wastes lie in unemployment and in idle plants. The magnitude of such losses to the public can be far greater than the money spent in liberal settlements; to the manufacturer, these losses can represent vastly more than the extra funds that might result from interminable litigation. Policies must be firmly established *now* whereby the manufacturers, including subcontractors and suppliers, will receive substantial settlements immediately in order that ample funds be available for reconverting plants and accumulating necessary inventories of peacetime goods. Nor must we overlook the fact that the uncertainty of long drawn-out disputes will have a stifling effect on enterprise and that final settlements, therefore, should be made as promptly as possible.

Plants that are equipped largely with special wartime tools and machines and that are fully stocked with materials, components, and finished military products will not be able to undertake any substantial degree of conversion until this machinery and this inventory are removed. Advance arrangements are essential for the prompt clearance of great numbers of plants the country over. Adequate warehousing facilities must readily be available so that the changeover to civilian production will not be hampered.

As war demands decline, civilian output will be resumed; and while we recognize that the demands for munitions must vary as the strategy of the military leaders is changed, it is hoped that the Armed Services already have or soon will develop schedules of their continued needs under different strategic assumptions. If we know in advance the probable curtailment in war requirements we are in position to estimate the timing and the quantities of raw materials, the number of workers, and the industrial facilities which will be available for peacetime purposes. It will then be possible to integrate the lifting of restrictions on civilian production with the drop in war production.

Needless unemployment and idle plants will prevail if restrictions on the output of civilian goods are removed at a slower rate than available manpower, materials and plants permit. On the other hand, if the controls on civilian production are removed prematurely or too freely, then the production of military requirements will be hampered correspondingly. There will be great clamor and pressure for eliminating all restrictions as soon as any measurable quantity of materials and numbers of workers are freed from war work. It will react adversely on industry as well as on government if these pressures are heeded indiscriminately, thereby retarding the production of munitions for our boys who still will be fighting and dying at the front. The coordination of declining war demands with increasing civilian production probably is the most difficult and at the same time the most important task in our entire reconversion problem. Advance planning and sound judgment are essential.

An order of priority for initiating non-war or civilian production must be prepared beforehand. The schedule of resumption of peacetime production should be governed by the amounts of

materials, manpower and facilities that are available as well as by the relative needs or importance of different products. There will be strong competition for priority among the various kinds of consumer goods, equipment needed for reconversion, producers goods required for expansion and modernization, and export demands. Relative need obviously is the most compelling criterion. But because of the importance of expediting reconversion, earliest consideration is urged for the tools and fixtures and models which will expedite large-scale civilian production when adequate labor and materials are available. In any case, advance schedules will be needed to avoid a makeshift, piecemeal lifting of controls on the basis of who shouts the loudest.

Another difficult problem of the reconversion period will be to keep to a minimum the distortion of inter-industrial and intra-industrial relationships. Many varieties of consumers goods compete for the consumer dollar, and some industries will offer strong resistance if the green light is given first to industries whose products may thereby acquire a time advantage.

Even more difficult will be the matter of competition between companies producing the same products. Some manufacturers may find themselves tied up with continuing war contracts with restrictions on their peacetime products suddenly lifted and their competitors free to take advantage of the situation. The declining need for different kinds of war materiel will vary greatly, and some producers inevitably will be available for peacetime production considerably in advance of some of their competitors.

This raises the question of victory models or nucleus plants to eliminate competitive advantages among producers of identical products pending the time when all are on an equal footing again. Policies controlling this should take into account the degree or the extent of competitive advantage which reconversion might bring, and also upon the time interval during which these advantages will prevail. Such programs necessarily mean increased government control, hence they should be adopted only under the most pressing circumstances.

There is the important question of termination as between large and small plants. Fairness must be exercised, and undue advantage to either group must be avoided in extending opportunities to continue receiving profitable war orders or in getting back into civilian production. The problems of small manufacturers must not be neglected in this period. Likewise, any restraints on new ventures and on more vigorous competition must meticulously be avoided.

There also is the question of communities which have been greatly enlarged and others which actually have been brought into being by the war. It might be advisable to terminate contracts in these areas first in order that the workers might be encouraged to migrate elsewhere while employment prospects are most favorable. Also, if continued production of some armaments is contemplated after the war, it might be well to concentrate this production in communities which otherwise would be stranded.

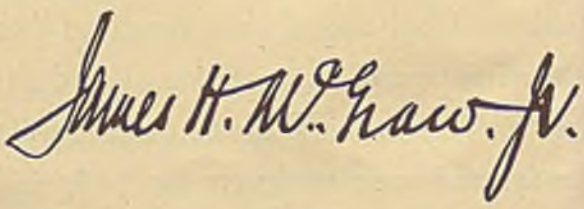
If the process of terminating contracts is to be geared into meeting continued demands for munitions and also expediting reconversion, then the Armed Services must accept broad policy considerations as criteria for cancelling contracts. Procurement officers might be inclined to cancel contracts with all high cost producers first. Or they might be inclined to cancel small producers first so as to reduce the administrative burden. Then again, they might cancel the newer producers of specific products rather than the older, time-tried manufacturers.

These procurement criteria may all be highly desirable and efficient but other important considerations such as those mentioned above must be given proper attention. *Demobilization cannot be a separate process from reconversion.* They must be united. The termination of contracts is a demobilization task, but I am confident that the procurement agencies appreciate the importance of this operation in facilitating reconversion and that they will take full cognizance of the policies necessary for giving every assistance to initiating peacetime production.

I have not attempted to raise all the important policy questions in terminating contracts, nor do I propose specific solutions for each major problem. Rather it has been my purpose to indicate the complexities of the task which faces us and to urge that intelligent and sound plans be developed now while there is time. By so doing, we can avoid the dislocations and economic disorder which otherwise might characterize the reconversion period. The better we are prepared, the more rapid will be the resumption of full employment and good business after the war is won.

This job of changing America's industrial pattern from war to peace speedily and efficiently, is one which will tax the talents and knowledge of the ablest business men of the country. These men can, and I am sure that they will, attack this task with the same energy and determination that characterized their efforts in the period of mobilization for war.

Industry advisory committees were established to cooperate with governmental agencies in the great task of conversion to a full war economy. These committees are the means through which industry has the opportunity to play a major role in the solution of the problems of reconversion. It must assume that responsibility or accept the consequences in the form of enforced government control. Industry must take a renewed interest in these committees and make certain that our best minds and strongest men are available for the challenging job of conversion which we face now. It is a job that must be done well if we are to have a good start on the road to a greater democratic and free enterprise nation



President, McGraw-Hill Publishing Company, Inc.

NEWS FROM ABROAD

NEED FOR FUEL ECONOMY STIMULATES BRITISH STUDY OF CHEMICAL PLANT DESIGN

Special Correspondence

A VEIL OF secrecy is drawn over all new installations in the British chemical industry, and it is seldom that information about new plants and investments is allowed to escape. Nevertheless it is known that considerable construction work has been undertaken, not only for chemical manufactures directly connected with production of munitions, but in plants which are serving indirectly in the war effort. Organic chemistry in particular has been active, and the expansion of the production of valuable byproducts from coal and coal derivatives is well illustrated by the fact that since 1940 benzol recovery has increased by 20 percent. In addition to recovery at coke ovens, 95 percent of the gas produced at works carbonizing more than 5,500 short tons of coal per annum is now being treated for the extraction of benzol. At the annual meeting of Low Temperature Carbonisation Ltd., a company which has been very persistent in its endeavors to open up a new avenue of chemical utilization for British coal, it was stated that the value of the company's liquid products has greatly increased as a result of research. This is typical of the present trend of development in this branch of British chemical industry.

From Wales comes a description of a new activated carbon plant at gasworks which is entirely automatically controlled. The plant has a capacity of 2,500,000 cubic feet of gas per day and is capable of giving an efficiency of over 99 percent of benzol recovery. It consists of an adsorber (in duplicate), vertical gas cooler, horizontal condenser for benzol vapor, spirit separator, test tank, storage tank, heater for recirculated gas, control box and valve gear, gas recirculating fan and air compressor, actuated by a 4 h.p. electric motor. When the carbon is thoroughly saturated with benzol, the gas flow into the adsorber is automatically diverted into a second adsorber. The carbon is cleansed of the adsorbed benzol by the introduction of open steam. The benzol and steam vapors are condensed, and the condensates pass to a separator from which the benzol spirit flows to a test tank and then on to a storage tank. After cleansing the carbon is dried and cooled. It is then ready for the next adsorption period. While one adsorber is working, the other one is being steamed and dried. Steaming-cleansing takes as much time as drying-cooling, and the two periods together equal that of adsorption, namely one hour, though the

total cycle can be shortened. Automatic control is effected by a control box mechanism and by valves spring-loaded to open, and closed by the inflation of rubber diaphragms with air from a small air compressor giving a pressure of about 10 lb. per sq.in. About 40 pounds of steam are required in the plant for every gallon of benzol recovered, but the exact amount varies according to the state of the carbon. The highest possible benzol test is obtained, there is no naphthalene left, and the gas has a residual sulphur content of less than 10 grains.

FUEL-SAVING DEVICES

It is likely that much new information about this field of chemical industry will be obtained as a result of the emphasis now being laid in British factories on fuel-saving devices. Brian N. Reavell, reporting on "Heating by Liquids" to joint meetings of the Association of British Chemical Manufacturers and the British Chemical Plant Manufacturers' Association in London and Manchester, referred to developments in this field in the United States where in addition to mineral oils, diphenyl compounds and water, a mixture of sodium nitrate and nitrite is in use. Investigation of other alternative liquids is being carried out in Great Britain, and these include melted lead which has been used for tar distillation. Constructional engineers in Great Britain favor heating by means of intermediary liquids, in particular where, at comparatively low temperatures, the lower fluid pressure as compared with steam heating, permits of cheaper design of jacketed vessels. Operators are being told of the importance of thermostatic control, clean surfaces to facilitate heat transmission, a high rate of oil circulation to avoid overheating and carbonization, and preference is being given to diphenyl compounds as intermediary liquid, especially where products are to be heated to about 300 deg. C. There is a tendency to install small waste heat recovery boilers and to use steam for neighboring processes in order to increase the overall efficiency which without such supplementary outlets is estimated at up to 50 percent.

Fuel economy is one of the most important considerations in industrial operations in the British chemical industry today, and special problems have been created by the need to use low-grade coals in certain cases. Interest in plant accessories which promise better utilization of fuels has generally increased, and it has been found that often greatly improved results can be obtained by slight modifications of traditional practice with regard to mechanical stokers requiring thin links and fine air-spacing to suit the conditions of the fuel, with regard to the quality of firebars and refractory bricks to reduce maintenance under increased rates of combustion, draught control, cooling of furnace walls by water tubes connected with the circulation system of the boiler, air pre-heating to give better absorption of heat from flue gases, feed-water temperature, removal of condensate from steam pipes by using better types of steam traps. Some of these may be small points hardly worth attention, but altogether they may result in considerable savings.

A new type of chemical apparatus made by one plant manufacturer may be described as typical of work which is being undertaken by quite a number of firms in the plant accessory industry. One of them is a new type of crystallizer for corrosive liquors like ammonium sulphate, ferrous sulphate, etc. The liquor is heated and fed to a rotary atomizer which sprays it into a cylindrical chamber where a current of cold air is blown uniformly over the hot spray causing each spray particle to cool rapidly and crystallize. The crystals are collected in a settling tank at the bottom of the chamber together with the remaining mother liquor which is continuously drawn off and pumped back to the spray, while the crystals are discharged to a centrifuge. Acid-resisting materials like lead or stainless steel are used for the atomizer and chamber, and labor charges are said to be very low.

A new evaporator for use in the concentration of industrial liquors containing salts with inverse solution ratios, which tend to scale rapidly heating surfaces, also contains a chamber into which the liquor is sprayed to be subjected to a current of hot air. The spray particles evaporate and fall to the bottom of the chamber where they are collected. Any salt which tends to form on the walls of the chamber is continuously washed off by downcoming liquor. There are no heating surfaces, therefore, on which scale can form, since the heat is supplied by means of hot air. The chamber can be built of acid-resisting materials so that it may be used for corrosive liquors.

SPECIAL DRIER FROM PLASTICS

To make a special drier formerly used for drying filter press cakes and other semi-solid materials available for drying borax, the entire drying system was constructed of a special plastic material, thus avoiding all metal contact. The rotary screw feeder, drying column, cyclone separator and hot air fan are all made of plastics. The use of plastic materials for chemical apparatus has provided a solution for a problem which has become rather important of late, that of keeping castings in working condition. Where castings are used at high pressures and temperatures, scrapping because of porosity and consequent weeping of fluid becomes too expensive, and it was found that the serviceability of castings will be maintained if they are subjected to a treatment with a plastic sealing solution. This is applied under moderate pressure to seal all pores, followed by a controlled heat treatment in an oven and testing after cooling. Several sealing solutions are available, possibly for double treatment, and impregnation is by means of a pressure pump. Approximately 1,000 castings are said to have been treated so far.

Other new apparatus recommended with a view to fuel economy includes chlorination equipment of which special types have been made for various industrial uses, waste oil recovery plant and other secondary apparatus, but special attention is being paid to the transformation of the fuel material before use to the form which promises to give maximum heat efficiency and this is a big subject in itself.

SPANISH COMPANIES CUT DOWN POTASH PRODUCTION

PRODUCTION of the three potash companies in the Province of Barcelona, Spain, dropped about 20 percent in 1942, compared with the preceding year, principally because of a severe decline in coal deliveries.

The output in 1942 amounted to 89,000 metric tons, while in 1941 it totalled 117,000 tons, but during the first half of 1943, when coal again became available in sufficient quantities, production increased from 10 to 15 percent over the 1942 total. However, the output of potash is expected to show a substantial reduction during the second half of this year, because of a heavy drop in domestic sales and a decline in exports.

Shipments of muriate and sulphate of potash were sharply reduced in 1942, compared with the preceding year, having decreased from 138,204 metric tons, valued at 10,032,781 gold pesetas, in 1941, to only 70,720 tons, valued at 5,171,886 pesetas, in 1942, according to official Spanish statistics.

New sales are not being made on the local market, partly because dealers anticipate a drop in prices and partly because stocks are already fairly large. Company warehouses are filled almost to capacity, and mills may be forced to suspend operations, either partially or entirely.

NEW SULPHURIC ACID PLANT IN CANARY ISLANDS

ACCORDING to reports to the Department of Commerce a new plant at Santa Cruz de Tenerife, Canary Islands has been placed in operation. Apparatus has been installed for production of highly concentrated sulphuric acid with a capacity of 40 tons a day with the possibility this will be doubled. Most of this acid will be used in making superphosphate and sulphate of potash.

Pyrites imported from Spain furnish the raw materials necessary for making the acid. In addition to making acid for fertilizer chemicals, equipment has been set up in one wing of the new plant for concentrating sulphuric acid for use in the adjoining petroleum refinery of Compania Espanola de Petroleos, S. A. Equipment for one ton per day nitric acid production also has been included.

RUMANIAN CHEMICAL COMPANY INCREASES ITS CAPITAL

"NITROGEN," an important producer of chemicals and artificial fertilizers in Rumania, has increased its capital from 320,000,000 lei to 480,000,000 lei, the Rumanian press reports.

The company's production of carbide has declined somewhat of late—from 3,843,705 kilograms in 1941 to 3,457,941 in 1942. Caustic soda registered a slight decrease; output in 1942 amounted to 2,545,876 kilograms, compared with 2,719,413 in 1941. Liquid ammonia production remained almost level—1,178,735 kilograms in 1942 and 1,222,850 in 1941. Smaller amounts of several other chemicals were produced.

BRAZIL WILL EXPLOIT NEW WAX AFTER THE WAR

A NEW Brazilian industry, exploitation of cauassu wax, reportedly will not be developed further until after the war. Manpower shortages as well as various other wartime difficulties make present commercial advance impossible.

The greatest advantage of producing cauassu is that its harvest is much easier than that of the carnauba palm, yet the wax obtained from the underside of the cauassu leaf is said to be equal in quality to that of the carnauba.

Cauassu grows on the highlands of the State of Para. Its appearance resembles a small banana tree, and, because of this diminutiveness, the leaves are easily accessible. The problem of transporting the crop is minimized by the fact that the plant flourishes near streams.

One problem awaiting solution for both cauassu and carnauba wax production is that of improving the means of extracting wax from the leaves; much of the product is said to be lost by the hand method now employed.

Leaves of the cauassu plant are used at present to wrap fresh meat and to make containers for flour, sugar, and similar products.

CANADIAN FLAXSEED MOVED THROUGH GREAT LAKES

MOVEMENTS of Canadian flaxseed down the Great Lakes between the opening of navigation and October 21, 1943, amounted to 3,714,538 bushels, according to data released by the Agricultural Branch of the Dominion's Bureau of Statistics.

These figures represent an amount 10 times as great as the quantity transported in 1938 and more than 6 times as great as the 587,937 bushels shipped in 1942. Shipments to both Canadian and United States ports are included in the compilation.

CHEMICAL RESEARCH PROGRAM PLANNED IN INDIA

THE Advisory Board of the Imperial Institute of Sugar Technology, India, has planned a research program which includes the manufacture of plastics and cellulose from bagasse, and the production of potash, citric acid, and lactic acid from molasses.

The Institute has also recommended the establishment of pilot plants to manufacture butyl alcohol, acetone, glucose, cane wax, and food yeast. Research had already been done on the production of these materials as well as on refined sulphur and power alcohol.

PALESTINE MAKES CHEMICALS FROM CITRUS PEELINGS

A METHOD has been developed in Palestine for obtaining solvents from citrus-fruit peelings, a British chemical journal reports. Ethyl alcohol, butyl alcohol, acetone, and acetic acid are produced by fermenting citrus-fruit peelings or pulp residue from the extraction of pectin or essential oils. Yields of more than 63 percent of solvents have been obtained.

SWEDEN MAY FINANCE PLANTS FOR SYNTHETIC RUBBER

BUNA synthetic-rubber imports from Germany into Sweden have not come up to expectations, and the State Traffic Commission is considering a future reduction of 5,000 vehicles, in addition to the 12,000 motor trucks scheduled to have been taken out of service by October 1, 1943. Delivery of 172 tons of crude rubber, small amounts of which are necessary in the manufacture of Buna synthetic-rubber products, was made in September.

An appropriation of 6,150,000 crowns for the manufacture of synthetic rubber has been proposed, 750,000 crowns to be used for doubling the capacity of the Ljungaverk plant and 3,900,000 crowns to be made available for the erection of a new synthetic-rubber factory with an annual capacity of 800 metric tons. If both projects were carried out the annual synthetic-rubber capacity of these two plants would be 1,600 metric tons.

GUATEMALA INCREASES OUTPUT OF ESSENTIAL OILS

ESSENTIAL oil production in Guatemala has shown a measurable increase in the first 9 months of 1943 over that of the comparable period of the preceding year. The quantity of citronella, eucalyptus, and lemongrass oils exported was about one-third greater, and the value of those three products was more than 70 percent larger, from January to September 1943 than for the first three quarters of 1942. Guatemala shipped 102,683 pounds of citronella oil, 139,986 pounds of lemongrass oil, and 2,384 pounds of eucalyptus oil valued at a total of $405,896, during the first 9 months of 1943 compared with a combined total of 183,195 pounds valued at $236,616 for the corresponding months of 1942.

PERU HAS NO SURPLUS GUANO FOR EXPORT TRADE

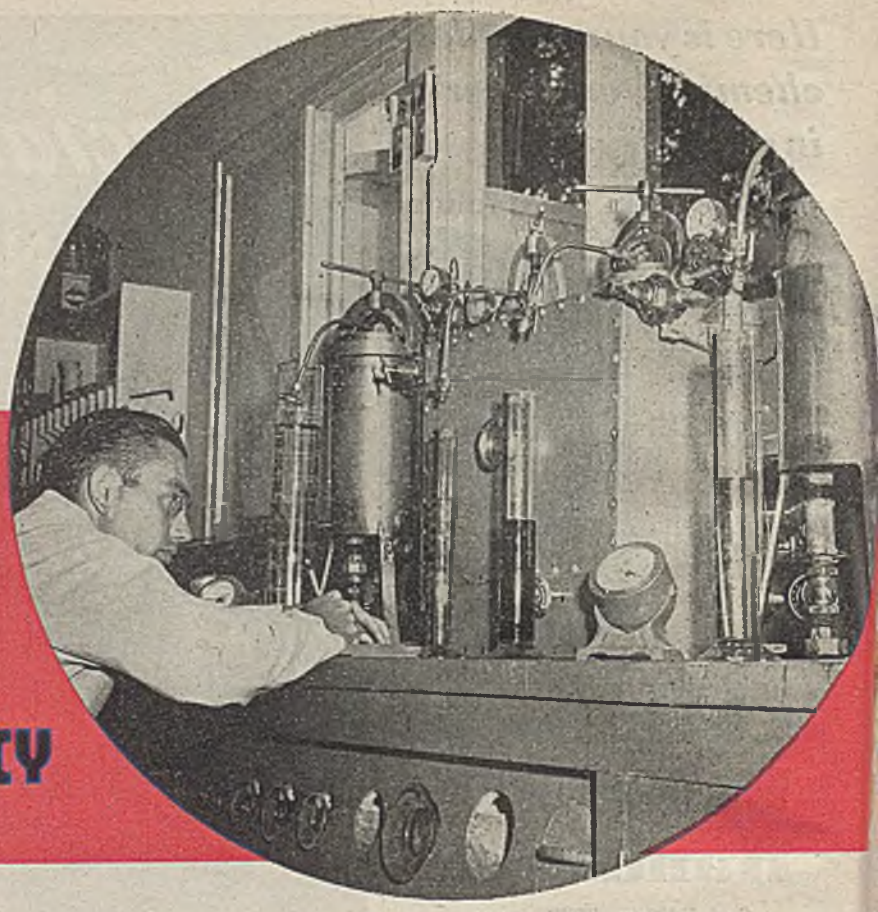
PRODUCTION of guano in Peru continues to decline; since 1941 there has been a high mortality rate among sea birds as a result of abnormal atmospheric and oceanic conditions.

Not more than 62,500 tons of guano are expected to be produced this year, compared with 67,420 tons in 1942. Since this amount is not sufficient for Peruvian agricultural needs, no exports will be made. Growers of food crops are given preference in the distribution of guano, and they are receiving all their requirements, it is stated.

CEYLON CONDUCTS EXPERIMENTS IN PLASTICS MANUFACTURE

EXPERIMENTS in the production of plastics from residue materi[illegible] acid manufacture [illegible] carried out successfully by the [illegible] Laboratory of the Ceylon Department of Commerce.

This plastic material, which has been used extensively in some countries in the manufacture of plywood, is said to compare favorably with imported plastics. It is hoped to conduct further experiments at the plywood factory at Gintota.



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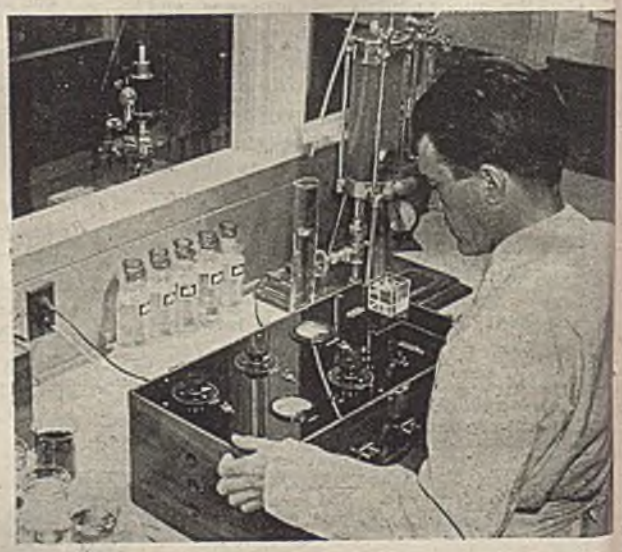

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NAMES IN THE NEWS

B. F. Stauffer

Gaston F. DuBois

Harold T. Lacey

B. F. STAUFFER, who has been with the B. F. Goodrich Co. for the past 50 years, was elected president and general manager of American Anode, Inc. He assumed his new duties January 1, succeeding R. W. ALBRIGHT, who has been named vice president and general manager of Distillation Products, Inc., of Rochester, N. Y.

THOMAS H. CHILTON has been awarded an honorary degree of doctor of science by the University of Delaware. The presentation was made last month.

VIRGIL D. DRUMMOND recently joined the development and new chemicals division of the Publicker Commercial Alcohol Co. and has been appointed chief chemical engineer of this division. Other new appointments at Publicker include JOHN H. KARRH as plant manager of the new butadiene plant at Eddington, Pa.; DR. ALFRED CLARK, DR. P. J. ELVING, R. S. WILDER, and DR. GEORGE D. MARTIN.

LAWRENCE H. FLETT has been transferred from the Buffalo Plant to the Sales Department, National Aniline Division, Allied Chemical & Dye Corp., and will be located at the Division's New York office. In his new capacity of Director, New Products Division, Mr. Flett will afford specialized technical research service to National's customers.

P. J. RYAN has been promoted to vice president in charge of the Detroit plant of Reichhold Chemicals, Inc. In his new position he will have complete supervision over all production and technical development at RCI's main plant. In addition he will continue to serve as Technical Advisor to the Board of Directors.

MICHAEL B. DWYER, district sales manager in charge of the St. Louis office of the Pennsylvania Salt Manufacturing Co., has retired from active duty with the company as of Dec. 31, 1943. He will be succeeded by DONALD W. GRAHAM.

GASTON F. DUBOIS, vice president of Monsanto Chemical Co., received the 38th impression of the Perkin Medal on January 7 at a joint meeting of all the societies represented on the committee of award. DR. FOSTER D. SNELL, chairman of the American Section, Society of Chemical Industry, presided. The medal was awarded to Mr. DuBois in recognition of his work on vanillin, intermediates, phosphorus, bismuth and synthetic resins. Mr. DuBois' address of acceptance was "The Chemist Steps Out of the Laboratory."

LEIGHTON M. LONG, formerly chief metallurgist and foundry superintendent of the Bunting Brass & Bronze Co., Toledo, Ohio, has been named an assistant research supervisor at Battelle Memorial Institute, Columbus, Ohio. Other new appointments to the research staff at the Institute include ELMER F. STEPHAN, formerly an assistant professor of chemistry of the faculty of St. Bonaventure College who will be engaged in studies of industrial problems in the field of electrochemistry; CHARLES D. YOUNG, formerly an assistant in the department of chemistry of Ohio State University who has been assigned to the division of non-ferrous metallurgy; and WARREN R. FARRINGTON in the division of analytical chemistry.

A. GEORGE STERN joined Westvaco Chlorine Products Corp. on Jan. 1 to become chief of the Research Division at Newark, Calif. Prior to joining Westvaco, Mr. Stern held the position of Senior Chemical Engineer with the U. S. Bureau of Mines and was located in Washington, D. C.

GEORGE M. CARVLIN has been elected a vice president of Koppers Co., Engineering and Construction division. He started with Koppers as a research engineer in 1925, later serving in the operating and sales departments. He had been assistant to JOSEPH BECKER, vice president and general manager of the division, since 1940.

HAROLD T. LACEY has been appointed Division Chemist by the Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J. Dr. Lacey will be in charge of lakes and intermediates for the dry color and printing ink trades.

IRVING BEILEY, formerly supervisor of pilot plant operations for the Amino Products Division of International Minerals and Chemical Corp., has been appointed manager of the development department of Rumford Chemical Works, Rumford, R. I.

MILTON KUTZ has been made acting assistant general manager of the Electrochemicals Department of E. I. du Pont de Nemours & Co., effective Jan. 1. The appointment marks the return of Mr. Kutz to the post which ill health forced him to relinquish 18 months ago.

ATHERTON LEE has resigned from his position of chief of the Natural Rubber Section of the Office of Rubber Director. He has been in charge of the work of reviewing and evaluating programs for getting natural rubber into production. He is leaving the government to enter private business.

DAVIS BLACKWELDER, chemical engineer, has been appointed chief engineer of the Reynolds Metals Co. in Richmond, Va. He has been connected with E. Sirrine & Co. for 21 years and since 1937 has been a partner.

W. A. THOMPSON, JR. has been made manager of the petroleum and chemical division of the construction firm of Barrett & Hilp.

GEORGE L. CRAIG has been appointed director of research of Calumet and Hecla Consolidated Copper Co. Mr. Craig is a metallurgist and research engineer who joined the Calumet and Hecla organization in 1934 and prior to that was engaged in research work with the Battelle Memor-

ial Institute. He will make his headquarters in Calumet, Mich.

RALPH L. ATKINSON has been appointed director of engineering for United Wall Paper Factories, Inc. Mr. Atkinson will direct engineering in the company's wallpaper and war plants. He will also be in charge of all postwar development. Prior to joining United last July, Atkinson for eight years was president and general manager of Transparent Package Co., Chicago. He began his business career with Arthur D. Little, Inc., development engineers, where for a number of years he directed mechanical and chemical engineering projects.

D. BRUCE JOHNSTON has been appointed assistant to the director of research of Lukens Steel Co., and its subsidiaries, By-Products Steel Corp. and Lukenweld, Inc., Coatesville, Pa. At the same time the company announced the appointment of S. D. LEMMON as research metallurgist.

E. L. HUFF, formerly electrical engineer at the Brakenridge plant of the Allegheny Ludlum Steel Corp., has been appointed chief engineer of all the plants of the corporation according to a recent announcement.

JOHN H. INGMANSON has resigned from the research group on rubber at the Bell Telephone Laboratories at Murray Hill, N. J., to accept a position as works manager for Whitney Blake Co., manufacturer of insulated wire and cable, Hamden, Conn. He joined the Bell Laboratories in 1928 and previously he had been works manager for manufacturing intermediates for dyestuffs at Crown Chemical Corp.

E. T. T. WILLIAMS of Becton, Dickinson & Co., has been elected chairman of the executive committee of the drug, chemical and allied trades section of the New York Board of Trade, to succeed VICTOR E. WILLIAMS of the Monsanto Chemical Co.

J. C. HOSTETTER has become president of the Mississippi Glass Co., St. Louis, Mo. He was formerly vice president and director of research and development of the Hartford-Empire Co., Hartford, Conn.

J. BARAB is now engaged in consulting practice as chemical engineer specializing in explosives. Mr. Barab, who was with the Hercules Powder Co. for 21 years serving in various capacities and for the last 2½ years was chief chemist for Todd & Brown, Inc. He resigned from the latter position last October.

FRANCIS J. BYRNE has retired from his position as assistant director of the DuPont Public Relations Department with which he had been associated for 27 years.

CARL SHIPP MARVEL, professor of organic chemistry, University of Illinois, has been awarded the 1944 William H. Nichols medal of the New York section of the American Chemical Society. The award is made annually to stimulate original research in chemistry and DR. MARVEL was cited for "outstanding organic chemical contributions to the structure of vinyl

polymers." Presentation of the medal will be made at a meeting of the New York section on March 10, 1944.

F. W. Sullivan, Jr. has resigned as technical director of the Institute of Gas Technology. He is to be associated with Hydrocarbon Research, Inc.

Gustav Egloff has accepted an invitation from Governor Dwight H. Green to become a member of the committee on industrial plant opportunities of the Illinois Post-War Planning Commission.

A. E. Buchanan, Jr., organizer of the research division of Remington Arms Co., has been made technical division manager. He will be assisted by George O. Clifford, formerly manager of Remington's Ilion, N. Y., arms plant.

Frank S. MacGregor, who has been assistant general manager of the electrochemicals division of E. I. DuPont de Nemours & Co., Wilmington, Del., has been appointed general manager to succeed Dr. E. A. Rykenboer who retired last month because of ill health.

Robert C. Hockett has been appointed scientific director of the Sugar Research Foundation, Inc. Prior to joining the Foundation, Dr. Hockett was associate professor of chemistry at the Massachusetts Institute of Technology.

Nathaniel Baum has been appointed head of a new organic research laboratory in the Los Angeles laboratory of Turco Products, Inc.

J. M. Darbaker has been appointed assistant manager of Chicago district operations of Carnegie-Illinois Steel Corp., United States Steel subsidiary. Charles A. Ferguson, assistant general superintendent of the Gary Sheet & Tin Mill since December 1938, has been promoted to general superintendent succeeding Mr. Darbaker.

R. E. Warriner, having completed his assignment with the Tank Automotive Center of the Army Ordnance Department, has resumed duties with the International Nickel Co., Inc., and is now supervising the movement of nickel required to meet the demands of the steel industry.

J. L. Howerton has been transferred from Texas back to Monsanto, Ill. to take the job of Manufacturing Superintendent in charge of the inorganic section of the plant of Monsanto Chemical Co. This position was vacated by S. Cottrell who became Assistant Plant Manager.

V. N. Crasnoff, an authority on sporting and military ammunition has been made assistant general superintendent of Western Cartridge Co. where he will supervise product engineering and manufacturing.

Ralph L. Wilson, former chief of the Constructional Steels Section of the Metallurgical and Conservation Branch, Steel Division of the War Production Board, has joined the Timken Roller Bearing Co.,

Canton, Ohio, as chief metallurgical engineer.

William D. Ennis, Humphreys professor of engineering economics at Stevens Institute of Technology, will retire from that position on March 1 because of ill health.

Robert A. Boyer, formerly director of soybean research for Henry Ford, has joined the Drackett Co., where he will continue scientific research on soybeans.

John B. Ross, formerly with Linde Air Products Co., has been appointed to the West Coast engineering office of Handy & Harman. He will serve West Coast industries and shipyards in the capacity of brazing engineer in the application of Handy & Harman's silver brazing alloys and other precious metal products. His headquarters will be made at the company's Los Angeles offices.

Ralph H. Everett has been elected executive vice president and general manager of M. J. Merkin Paint Co.

OBITUARIES

John S. Fonda, assistant director of sales, Grasselli Chemicals Department of E. I. du Pont de Nemours & Co., died Dec. 22 in the Delaware Hospital of a heart attack following complications contracted from pneumonia. Dr. Fonda made important contributions to the field of rayon research, several patents being issued in his name. He would have been 43 years of age on Dec. 29.

H. K. Ferguson, president of the well known industrial building firm bearing his name, died Dec. 9 in Cleveland, Ohio, at the age of 60.

Arthur B. Jones died Dec. 13 after an illness of several months. From 1900 to 1917 Mr. Jones was with the General Chemical Co. in various capacities. From 1917 until the time of his death he was vice president of the engineering firm of Clark, MacMullen & Riley, Inc.

Britton Osler, K.C., of the firm of Osler, Hoskin & Harcourt, barristers, died suddenly Dec. 11 at his residence in Toronto. Mr. Osler, who was in his 70th year, was an outstanding Canadian corporation lawyer and a director of the International Nickel Co. of Canada, Ltd., as well as a member of its executive and advisory committees. His firm is Canadian counsel for the Nickel Co.

Harry L. Gilchrist, former chief of the Chemical Warfare Service, died last month at the Walter Reed Army Hospital, at the age of 73. Major General Gilchrist was medical director of the Chemical Warfare Service in France from December 1917 to December 1918, and chief of the Chemical Warfare Service of the Army from March 1929 to May 1933. He retired on Jan. 31, 1934.

Harry B. Eaton, former manager of the construction division of the DuPont Co.,

died Dec. 18 at his home in Westover Hills, Del. At the time of his death he was consultant on construction for the engineering department. He was 59 years old.

Robert D. Howerton, western sales manager of Calco Chemical Division, American Cyanamid Co., died last month. Prior to his association with the firm he had been identified with textile dyeing and finishing business in the South.

David B. Piersen, chairman of the board of directors of the Stephens-Adamson Mfg. Co., Aurora, Ill., died on Nov. 29 of a heart attack at the age of 63.

William H. Stanton, former director and works manager of the Philadelphia Quartz Co., Philadelphia, Pa., died Dec. 11 at the age of 83. He had been associated with the Quartz Co. since 1889 when he assumed the duties of superintendent of their Anderson, Ind. works. He retired from active service in 1919.

R. H. Chittenden, who served as director of the Sheffield Scientific School at Yale for 24 years, died Dec. 26. He was 88 years of age.

Paul Hodges, production manager, Crossett Paper Mills, Crossett, Ark., died suddenly on Nov. 19 at Cincinnati, Ohio, from heart trouble. Mr. Hodges was 37 years of age.

Joseph T. Ellis, former manager of the steel boiler and oil heating division, National Radiator Co., died Nov. 19 after a severe illness. Mr. Ellis had been with the Radiator Company for 30 years. He had been acting as manager of the Newark, N. J. branch office when taken ill.

Levin B. Broughton, dean of the College of Arts and Sciences of the University of Maryland, died at his home from a heart attack on Dec. 14. He had been connected with the University of Maryland for more than 30 years, having been head of the department of chemistry and in charge of chemical engineering work for a considerable part of that period.

Edward L. Robins, well-known figure in the fertilizer industry, died of a heart attack on Dec. 10 at Shreveport, La. He was 73 years of age.

Edgar V. O'Daniel, vice president and director of the American Cyanamid Co., died last November in New York City. He was 59 years of age.

Edgar B. Kerst, Sales Department of Proctor & Schwartz, Inc., died at his home on Dec. 2 after an illness of several weeks. He had been associated with the firm for about 35 years, most of which were spent in the Sales Division.

James T. Pardee, former chairman of the board of directors of the Dow Chemical Co. died at his home in Midland on Jan. 3. He had been in poor health since his retirement in 1941. He was 76 years of age.

INDUSTRIAL NOTES

WOBURN DEGREASING CO., Harrison, N. J., has changed its name to WOBURN CHEMICAL CORP. The change was made to conform more with the present nature of its business. Production of organic chemicals is now centered in plants at Harrison, N. J., and Toronto, Canada. Production of insecticides and fungicides will continue at Elkton, Md., and Moore Haven, Fla.

CARDOX CORP., Chicago, has put H. W. Lange in charge of sales of its fire division. Mr. Lange has been acting as chief engineer of that division where he will be succeeded by H. R. Harper who had been assistant chief.

AMERICAN CYANAMID CO., Calco Chemical Division, Bound Brook, N. J., has announced the appointment of Morton Starr Cressy, Jr., as sales representative in the chemicals and intermediates department. Mr. Cressy has been identified as head of the aniline, rubber accelerator and beta naphthol plants at Bound Brook.

DOW CHEMICAL CO., Midland, Mich., has announced the personnel of its Philadelphia and New England sales offices. Alexander Leith, Jr., who has been in the New York office since 1923 will head the new Philadelphia office at 1400 South Penn Square and Alfred A. Lawrence who has been with Dow since 1940 has been selected as manager of the new office at 20 Providence St., Boston.

WICKWIRE SPENCER STEEL CO., New York, has appointed Robert T. Dunlap as general superintendent of the Buffalo works of the company to succeed William A. Steel, resigned. Mr. Dunlap has been recently appointed assistant to the president.

GREENE, TWEED & CO., New York, has purchased THE ASBESTOS FIBRE SPINNING CO. of North Wales, Pa. Plans are being made to enlarge the facilities and expand the operations of both companies. O. W. Trumbull vice-president and general manager of GREENE, TWEED & CO. will act in a like capacity for the spinning company.

PITTSBURGH EQUITABLE METER CO.-MERCO NORDSTROM VALVE CO. has opened new offices in Atlanta. C. C. Moore, who has been in charge of the Memphis office is district manager. The Memphis office has been closed and all southern operations will be handled through Atlanta.

THE JOSHUA HENDY IRON WORKS, Crocker-Wheeler electric division, Ampere, N. J., has appointed R. D. Ulrey manager of its newly opened office at 523 West Sixth St., Los Angeles. Mr. Ulrey was formerly associated with U. S. Electrical Motors.

AMERICAN BRAKE SHOE CO. through its Kellogg division has acquired the CROWN SPRAY GUN MFG. CO. of Los Angeles. Manufacture of spray gun equipment will continue under the direction of H. O.

Winkler, formerly president of the Crown company but now vice-president of the Kellogg division.

The Dorr Co., New York, is expanding it research and testing laboratories at Westport, Conn. The Westport mill contains all the offices and laboratories for problems of liquid-solid handling. The extension will increase the number of research laboratories and will provide an additional wet laboratory for specialized Dorr work.

Westinghouse Electric and Mfg. Co., East Pittsburgh, has appointed James H. Jewell assistant manager of industry departments. Mr. Jewell will continue to head the company's agency and specialties departments. In his new position he will supervise all activities of the industry departments except application data and training and general contract which will report to F. H. Stohr.

Atlas Powder Co., is establishing a central research laboratory near Wilmington. K. R. Brown, director of research for Atlas explained that this step was taken for necessary extension of research problems vital to the war effort and to relieve the crowded conditions of present facilities. Dr. R. S. Rose, Jr., will be the director of the new laboratory.

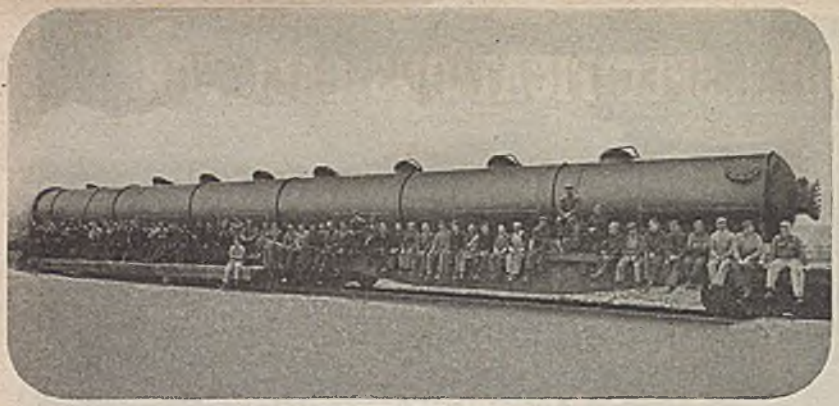
Interchemical Corp., New York, has established a trade sales division which will become the official outlet for all consumer products developed by the corporation, its divisions and its subsidiaries. Headquarters for the new division will be Paterson, N. J.

The American Pulley Co., Philadelphia, reports that Archie Chandler has retired from general sales management of the company. Mr. Chandler will return to San Francisco where he will continue as vice-president and will direct the company's sales and service on the West Coast.

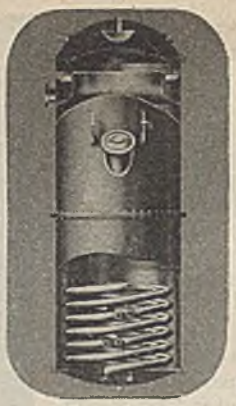
Templeton, Kenly & Co., Chicago, has brought A. C. Lewis into the company in the capacity of vice-president in charge of sales. Mr. Lewis originally went with the company in 1912 but later left to head his own company in Canada.

Lukens Steel Co., Coatsville, Pa., has appointed William Butler 3rd to the position of advertising manager for the company and its subsidiaries. Mr. Butler joined the company nine years ago as an apprentice in the research department. He succeeds George M. Gillen who recently was named assistant manager of combined sales for Lukens and its subsidiaries.

Fairbanks, Morse & Co., Chicago, has moved O. O. Lewis from Atlanta to serve as assistant sales manager at Chicago. V. O. Harkness has been named manager of the diesel engine sales division at Chicago. H. J. Renken has been made branch manager at Dallas. J. S. Peterson formerly a department manager at Cincinnati has replaced the late Stanley Eaton as branch manager and G. N. Van Epps has been moved from Chicago to act as branch manager at Atlanta.



ALL WELDED STEEL COLUMN
FOR SYNTHETIC RUBBER PRODUCTION



VACUUM PAN FOR
MILK & FOOD PRODUCTS

SELF-CONTAINED UNIT
FOR SOLVENT RECOVERY

ACME COPPERSMITHING & MACHINE CO.

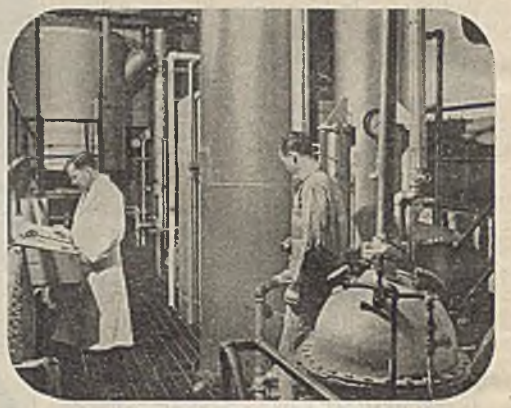
Versatility...

In the Process Industries, versatility demands the facilities, the experience, and above all the vision required to meet new problems successfully.

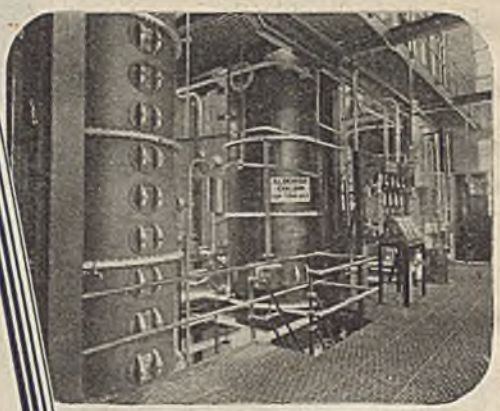
For many years, Acme has encouraged in its engineering department the ingenuity and the enthusiasm that lead to new engineering achievements.

It is because of this alert, creative attitude—coupled with expert craftsmanship—that Acme has been called upon so many times to assist in the development of a new process or in perfecting equipment for an old one.

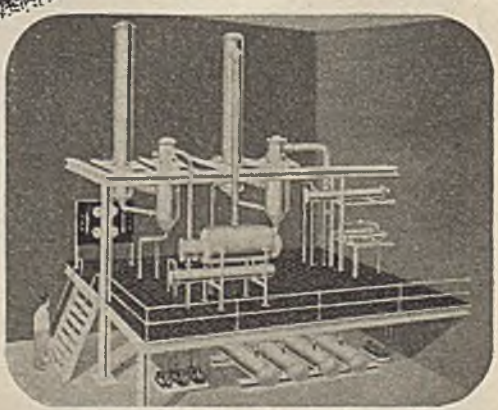
From the simplest unit to a complete plant, from pilot plant to commercial operation, Acme's modern facilities insure the most efficient and economic operation.



VITAMIN EXTRACTION PLANT



DISTILLATION PLANT FOR THE
PRODUCTION OF SUPERFINE ALCOHOL



TYPICAL PILOT PLANT INSTALLATION

ACME Processing Equipment

ACME COPPERSMITHING & MACHINE CO., ORELAND, PA.

Heat Transfer • Evaporation • Drying • Distillation • Absorption • Extraction • Crystallization

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

SMOKE ABATEMENT has been exalted into a moral obligation, especially in the esteem of the neighborhood housewives who are addicted to the old Monday morning convention. Woe to the malefactor whose unruly chimney besmirches the linen! The theory that neither a chimney nor a man has any excuse for smoking is not borne out in practice. When the design for our new steam plant was laid down in '31, the high volatile gas slack coal, plentifully available at our back door, offered maximum B.t.u. per dollar of cost. This coal could not be burned on stokers, and anyway, the lack of room for stokers, as well as numerous other conditions, pointed to pulverizers. Nevertheless, a youthful stoker salesman submitted as his only argument against pulverizers a sheaf of newspaper excerpts reporting lawsuits. Our advice was that he develop sales versatility by designing a pulverizer to supplement the famous stokers that his house built. A saving of a dollar a ton on an annual coal consumption of 85,000 tons left a large margin for a smoke washer. An electric precipitator, guaranteed to avoid lawsuits, was offered at $70,000. On the other hand, Brother MacKenzie of the Consumers Power Co. of Jackson, Michigan and Guy Randall of the Champion Coated Paper Co. of Dayton, Ohio, generously supplied the data of their experiences with a practical smoke washing device from which the design illustrated was evolved.

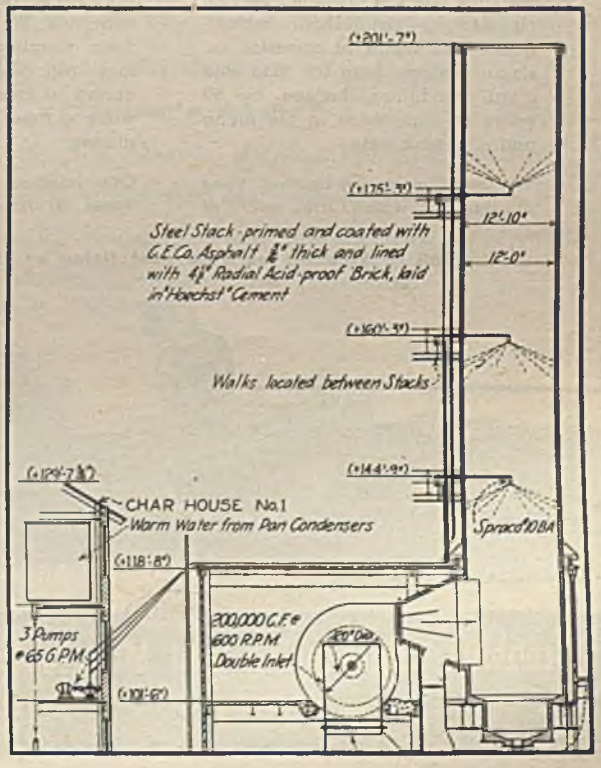
AT THE INCEPTION of plant operation the Old Man's idea was to cover the entire gamut of operating complexity at once. He wanted all of the children's diseases to come out immediately. He bought the dirtiest, slag- and smoke-infested coal available. In retrospect we believe it would have been advantageous to have postponed this headache with the preliminary use of smokeless coal and thus to allow more time for learning and acquiring operating proficiency in respect to other complications. With accumulated experience and adjusted equipment, we are now able to burn the most offensive coal with a reasonable assurance against neighborhood reverberations.

WHEN THE FIRST black cloud issued forth before the washer installation was completed, Imogen Oakley, the Civic Club's official smoke inspector, observed it from the roof above her apartments in the Bellevue Stratford. The operators had not learned to interpret the temperature and CO_2 readings on the instruments. Inspector John Lukens dropped in to pay his respects. The neighborhood housewives raised a fury. The corner saloon, where political action focuses, called a meeting. The next day a crowd of ward leaders, politicians and neatly dressed housewives swooped down on the smoke inspection department at the "Hall". Every time somebody caught a particle of dirt in their eye, we received the blame because of our obnoxious smoke effusions—and this in spite of the fact that good Providence provided a prevailing wind that blew our smoke in the opposite direction across the mile-wide Delaware.

JOHN LUKENS suggested to the crowd that they curb their wrath. He offered to take them down to the plant and introduce them to a hard-working bunch of operators who are entitled to forebearance. John and the Commentator led the guests through the works from top to bottom and showed them the stack gas washer that would shortly be in operation. At the conclusion, they went their way rejoicing. Then Madam Oakley and a companion came dragging John Lukens by the hair and bringing a lady reporter from an evening paper. They had blood in their eyes! However, by this time the gas washer was in operation, pumping 16 tons of water into the stack per hour, and beside, the operators were acquiring the technique. Mrs. Oakley dunked her hands into a bucket of slurry caught under the stack washer discharge and brought up a handful of ash to show that the washer was performing. The ladies were happy. We provided the bewildered reporter with a plant description which she wove into her feature story that appeared in the paper a few days later. The only faux pas was charged to Superintendent C. R., usually the master with the ladies. By way of a parting gesture in his luxurious office, he brought out a bottle of rare Scotch—doubly rare in 1932! John and two of the ladies partook with gusto, but Madam Oakley bristled! However, the plant and the neighbors settled down to peaceful cooperation and objections ceased.

A KIBITZER got past the watchman by the password of Smoke Inspector and asked to see the Engineer "privately". He stated that there had been complaint about our stacks. We called his attention to the clarity of the gas and told him our gas washing apparatus was working perfectly. And in addition, for the past week the wind had been blowing across the Delaware which precludes the

Details of spray-type gas washer installed in stacks shown in photograph at the upper left of the page. It is now possible to burn the most offensive coal with a reasonable assurance against neighborhood reverberations



possibility of any complaint from the direction of Shackamaxon Avenue. This took the wind out of his sails and he said that the complaints actually were made against certain neighborhood plants. He had recently been assigned to our territory to make weekly visits and he wanted to make a good report! He inquired if the sugar business was good and if we make cubes. He desired especially to try our sugar and would appreciate having a sample package—but "Don't tell John about it!" He would also accept a 5-gallon can of ethyl alcohol. We chased the imposter out of the door.

THE WALKWAYS which are provided for accessibility to the sprays served an unexpected purpose. One night a Philippine sugar ship docked at pier 47 opposite the boiler house. The sailors had a cageful of little monkeys which they sold at four bits. Two of these got away and made a tour of the refinery. The next morning they were found suspended by their tails from the topmost landing which is about 175 ft. above the ground.

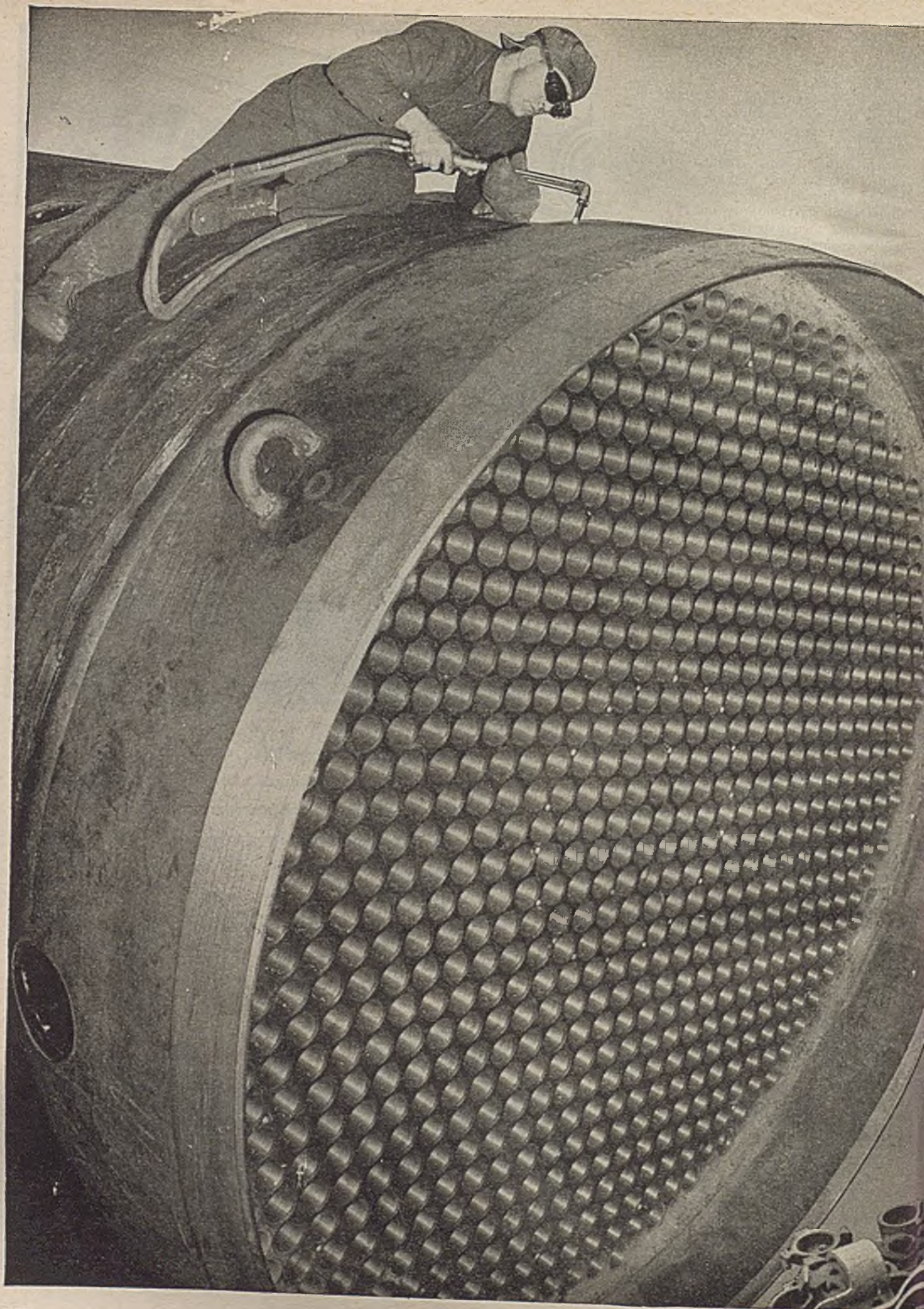
TO SPAN THE DELAY in the delivery of the special cast iron pipe required to resist the attack of the soot slurry, a steel pipe was temporarily installed. In a couple of weeks little geysers developed in the pipe. Operation was maintained with bandages of old inner tubes till the new pipe arrived. On an occasion while the washer was out of commission and the wind was unpropitious, the stack emitted a particularly black cloud. Shortly thereafter, a message was delivered to the Engineer requesting him to call the Principal of the Chandler School which was directly under the cloud a few blocks away! All the Principal wanted was permission to take her "opportunity class" (euphemism for rascality) through the refinery. Could she come in? You bet she could! It required one police sergeant, two teachers and three refinery attaches to keep the dozen kids on the right track. When they finally reached the end of the trip, they had their pockets bulging with sugar samples and they yelled an enthusiastic vote of thanks. Smoke or no, some good-will was engendered.

ON THE OTHER HAND the optimistic West Coast promoters needed smoke for an important purpose. The old sugar house at Fallon, Nevada, was an ill-assorted conglomeration of equipment gathered from Watsonville, California and other abandoned factories. It was built in the desert in expectation of exploiting the drawing power of a new government irrigation works. The soil and the new settlers did not at once take to beets. The promoters needed a prospectus to attract investors. The picture that their photographer sent to the printer showed that Chief Engineer Tom Powers was firing efficiently as the haze above the stacks was just barely visible. The promoters averred that the plant looked dead. They sent the photographer back and Tom accommodated them with a rope of black smoke unequaled in Pittsburgh.

A RANDOM SELECTION in the telephone directory for a mimeograph service brought a representative with samples of his work and a photograph of his shop. Close observation of the photograph disclosed that the operatives, above 40 in number, possessed structural deficiencies. Paralysis had left one young woman with a withered arm. Another had lost control over her legs. A third was hunchbacked. However, for each a job was found which she could carry out efficiently and extract therefrom the exhileration of useful accomplishment. Upon inquiry it was learned that the financial angel of this institution, that is, the fellow who makes up the deficits, was one, Frank B. ("Daddy") Allen. He is, in fact, the very man who heads the outfit that built the ash pipes mentioned above. To put over a job such as he did requires hard cash and a soft heart and Daddy Allen is known in every great power plant in the land for his flint-like castings. A man of high moral quality at home cannot perform indifferently at his craft.

BOB SMITH finished college as a master in chemistry and straightway matriculated in an irrigation construction outfit in the Wyoming desert. After a summer's work he had acquired a high degree of skill as a mule skinner. Bob then moved from the irrigation ditch into the laboratory of a beet sugar house and by rapid strides reached the top technical job with the great Holly Sugar Corporation whose plants are scattered throughout the West. Observation of Bob's qualities leads to the conclusion that a semester's association with mules developes rare and highly prized characteristics both human and technical. They include cooperativeness and the generous concession of the right to a difference of opinion. The reader may select a variety of implications from this episode of Bob's. The Chronicler's choice is the lesson of cooperation. It is advantageous for a leader like Bob to acquire early in his career the ability to bend stubborn resistance to his purpose. God made both mules and men, and in each He implanted a certain degree of plasticity. The metal of a machine is frequently more plastic than the mind of an operative. It is therefore expedient on occasion to remold cast iron to promote harmony and efficiency.

DAVE GARDOPEE possessed expertness in electrical wizardry far out of proportion to his bantam size. He was one of those fellows who insisted on doing everything himself. He couldn't get along with his helper. One day the chief gave him a new helper, who was the biggest man we ever had in the plant. The big fellow towered 6'-4", and weighed 250 pounds. Dave weighed 115. When Dave required to do some work that was beyond his reach, the big fellow hoisted him aloft, and held him there as a waiter holds a tray till the job was done. Occasionally when some small motor, not over 50 pounds in weight, had to be brought to the shop, Dave would march ahead with the motor on his shoulder, while the giant trundled along behind, carrying an extension cord.



PROBLEM SOLUTIONS
IN HIGH-TEMPERATURE HIGH-PRESSURE DESIGN

This vessel is a typical example of the cooperative effort of Babcock & Wilcox and customers' engineers in designing and producing process equipment. Designed for operating temperatures of 750 F.-1200 F., with wide fluctuations, at 135 psi, and with the large number of tubes in the one sheet, the vessels presented a very difficult design and stress-distribution problem.

B&W engineers, backed by a fund of such experience and the most up-to-date laboratory and production equipment, are always at your service to aid in solving similar high-pressure, high-temperature problems in process equipment design.

ALLOY CASTINGS

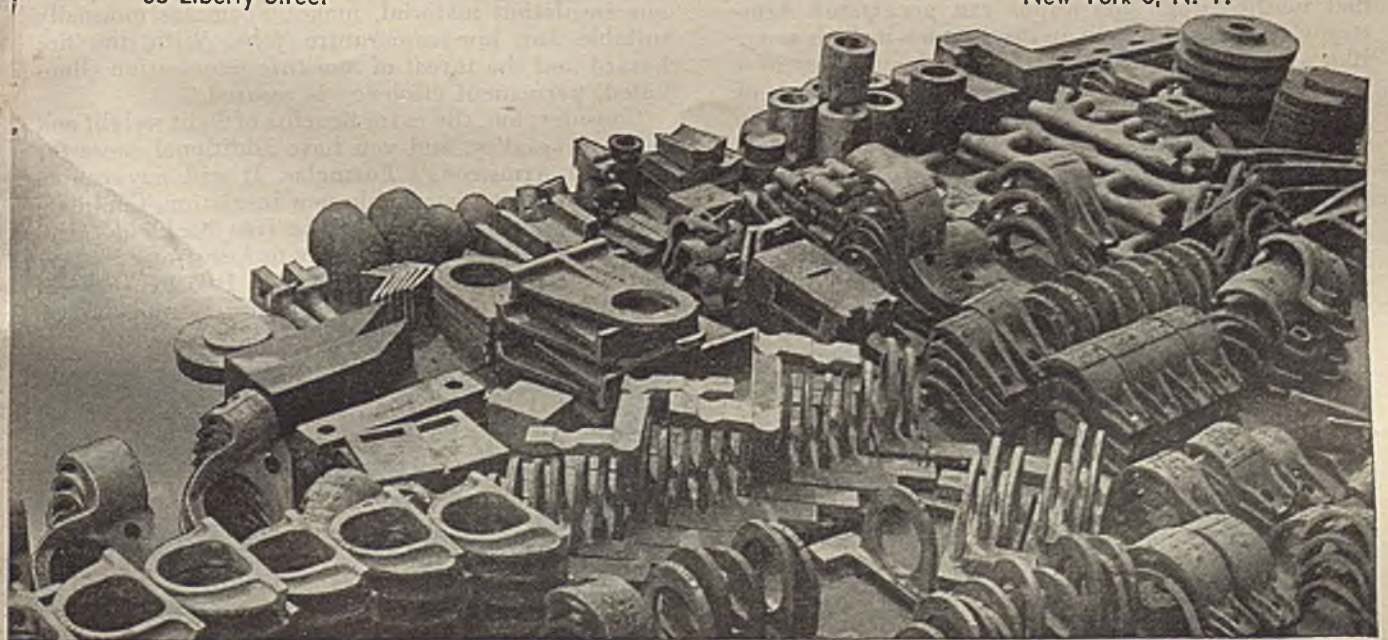
No service failures have been reported, in more than two million pounds of B&W oil still tube support castings operating at temperatures as high as 2000 F. Other castings produced, some of which are shown below are: soot blower elements, heat-treating furnace parts, lead-melting wire annealing pots, cement mill castings, paper mill and chemical plant castings, boiler castings, baffles, impellers, oil burner nozzles and rolling mill plugs.

S-46T

BABCOCK & WILCOX

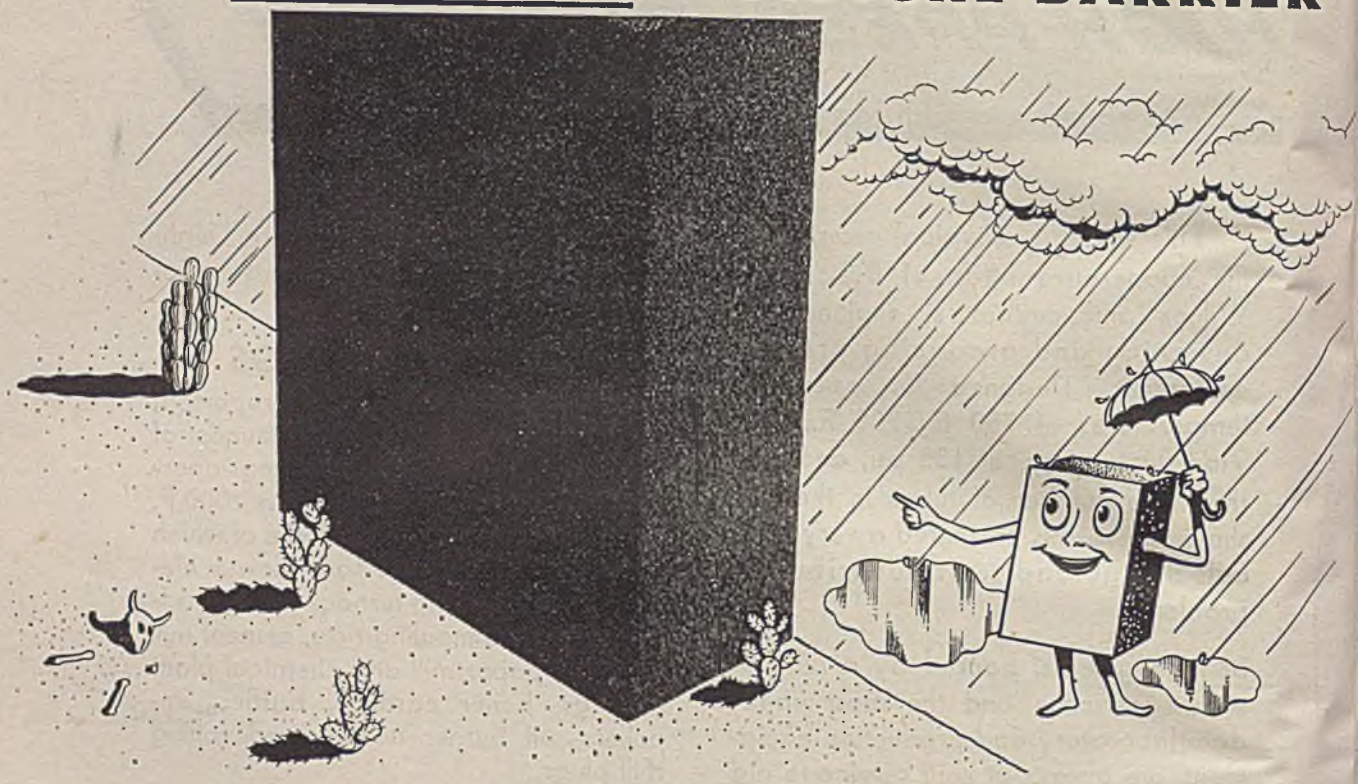
THE BABCOCK & WILCOX COMPANY

85 Liberty Street New York 6, N. Y.



FOAMGLAS

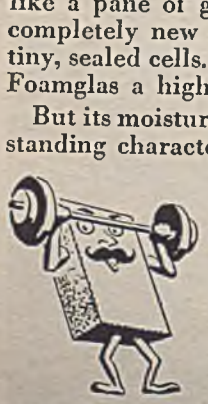
IS A PERMANENT MOISTURE BARRIER



This new low-temperature insulation is also fireproof and structurally strong

DO YOU NEED an efficient, low-temperature insulation that neither water nor vapor can penetrate? Armstrong's Foamglas is such an insulation—it sheds water like a pane of glass. In fact, Foamglas is glass in a completely new form. It's made up of thousands of tiny, sealed cells. These minute sealed air spaces make Foamglas a highly efficient insulating material.

But its moistureproof property is just one of the outstanding characteristics that make it an ideal insulation for low-temperature work.



STRUCTURALLY STRONG — This is another important Foamglas advantage. It has an average compressive strength of 150 pounds per square inch. Thus, walls of the material are self-supporting.

FIREPROOF—Armstrong's Foamglas eliminates fire hazards. Like other forms of glass, *it will not burn.* This can be demonstrated easily by exposing a piece of the material to open flame.

The combination of these important properties in one insulation material, makes Foamglas unusually suitable for low-temperature jobs. With the fire hazard and the threat of moisture penetration eliminated, permanent efficiency is assured.

Consider, too, the extra benefits of light weight and easy workability, and you have additional cause for choosing Armstrong's Foamglas. It will pay you to investigate this remarkable new insulation. Complete physical data are given in the free booklet, "Armstrong's Foamglas." Write today to Armstrong Cork Company, Building Materials Division, 3301 Concord Street, Lancaster, Pennsylvania.

ARMSTRONG'S FOAMGLAS

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CONVENTION PAPER ABSTRACTS

CRACKING-COIL TUBES

CRACKING, both thermal and catalytic, constitutes one of the most important basic operations in the production of aviation-gasoline components. Although the various catalytic units completed or under construction may be counted upon to make the greatest possible contribution to this production, the time and material availability elements clearly indicate that we must continue to look to existing thermal-cracking equipment for further additional olefins and aromatics. From such equipment must come the marginal aviation-gasoline components which will do much to determine how quickly this war is won.

A method is proposed for calculating the safe working life of cracking-coil tubes as a function of the internal oil pressure, the tube material and dimensions, and the outside tube metal temperature. It is shown that:

$$T' = 11.4 \left(\frac{F}{f}\right)^N$$

where T' is working life in years, F is the equivalent of the metal in pounds per square inch, f is the stress on the tube metal in pounds per square inch, and N is a constant depending on the tube material. Also:

$$f = RP/1.2t,$$

where R is the outside radius of the tube in inches, P the pressure in the tube in pounds per square inch, and t the tube wall thickness in inches.

It is believed that aviation-gasoline component production in existing thermal-cracking equipment could be increased considerably by widespread application of the method of tube-life calculation given if a one- to three-year safe tube life is felt to be justified by the need for this product.

P. J. Harrington, M. S. Northup, and C. O. Rhys, Sr., Standard Oil Development Co., Elizabeth, N. J., before the 24th annual meeting of the American Petroleum Institute, Chicago, Ill., Nov. 9, 1943.

TREATING WASTE PICKLE LIQUORS

EXTENSIVE investigations were carried out by the American Iron and Steel Institute's fellowship on the use of several types of organic compounds including alcohols, ethers, hydrocarbons, ketones, acids and esters to separate the ferrous sulphate and free sulphuric acid in waste pickle liquors obtained from batch and continuous strip picklers. Acetone was selected for detailed quantitative studies.

A process was developed, which included making some special equipment, whereby approximately 87 percent of the iron sulphate was removed from the waste liquor. About 93 percent of the free acid in the liquor was recovered. Acetone losses in process were reduced to approximately 1 percent.

The possibility of reusing the recovered sulphuric acid for cleaning steel surfaces was investigated. Recovered acid, made up to pickling strength by addition of concentrated acid, was used through six cycles of pickling and recovery of acid by applying acetone in the differential solubility process (U. S. Patent 2,322,134). The results of this laboratory-scale pickling of small steel plates were considered to be quite satisfactory by experienced pickling department foremen. The big problem remaining is how to utilize the large amounts of copper as recoverable from the spent pickle liquors. The use of more iron salts in the purification of water supplies and in sewage treatment offers favorable possibilities for investigation in cities located near iron and steel plants.

Willard W. Hodge, West Virginia University, Morgantown, W. Va., L. L. Friend, Jr., and Richard D. Hoak, Mellon Institute of Industrial Research, Pittsburgh, Pa., before the American Chemical Society, Pittsburgh, Pa., Sept. 6-10, 1943.

INSPECTION OF PRESSURE VESSELS AND PIPING

METHODS of inspecting welding, namely visual, radiographic, sampling, and magnetic powder, are all applicable to pressure vessels and piping. Except for specific requirements of pressure vessel codes, any decision as to what method of inspection should be followed must be based on the nature of the information desired.

The visual method of inspection is applicable primarily only while the weld is being made. While the contour of a finished weld may furnish some information regarding its probable soundness, provided that there is knowledge of the manner in which the parts were prepared for welding, such surface inspection cannot be expected to give any positive knowledge of the soundness of a weld.

Visual examination of a weld as it is made affords an opportunity to determine that the parts have been properly prepared, acceptable materials are being used, that the welding operator is keeping the weld free from serious slag inclusions and that the weld is being fused to the base metal. The visual method is productive of reliable results provided competent welding operators are used, the inspector is capable, and inspection is extensive enough to watch every inch of the welding.

Radiographic inspection may be carried out by the use of X-ray or by gamma-ray. The former is accomplished by use of an X-ray tube and the latter by a capsule of radium or radium material. The X-ray method is most generally applicable in the shops of manufacturers of pressure vessels although some X-ray examinations have been made in the field. Field examination is limited because of bulk of the equipment, while the gamma-ray method involves equipment of relatively small bulk.

Radiographic inspection is most suitable on butt welds where both sides of the weld are readily accessible. The method is less applicable to welds attaching nozzles to shells. Either method of radiographic examination as commonly used furnishes a record on a photographic film. The principle of either is that any defect, such as a slag inclusion, porosity, certain types of cracks and serious lack of fusion, do not

absorb the penetrating ray to the same degree as solid weld metal or base material. These defects are shown on the film as dark areas. Interpretation of such evidence requires some degree of experience.

There are certain types of cracks or lack of fusion that are not detected by X-ray examination as ordinarily applied. It should be understood that the plane of the crack must be parallel to the penetrating ray, or nearly so. Fortunately, a crack of any depth in a butt weld will usually be in that plane and can, therefore, be detected by radiographic examination.

Sampling inspection of welding may be carried out either by trepanning of plugs or by removal of a boat-shaped specimen. Either method removes samples from the welded seams at selected points definitely under suspicion or selected at random to get an idea of the average quality of the weld. When plugs are removed by trepanning, the hole so made is sometimes closed by a threaded plug which may be seal welded for tightness or a plug may be welded into the hole. There has been some objection to this method of examination when the hole is closed by welding, as some have felt that severe stresses are set up by welding in a constricted place. The boat-shaped specimen removed by the Weld Prober provides material that can be tested in several ways such as for soundness, tensile strength, and ductility. The opening left lends itself readily to rewelding without great difficulty.

The magnetic powder method involves magnetizing the portion of the weld to be examined and then applying a suitable paramagnetic powder, such as iron filings, to the surface. When properly magnetized, the powder will gather at any crack that extends to the surface and may also reveal sub-surface defects provided they are not too far below the surface and are of sufficient magnitude to provide the magnetic field at the surface to hold the powder.

Inasmuch as cracks which develop in welds as they are being made are one of the most serious types of defect that may be encountered and are frequently difficult to detect except upon a most minute examination, the magnetic powder method of inspection is valuable for use as a weld is being made. This method has been used for each layer of welding as applied, and where radiographic methods were not available, and in many instances cracks have been found which were repaired before further welding was done.

W. D. Halsey, Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn., before the 24th annual meeting of the American Welding Society, Chicago, Ill., Oct. 18-21, 1943.

EXTRACTION OF AROMATICS FROM GASOLINE

SEPARATION of aromatics from non-aromatics in a hydrocarbon mixture is shown to be possible by the use of two miscible solvents. Equilibrium or solvent/feed ratio is not fixed by the operating temperature as with single solvents, since the ratio of the solvents can be varied within limits to suit required conditions. A wide choice of solvents is available for a mixture of components and similar properties.

Use of rectangular coordinates is shown to represent a hydrocarbon system with methanol or dipropylene glycol and ethylene glycol as the mixed solvents by experimental and pilot plant work with paraffin-naphthene-aromatic mixtures. The equilibrium and solubility diagrams should be determined for the aromatic and the most soluble non-aromatic component of lowest molecular weight to be encountered in gasoline extraction.

Results for the operation of a 42-ft. packed column in continuous extraction of several cracked gasolines with extract reflux show that all aromatics are readily separated from paraffins. Olefins and naphthenes are distributed between extracts and reaffinate in proportion to their initial ratio with the aromatics. The efficiency of the column used was inadequate to eliminate more than 93 percent of the paraffins and naphthenes present in the feed. The recovery of aromatics was 90–100 percent when operating for maximum aromatic concentration in the extract. By distillation and chemical treatment of the extract from a whole gasoline, commercially pure aromatics are ultimately obtainable.

Allen S. Smith and J. E. Funk, Blaw-Knox Division, Blaw-Knox Co., Pittsburgh, Pa., before the American Institute of Chemical Engineers, Pittsburgh, Pa., Nov. 16, 1943.

DUSTS FOR KILLING GRAIN WEEVILS

Some interesting research on the use of fine dusts as insecticides, particularly in dealing with the grain weevil and similar pests, has recently been reported. One method used in testing the potency of dusts as insecticides was to mix with 50 grams of wheat containing approximately 14 percent moisture, in equilibrium with air of about 70 percent relative humidity, a weighted amount of the dust under test. This was usually 1 percent by weight of the wheat. Fifty healthy adult weevils were put on the prepared wheat in a tube closed with muslin and thermostatically held at 73.4 deg. F.

A large variety of materials has been tested, including fine diamond dust thoroughly purified by treatment with benzene or other solvents. This and carborundum dust proved very effective in killing weevils, and it was concluded provisionally that the lethal action of mineral dusts is purely physical, and that it is a surface action affecting the outer casing of the insect. It was found that humidity plays an important part.

In the search for a dust insecticide for production on a large scale, it was concluded that the hardness of the material must be at least 6.5 on the Moh scale and that the dust must be very fine, with particles mostly under 10 mu and a large proportion between 1–5 mu. It would be well, of course, if the dusts did not contain free silica, so as to eliminate the risk of silicosis among workers.

Wet and dry grinding have been compared in respect to efficiency. It has been established that the nature of the liquid used in wet grinding is immaterial except as it affects speed of grinding. The difference in insecticidal efficiency between wet and dry varies with the material ground. It

is large for quartz, clinker and magnesite, but practically nil with sapphire, rutile and activated gas-mask carbon. Precipitated material chemically prepared will often be as effective as wet-ground material. The so-called micronized powders are no better than wet-ground products.

H. W. A. Briscoe, The Imperial College, London, England, and G. W. Cass, Middlesex, England, in *Food Industries*, January, 1944.

ELECTROLYTIC TIN PLATE

ELECTROLYTIC tin plating is one of the outstanding contributions made by electrochemists in the last ten years. Some idea of the magnitude of the potential field that has been opened up to electroplating can be obtained from the yearly tinplate production figures. These data are impressive tonnage-wise but are more striking when expressed in terms of area. In 1941, the tinplate mills in the United States produced enough plate to form a continuous strip 30 in. wide and well over 1,000,000 miles long.

Successful introduction of electro-tinplate as a wartime substitute for hot-dipped plate is a significant contribution of the electrochemist. It is not practical to apply tin coatings by hot dipping that are less than 1.25 lb. per base box. Plate bearing a 0.5-lb. per base box electrolytic tin coating, inside- and outside-enameled, is therefore being substituted for many food products. This results in a substantial saving of tin.

After the war, it is expected that 0.5 lb. electrolytic and cheaper plates will find considerable application in containers for non-processed products. Whether or not electrolytic plate is used for processed cans probably depends upon the weight of electrolytic tin coatings which will be required to give a service life equal to that obtained with standard hot-dipped plate, and also whether or not such a coating can be applied more economically by electrodeposition or hot dipping. At present, cans made of 0.5-lb. electrolytic plate must be inside- and outside- enameled to provide performance approximating that obtained with hot-dipped plate, and double-enameled electrolytic plate costs more than plain hot-dipped plate. If the corrosion resistance of electrolytic plate is not improved to the point where enameling is made unnecessary, the return to hot-dipped tin plate for processed food cans after the war is indicated.

K. W. Brighton, research department, American Can Co., Maywood, Ill., before the Electrochemical Society, New York, N. Y., Oct. 15, 1943.

TREATMENT OF DISTILLERY WASTE WITH BENTONITE

AQUEOUS dispersions of bentonite, when added to distillery waste, precipitate the soluble and suspended proteins in a form which is easily filtered or centrifugally clarified. Under optimum conditions of temperatures of 40-50 deg. C. and a pH of 3.5-4.0, practically complete removal of the proteins is effected. The precipitation is probably electrochemical insofar as

suspended proteins are concerned, while the precipitation of those in solution occurs as a double salt—the hydrous aluminum silicate in combination with the amino nitrogen group of the protein molecule.

Bentonite was found to be the most efficacious of a number of clays and other protein precipitants investigated. It was equally effective for rye and bourbon stillage and for the press waters from brewery sparging operations.

Samples of the hot "thin slops" directly from the reels or presses were collected in sterile containers and stored at a temperature just above freezing until used. No additions or adjustments of pH were made. Acids, alkalies, and other electrolytes adversely affected protein removal.

A comparatively small amount of bentonite (0.3-0.8 percent, depending on the type of stillage) added in the form of a 7 percent dispersion, was required. Reaction took place during the time required for thorough mixing. The reaction mixture filtered rapidly, and nitrogenous residues as determined by a semi-micromethod, were very low. Solids in filtrates consisted chiefly of carbohydrates and minerals, and the 5-day B.O.D. of filtrates was usually between six and eight thousand parts per million. The stock feeding value of protein recovered is believed to be unimpaired except for increase in ash content, and may possess physiological virtues.

Robert R. Fulton, Mellon Institute of Industrial Research, Pittsburgh, Pa., before the American Chemical Society, Pittsburgh, Pa., Sept. 6-10, 1943.

COMMERCIAL MANUFACTURE OF LACTIC ACID

In the United States, lactic acid is made by the fermentation of (1) solid hydrolyzates of various degrees of purity (2) molasses or (3) whey. Edible and higher purity acids may be made from any of these substrates, as well as crude acids.

A wide variety of process technique is employed, depending to some extent upon the starting substrate as well as preference of the producer. In some cases the substrate is refined, while in others calcium lactate is crystallized out as the primary refining step, while in still others solvent extraction is employed. Crude acids are largely characterized by the starting substrates and methods of processing. The factors, however, have little, if any, effect on the better grades.

Corrosion is probably the greatest problem in lactic acid technology. No wholly satisfactory materials have been found. Metals, other than noble metals, are corroded; ceramics are resistant, but low in heat transfer capacity; some resins and some rubbers are satisfactory, but likewise cannot be used on heat transfer surfaces; wood also has its limitations.

United States production of lactic acid is probably double the pre-war level. Existing manufacturing installations are now operating at capacity. New, additional installations at larger volume levels may present some opportunity for decreased prices, which in turn may permit expanded uses.

George T. Peckham, Jr., Clinton Co., Clinton, Iowa, before the American Chemical Society, Pittsburgh, Pa., Sept., 1943.

FOREIGN LITERATURE ABSTRACTS

WOODEN RECTIFICATION COLUMNS

PRACTICAL experiments have shown that wooden rectification columns are not inferior to those of metal for distillation of alcohol. For the sake of comparison, work was done with both wooden and metal columns, using a water-alcohol mixture. The wooden columns were one meter high, had an inside diameter of one inch and were filled with small pieces of glass tubing. The attached table shows the concentration of alcohol (at 15.5 deg. C) at different stages in the two types of experimental equipment. Anhydrous alcohol could not be obtained with an initial mixture of alcohol and water, since such a mixture forms an azeotropic solution with a minimum boiling point. This handicap can be overcome by the addition of a third element, such as benzene or ethylene chloride.

Advantages of the wooden columns are their low cost, their simple construction (they do not require skilled labor for installation), and their efficiency. Such a wooden column is being used commercially at present in a plant in Sao Paulo, Brazil. This installation has a distilling capacity of 150 l. per hr. The column, which is 9.8 m. high, has a rectangular cross-section, and is packed with charcoal. The alcohol content of the product is 92 percent.

Digest from "The Use of Wood in the Construction of Rectification Columns," by Julio Rabin, *Anais da Associacao Quimica do Brasil*, II, No. 2, 121–126, 1943. (Published in Brazil.)

Concentration of Alcohol at Different Stages in Two Types of Experimental Equipment

Wood Column				Metal Column			
Alcohol Concentration, Percent by Volume			Loss of Alcohol, Percent	Alcohol Concentration, Percent by Volume			Loss of Alcohol, Percent
Initial	Distilled	Residue		Initial	Distilled	Residue	
43	85	5.5	2.0	44	82	6	1.5
81	86	52	1.5	82	86.5	56	1.5
86	92	76	1.4	86.5	92.5	74	1.2
92	94.5	83	1.5	92.5	94.5	84	1.5
95	95.5	90	1.5	94.5	95.5	94	1.5
96	96.5	95	1.5	96	96.5	94.5	1.5

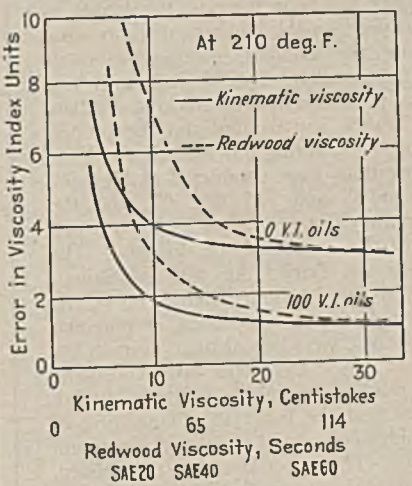
VISCOMETRY

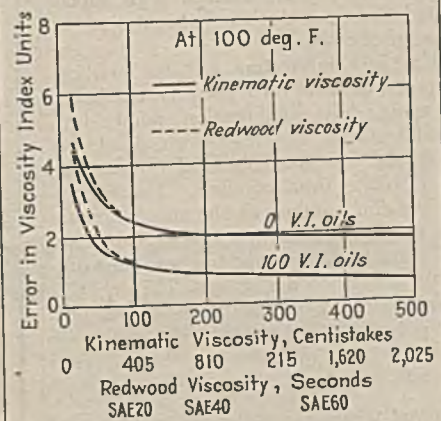
ONE of the reasons for the call for greater accuracy in viscosity determinations is the adoption of the viscosity index system for comparing viscosity-temperature relations of lubricating oils. V.I. figures are calculated from viscosities determined at 100 and 210 deg. F. The effect of 1 percent errors in these determinations on the calculated V.I. is shown in the accompanying illustrations. Curves similar to these for the Redwood would apply for the Saybolt and Engler.

It is one of the peculiarities of the V.I. system that the greatest accuracy is required in the determination of the 210

deg. F. viscosity, particularly at low values. These are just the conditions where the efflux instruments fail, due not only to the high temperature introducing technique troubles, but also to the short efflux time, when efflux is no longer proportional to viscosity.

Capillary instruments of recent design are superior in almost every respect to the efflux type. They are capable of greater





Error introduced into viscosity index by 1 percent errors in determination of viscosity by Redwood and kinematic methods.

accuracy. They practically eliminate the effects of technique and are simpler to manipulate so that inexperienced operators can obtain excellent results. With choice of capillaries, individual determinations average shorter time than with efflux instruments, and for routine control work where a number of tubes can be used in rotation, much greater speed is obtainable than with a four-compartment set of efflux viscometers. The technical instruments have their own localities and use: the Redwood in British countries, the Saybolt in the United States, and Engler in Europe. The capillary instruments, on the other hand, give results in absolute units which have world-wide recognition and therefore obviate the endless arguments which have occurred over conversion tables with former viscometers.

The only advantage which the efflux viscometers can claim is their robust construction. This advantage is largely lost when compared with some of the modern capillary viscometers where the instrument need never be removed from the constant temperature bath except for periodical

cleaning with chromic acid, the solvent and oil from routine cleaning operations being drawn off through a permanent vacuum connection to a trap.

Digest from "A Critical Review of Viscosity Determination," by C. H. G. Smith, *Journal of the Australian Chemical Institute* 10, No. 2, 45–60, 1943. (Published in Australia.)

SYNTHETIC LUBRICATING OILS

Work has been done in the USSR in recent years on the synthesis of lubricating oils by the catalytic polymerization of cracking distillate. Special work was done on the polymerization of cracking distillate from ceresin and paraffin and the properties of the resulting oils studied.

Operations were conducted at temperatures of 65 and 125 deg. C., and the aluminum chloride catalyst used was 3 percent of the weight of the distillate. The reaction was carried out with continuous agitation for 30 hours and 3 hours, respectively. Upon completion of polymerization there were two distinct layers in the reaction vessel, the upper layer consisting of a solution of oil in saturated hydrocarbons and the lower layer consisting of a complex compound of oil and aluminum chloride. The upper layer was neutralized, washed with water, distilled with superheated steam, and then concentrated to the desired viscosity.

The best lubricating oils for aviation purposes, as far as their viscosity, resistance to aging, low solidification point, low specific gravity and high flash point are concerned, are those obtained from cracking distillate from paraffins. The higher the paraffin content of the raw material, the better the resulting oils. Qualitative and quantitative properties of the oils synthesized at 65 deg. C. and 125 deg. C., respectively, are practically the same, but the polymerization process takes place almost 10 times as fast at the higher temperature.

Digest from "Synthetic Oils from Cracking Distillates," by M. G. Mamedli, *Zhurnal Prikladnoi Khimii* XVI, No. 3–4, 143–151, 1943. (Published in Russia.)

UTILIZATION OF GAS FROM SEWAGE SLUDGE

Gas produced as a byproduct of sewage treatment consists of 60-80 percent methane and 20-30 percent carbon dioxide. Its composition and quality vary with changes in temperature, pH of the sludges being digested, and other biochemical factors. In Sao Paulo, Brazil, the average per capita production is 31.4 l. of gas per day from 250 l. of sewage per person per day. This gas can be used (1) to heat the sewage digesters, (2) to furnish the plant with motive power, (3) to be added to illuminating gas, (4) to run motor vehicles, (5) to supply methane for industrial purposes, and (6) to dry or burn the sewage sludge.

Use of this gas for running trucks and passenger cars is of particular interest now that there is such a shortage of gasoline. This application is still in the experimental stages, although it is in practical use in Johannesburg, South Africa. Tests were made on a 6-cylinder, 2.5-ton truck, using gas containing 72 percent methane and 28 percent carbon dioxide. The theoretical gas-air ratio for complete combustion was 6.85 volumes of air to one volume of gas.

Starting and acceleration were slow with the sewage gas but the motor ran more smoothly than with gasoline at a speed of more than 35 miles per hour. In a 69-mile run at an average speed of 18.4 m. per hr. the truck used approximately 19 cu. ft. of gas per mile.

Digest from "Sewage Gas—Its Utilization," by Heitor Pinto Tamelrao, *Revista Brasileira de Quimica* XVI, No. 91, 39–40, 1943. (Published in Brazil.)

TERPENE SOLVENTS FROM CITRUS OILS

SINCE imported solvents such as turpentine are now difficult to procure, the National Institute of Technology at Rio de Janeiro has been conducting a series of investigations on possible substitutes for use in the paint and varnish industry. The terpene hydrocarbons are more like turpentine than any other compounds. They occur in certain essential oils, particularly those of citrus fruits, and orange oil has a terpene content of more than 90 percent.

Comparison tests were run on a mixture of such terpenes and on a turpentine for application in paints and varnishes. The following properties were determined: appearance, color, odor, density, index of refraction, power of rotation, boiling point, rate of evaporation, residue at 100 deg. C., and degree of polymerization. A study was also made on the solubility of this mixture in various solvents as well as its action on drying oils and other ingredients used to make up paints and varnishes.

Samples of Duco enamel diluted with the terpene mixture and with turpentine, respectively, dried at an equal rate and formed films which were equally durable and brilliant. A varnish prepared with the two solvents had the same color, but different odors. The resin dissolved more readily in the citrus terpenes and the resulting varnish was easier to apply, dried much more rapidly and produced a more resistant film. The best varnishes were produced from the fraction distilling at 175–176 deg. C. This is chiefly limonene.

Digest from "The Application of Citrus Oil Terpenes as Solvents," by Waldemar Raoul, *Anaida Associacao Quimica do Brasil* II, No. 1, 48–56, 1943. (Published in Brazil.)

SHALE TAR PHENOLS

A PLANT in Estonia is now cracking shale tar for production of benzine. A crystalline phenolic product has been isolated from the cracked tar and was subjected to analysis and study in order to determine its character. The crystals were of a brownish color and were impregnated with oil. Since they did not dissolve in benzene, the crystals could be washed free of the oil in this solvent, then re-crystallized from water and purified by sublimation. Their properties were found to be as follows: molecular weight = 136.6, OH content = 25.0, C = 69.51, H = 7.39, O = 23.10, melting point = 148 deg. C. Preparation of several derivatives showed the product to be 2,6-dimethyl hydroquinone.

Digest from "Phenols from Shale Tar," by V. A. Lanin and M. C. Gorokkolinskaya, *Zhurnal Prikladnoi Khimii* XVI, No. 1–2, 47–49, 1943. (Published in Russia.)

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NATURAL AND SYNTHETIC

TREES AND TEST TUBES. *By Charles Morrow Wilson. Published by Henry Holt & Co., New York, N. Y. 352 pages. Price $3.50.*

Reviewed by James A. Lee

THE AUTHOR obviously has written the book for popular consumption and has done a good job of making the subject dramatic and interesting. His descriptions of the Amazon Valley, Sumatra, and other growing areas are extremely colorful and well done. Much of his material no doubt is correct and the average layman can get an interesting account of the development of the rubber industry in the world even though he may shudder to think of the hardships of poor Juan Fialho, the typical seringueiro, a harvester of Amazon hevea rubber.

Having recently returned from an inspection of the efforts that are being made to increase the collection of rubber from the Amazon basin in Brazil and Bolivia, I found Mr. Wilson's description of that jungle and the life of the seringueiro accurate and interesting.

As he so well explains, the difficulties of getting rubber out of the country are tremendous. The wild rubber trees average one to an acre. They are separated by the thick, dense growth of the jungle and once the latex has been collected and the rubber smoked, the troubles are not over, because transportation is a real problem. For example, to convey rubber from a seringal near Riberalta, Bolivia, from which comes the finest rubber in the Amazon, to Belem, Brazil, requires from six to eight months and costs about 3½c. per lb. This is more than the United States industry has had to pay for rubber delivered in New York on some few occasions. And when the rubber reaches Belem, it must be inspected, graded, washed and shipped to the States, a distance of several thousand miles.

While he writes of natural rubber collection in the Amazon jungle with authority, having had first-hand experience in the American tropics and having lived on one of the experimental rubber plantations in Central America, I do not always agree with his statements regarding the synthetic rubber industry. Further, I believe that most well-informed persons will disagree with his statement, "For it must be remembered that even when Malaya and the Dutch East Indies are retaken, most of the rubber plantations will have been destroyed." When commenting on butyl rubber developed by Standard Oil Co. of New Jersey, he makes the statement that it is a copolymer of butadiene and isobutylene, while it is my understanding that butyl rubber combines isobutylene with a small amount of isoprene. He goes on to state that the buna rubbers are better products while I believe that it is generally accepted that butyl rubber is superior to the buna type for inner tubes and some other applications.

He writes that "It is noteworthy that the Rubber Reserve Corp. and the Co-ordinator of Rubber for the War Production Board have chosen to regard rubber made from grain or other vegetable alcohols as untried experiments and rubber from petroleum as an accredited success—." He may be correct in this statement but the fact is that the Institute, W. Va., plant, as operated by Carbide & Carbon Chemical Corp. at the time of my visit in June, depended for a source of alcohol for producing butadiene upon material derived from the fermentation of grain.

The author appears to have a particular dislike for the large manufacturing company. He goes after the four great rubber companies who "dominate the strength of the United States buying power in the world rubber markets." He takes a crack at "the propaganda department of the Standard Oil Co. of New Jersey." I am sure there are many chemical engineers who will not agree with him in his statement "But as one onlooker, the author contends that American business concerns can and should be blamed and duly punished for participation in anti-social collusion or conspiracy or for entering or seeking to enter such agreements with actual or potential enemies of the United States; also that commercial organizations are surely culpable for forming industrial blocs and setting forth in a more or less deliberate and common effort to employ government affiliations and subsidies for creating industrial monopoly of so indispensable a material as rubber when American survival swings in the balance of world war."

Notwithstanding these and other statements with which I do not agree, the book as a whole is interesting and worthwhile.

COLLECTED DATA

TUNGSTEN, ITS HISTORY, GEOLOGY, ORE-DRESSING, METALLURGY, CHEMISTRY, ANALYSIS, APPLICATIONS, AND ECONOMICS. *By K. C. Li and Chung Yu Wang. Published by Reinhold Publishing Corp., New York, N. Y. 325 pages. Price $7.*

SINCE our war with Japan has cut off supplies of tungsten from China, Burma and Malaya and at the same time accentuated our industrial needs of this metal, there has been a tremendous stimulation in this country in exploration, ore dressing, and metallurgy of wolframite and scheelite, the principal tungsten minerals. For the geologists, mining engineers, metallurgists and chemists interested in tungsten, this volume written by two of the outstanding authorities in the field, will prove of great value. The authors have collected, organized and evaluated the vast amount of scattered data on this metal, its ores and its applications, and have compiled an extensive bibliography for those interested in original sources.

A large section of the book is devoted to the geology of tungsten, with considerable details on the Chinese and Burmese deposits and a summary of known deposits in the United States and elsewhere. Data are also given on the methods of ore dressing and metallurgical treatment. Patent references to processes are included. Another chapter gives the chemical properties of tungsten and its all its compounds, while a brief section deals with analytical procedures. The sections on industrial applications, substitutes and economics include useful data compiled from many sources. Finally, an appendix gives details of the Metals Reserve Co.'s terms of purchase of tungsten ores according to the country of their origin.

PATENTS

PATENT LAW. *By Chester H. Biesterfeld. Published by John Wiley & Sons, New York, N. Y. 225 pages. Price $2.75.*

Reviewed by A. W. Deller

"PATENT LAW" is addressed particularly to chemists, engineers and students, in an effort to give them a comprehensive background of the basic principles of patent law. By condensing a vast amount of material into a comparatively small space, the author has achieved his object. The fact that the book was the outgrowth of a series of lectures given by Mr. Biesterfeld at the University of Delaware undoubtedly contributed to its clarity and succinctness.

The twenty-one chapters of the book are respectively devoted to a like number of subjects. After a historical introduction, the author discusses "invention" and "novelty," which are two of the essential requisites of a valid patent. A clear exposition is given of the subject of the "claims" of a patent, with particular reference to functionality and to permissible breadth of those relating to chemical and metallurgical inventions. The author then treats of the troublesome problems of the patentability of uses and of double patenting. Thereafter the question of remedying defective patents by means of reissue and disclaimer is discussed.

In addition to discussing the course of the patent application through the Patent Office and its involvement in an interference proceeding with another application or patent claiming the same invention to determine priority of invention, the author takes up the various problems which arise after the issuance of the patent itself. Thus, the author treats of the incidents of patent ownership, such as the granting of licenses, the question of shoprights, and the transfer of ownership in a patent, as well as the problem of infringement and the wide field of patent litigation. There is also included a chapter on trade secrets as contrasted with patenting an invention. The final chapter deals briefly with the matter of searches, with particular emphasis on validity searches. More space might have been devoted to searches, es-

pecially in view of the importance of novelty searches which should be undertaken before preparation of a patent application.

Generally speaking, the plan followed in the text is to begin with a discussion of the subject under consideration, to support the discussion with citation of authorities, and to amplify or clarify the point under discussion with a quotation from a leading case. In the citations and quotations, the author has made reference to a substantial number of outstanding cases which make the text valuable to the reader.

It is fortunate that the text does not suffer from errors which might ordinarily follow upon too great condensation or simplification of statement. It is believed that some improvement would follow had the chapters been arranged in a different sequence to group those subjects relating to the patent application and those relating to issued patents and incidents of ownership. It is also suggested that it would have been helpful to the reader if separate chapters had been included on classes of patentable inventions and on persons entitled to obtain patents, since questions relating to these topics arise in connection with every invention.

On the whole, however, the author has provided a very readable and informative text, simple and direct in language, and free from legalistic terminology and fine-spun legal theories. For those who desire insight into the subject of patents, without the dangers either of acquiring too little knowledge or of being confused by a discussion of complicated points, Mr. Biesterfeld's book is highly recommended.

GAS PURIFICATION

DRY BOX PURIFICATION OF GAS WITH AN ANNOTATED BIBLIOGRAPHY. *By Gilbert E. Seil. Published by American Gas Association, 420 Lexington Avenue, New York City. 289 pages. Price $3.50 to members; $5 to non-members.*

Review by R. S. McBride

THIS is a thoroughly authoritative volume on removal of sulphur from gas. It is written primarily for the operator of the manufactured gas works used in city public utilities service. But the technical instructions and bibliography are of great value for natural gas operators and for any industrial plant or laboratory where removal of H_2S from any gas is desired. Incidentally, there is considerable information on other impurities of gases and a complete and accurate description of gas testing methods which will be applicable in the petroleum refinery laboratory as well as the gas works.

RECENT BOOKS and PAMPHLETS

A.S.T.M. Standards on Paper and Paper Products. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 135 pages. Price $1.35. First publication of all A.S.T.M. standards on paper and paper products. Included are six specifications and 30 test methods.

Growth and Distribution of Population in South Carolina. By J. J. Petty. Bulletin No. 11, State Planning Board, 100 Calhoun State Office Bldg., Columbia 10, S. C. 233 pages.

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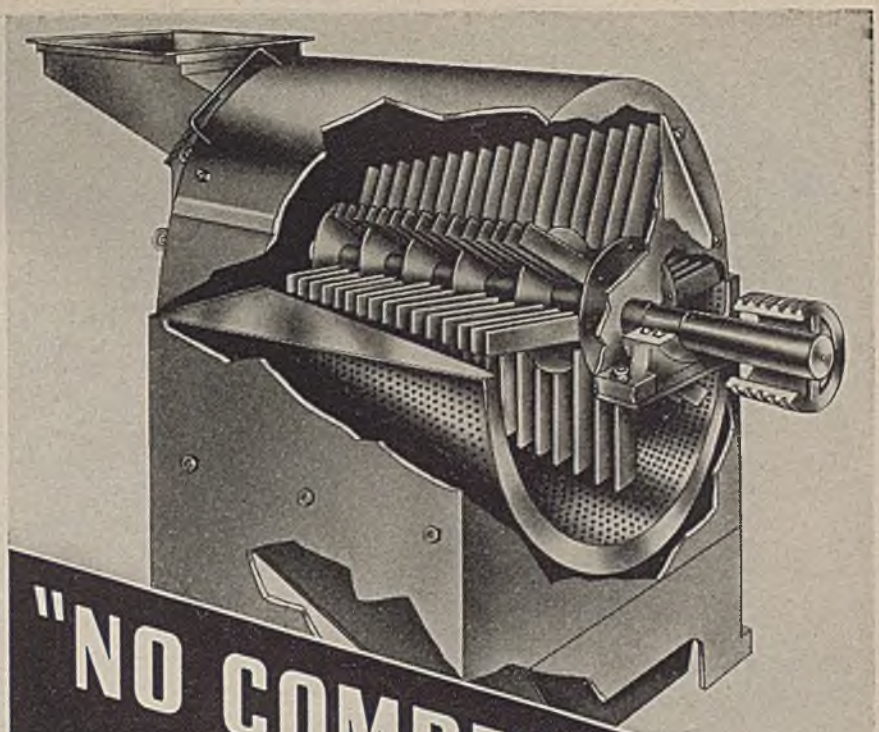

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Gratis. Considers the growth in number of people, the changing composition, characteristics and distribution and re-distribution of the population, and indicates the broader aspects of the economic and social development of the State.

Seventy-Fifth Penn Metal Year. Published by Penn Metal Corp. of Penna., Philadelphia, Pa. 27 pages. Booklet commemorating the founding of the company in 1869.

Maintenance Arc Welding. Published by James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio. 234 pages. Price 50 cents. Second book from the 1940-42 Industrial Progress Award Program. Comprised of 25 of the most significant papers in the program's maintenance classification.

A.S.T.M. Standards on Plastics. Second edition. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 431 pages. Price $2. 85 specifications, tests and definitions. More than 25 new specifications have been standardized during 1943, with particular emphasis on purchase specifications.

Source Data on Municipal Water Treatment Plants in the United States. By M. C. Schwartz. Published by Louisiana State University Press, Baton Rouge, La. 52 pages. Price 50 cents. A listing of towns and cities of the U. S. with literature references to information on their water-treatment plants.

Geology. By J. A. Allan. Report No. 34, Research Council of Alberta, University of Alberta, Edmonton, Alberta, Canada. In five parts, two of which are of possible interest to Chem. & Met. readers: "Rock Salt Deposit at Waterways" and "Coal Areas of Alberta."

Unloading Anhydrous Hydrofluoric Acid From Tank Cars. Manual Sheet TC-5, Published by Manufacturing Chemists' Association, 608 Woodward Bldg., Washington 5, D. C. 9 pages. Price 25 cents. Recommended practice.

When I Get Out Will I Find a Job? By M. S. Stewart. Pamphlet No. 86, published by Public Affairs Committee, 30 Rockefeller Plaza, New York 20, N. Y. 31 pages. Price 10 cents. Speed with which servicemen and women can be demobilized will depend in part on the skill with which industry is shifted from war to peace production.

Your Future in Chemistry. By V. F. Kimball and M. R. Bhagwat. American Job Series Occupational Monograph No. 37, published by Science Research Associates, 1700 Prairie Ave., Chicago 16, Ill. 48 pages. Price 60 cents. Chemists in the United States—their place in society, and the work they do. Educational requirements and advantages of the profession are described and advice to job seekers is included.

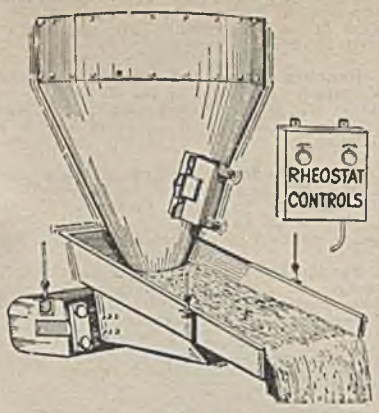
Symposium on Paint. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 60 pages. Price $1. Seven papers presented at the Spring meeting of A.S.T.M. Included are short papers on emulsion, blackout and luminous paints, and an extensive article on protective concealment paints.

Symposium on Powder Metallurgy. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 55 pages. Price $1. Seven papers and discussion presented at the Spring meeting of A.S.T.M. Included are papers on fundamentals, effect of pressure on properties of compacts, effect of particle size on shrinkage, alloy powders, and hot pressing.

A.S.T.M. Specifications for Steel Piping Materials. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 255 pages. Price $1.75. The 1943 edition which includes 44 standards and 25 emergency alternate provisions.

A.S.T.M. Standards on Petroleum Products and Lubricants. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 442 pages. Price $2.25. Sixteenth edition gives some 80 specifications, tests and definitions. New items include a test for oil content of paraffin wax, emergency test for color of U. S. Army motor fuel and two new proposed tests covering saponification number of petroleum products by electrometric titration and oxidation characteristics of steam turbine oils. Changes were made in the standards on knock characteristics of aviation and motor fuels, and in the viscosity-temperature charts.

Proceedings of the Nineteenth Annual Convention of the National Fertilizer Association. Published by the Association, Washington, D. C. 92 pages. Proceedings of the meeting held last June. Contains, along with NFA



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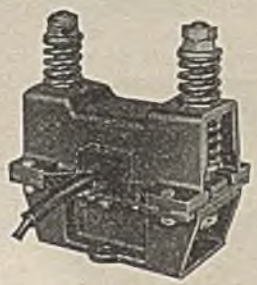

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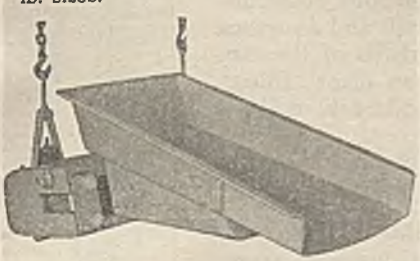

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business, addresses and papers on the wartime work of NFA, nitrogen supplies and their allocation, potash and superphosphate supplies and problems, pricing problems, distribution program and formulating fertilizers for 1943-44.

Elastic and Creep Properties of Filamentous Materials and Other High Polymers. By H. Leaderman. Published by the Textile Foundation, Washington 25, D. C. 278 pages. Price $2. Concerned with a study of a phenomenon (delayed elasticity) which is observed in most high polymers. An account of experiments on the creep and creep recovery behavior of rayon, nylon, and silk filaments. Experimental results are interpreted in terms of the structure of these materials and conclusions are drawn concerning the mechanism of elastic and plastic deformation of textile filaments. Presents current concepts concerning structure and mechanical behavior of filamentous materials.

Pipe and Tube Bending Handbook. Published by Copper & Brass Research Association, 420 Lexington Ave., New York 17, N. Y. 80 pages. Bending methods and devices, filling materials, equipment, wrinkle bending. Also tables of sizes of pipes, tolerances and weights.

How to Estimate Your Postwar Sales Expectancy. Published by Eddy-Rucker-Nickels Co., Harvard Square, Cambridge 38, Mass. 4 pages. Price 10 cents. Three charts which will enable manufacturers and wholesalers to estimate postwar sales outlook, according to any level of national income between $70 and $150 billion by relating past sales with the level of national income.

Incentive Wages and Inflation. By Albert Raymond. Published by the Bedaux Co., New York. N. Y. 16 pages. An address which attempts to show that incentive pay is anti-inflationary.

Spot and Seam Welding of Low Carbon Steel. Published by American Welding Society, 33 West 39 St., New York, N. Y. Four pages. Price 10 cents. An A. W. S. emergency standard of recommended practice.

Foreign-Trade and Exchange Control in Germany. U S. Tariff Commission Report No. 150, Second Series, 1942. Available from Superintendent of Documents, Washington, D. C. 294 pages. Price 35 cents. A report on the methods and policies of German foreign-trade control, with special reference to the period 1931 to 1939.

Trail Blazers to Radionics and Reference Guide to Ultra High Frequencies. Compiled by E. Kelsey, Zenith Radio Corp., 680 N. Michigan Ave., Chicago 11, Ill. 56 pages. Brief biographies of scientists and a bibliography of uhf literature.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. In ordering any publications noted in this list always give the complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the Bureau responsible for its issue.

Annual Report of the Mining Division, Fiscal Year 1942. By Chas. F. Jackson. Bureau of Mines. Report of Investigations R. I. 3664. Mimeographed.

Coke from Low-Ash Appalachian Coals for Carbon Electrodes in Aluminum Industry. By W. A. Selvig, W. H. Ode, and F. H. Gibson. With a Chapter on Comparison of Results Obtained by Trent Process for Cleaning Coal with those by Float-and-Sink Methods. By Joseph D. Davis. Bureau of Mines. Report of Investigations R. I. 3731. Mimeographed.

Air Flow at Discharge of Fan-Pipe Lines in Mines. Part II. Effect of Size and Shape of Pipe and Adjacent Walls on Velocity and Entrainment Ratios. By G. E. McElroy. Bureau of Mines. Report of Investigations R. I. 3730. Mimeographed.

Recent Developments in Fuel Supply and Demand. By Arno C. Fieldner. Bureau of Mines. Information Circular. I. C. 7261. Mimeographed.

Accidents Due to Misuse of Explosives. By D. Harrington and J. H. East, Jr. Bureau of Mines. Information Circular. I. C. 7259. Mimeographed.

Mine-Fan Signal Alarms and Power Releases. By W. J. Fene and H. F. Weaver, Bureau of Mines. Information Circular. I. C. 7262. Mimeographed.

Effect of Temperature, Catalyst, and Rank of Coal on Rates of Coal-hydrogenation Reactions. By H. H. Storch, C. H. Fisher, C. O. Hawk, and A. Eisner. (Pt. IV. of Hydrogenation and Liquefaction of Coal). Bureau of Mines. Technical Paper 654. Price 10 cents.

Carbonizing Properties and Petrographic Composition of Thick Freeport-Bed Coal from Harmar Mine, Harmarville, Allegheny County, Pa., and the Effect of Blending This Coal with Pocahontas No. 3- and No. 4-Bed Coals. By J. D. Davis, D. A. Reynolds, G. C. Sprunk, C. R. Holmes and J. T. McCartney. Bureau of Mines. Technical Paper 655. Price 10 cents.

The Coso Quicksilver District Inyo County, California. By Clyde P. Ross and Robert G. Yates. Geological Survey. Bulletin 936-Q. Price 40 cents.

Manganese Deposits of the Elkton Area, Virginia. By Philip B. King. Geological Survey. Bulletin 940-B. Price 75 cents.

Quality of Surface Waters of the United States, 1941. By W. D. Collins, C. S. Howard, and S. K. Love. Geological Survey Water-Supply Paper 942. Price 15 cents.

The Caribbean Islands and the War. Department of State. Publication No. 2023. Price 25 cents.

Statistical Summary of Education, 1939-40. Volume II, Chapter I. Federal Security Agency. Price 10 cents.

Statutes and Congressional Reports Pertaining to National Labor Relations Board. 1943. National Labor Relations Board. Price 20 cents.

Union Membership and Collective Bargaining by Foremen. (Reprinted from the Monthly Labor Review June 1943, with additional data.) Department of Labor. Bulletin No. 745. Price 5 cents.

Settling Plant Grievances. U. S. Department of Labor. Division of Labor Standards. Bulletin No. 60.

Products and Priorities. War Production Board. Issued monthly. $2.00 per year subscription. 20 cents single copy.

The Structural Design of Concrete Pavements. (Reprinted from "Public Roads," portions of Vols. 16, 17 and 23.) Public Roads Administration. Price 40 cents.

Health Service in War Time. (A Manual for Health and Medical Committees of Local Defense Councils.) U. S. Office of Civilian Defense. OCD Publication 3627. Price 5 cents.

Fire Guard Instructor's Manual. June 1943. Office of Civilian Defense. OCD Publication 2027. Price 35 cents.

Area Analysis—A Method of Public Works Planning. National Resources Planning Board. Price 15 cents.

Regional Planning, Part XII—Arkansas Valley. June 1943. National Resources Planning Board. Price 50 cents.

Cumulative Supplement to the Code of Federal Regulations. Book I, containing all Presidential documents issued from June 2, 1938 through June 1, 1943, with appropriate tables and index. Price $3.00.

Studies of Methyl Bromide in Greenhouse and Vault Fumigation. By Henry W. Richardson, A. C. Johnson, J. W. Bulger, A. H. Casanges, and G. V. Johnson. Department of Agriculture, Bureau of Entomology and Plant Quarantine. Price 5 cents.

Effects of Phosphorus Supplements on Cattle Grazing on Range Deficient in this Mineral. By W. H. Black, L. H. Tash, J. M. Jones, R. J. Kleberg. Department of Agriculture. Price 10 cents.

Derris Culture in Puerto Rico. By Rufus H. Moore, Puerto Rico Experiment Station. Department of Agriculture. P. R. Circ, 24C. Price 10 cents.

Recommended Commercial Standard for Bituminized-Fibre Drain and Sewer Pipe. National Bureau of Standards. Recommended Commercial Standard TS-3619. Mimeographed.

Occupations Related to Occupations (sic.) in Cane-Sugar Refining. War Manpower Commission. Job Family Series No. I-41. Price 15 cents.

MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Safety Equipment. Mine Safety Appliances Co., Pittsburgh, Pa.—Bulletin 433—32-page booklet entitled "How to Make Your Safety Equipment Last Longer." Outlines a conservation program, illustrates, and describes briefly the principles of good maintenance for a large number of safety equipment items.

Turbines. General Electric Co., Schenectady, N. Y.—Bulletin GEB129—24-page pamphlet giving the story of the turbine in simple language from its earliest development down to the present day. Extensively illustrated with photographic reproductions of industrial installations.

Resistant Coatings. The Quaker Oats Co., 141 West Jackson Boulevard, Chicago 4, Ill.—Bulletin 58—one-page form which gives specific directions for use of this concern's furfuryl alcohol to impart chemical resistant coatings to wood and other porous materials by resinification.

Resins. American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York 20, N. Y.—72-page bound booklet dealing with the various lines of resins put out by this concern for specification finishes. Includes sections on allocation procedure and characteristics of these synthetic resins. Contains detailed data on specifications and suggestion formulations as put out by the U. S. Army, Navy, Maritime Commission, Treasury Department, Society of Automotive Engineers, and other federal and miscellaneous agencies. Very useful information for those interested in synthetic resin formulation.

Stedman Packing. Scientific Glass Apparatus Co., Bloomfield, N. J.—4-page form describing briefly the use of Stedman packing for close fractionation in laboratory work. Includes tables of characteristics and dimensions.

Ampoules. PerfeKtum Products Co., 300 Fourth Ave., New York 10, N. Y.—4-page form briefly describing and illustrating this concern's automatic electric ampoule filling and sealing machines. Also a 4-page form dealing with the automatic electric ampoule washing machine.

Wooden Barrels. Associated Cooperage Industries of America, Inc., 408 Olive St., St. Louis, Mo.—4-page reprint describing and illustrating the correct method of opening, closing and shipping slack and tight wooden barrels.

Log Washers. Pennsylvania Crusher Co., Liberty Trust Building, Philadelphia, Pa.—Bulletin 4003—4-page form describing briefly the principles of operation, application and other features of this concern's line of log washers for clay and various ores.

Grease Removal. The Dorr Company, 570 Lexington Ave., New York 22, N. Y.—4-page leaflet describing briefly and giving cross-sectional drawings of this concern's "Dorreo Vactuator" new unit for vacuum flotation of greases and light, difficult-to-settle solids from sewage and trade wastes prior to clarification.

Corrosion Resistant Coatings. Corrosion Control Corp., 34 Smith St., Norwalk, Conn.—Data sheets on the usages of this concern's "Co-Res-Co" corrosion resistant coatings by chemical and process industries, Army engineers, etc. Contains a price list and directions for application.

Tube Cleaners. Elliott Co., Tube Cleaner

Dept., Springfield, Ohio.—Bulletin Y-15—4-page folder describing this concern's new "1300" series tube cleaner with improved metallurgy, heat treating and lubrication. Includes a table of recommended sizes.

Valves. The Economy Valve Seat Co., 2617-25 Fletcher St., Chicago, Ill.—4-page circular describing this concern's renewable seat and re-seating tools for valves, faucets, bibs, etc. Illustrated.

Exhaust Fans. Hartzell Propeller Fan Co., Piqua, Ohio—4-page circular describing this concern's "single propeller" tear-drop fan for industrial exhaust purposes. Contains photographs of the unit.

Industrial Hoods. J. O. Ross Engineering Corp., 350 Madison Ave., New York, N. Y.—Bulletin 27—4-page bulletin describing briefly and giving installation photographs of this concern's line of industrial hoods.

Steel. American Manganese Steel, Division of the American Brake Shoe Co., Chicago Heights, Ill.—Bulletin 1043CM—32-page booklet dealing with the use of this concern's manganese steel for cement mill equipment. Various pieces of equipment are described and illustrated.

Colloidal Graphite. Acheson Colloids Corp., Port Huron, Mich.—Bulletin 431—4-page form dealing with the use of "dag" colloidal graphite for impregnation and surface coating of various industrial products. Illustrated.

Electric Trucks. The Yale & Towne Mfg. Co., Philadelphia Division, Philadelphia, Pa.—75-page booklet dealing with this concern's line of electric industrial trucks of the tiering, telescopic tilting fork and ram, low elevating platform, crane and other types. Each unit is illustrated. Contains cross sectional drawings and detail specifications of the various types of electric trucks. while numerous installation photographs show principles of application.

Optical Crystals. The Harshaw Chemical Co., 1945 East 97th St., Cleveland 6, Ohio—Price list of the synthetic optical crystals of sodium chloride, potassium bromide and lithium fluoride put out by this concern. Describes briefly method of growing these crystals and their application.

Soap. The Procter & Gamble Co., Gwynne Building, Cincinnati, Ohio—26-page booklet discussing in simple language the various industrial applications of soap. Contains numerous sketches.

Gages. Clapp Instrument Co., Webster, Mass.—20-page booklet which illustrates, gives specifications and list prices, and describes briefly the line of industrial gages put out by this concern. Contains a service guide chart.

Laboratory Glassware. Corning Glass Works, Corning, N. Y.—Supplement 4—12-page pamphlet listing and describing the new items in Pyrex laboratory glassware, including fritted glassware, put out by this concern. Includes a price list and specification data.

Variable Speed Control. Reeves Pulley Co., Columbus. Ind.—Catalog G435—128-page general catalog illustrating, describing in detail and giving specifications of this concern's line of variable speed control units. Contains extensive dimension diagrams and tables and chart of speed variations. Extensively illustrated.

Equipment. Hardinge Co., York, Pa.—Bulletin 35B—8-page bulletin illustrating and discussing the line of sanitation equipment, such as clarifiers, digesters, etc., put out by this concern. Also bulletin 18A, 16-page publication describing and discussing the various types of tube mills put out by the concern. Well illustrated with photographic reproductions and diagrammatic charts.

X-Ray Equipment. Picker X-Ray Corp., 300 Fourth Ave., New York, N. Y.—Bulletin 1743—24-page bulletin illustrating and describing briefly the industrial applications of this concern's line of X-Ray equipment. Contains dimensional data, technique of industrial radiography and information on accessories. Also a four-page form which deals with the high-intensity industrial X-Ray illuminator put out by this concern.

Wage Calculator. George F. May Co., 2600 North Shore Ave., Chicago, Ill.—Cardboard calculator for determining pay-as-you-go tax deductions under the simplified method. Accurate and simple to operate.

Flexible Tubing. Chicago Metal Hose Corp., Maywood, Ill.—Manual SS44—32-page sturdily-bound manual containing much engineering data and specifications on the "Rex-Flex" stainless steel flexible tubing and bellows. De-

tailed photographs and illustrations.

Stainless Steel. S. Blickman, Inc., Weehawken, N. J.—a 16-page guide to the selection of stainless steel for particular processing applications. Includes text material on grades, finishes, design and performance requirements. Illustrated with photographic reproductions and diagrams.

Synthetic Rubber. New York Belting & Packing Co., 1 Market St., Passaic, N. J.—a 32-page bulletin discussing briefly in simple style the physical and chemical properties of Buna-S, Neoprene, Butyl and other types of synthetic rubber. Also a short summary of the development of synthetic rubbers. Illustrated.

Corrosion Resistance. Corrosion Control Corp., 34 Smith St., Norwalk, Conn.—A 6-page data sheet on the uses of "Co-Res-Co," this concern's product, which contains technical data on this corrosion resistant coating for various applications.

Emulsion Cleaning. The Enthone Co., 442 Elm Street, New Haven, Conn.—4-page leaflet describing the emulsion cleaning product marketed by this concern and its applications for ferrous and non-ferrous metals.

Heat Exchangers. Formed Steel Tube Institute, 1621 Euclid Ave., Cleveland 15, Ohio—A chart showing the markings of various manufacturers for identification of welded heat exchangers and condenser tubing.

Protective Coatings. Prufcoat Sales Co., 202-07 104th Ave., Hollis 7, N. Y.—Technical Bulletin A—Flyleaf folder giving preparation and application directions for this concern's acid and alkali-proof coatings for cement floors, tank linings and waterproofing.

Furnaces. Surface Combustion Co., Toledo, Ohio—20-page booklet presenting a short review of the background of industrial furnaces. Discusses war trends and developments in furnace types, and the influence heat treatment applications will have in postwar manufacturing.

Pipe Wall Thickness. Midwest Piping & Supply Co., Inc., St. Louis 4, Mo.—Bulletin 43A—16-pages of text including specification and comparison charts on simplified methods of calculating pipe wall thickness. Includes charts and engineering data on oil pressure, power, and gas and oil piping systems.

Presses. Watson-Stillman Co., Roselle, N. J.—Bulletin No. 320-A—38-pages treating on this concern's 10 types of straightening and bending presses. Contains tables of working capacities and technical data. Illustrated.

Special Alloys. The Duraloy Co., Scottdale, Pa.—Bulletin 4328-G—A 12-page booklet giving data on "Duraloy" centrifugal castings, their characteristics and uses. Illustrated.

Clarification Filters. Swenson Evaporator Co., Division of Whiting Corp., Harvey, Ill.—a new 8-page catalog, Bulletin F-103, which announces a new principle embodied in filter construction, the use of synthetic porous stone as a support for filter-aid, with fully mechanized cleaning. Contains cutaway illustrations and several diagrammatic drawings.

Lift Trucks. Towmotor Corp., Cleveland, Ohio.—a 24-page "Lift Operator's Guide", explaining basic methods of lift truck operation, safety rules and space-saving methods of building loads. Illustrated with diagrams.

Full-View Fittings. Henry E. Jacoby, 205 E. 42nd St., New York 17, N. Y.—Bulletin 43—8-page booklet illustrating and describing the line of full-view fittings, such as flow glasses and sight tubes, put out by this firm. Includes data on sizes and dimensions.

Alloys. The Eimco Corp., Salt Lake City 8, Utah—4-page form announcing this concern's new alloy "Utaloy" steel for casting purposes. Describes briefly composition and advantages of this alloy.

Mixers. Edge Moor Iron Works, Edge Moor, Del.—Bulletin 117—4-page form illustrating and describing briefly the line of horizontal mixers and blenders put out by this concern. Contains photographic illustrations and cross-sectional drawings.

Flowmeters. Cochrane Corp., Philadelphia, Pa.—Reprint 28—An 8-page manual, "How To Keep Flowmeters Accurate", dealing with correct installation and maintaining accuracy. Well illustrated with diagrams, and contains engineering data.

Water Conditioner. American K. A. T. Corp., 331 Madison Ave., New York 17, N. Y.—A

4-page bulletin describing the all-colloidal action of K. A. T. water conditioner for laboratory stills, and its prevention of scale formation, corrosion, and foaming in the stills.

Oil Purifiers. Youngstown Miller Co., Sandusky, Ohio.—Bulletin YM 600—A new 6-page bulletin describing and diagramming this concern's "A" and "GH" lines of lubrication and hydraulic oil reclaimers.

Furnaces. Hevi Duty Electric Co., Milwaukee, Wis.—Bulletin HD 643—A 10-page publication entitled "Protective Combusted Atmospheres in Hevi Duty Furnaces". Each of this concern's furnace models are described and illustrated. Diagrams and engineering data are included.

Oil Separating. Cochrane Corp., Philadelphia, Pa.—Reprint 24—This 3-page reprint emphasizes the importance of selecting oil not only for its lubricating properties but also for its subsequent removal facility. Includes considerable engineering data. Also Reprint 26, giving new sizing data on relief valves used for low pressure equipment. Includes data to show how size and permitted pressure drop affect capacity. Includes engineering charts.

Valve Operators. Automatic Temperature Control Co. Inc., Philadelphia, Pa.—Bulletin A5—Constructional and performance data in this 4-page bulletin deal with this concern's "Type 3" valve operators for regulating temperature, pressure flow, etc. Also Bulletin A8 covering "ATC Type 303" valve operators, and Catalog A4 covering "Type 2" valve operators. All three bulletins include engineering data and diagrams.

Resinates. Hercules Powder Co., Wilmington, Del.—4-page folder which discusses properties and uses of "Dresinates," this concern's water soluble resinates, in both powder and liquid form. Includes tables on properties to show improved stability of emulsions as well as directions for preparing a typical emulsion.

Metal Coating. Rapid Electroplating Process, Inc., 1414 S. Wabash Ave., Chicago, Ill.—Folder and price list explaining the rapid metal coating process for use on bus bars, lugs and other electrical equipment parts.

Heat Exchangers. Brown Fintube Co., Elyria, Ohio.—Bulletin 432—The newly improved type "BFT-1" sectional hairpin heat exchanger is described and illustrated in this 6-page bulletin. Dimensional tables are given and the non-removable rear end assembly discussed.

Hydro-Abietyl Alcohol. Hercules Powder Co., Wilmington, Del.—Bulletin 927—An 8-page bulletin on the physical and chemical properties of hydro-abietyl alcohol. Discusses applications for this rosin-derived alcohol for protective coatings, resins, etc.

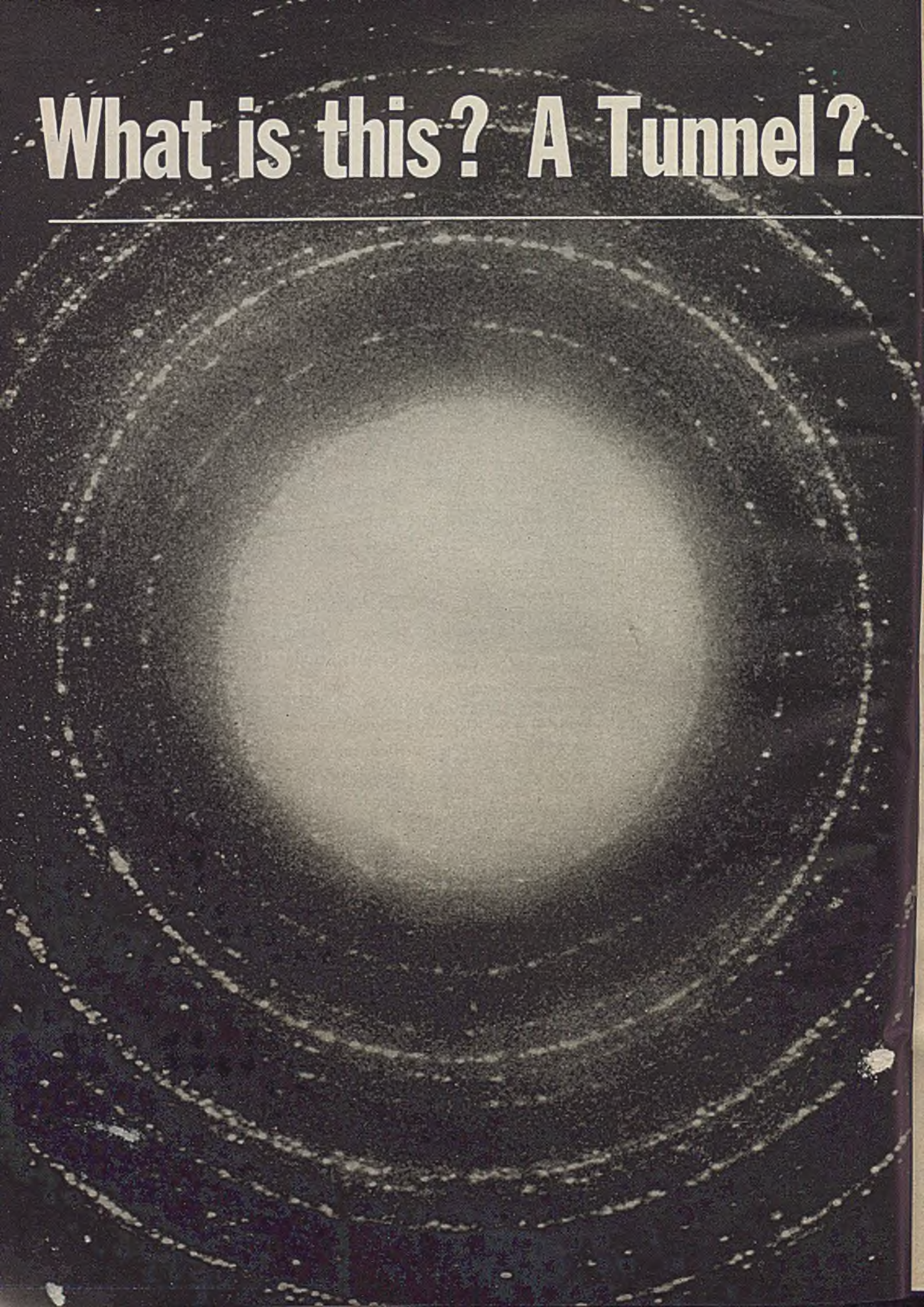
Fluid Straining. B. F. Drakenfeld & Co., Inc., 45-47 Park Place, New York, N. Y.—Folder describing briefly the principles and outstanding advantages of the "Rotospray" for straining fluids of all types. Contains information on capacity, dimensions and weight. Includes a cross-sectional drawing.

Hydrocarbons. Phillips Petroleum Co., Special Products Division, Bartlesville, Okla.—Bulletin 96A—8-page booklet which lists the new hydrocarbon products of this concern. Includes data on specifications, typical properties, shipping containers and price schedules of pure propylene, pure butene-1, pure butene-2, commercial isohexanes, isoheptanes and normal heptane.

Concrete Floor Patch. Agatex Corp., 1170 Broadway, New York 1, N. Y.—4-page bulletin on the advantages and application of this concern's "Agapatch" concrete floor patch for industrial uses requiring resistance to acids, strong alkalies, oils and greases and heavy trucking.

Pneumatic Control. The Bristol Co., Waterbury 91, Conn.—Instruction A1000—20-page booklet entitled "Air Control Theory and the Free Vane Controller" which covers basic theory and principles common to the five types of free vane air controllers put out by this concern. Gives a clear exposition of pneumatic control principles and their application to free vane controllers. Illustrated with diagrammatic sketches.

What is this? A Tunnel?



In a way, yes; it leads to the heart of a molecule

Study of electron diffraction patterns with the RCA Electron Microscope offers industry a direct approach to information that is of vital importance to industrial research chemists, metallurgists and physicists. Such a pattern is reproduced in the picture shown. To the qualified technician the diffraction pattern of any given substance is a road-map that indicates not only the chemical components but the atomic arrangement of its molecules. Leading companies and research organizations are finding that their Electron Microscopes are not only an important aid to product and process improvement as research instruments, but can render invaluable service as a means of checking operating results in actual practical production. Objects studied with these instruments can be directly observed in sharp detail at magnifications up to 25,000 diameters, and may be photographed and advantageously enlarged to magnifications up to 100,000 diameters. Please address inquiries to Electron Microscope Section, RADIO CORPORATION OF AMERICA, Camden, New Jersey.

RCA Electron Microscope

RADIO CORPORATION OF AMERICA

Check List OF MONSANTO PLASTICIZERS

. . . to help you make the most efficient use of available supplies!

With supplies of plasticizers short of wartime needs it is essential that the most efficient possible use be made of every available pound.

That's why it is suggested that you review the Monsanto plasticizers you are now using to make certain they are the best possible materials available for your needs.

A quick glance at this table of the principal Monsanto Plasticizers will give you a preliminary check. A letter will bring you the help of a Monsanto technical service representative in making a final decision. Write: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, St. Louis, Missouri.

CHARACTERISTICS OF MONSANTO PLASTICIZERS

	Mol. Wt.	Color and Form	Boiling Point	Cryst. or Melt. Point	Sp. G.	Lbs. per Gal.	Refrac. Index	Evap. Rate Gms./sq.cm/hr/ 100°C	Solubility in Water	Retentivity in N/C	Retentivity in Ac/C	Light Fastness in N/C	Light Fastness in Ac/C	USES
Tricresyl Phosphate	368	Colorless liquid	295°C/13 mm	Non-cryst., solid at −35°C	1.165/20°C	9.7	1.556/20°C	0.00000708	Less than 0.002% at 85°C	100 plus	0	Poor	—	Excellent compatibility with most resins and plastics except cellulose acetate; imparts excellent flexibility with a minimum decrease in tensile strength; excellent fire retarding properties.
Triphenyl Phosphate	326	White flakes	245°C/11 mm	48.5°C	1.268/60°C	10.5	—	0.00000028	0.001% at 34°C 0.002% at 54°C	100	80	Poor	Fair	Standard fire retarding plasticizer especially for cellulose acetate; gives clear tough compositions of good flexibility without tackiness.
Santicizer 8	199	Light amber liquid	—	—	1.188/25°C	9.9	—	0.0002659	0.13% at 23°C 0.213% at 48°C	100	90	Poor	Good	Excellent plasticizer for cellulose acetate, giving brilliance and polish; valuable plasticizer for coating designed to withstand petroleum products; increases flexibility of shellac and protein plastics.
Santicizer 9	171	White granules	—	105°C	1.313/25°C	10.9	—	0.000053 at 65°C	1% at 34°C	25–30	25–30	Poor	—	Imparts gloss; gives smooth working and uniform curing of molded phenolic and urea resins; blends readily with most synthetic resins; does not impart softening action of liquid plasticizers.
Santicizer B-16	336	Colorless liquid	219°C/5 mm	Below −35°C	1.097/25°C	9.15	1.490/25°C	0.0000881	0.0012% at 30°C	100	20–30	Excellent	Excellent	With nitrocellulose, gives clear, brilliant films that are flexible, tough, moisture resistant and have good weathering qualities; solvent for and imparts plasticity to most synthetic resins. Non-toxic.
Santicizer E-15	280	Colorless liquid	190°C/5 mm	20°C	1.180/25°C	9.84	1.498/25°C	0.0001106	0.0175% at 30°C	100	100	Excellent	Excellent	With both acetyl and nitrocellulose, it gives clear, tough flexible films that have much increased resistance to moisture penetration. Non-toxic.
Santicizer M-17	266	Colorless liquid	189°C/5 mm	Below −35°C	1.220/25°C	10.2	1.504/25°C	0.000221	0.09% at 30°C	100	100	Excellent	Excellent	Imparts high degree of permanent plasticity; excellent gasoline resistance. Non-toxic.
Dibutyl Phthalate	278	Colorless liquid	206°C/20 mm	−35°C	1.047/20°C	8.75	1.490/25°C	0.000221	0.001% at 30°C	100	Less than 20	Excellent	—	A standard lacquer plasticizer giving high degree of plasticity; excellent light stability and good weathering qualities.
Diethyl Phthalate	222	Colorless liquid	295°C	−0.3°C	1.123/20°C	9.35	1.503/20°C	0.000617	0.058% at 30°C	100	100	Excellent	Excellent	Generally used in mixture with Dimethyl Phthalate as a plasticizer for cellulose acetate.
Dimethyl Phthalate	194	Colorless liquid	282°C	0°C	1.196/15.6°C	10.0	1.515/20°C	0.001925	0.4% at 32°C 0.6% at 63°C	100	100	Excellent	Excellent	Standard cellulose acetate plasticizer generally used in mixtures with diethyl phthalate or other plasticizers.
Diphenyl Phthalate	318	White powder	—	69°C	1.28/25°C	10.68	1.572/74°C	—	Insol.	65	20	Poor	—	Compatible with nitrocellulose and with the sulfonamide, phenolic, polystyrene and vinyl types of resins; gives increased water resistance to all compositions in which it is used.

Tricresyl Phosphate and Triphenyl Phosphate have excellent Fire Retardation.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

PRODUCTION OF CHEMICALS SHOWS SIGNS OF LEVELING OFF AFTER RECORDING SHARP GAINS OVER 1942

INDEXES OF the Federal Reserve Board, recently revised in order to take into full account the new industries created by war-time necessity, tell an interesting story of our sharply expanding production of chemicals. On that basis of measurement, chemical output last year exceeded the 1942 total by approximately 39 percent. Actually the increase in rate of operations last year was only about 13 percent whereas in 1942, the output for December was nearly 30 percent higher than that for January. In the latter part of 1942 new production, such as alcohol, butadiene and other chemicals required in synthetic rubber manufacture, made its influence felt and by the end of the year the index number for chemical production had climbed up to 346 which compares with a yearly average of about 386 for 1943.

While the trend continued almost steadily upward throughout last year the rate of growth was slower and as more and more programs were cut back, there were indications that chemical production was moving more along an even line. Announcement that the military program would be pushed to a new high in the present year may mean that the peak demand for chemicals still lies ahead but all branches of war production do not have the same importance from the standpoint of chemical requirements and with some of the most important chemical-consuming branches subject to curtailment, it is probable that 1944 will not force chemical outputs much, if any, above the level attained in 1943.

However, the directors of our war program have stated that a bigger production job must be done this year, one that will top the miracle output of last year. It is admitted that cutbacks have been made and more may be ordered but the over-all picture is held to be unchanged, as for every line of production that eases up others will expand and this expansion may take the form of producing some goods for civilian use where raw material supplies and other conditions permit. Hopes for any real enlargement in civilian-goods output, however, are not encouraged for while some materials are more plentiful, the majority of materials still goes into war needs and it is further pointed out that there is little immediate prospect that manpower or machine capacity can be made available to make finished products demanding much work in process.

The *Chem. & Met.* index for consumption of chemicals, which does not include some of the purely war-time outlets, recorded only a moderate increase for the year as compared with 1942. The gain appears to be about 4 percent and the rate of consumption in the last quarter of the year did not vary much from that reported for the first quarter. The index number for November is 177.28 as against 169.69 for November 1942. The revised number for October is 181.94 with 174.08 for the corresponding month of 1942.

In some cases where essential requirements are heavy the outlook for civilian goods has been dimmed by virtue of government regulations. For instance, the shortage of pulp wood has resulted in an order restricting the amount of pulp which may be used in making the various types of paper and paperboard. Over-all paper and paperboard production for the first quarter of this year is estimated at approximately 1,400,000 tons per month or about 2.3 percent below the average monthly production in the third quarter of 1943. Proposed minimum production, however, is about 9 percent less than that proposed for the first quarter by the mills.

Another instance of enforced curtailment in civilian production is found in plastics where specific finished products are made subject to a cut in output because of the lack of necessary raw materials. War demands for benzol, especially for high-octane gasoline, have cut down the amount of this chemical available for turning out plastic compounds. Many marginal uses for polystyrene and phenolics may be curtailed completely because of this situation. WPB also has stated that the depletion of phthalate plasticized stock piles has made it necessary to adopt conservation measures that will have a direct bearing on the availability of cellulose acetate and butyrate acetate. Consumers have been instructed to use less critical plasticizers in making products which serve marginal civilian needs. The adjustments made necessary by this order will probably cause some delay before production gets under way according to the new order.

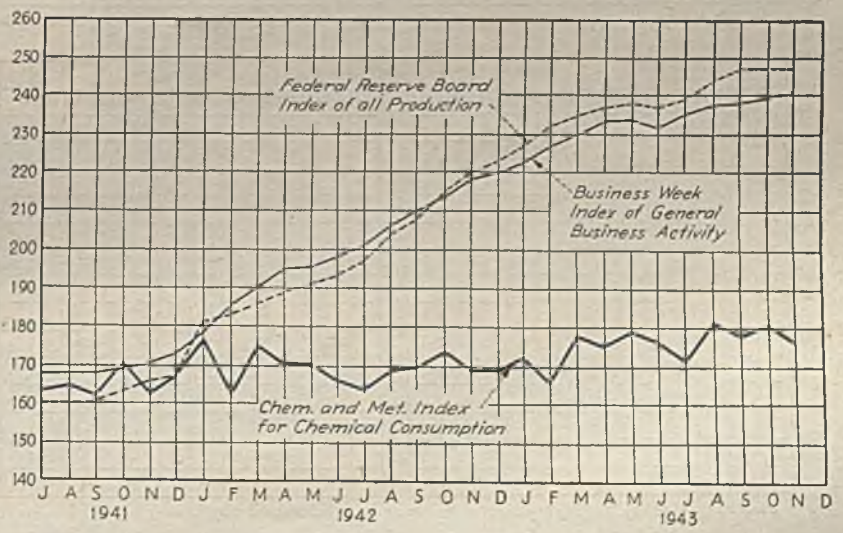
Chem. & Met. Index for Industrial Consumption of Chemicals 1935=100

	Oct. revised	Nov.
Fertilizers	40.20	40.80
Pulp and paper	18.77	18.40
Petroleum refining	16.79	16.39
Glass	20.60	18.94
Paint and varnish	16.09	15.40
Iron and steel	14.14	13.38
Rayon	15.86	16.18
Textiles	11.08	11.13
Coal products	9.76	9.09
Leather	4.35	4.20
Industrial explosives	6.00	5.27
Rubber	3.00	3.00
Plastics	5.30	5.10
	181.94	177.28

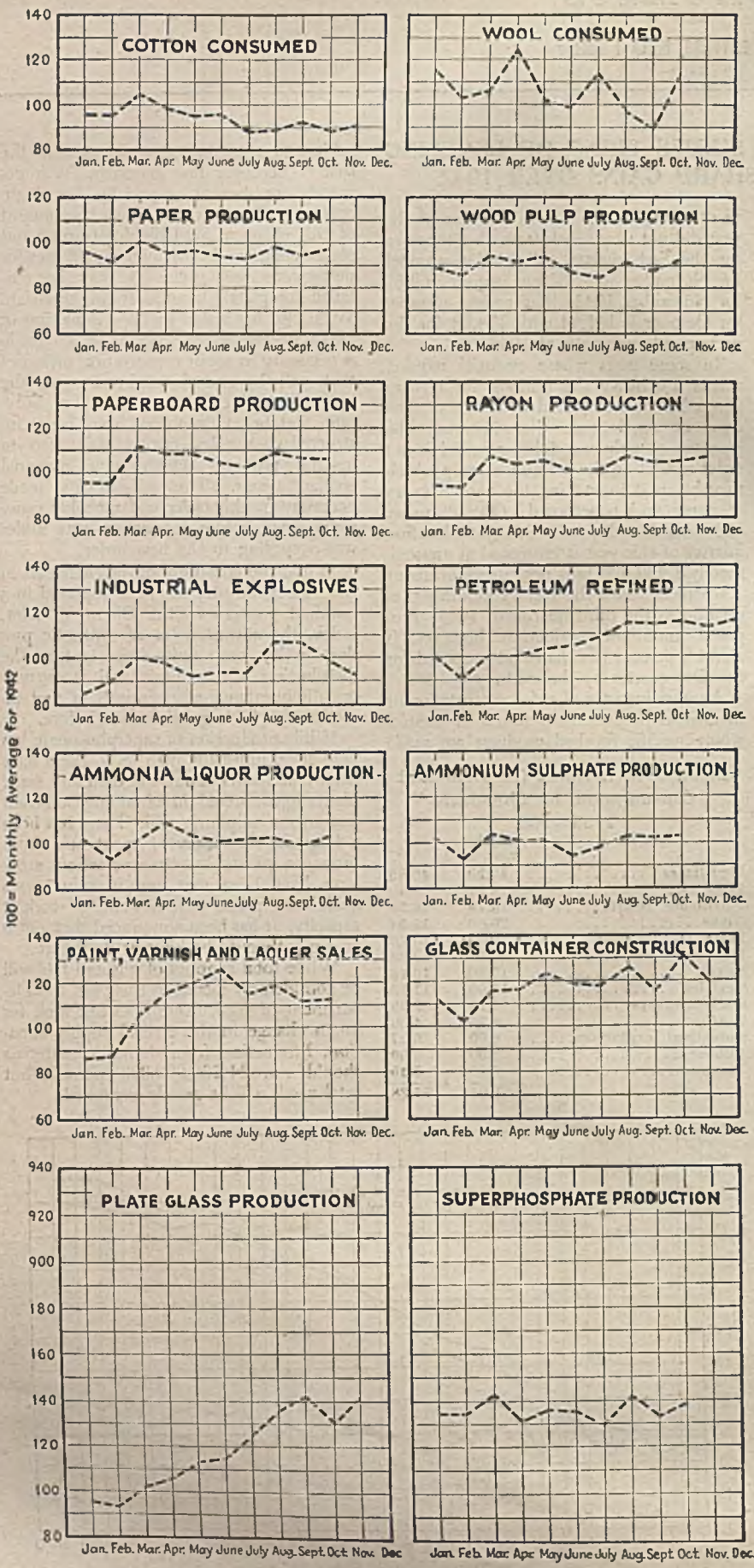
While the consumption of chemicals in the rubber industry has been reported in a nominal position in the *Chem. & Met.* index, the advancement of synthetic production has been quite important in the distribution of chemicals and from now on, disappearance of chemicals in that direction will be larger than ever before.

While production of superphosphate has held at an unusually high level, there have been complaints about the difficulty some plants encountered in obtaining sufficient amounts of sulphuric acid. There has been a large visible supply of spent acid from ordnance plants but transportation problems have been met and in some cases acidulating plants were not able to work at capacity. It has been announced that a new acid plant would be built at Baltimore.

While total supplies of oils and fats will be considerably increased this year, the Department of Agriculture does not look for much change in the civilian supply situation. Production from domestic materials should run 11,200,000,000 pounds but total needs will be greatly expanded.



PRODUCTION AND CONSUMPTION TRENDS



THE POSITION of some of the principal chemical-consuming industries has been undergoing change. Enlarged operations and a consequent larger use of raw materials, has been noted in petroleum refining, at iron and steel mills and in the fertilizer, rayon, glass, and rubber industries. Lower rates of production have been reached in the textile, pulp and paper, and leather trades. These trends which started last year have been carried into the new year and apparently will continue.

In the glass trade, activity in the container branch has been stimulated by the scarcity of packaging material and the consequent use of glass packaging in fields where, formerly, it had not been used. To satisfy this demand, production of glass containers was stepped up throughout 1942 and the rising trend was further accelerated last year when a record outturn was reported, the increase over 1942 figuring out at about 18 percent. This record was made despite stortages in manpower and materials which were met at times. Demand for containers continues high and promises to further test plant capacities.

Plate glass plants, following the dip in the automotive market, dropped production to less than one-third the prewar normal. In recent months there has been a moderate recovery but the 20 percent increase in output last year still shows production to be greatly subnormal. Window glass found a declining market in the latter half of 1942 and this condition carried well into 1943 with the result that mills turned out about 30 percent less in the latter period. As prospective building this year is to be on a curtailed scale, the prospects favor a still further drop in consumption of glass in that direction.

Textile mills have been worked at high speed since 1941 but the operating rate was downward in the latter part of last year. Labor problems and need for overhauling equipment were factors which cut down productive activities. Woolen mills have held an uneven pace with raw material supplies varying especially in the carpet wool branch. According to the present outlook stocks of all types of wool will be available in a larger way and most recent reports regarding mill activities indicate a considerable pickup in outturn.

An excellent summary of the fertilizer position has been made by the National Fertilizer Association which estimates that total consumption of all kinds of fertilizer in the fiscal year ending June 30, 1944 will be in excess of 11,000,000 tons. Last year 460,000 tons of actual nitrogen were used as fertilizer, 204,000 tons as side and top dressings and 256,000 tons in mixed goods. For this year 625,000 tons of nitrogen will be available, 271,000 tons for dressing and 354,000 tons for mixed fertilizer. There will be as much nitrate of soda for direct use as last season. Ammonium sulphate will be used entirely in mixed fertilizers except in the west. There will be larger supplies of cyanamide, uramon, and ammonium phosphate. There also will be cal-nitro formerly imported and now produced in this country.

CHEM. & MET.
Weighed Index of Prices for CHEMICALS
Base = 100 for 1937

This month	109.54
Last month	109.50
January, 1943	108.92
January, 1942	109.01

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell fob works, quotations are so designated. Prices are corrected to January 12.

INDUSTRIAL CHEMICALS

Acetone, tanks, lb	$0.07 –
Acid, acetic, 28%, bbl., 100 lb	3.38 – $3.63
Boric, bbl., ton	109.00 –113.00
Citric, kegs, lb	.20 – .23
Formic, cbys, lb	.10½– .11
Hydrofluoric 30% drums, lb	.08 – .08½
Lactic, 44%, tech., light, bbl.,lb.	.073– .075
Muriatic, 18°, tanks, 100 lb	1.05 –
Nitric, 36°, carboys, lb	.05 – .05½
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb	.11½– .13
Phosphoric, tech., tanks, lb	.04 –
Sulphuric, 60°, tanks, ton	13.00 –
Tartaric, powd., bbl., lb	.70 –
Alcohol, amyl	–
From Pentane, tanks, lb	.131–
Alcohol, butyl, tanks, lb	.10½– .18½
Alcohol, ethyl, denatured, 190 proof	–
No. 1 special, tanks, gal, wks	.50 –
Alum, ammonia, lump, bbl., lb	.04½–
Aluminum sulphate, com. bags, cwt	1.15 – 1.40
Aqua ammonia, 26°, drums, lb	.02½– .03
tanks, lb	.02 – .02½
Ammonia, anhydrous, cyl., lb	.16 –
tanks, lb	.04½–
Ammonium carbonate,powd.tech., casks, lb	09½– .12
Sulphate, wks., ton	29.20–
Amylacetate tech., from pentane, tanks, lb	.145–
Arsenic, white, powd., bbl., lb	.04 – .04½
Barium carbonate, bbl., ton	60.00 –65.00
Chloride, bbl., ton	79.00 – 81.00
Nitrate, casks, lb	.11 – .12
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching power, f.o.b., wks., drums, 100 lb	2.50 – 3.00
Borax, gran., bags, ton	44.00 –
Calcium acetate, bags	3.00 –
Arsenate, dr., lb	07 – .08
Carbide drums, ton	50.00
Chloride, flake bags, del., ton	18.50 – 25.00
Carbon bisulphide, drums, lb	.05 – .05½
Tetrachloride drums, gal	.73 – .80
Chlorine,liquid, tanks, wks., 100 lb	2.00 –
Copperas, bgs., f.o.b., wks., ton	18.00 – 19.00
Copper carbonate, bbl., lb	.19½– .20
Sulphate, bbl., 100 lb	5.00 – 5.50
Cream of tartar, bbl., lb	.57 –
Diethylene glycol, dr., lb	.14 – .15½
Epsom salt, dom., tech., bbl., 100 lb	1.90 – 2.00
Ethyl acetate, tanks, lb	.11½–
Formaldehyde, 40%, bbl. lb	.05½– .06
Furfural, tanks, lb	.09 –
Glaubers salt, bags, 100 lb	1.05 – 1.10
Glycerine, c.p., drums, extra, lb	.18½–
Lead:	
White, basic carbonate, dry casks, lb	.08½–
Red, dry, sck., lb	.09½–
Lead acetate, white crys., bbl., lb.	.12½– .13
Lead arsenate, powd., bag, lb	.11½– .12
Lithopone, bags, lb	.04½– .04½
Magnesium carb., tech., bags, lb.	.06½– .06½
Methanol, 95%, tanks, gal	.58 –
Synthetic, tanks, gal	.28 –
Phosphorus, yellow, cases, lb	.18 – .25
Potassium bichromate, casks, lb	.09½– .10
Chlorate, powd., lb	.10 – .12
Hydroxide (c'stic potash) dr., lb.	.07 – .07½
Muriate, 60% bags, unit	.53½–
Nitrate, bbl., lb	.05½– .06
Permanganate, drums, lb	.19½– .20
Prussiate, yellow, casks, lb	.17 – .18
Sal ammoniac, white, casks, lb	.0515– .06
Salsoda, bbl., 100 lb	1.00 – 1.05
Salt cake, bulk, ton	17.00 –
Soda ash, light, 58%, bags, contract, cwt	1.05 –
Dense, bags, cwt	1.15 –
Soda, caustic, 76%, solid, drums, cwt	2.30 – 3.00
Acetate, del., bbl., lb	.05 – .06
Bicarbonate, bbl., cwt	1.70 – 2.00
Bichromate, casks, lb	.07½– .08
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bl., lb	.03 – .04

CHEM. & MET.
Weighted Index of Prices for
OILS & FATS
Base = 100 for 1937

This month	145 24
Last month	145.24
January, 1943	142.32
January, 1942	135.60

Chlorate, kegs, lb	.06½–	.06½
Cyanide, cases, dom., lb	.14 –	.15
Fluoride, bbl., lb	.08 –	.09
Hyposulphite, bbl., cwt	2.40 –	2.50
Metasilicate, bbl., cwt	2.50 –	2.65
Nitrate, bulk, cwt	1.35 –	.....
Nitrite, casks, lb	.06½–	.07
Phosphate, tribasic, bags, lb	2.70 –	.....
Prussiate, yel. drums, lb	.10½–	.11
Silicate (40° dr.), wks., cwt	.80 –	.85
Sulphide, fused, 60–62%, dr. lb.	.03 –	.03½
Sulphite, crys, bbl., lb	.02½–	.02½
Sulphur, crude at mine, long ton	16.00 –	.....
Dioxide, cyl., lb	.07 –	.08
Crystals, bbl., lb	.39½–	.....
Zinc, chloride, gran, bbl., lb	.05½–	.06
Oxide, lead free, bag, lb	.07½–	.....
5% leaded, bags, lb	.07½–	.....
Sulphate, bbl., cwt	3.85 –	4.00

OILS AND FATS

Castor oil, No. 3 bbl., lb	$0.13½–	$0.14½
Chinawood oil, bbl., lb	.38 –	.....
Coconut oil, Ceylon, tank, N. Y., lb	nom	.....
Corn oil crude, tanks (f.o.b. mill), lb	.12½	.....
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12½–	.....
Linseed oil, raw car lots, bbl., lb	.15½–	.....
Palm casks, lb	.09 –	.....
Peanut oil, crude, tanks (mill), lb.	.13 –	.....
Rapeseed oil, refined, bbl., lb	nom	.....
Soya bean, tank, lb	.11½–	.....
Menhaden, light pressed, dr., lb	.1305–	.....
Crude, tanks (f.o.b. factory) lb.	.089–	.....
Grease, yellow, loose, lb	.08½–	.....
Oleo stearine, lb	.09½–	.....
Oleo oil, No. 1	.11½–	.....
Red oil, distilled, dp.p. bbl., lb	.11½–	.....
Tallow extra, loose, lb	.08½–	.....

COAL-TAR PRODUCTS

Alpha-napthol, crude bbl., lb	$0.52 –	$0.55
Alpha-naphthylamine, bbl., lb	.32 –	.34
Aniline oil, drums, extra, lb	.15 –	.16
Aniline, salts, bbl., lb	.22 –	.24
Benzaldehyde, U.S.P., dr., lb	.85 –	.95
Benzidine base, bbl., lb	.70 –	.75
Benzoic acid, U.S.P., kgs., lb	.54 –	.56
Benzyl chloride, tech, dr., lb	.23 –	.25
Benzol, 90%, tanks, works, gal	.15 –	.....
Beta-naphthol, tech., drums, lb	.23 –	.24
Cresol, U.S.P., dr., lb	.11 –	.....
Cresylic acid, dr., wks., gal	.81 –	.83
Diethylaniline, dr., lb	.40 –	.45
Dinitrophenol	.23 –	.25
Dinitrotoiluol, bbl., lb	.18 –	.19
Dip oil, 15%, dr., gal	.23 –	.25
Diphenylamine, dr. f.o.b. wks., lb.	.60 –	.....
H-acid, bbl., lb	.45 –	.50
Naphthalene, flake, bbl., lb	.07 –	.07½
Nitrobenzene, dr., lb	.08 –	.09
Para-nitraniline, bbl., lb	.47 –	.49
Phenol, U.S.P., drums, lb	.10½–	.11
Picric acid, bbl., lb	.35 –	.40
Pyridine, dr., gal	.170 –	1.80
Resorcinol, tech., kegs, lb	.75 –	.80
Salicylic acid, tech., bbl., lb	.33 –	.40
Solvent naphtha, w.w., tanks, gal.	.27 –	.....
Tolidine, bbl., lb	.86 –	.88
Toluol, drums, works, gal	.33 –	.....
Xylol, com., tanks, gal	.26 –	.....

MISCELLANEOUS

Casein, tech., bbl., lb	$0.21 –	$0.24
Dry colors		
Carbon gas, black (wks.), lb	.0335–	.30
Prussian blue, bbl., lb	.36 –	.37
Ultramarine blue, bbl., lb	.11 –	.26
Chrome green, bbl., lb	.21½–	.30
Carmine, red, tins, lb	4.60 –	4.75
Para toner, lb	.75 –	.80
Vermilion, English, bbl., lb	3.05 –	3.10
Chrome yellow, C.P., bbl., lb	.14½–	.15½
Gum copal Congo, bags, lb	.09 –	.30
Manila, bags, lb	.09 –	.15
Demar, Batavia, cases, lb	.10 –	.22
Kauri, cases, lb	.18 –	.60
Magnesite, calc, ton	64.00 –	.....
Pumice stone, lump, bbl., lb	.05 –	.07
Rosin, H., 100 lb	4.80 –	.....
Turpentine, gal	.86½–	.....
Shellac, orange, fine, bags, lb	.39 –	.....
Bleached, bonedry, bags, lb	.39 –	.....
T. N. bags, lb	.31 –	.....

NEW CONSTRUCTION

	Current Projects		Cumulative 1943	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	.....	$475,000	$1,267,000
Middle Atlantic	$2,160,000	$2,040,000	16,799,000	18,476,000
South	.....	.....	12,270,000	34,520,000
Middle West	700,000	620,000	12,495,000	18,204,000
West of Mississippi	7,790,000	6,025,000	35,030,000	43,288,000
Far West	.....	.....	22,125,000	70,683,000
Canada	305,000	948,000	12,091,000	3,502,000
Total	$10,955,000	$9,633,000	$111,285,000	$189,940,000

PROPOSED WORK

Ill., East St. Louis—Aluminum Ore Co., 3300 Missouri Ave., soon takes bids for aluminum oxide experiment plant. $300,000.

N. J., Deepwater—Pure Carbonic, Inc., 60 East 42nd St., New York, N. Y., is having plans prepared for the construction of a regenerator building at its plant here.

N. J., Paulsboro—Socony Vacuum Oil Co., Paulsboro, N. J. is having plans prepared for the construction of a 1 story, 65x163 ft. shop building for its new refinery plant. Estimated cost $80,000.

O., Akron—B. F. Goodrich Co., 500 South Main St., Akron, plans an addition to 2 story factory building, South Main St. Estimated cost $50,000.

O., Barberton—Seiberling Rubber Co., Barberton, O., will soon let contract for 2 story, basement building. Estimated cost $350,000. Albert Kahn, Inc., 321 New Center Bldg., Detroit, Mich.

Oklahoma—B. F. Goodrich Co., 500 South Main St., Akron, O., plans to construct a new plant here. Estimated cost $5,000,000.

Pa., Jeanette—Penn Tire & Rubber Co., Jeanette, is having plans prepared by Fletcher-Thompson, Inc., 211 State St., Bridgeport, Conn., for construction of a 1 story, 175x200 ft. rubber plant. Estimated cost will exceed $40,000.

Pa., Philadelphia—Publicker Industrial Alcohol Co., 1429 Walnut St., Phila., Pa. is having preliminary plans prepared for an evaporating plant. Estimated cost $2,000,000. United Engineers & Constructors, Inc., 1401 Arch St., Philadelphia, Pa., Engrs.

Tex., Beaumont—Southern Acid & Sulphur Co., Inc., Beaumont and 7621 Wallisville Rd., Houston, plans the construction of a new acid and sulphur plant unit. Estimated cost $450,000.

Tex., Carthage—Arkansas-Louisiana Gas Co., Marshall, Tex., subsidiary of Cities Service Co., Shreveport, La. plans the construction of an absorption type gasoline plant. Estimated cost $200,000.

Tex., Houston—Cook Paint & Varnish Co., 1812 Main St., plans to construct a new unit at its factory. Estimated cost will exceed $40,000.

Tex., Pasadena—Defense Plant Corp., Washington, D. C., plans to enlarge refinery here, which is being operated by Crown-Central Petroleum Corp., Pasadena and Houston. Estimated cost $2,100,000.

Ont., Toronto—Great Bend Oils, Ltd., 13 Yarmouth Gardens, Toronto, plans oil development and constructing a refinery. Estimated cost $75,000.

Ont., Toronto—D. R. Kennedy & Co., Ltd., 2881 West Dundas St., Toronto, plans the construction of a plant to manufacture plastic gears and by-products. Estimated cost $40,000.

Ont., Toronto—Kimberly-Clark Corp. of Canada, Ltd., 80 West King St., Toronto, plans pulp mill. Estimated cost $100,000.

Que., Joliette—Barrett Co., Ltd., 551 St Hubert St., Montreal, Que., plans the construction of a 2 story plant addition, to manufacture roofing materials. Estimated cost $50,000.

Que., Montreal—Minerals & Chemicals, Ltd., 359 West St James St., Montreal, plans the construction of a plant.

CONTRACTS AWARDED

Ill., North Chicago—Abbott Laboratories, North Chicago, Ill., has awarded the contract for the construction of a penicillin plant to W. E. O'Neil, 2751 Clybourn St., Chicago, Ill. Estimated cost $120,000.

N. J., Bayonne—Tidewater Oil Co., 17 Battery Pl., New York, N. Y. has awarded contract for the construction of a refinery here, including new thermofore catalytic cracking unit to the Lummus Co., 420 Lexington Ave., New York, N. Y. Estimated cost $2,000,000.

O., Cleveland—Industrial Rayon Corp., West 98th St. and Walford Rd., Cleveland, has awarded contract for altering a factory and constructing plant additions to George A. Rutherford Co., Cleveland, O. Estimated cost is $500,000.

Pa., Greensburg—American Glass Corp., Greensburg, awarded contract for 1 story, 25x80x100 ft. glass manufacturing plant to Westmoreland Construction Co., Greensburg, Pa.

Tex., Bishop—Celanese Corp. of America, 180 Madison Ave., New York, N. Y. has awarded the contract for constructing and equipping an acetic acid manufacturing plant to Gasoline Plant Construction Corp., Second Bank Bldg., Houston. Estimated cost $5,000,000.

Tex., Borger—Phillips Petroleum Co., 404 North Douglas St., Oklahoma City., Okla., has awarded the contract for construction of a gasoline plant in this area to L. O. Stocker Co., Borger. Estimated cost $850,000.

Tex., Trinidad—Lone Star Producing Co., 1915 Wood St., Dallas, will construct a gasoline plant for the manufacture of components used in aviation fuel and synthetic rubber. Work will be done by subcontracts. Estimated cost $175,000.

Ont., Niagara Falls—Lionite Abrasives, Ltd., 21 Stamford St., Niagara Falls, has awarded contract for an addition to its plant to Smith Brothers Construction, Ltd., 1740 Ellen St., Niagara Falls.

Ont., Toronto—Goodrich Refining Co., Ltd., Port Credit, Ont., awarded contract for the fabrication and erection of two 4,000,000 gallons steel storage tanks at Lakefront, Port Credit. to Horton Steel Works, Ltd., Fort Erie, Ont. Estimated cost $113,500.

Que., Hull—Mica Company of Canada, Ltd., 2 Loise St., Hull, awarded contract for plant addition to E. Burnet & Sons, Hull. Estimated cost $40,000. Richards & Abra, 55 Metcalfe St., Ottawa, Ont., Archts.

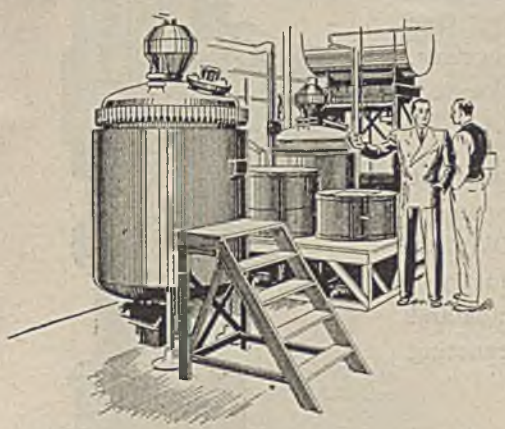
Que., Drummondville—Canadian Celanese, Ltd., 1401 McGill College Ave., Montreal, has awarded contract for a 1 story, 157x294 ft. and 4 story, 75x150 ft. plant buildings to Stewart Construction Co., Ltd., 70 Dufferin Ave., Sherbrooke. Estimated cost $500,000.

Que., Montreal—Canadian Copper Refiners, Ltd., 14 Durocher St., Montreal, East, awarded contract for the construction of a selenium products plant and addition to power plant at refinery to Foundation Company of Canada, 1538 West Sherbrooke St., Montreal, Que. Estimated cost $114,000.

Que., Montreal—Shell Oil Co., Ltd., 600 West St Catherine St., has awarded contract for an addition to its refinery to Canadian Kellogg Co., Ltd., 660 West St Catherine St., Montreal. Estimated cost $100,000.

Que., St Joseph de Sorel—Wood Preservation Industries, Ltd., 552 MacEacherne Ave., Montreal, has awarded the contract for the construction of a wood products creosoting factory to E. Cournoyer, St Joseph de Sorrel.

Trained Men to Give Practical Advice where Synthetic Organic Chemicals are Used



IN THE PLANT – Our technical representatives frequently can give advice on customer problems involving solvents, emulsifying agents, wetting agents, plasticizers, coupling agents, and chemical intermediates. They are thoroughly familiar with the properties, applications, and uses of the more than 160 chemicals we make.

IN THE LABORATORY – They can give you information on the many new chemicals we have announced for research study. And they can tell you about recent applications of older products that you may be using. These representatives are chemists and chemical engineers who have had experience in our research laboratories and understand research problems and techniques.

IN THE OFFICE – In your chemical purchasing problems as well, our representatives can be of service . . . advising on price, shipping, and priority regulations, the routing of orders, and the availability of chemicals we make, or their replacements. These men are located in all the major chemical-consuming cities throughout the country.

BUY UNITED STATES WAR BONDS AND STAMPS

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.

PRODUCERS OF SYNTHETIC ORGANIC CHEMICALS

Why an **MP** *in a*

Well—you know what "Military Police" signifies, don't you? It's the designation of specially qualified, specially fitted men who are charged with the duty of seeing that "things run smoothly." One of their most important functions, wherever troops and supplies are located, is to *control the flow* of traffic.

So—an "M P" is in this advertisement because he signifies the thorough-going job performed by POWELL VALVES in every branch of industry—in *controlling the flow* of liquids and gases—often under the most exacting conditions.

The Wm. Powell Co.

Dependable Valves Since 1846

Cincinnati 22, Ohio

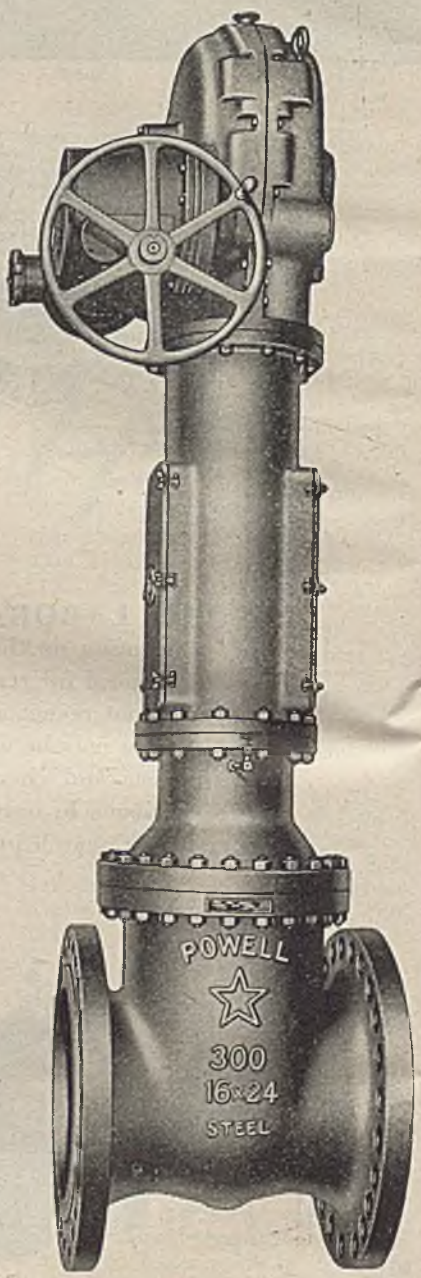


Fig. 3023 Mod.—A striking example of Powell engineering—this valve is one of several specially designed and built by Powell to be used in a large Southwestern refinery for making synthetic rubber. It is a Class 300 pound, 16-inch port size Cast Alloy Steel Gate Valve with flanged ends venturied to 24-inch pipe size to accommodate insulation on inside of pipe. It is operated by an electric, top-mounted, fully enclosed, explosion-proof motor operator for quick, positive opening and closing.

POWELL

POWELL VALVE ad?

The complete POWELL Line includes Globe, Angle, Gate, Check, Relief, Y, Non-Return and other types of valves in bronze, iron, steel, pure metals and special alloys to meet the demands of all branches of Industry for DEPENDABLE FLOW CONTROL EQUIPMENT.

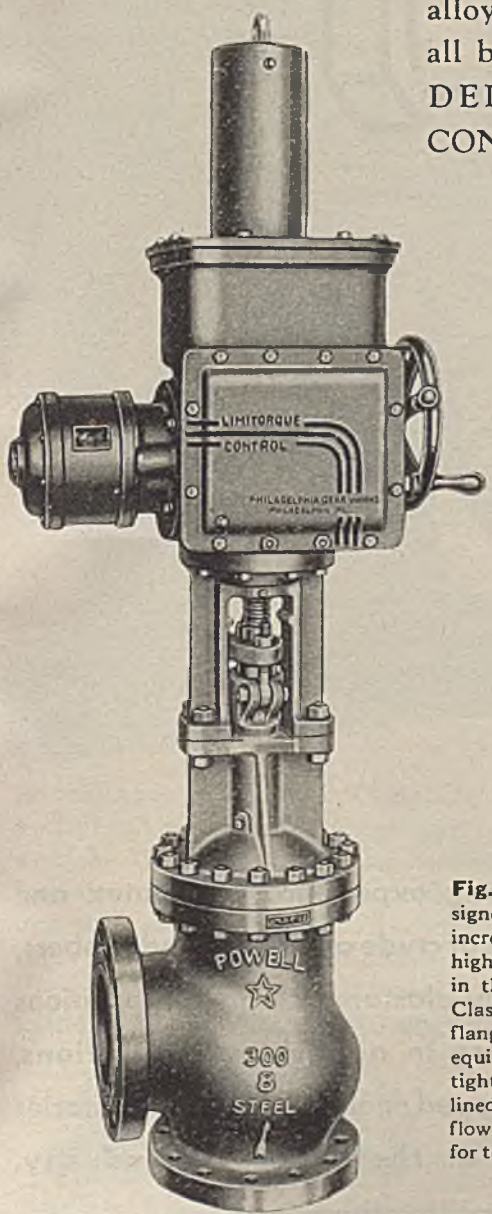
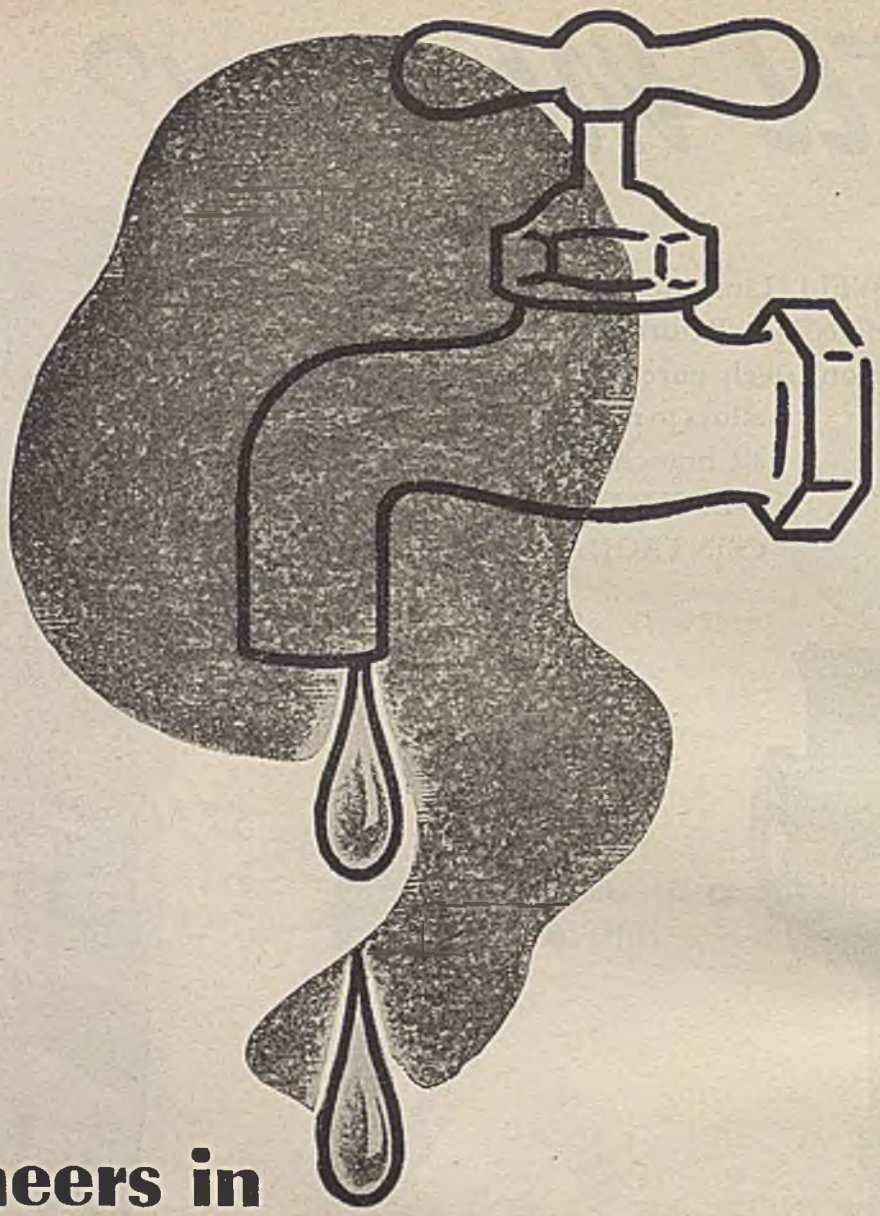


Fig. 3053 Mod.—This valve is scientifically designed and is built especially to handle not only increasing temperatures and pressures but the highly corrosive and erosive media encountered in the chemical and process industries. It is a Class 300-pound Cast Steel Angle Valve with flanged ends and bolted flanged yoke and is equipped with an electric, top-mounted, dust-tight, explosion-proof motor operator. Streamlined areas through the body assure maximum flow with minimum pressure drop. It is adapted for temperatures up to 1400°F.

VALVES



Pioneers in water-dispersed materials

In addition to long experience with latex and water dispersions of crude and reclaimed rubbers, we disperse many elastomers and compositions applicable to use in adhesives, saturations, coatings and dipped goods. Our laboratories and plant are at the service of industry.

Dispersions Process, Inc.

symbolizing research and development in water dispersions

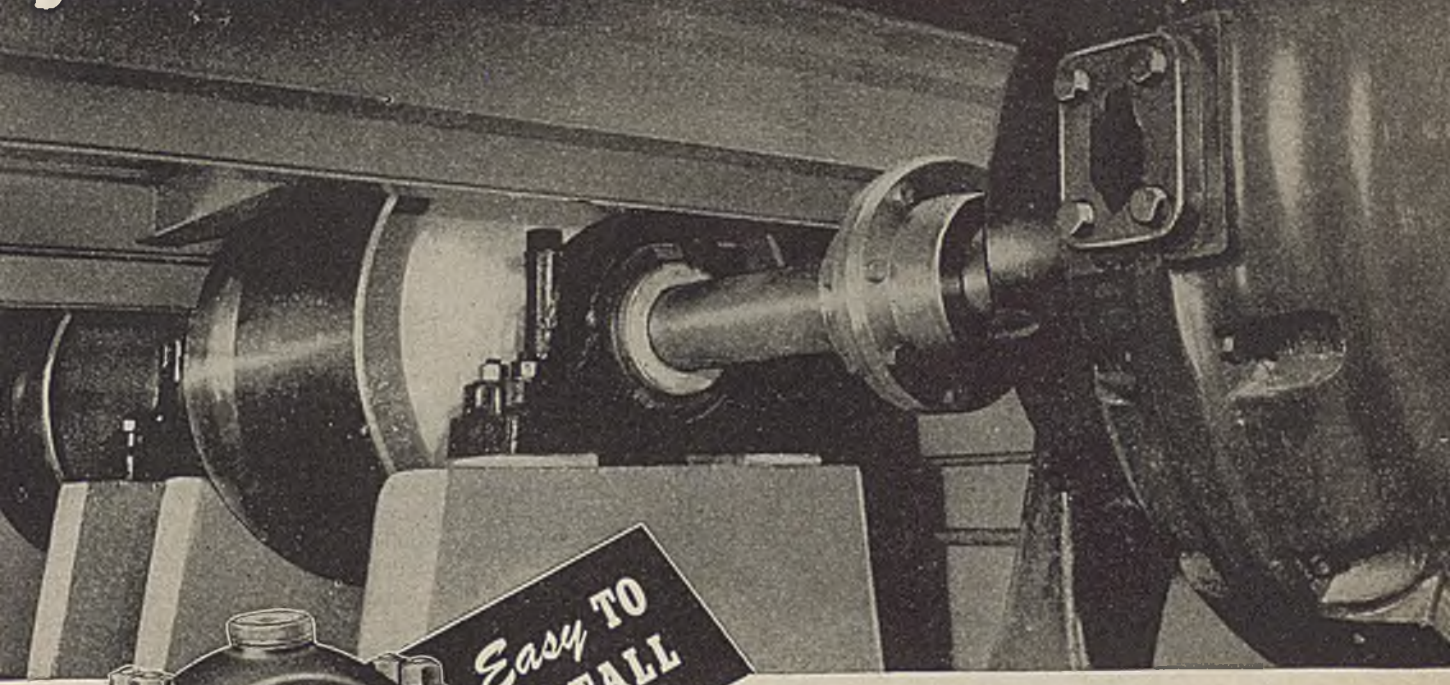
(under management)

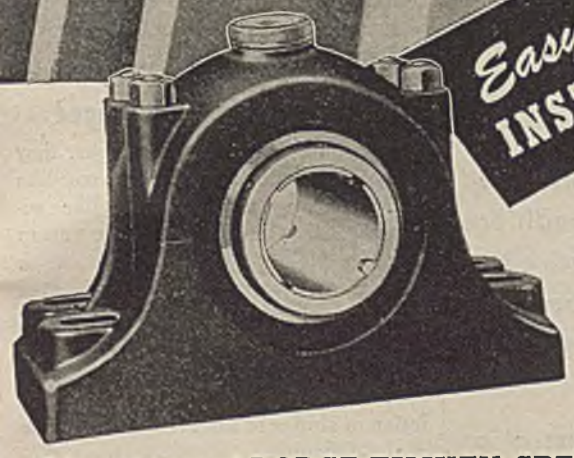
UNITED STATES RUBBER COMPANY

1230 Sixth Avenue, New York 20, N. Y.

RUGGED DODGE-TIMKEN BEARINGS

get more *Battle Power* out of *Horsepower*



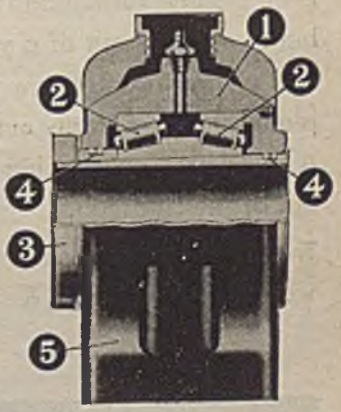


Super-rugged . . . Dodge-Timken bearings have what it takes to withstand the "beatings" bearings get in today's 168-hour weeks of war production. Completely assembled . . . ready for instant installation . . . capable of 30,000 hours of service . . . pre-lubricated for 50-million revolutions under normal conditions without relubrication . . . sealed against admission of dirt or leakage of lubricant. They eliminate maintenance delays . . . conserve vital man-hours and critical materials . . . speed peak production.

Advantages of DODGE-TIMKEN SPECIAL DUTY BEARINGS
1—Full ball and socket self-alignment . . . guards against power waste and wear. 2—Timken tapered roller bearings give full radial and thrust load capacity . . . put full power in production. 3—Easy to install—simply slip over shaft and tighten collar. 4—Piston ring seals retain lubricant and exclude dirt. 5—Rugged outer housing gives over-all protection to bearing.

Contact Local Dodge Distributor or write to

DODGE MANUFACTURING CORPORATION, Mishawaka, Ind., U.S.A.

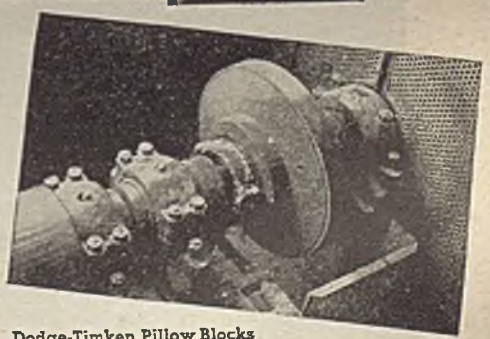


Dodge-Timken Special Duty Ball-and-Socket Pillow Block

Dodge-Timken Special Duty "D" Unit Mount

Dodge-Timken Special Duty "S-1" Unit Mount

Dodge-Timken Special Duty "B-1" Unit Mount



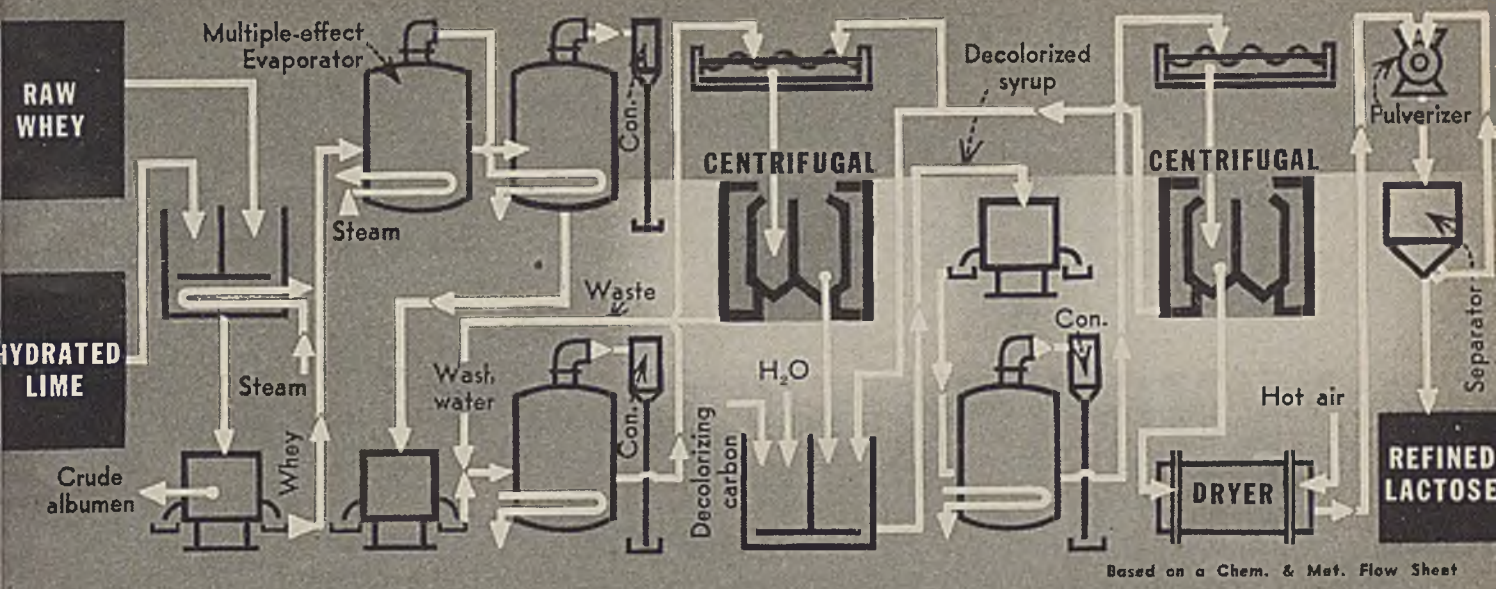
Dodge-Timken Pillow Blocks and Dodge Diamond "D" Clutch . . . dependable operation . . . low maintenance.

DODGE
MISHAWAKA

THROW ALL YOUR SCRAP INTO THE FIGHT! . . . BUY MORE WAR BONDS!

THE RIGHT DRIVE FOR EVERY JOB

PUT *ALL* YOUR POWER IN THE JOB



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FASTER SEPARATION

of Crystals from Liquids

CENTRIFUGAL SEPARATION of lactose crystals from the mother liquor is a matter of minutes instead of hours. For lactose is only one of many materials being processed faster—more economically with Tolhurst Centrifugals. What about your processes? If one or more are slowing production of war materials, remember—

whatever the Force of Gravity can do for production, Centrifugal Force can do it faster. Reason: Centrifugal Force, as Tolhurst applies it, is from a few hundred to several thousand times the Force of Gravity.

Tolhurst maintains a complete laboratory for centrifugal research. Send us samples of your materials together with pertinent data. Tolhurst Engineers will gladly make test runs and assist you in determining the correct centrifugal equipment for your requirements. There is no obligation. Investigate these time and cost-saving machines.

Do these

6 PROCESSES

faster—more economically

DRAIN a solid by removing adhering liquid.

FILTER a solid from a suspension.

DEHYDRATE a solid by displacing water by a miscible solvent.

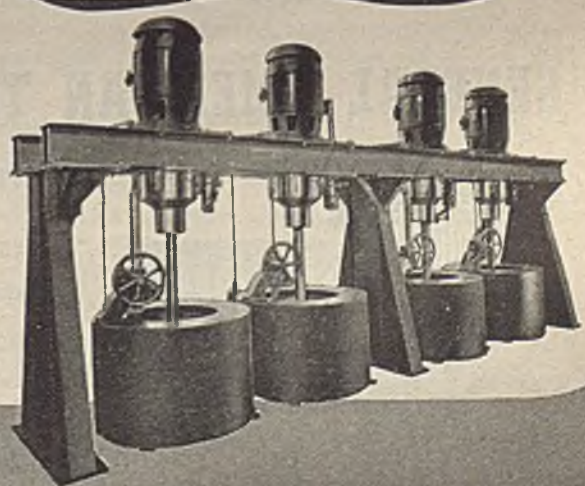
CLARIFY a liquid by throwing fine solids out of suspension.

THICKEN a suspension by removing part of the liquid.

SEPARATE two or more solids suspended in a liquid or an unfilterable gelatinous material from a liquid.

TOLHURST

suspended centrifugals



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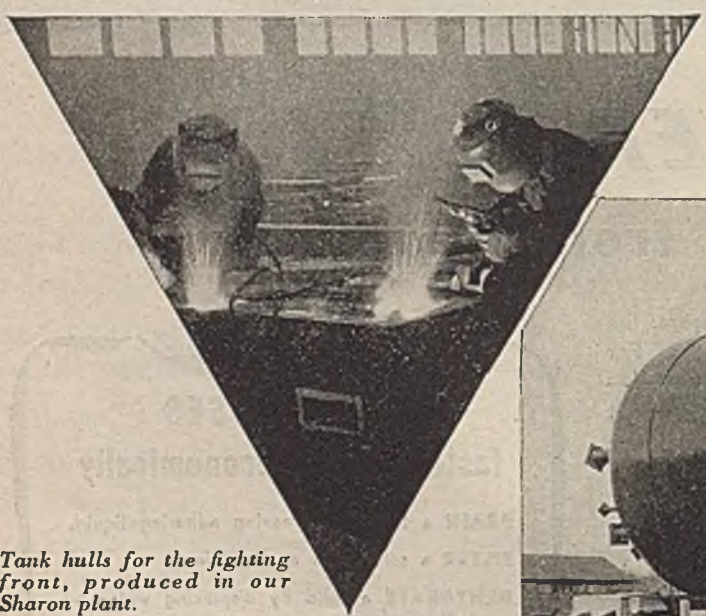
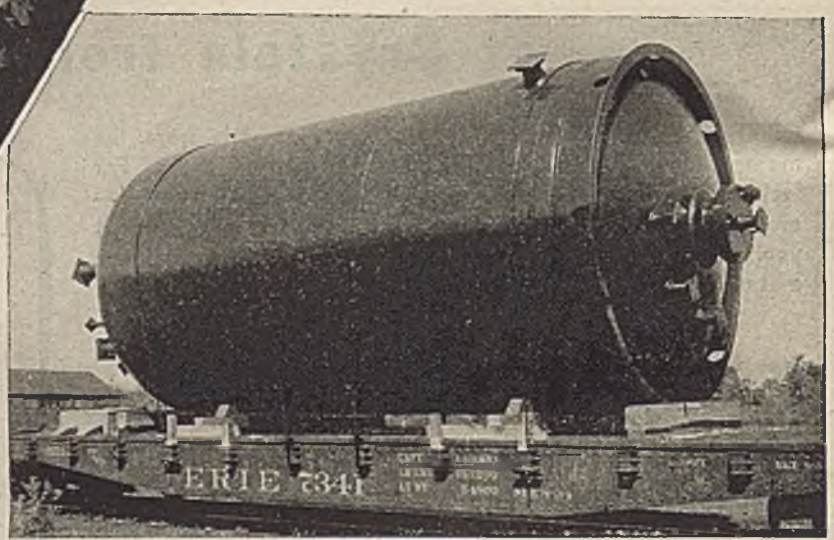
Here in the General American Plate & Welding division plant at Sharon, Pennsylvania, men weld the armored hull of General Sherman tank. It's one of the best tanks in the world; everything that goes into it must be thoroughly *right*—so its makers place their confidence in GATX, as do industrial leaders in hundreds of widely different lines.

The most important thing we're producing now at Sharon and other GATX plants is *know-how*—vastly augmented experience, gained from geared-up wartime production, that will enable us to better serve YOUR peacetime needs.



Tank hulls for the fighting front, produced in our Sharon plant.



Pressure vessels for the industrial front, produced at our Sharon plant.

Building for today's fighters—Planning for tomorrow's builders

GENERAL AMERICAN TRANSPORTATION CORPORATION

GATX GENERAL AMERICAN PLATE & WELDING DIVISION PLANT AT SHARON, PA.

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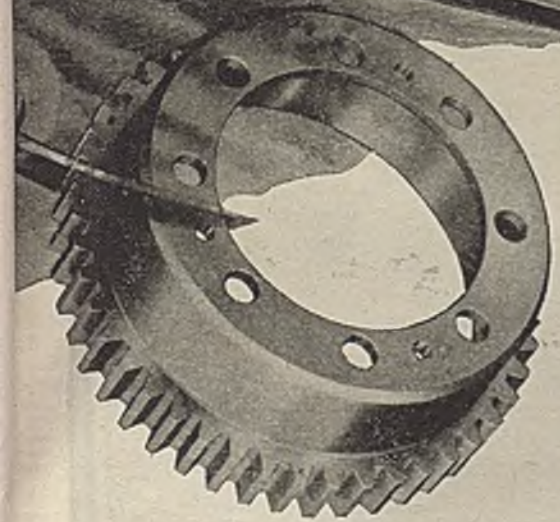
back of them...

the shadow of GEARS



THERE is no substitute for "soup" any airman will tell you—"soup," the concentrated energy that giant Pratt & Whitney engines develop to speed the mighty Hellcat on its missions of destruction.

And back of these planes—back of the giant 2,000 horsepower engines that power them are gears. Gears of such extreme precision—held to such close tolerances—that each one is a modern marvel of engineering and manufacturing perfection.

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And Foote Bros. are looking ahead to the day when these precision gears will mean a new approach in the economical transmission of power in peacetime machines. Already on the drafting boards of many manufacturing plants are machine tools and construction equipment—combustion engines and other machinery that promise new efficiencies because of the precision gears they will employ.

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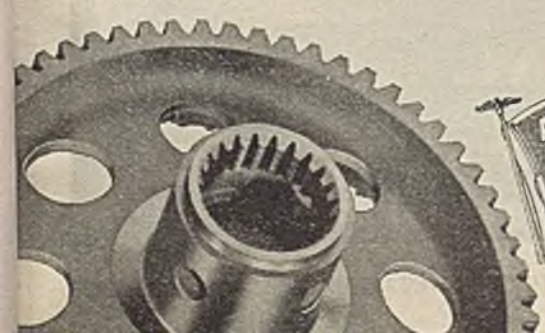

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Better Power Transmission Through Better Gears

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Platinum Laboratory Ware

Tested by Use

Tests of any piece of apparatus under conditions that simulate those under which it will have to operate are valuable, but nothing can equal workaday use really to show the quality of a piece of equipment.

Baker Laboratory Ware is under the continual trial of *test by use*, because we employ it freely all the time in our own laboratories. In this way we discovered how the stems of stationary type electrodes tended to break at their juncture with the cylinder and corrected the fault by reinforcing the joint there.

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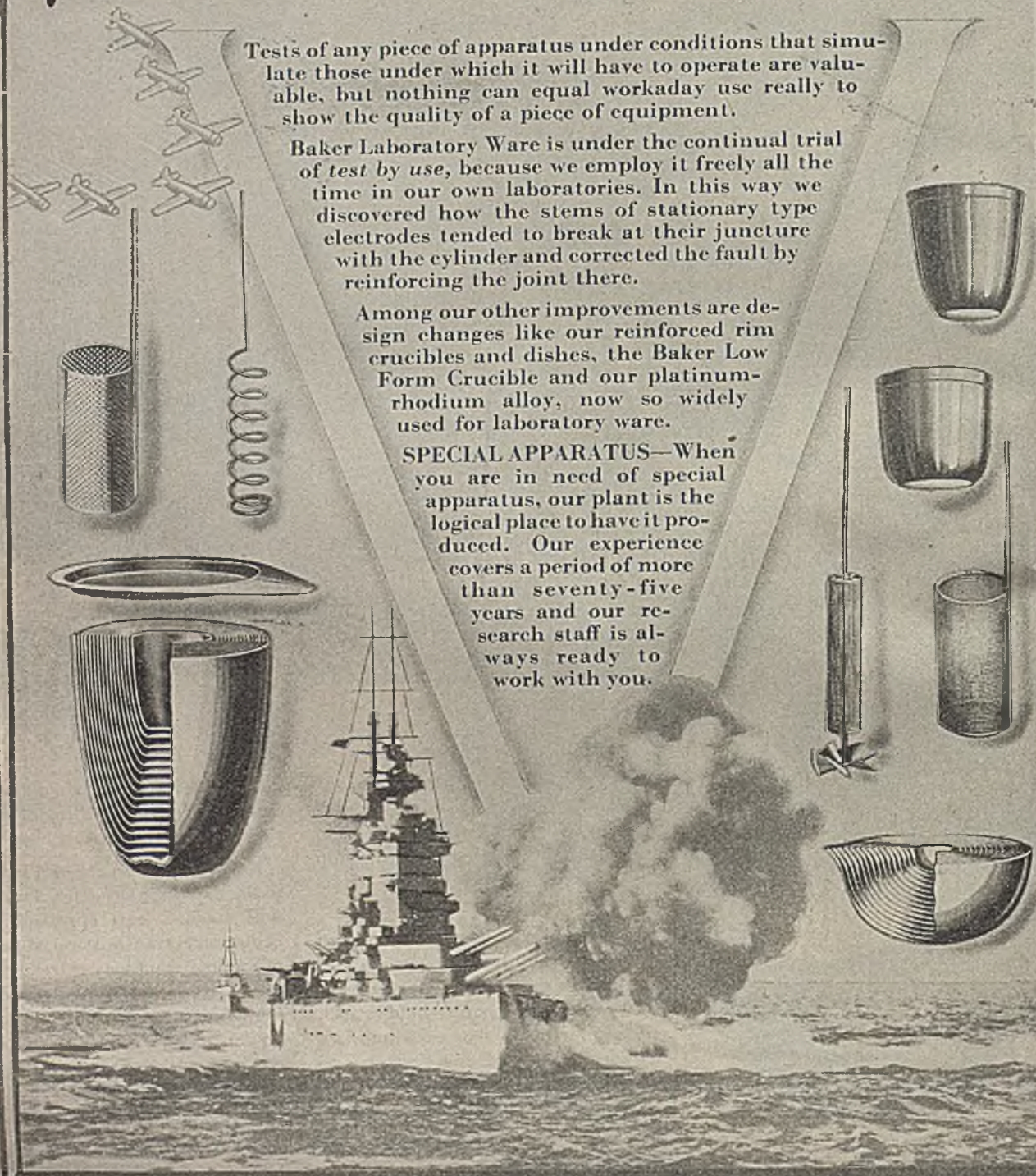
SPECIAL APPARATUS—When you are in need of special apparatus, our plant is the logical place to have it produced. Our experience covers a period of more than seventy-five years and our research staff is always ready to work with you.



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