

# TECHNOLOGY

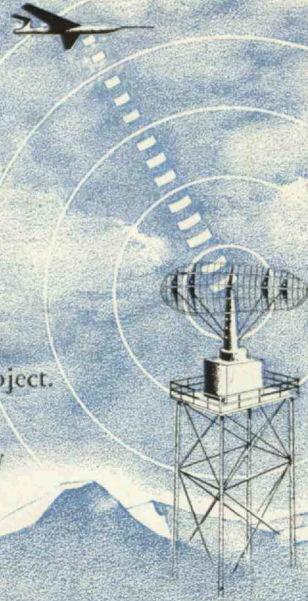
REVIEW *December* 1952





# *Pioneers in Precision*

**Bendix Aviation Corporation** engineers pioneered Radar and originated the concept of its use in intercepting and tracking a moving object. Many remote control, remote indicating systems, and other highly specialized devices on the security regulations list, are current products of this Pioneer in Precision.



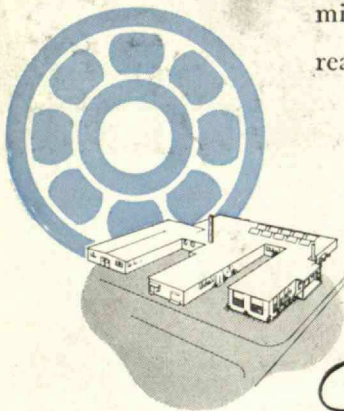
## **Miniature Precision Bearings**

incorporated, are the originators and pioneer manufacturers of precision ball bearings in miniature sizes. The original concept of practically every new development in this field has been by **MPB**; the pioneer in designs and dimensions now being internationally standardized.

More than 120 types and sizes are regularly supplied in 10 design series, ranging from 1/10" o.d. **MPB** ball bearings are fully ground, lapped, honed and/or burnished to ABEC 5 tolerances or better. Exclusive, exacting finish and inspection details assure highest quality bearings—quality which has prompted more than a million applications. **MPB** ball bearings can be supplied in specific clearances and graded within the tolerance, for prompt assembly and maximum service.

**MPB** ball bearings are indicated for many unusual applications involving miniaturization. Complete information and detailed engineering assistance is readily available. Write for catalog—survey sheet TR 12

*Demand for our product has necessitated an extensive expansion in facilities—has prompted a continued processes development. We will soon be in a position to offer greater services to you.*



## **Miniature precision Bearings**

*Incorporated*

Keene, New Hampshire



*"Pioneer Precisionists to the World's foremost Instrument Manufacturers"*

*save  
space  
weight  
friction*



# More go per gallon

Your automobile motor has more than 200 parts. They require close to 900 precision grinding operations.

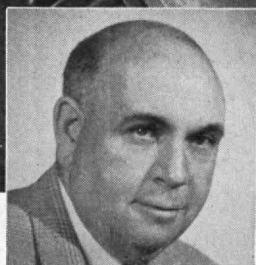
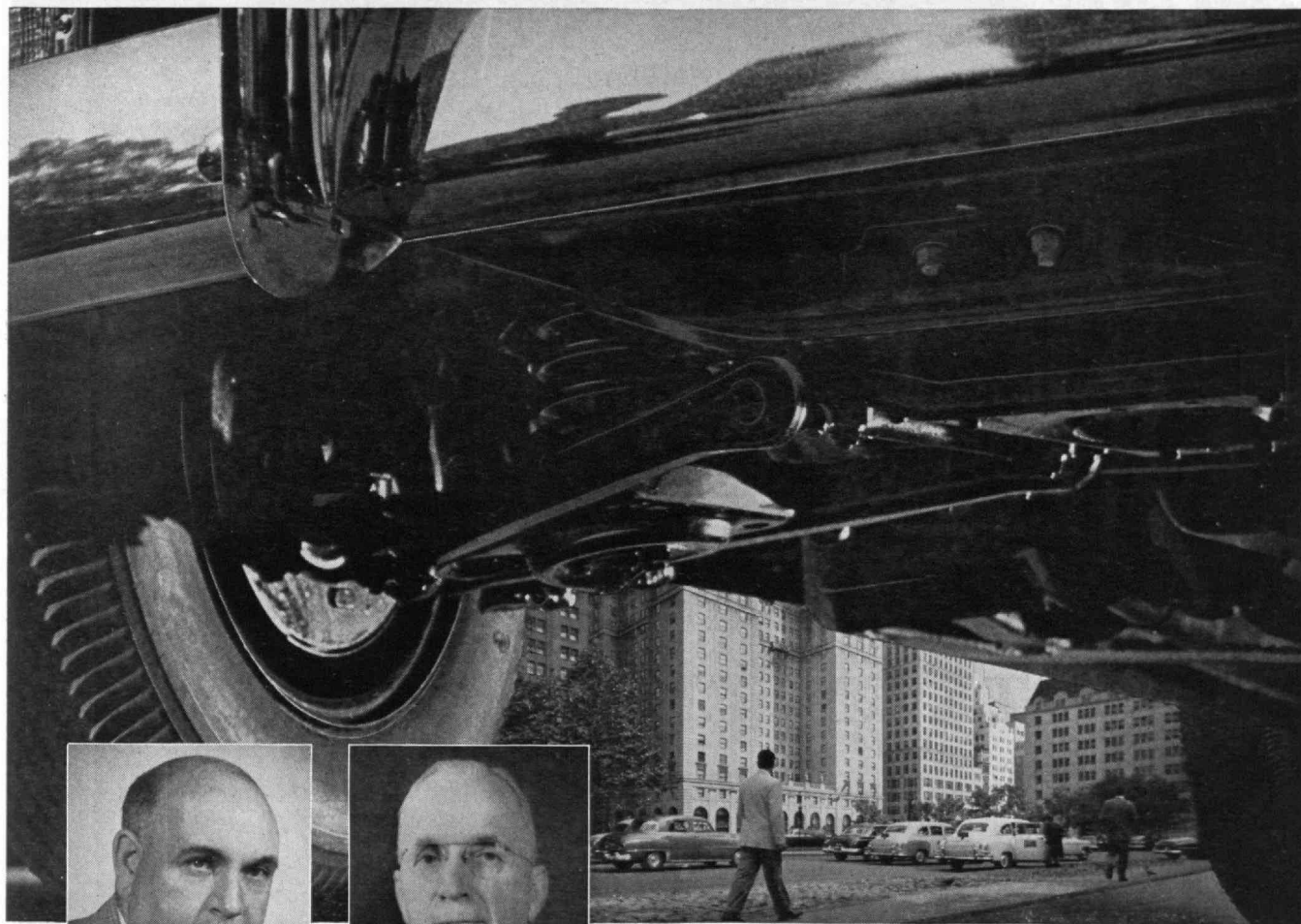
Your motor's crankshaft, for instance, must be dimensionally true within .001 inch. It gets this accuracy from Norton ALUNDUM\* grinding wheels on high production Norton grinding machines. The finishing touch is given with a special Norton lapping machine, using Behr-Manning Lightning ADALOX\* coated abrasive. Such true, smooth surfaces make parts fit . . . cut friction . . . give you "more go per gallon."

The automotive industry is only one of many industries which rate Norton and Behr-Manning products essential to their production. As the world's largest manufacturers of abrasives and abrasive products, Norton and Behr-Manning keep seeking better ways to help *all* industries make better products.

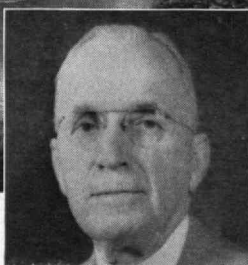
*NORTON makes abrasives, grinding wheels, refractories, Norbide grain and molded products, grinding and lapping machines, non-slip floors. Norton Company, Main Office and Works, Worcester 6, Massachusetts.*

*BEHR-MANNING makes abrasive paper and cloth, oilstones, abrasive specialties, Behr-Cat brand pressure-sensitive tapes. Behr-Manning Corporation, Division of Norton Company, Troy, New York.*

*Plants, Distributors and Dealers the world over*



J. HOWARD BAKER is General Superintendent of the Behr-Manning Abrasive Division. His exceptional ingenuity in 34 years' service has resulted in many outstanding improvements in the quality of Behr-Manning products.



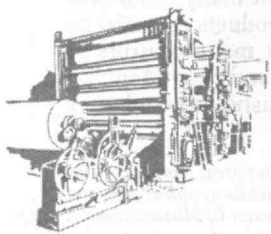
HARRY O. ANDERSON has completed 51 years with Norton. Now Chief Grain Inspector of the Abrasive Division, he has originated and patented many improvements in abrasive processing and quality control.

\*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries



*Making better products to make other products better*

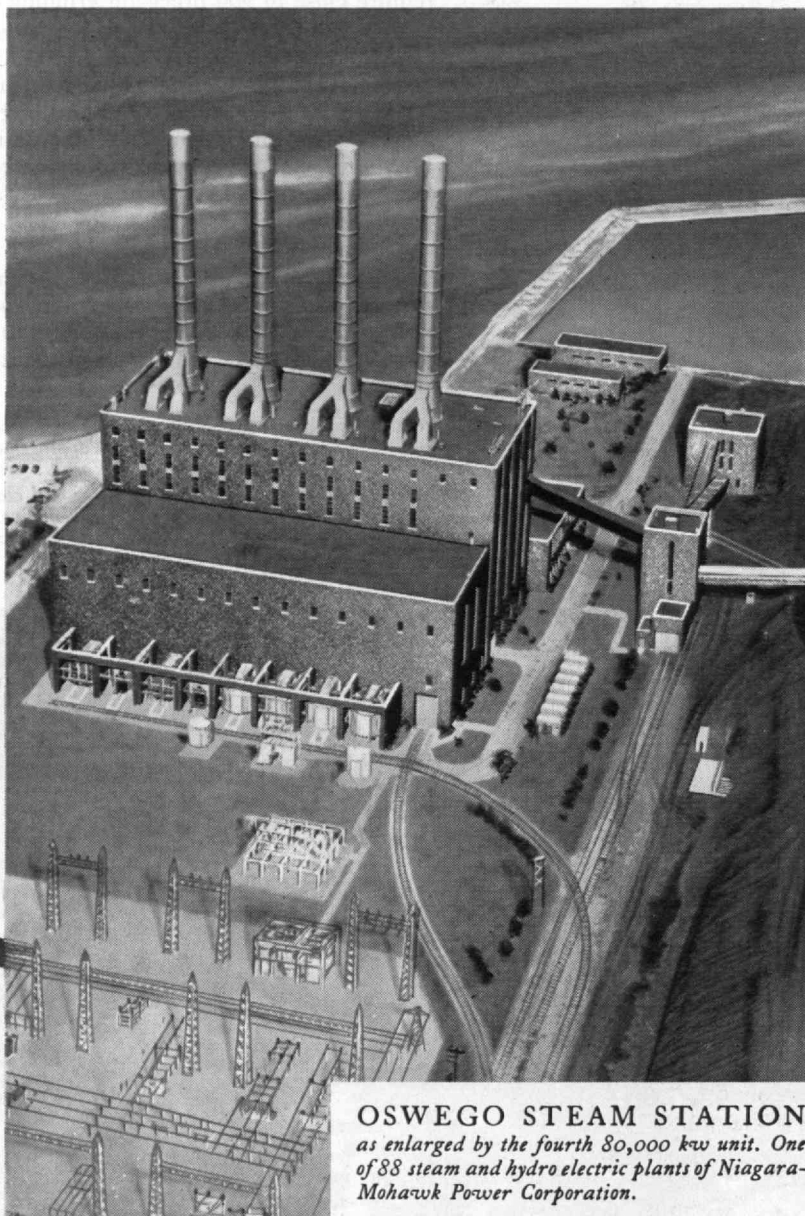
# NORTON • BEHR-MANNING



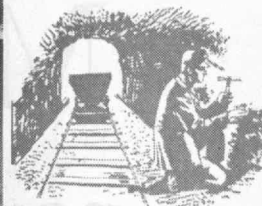
NIAGARA FALLS

BUFFALO

DUNKIRK



**OSWEGO STEAM STATION**  
as enlarged by the fourth 80,000 kw unit. One of 88 steam and hydro electric plants of Niagara-Mohawk Power Corporation.



SCHENECTADY

ALBANY

# PRIVATE ENTERPRISE *In Action...*

The Niagara-Mohawk Power Corporation has 7000 circuit-miles of transmission lines and 85,000 conductor-miles of distribution lines in upper New York state. Its entire system has a rated capacity of 2,186,451 kw with 600,000 kw now under construction.

A current example of their enterprise is the Oswego Steam station, designed by their engineering department with construction supervision by Stone & Webster Engineering Corporation.

The benefits of competent business management of a privately-owned utility are again demonstrated by the Niagara-Mohawk system.



**STONE & WEBSTER ENGINEERING CORPORATION**

A SUBSIDIARY of STONE & WEBSTER, INC.

# NEW *Styroflex* COAXIAL CABLE

Made by Phelps Dodge in semi-flexible 1000-ft. lengths without joints

Cut-away Section of  
Styroflex Coaxial Cable

Inner Copper Conductor

Styroflex Tape Helix

- Keeps inner conductor absolutely and permanently centered, even at sharp bends.
- Provides a uniform combination of solid and air dielectrics at every cross-section of cable.

Outer Belt of Styroflex Tape

- Increases leakage path between inner conductor and outer aluminum sheath.

Outer Aluminum Sheath

- Consists of continuous aluminum tube without joints.
- Acts as outer conductor.

Phelps Dodge Copper Products Corporation's new semi-flexible, aluminum sheathed Styroflex cable is specially designed to meet the need for a high-power, efficient low-loss coaxial cable in the AM, FM, TV and microwave fields. The cable reduces reflections—which cause ghost images in television and distortions in communications—to an absolute minimum.

It was developed by Felten & Guillaume Carlswerk, of Cologne, Germany, which has made a great many successful installations of the cable throughout Europe. Phelps Dodge is currently making the cable for sale in the United States in standard American sizes and impedances under a working agreement with the Cologne firm. The cable is manufactured in continuous 1000-foot lengths, without joints, and shipped on reels.

Outstanding feature of the cable is the use of insulating Styroflex film to form a helix. This helix, built up of hundreds of precision-wound Styroflex tapes, firmly supports and centers the inner conductor coaxially in an aluminum sheath at all times, assuring retention of excellent electrical properties. Essential flexibility of the Styroflex tape is obtained by special manufacturing techniques.

***PHELPS DODGE COPPER PRODUCTS***  
**CORPORATION**

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an AIRCRAFT engineer?

But I haven't majored in  
aeronautical engineering

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It's your aptitude, your knowledge of engineering principles,  
your degree in engineering that count.

Those—plus the opportunity Lockheed is offering you—are all you need for a  
career as an aircraft engineer. In Lockheed's special program for engineering  
graduates, you may go back to school, or you may convert to aircraft work by  
doing—on-the-job training. But whichever it is, you receive full pay while learning.

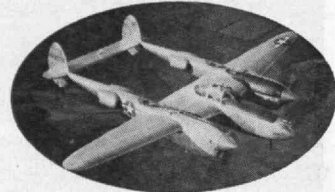
But Lockheed offers you more than a career. It offers you a new life, in an area  
where living conditions are beyond compare. Outdoor living prevails the  
year-'round. Mountains, beaches are an hour from Lockheed.

See your Placement Officer today for the details on Lockheed's Aircraft Training Program  
for engineers, as well as the better living conditions in Southern California.

If your Placement Officer is out of the illustrated brochures describing living and  
working conditions at Lockheed, write M. V. Mattson, Employment Manager

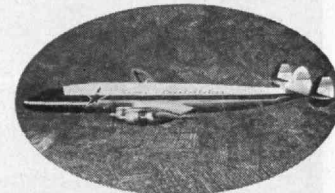
*Lockheed* Aircraft Corporation  
Burbank, California

This Plane made History



The P-38 Lightning—first 400 mile  
per hour fighter-interceptor, the  
"fork-tailed Devil" that helped  
win World War II.

This Plane is making History



The Super Constellation—larger, faster,  
more powerful; the plane that bridges  
the gap between modern air transport  
and commercial jet transport.

This Plane will make History

The jet of  
the future—the plane  
you will help create—  
belongs here.

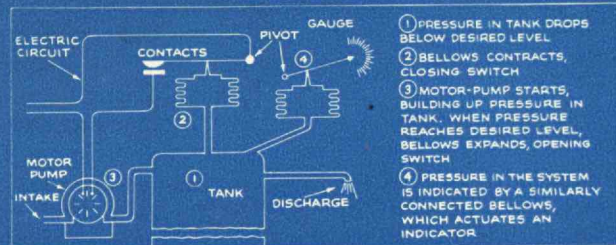
This plane—which exists only in  
the brain of an engineer like yourself  
—is one reason there's a better  
future for you at Lockheed. For  
Lockheed will always need engineers  
with ideas, engineers with  
imagination, engineers who build  
the planes that make history.



# 8 Ways

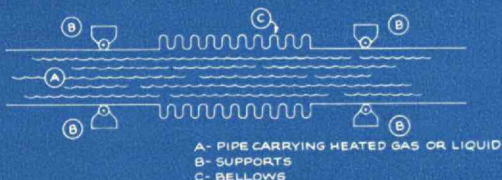
## Clifford bellows help you solve design problems

Perhaps you, too, can benefit from flexible, leak-proof, metallic Clifford bellows assemblies. For individual requirements in assembling bellows to fittings, Clifford is equipped to use new molecular bonding processes, resistance welding and heliarc-welding. Write direct for complete details on how Clifford bellows assemblies can help you. Clifford Manufacturing Company, 142 Grove Street, Waltham 54, Massachusetts. *Division of Standard-Thomson Corporation.* Sales offices in New York; Detroit; Chicago; Los Angeles; Waltham, Mass.

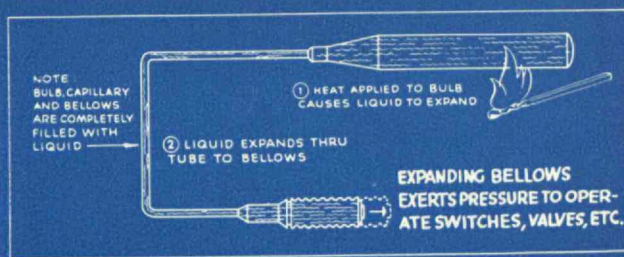
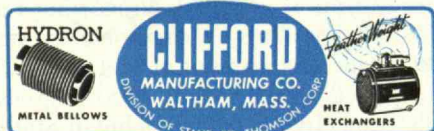


**Controlling and/or indicating pressure.** Clifford Hydron bellows assemblies provide close control and accurate indication in pressure systems. Pressure, exactly equal throughout the system, is immediately exerted on bellows which respond without lag. Common applications: instruments to control temperature, pressure, flow rates, liquid level.

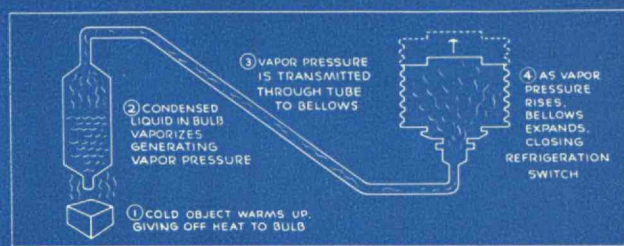
BELLWS USED AS FLEXIBLE CONNECTORS



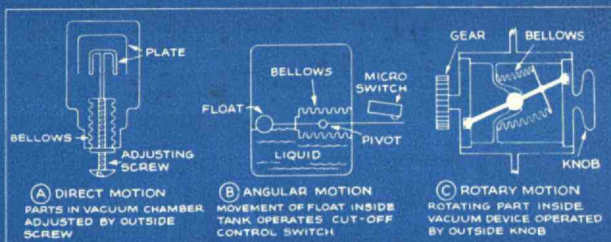
**Allowing for thermal expansion** in flexible piping. Clifford bellows compensate for dimensional changes caused by heated gas or liquid that would expand and buckle ordinary piping... without imposing excessive strain on supports. Sidewise movement of supports with respect to each other is also permitted.



**Controlling wide range of temperature** with one adjusting device. Liquid filled Clifford bellows assembly permits one knob to adjust temperatures by remote control from 200° to as high as 650° or 700°. Common applications: domestic and industrial oven controls.

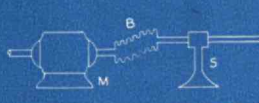


**Controlling narrow range temperatures.** Vapor pressure Clifford bellows system forms temperature control unit used in thermostatic devices. This device can be designed to be "fail safe" to prevent overheating even if bellows fails to function. Adjustment commonly limited to lower range than liquid filled system. Applications: refrigerator controls, auto thermostats, tank regulators.



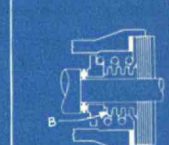
**Transmitting motion from one medium to another** while maintaining a hermetic seal. The inherent flexibility of leakproof Clifford Hydron bellows permits extension, retraction, rotary motion or combinations of these to be applied while hermetically sealing unit's internal elements. (A) shows direct motion, (B) shows angular motion, (C) shows rotary motion.

FLEXIBLE SHAFT COUPLING



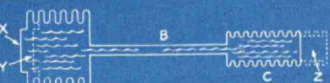
**Operating as flexible shaft coupling.** Clifford bellows assemblies provide constant velocity torque and compensate for misalignment.

SHAFT SEAL



**Operating as shaft seal.** Clifford bellows seal in gases and liquids and prevent leakage around rotating shafts.

HYDRAULIC TRANSMISSION



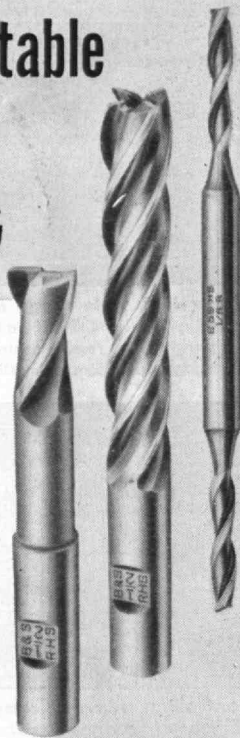
**Operating in hydraulic transmission systems.** Clifford bellows approximate frictionless lever-action for transmitting force in remote control systems.



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... choose the right end mill from the extensive Brown & Sharpe line. By matching the end mill to your needs, you'll get faster, more efficient, and more profitable cutting.

Brown & Sharpe offers 20 styles of end mills with a complete range of sizes in each. Send for the catalog containing specifications and prices. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



*We urge buying through the Distributor*

## BROWN & SHARPE

## THE TABULAR VIEW

**Metals.**—For a long period of time it has been The Review's practice to devote the July issue (the last of each volume of The Review) to the exhilarating and uplifting events of Alumni Day and commencement activities. Thus the Metals Processing Laboratory failed to receive the editorial attention which the splendid new equipment and buildings warrant, although pages 500 and 501 of the July issue did report the dedication of the laboratory as a news event. A description of the new facilities appears in three articles in this issue of The Review.

First of the trio of articles (page 89) describes the laboratory building, and illustrates the assignment of space to the Department of Mechanical Engineering and the Department of Metallurgy for their respective teaching and research programs at the undergraduate and graduate levels. In the preparation of this article, the editor acknowledges with thanks the wholehearted co-operation of Robert M. Kimball, '33, and Philip A. Stoddard, '40, Director, and Assistant to the Director, respectively, of the Institute's Division of Business Administration; and the assistance of John J. Rowlands, Director of News Service, editorial associate, and perennial friend of The Review.

**Machines.**—When it left Boylston Street to take up new roots in Cambridge, one of the show places of the new Technology was the Machine Tool Laboratory of the Department of Mechanical Engineering. With the dedication of the new Metals Processing Laboratory, this portion of the activity of Course II, along with research in metal cutting, has been transferred to the new and greatly improved quarters, where emphasis on the science of metal working can be developed more fully than ever before. The program of teaching and research which the Department of Mechanical Engineering now conducts in the Metals Processing Laboratory is described (page 93) by PRESCOTT A. SMITH, Associate Professor of Mechanical Engineering. Following his graduation from the Institute, from which he received the S.B. degree in Mechanical Engineering in 1935, Professor Smith spent a decade in industry as equipment engineer, manufacturing engineer, methods engineer, superintendent plant engineer, and factory manager. With this wealth of practical experience, he returned to M.I.T. in 1945 where he has since been in charge of the Machine Tool Laboratory.

**Metallurgy.**—As the physical and chemical structure of metals and alloys is more thoroughly understood, significant advances in the casting, welding, and working of metals, as well as in powder metallurgy, occur. The program of the Department of Metallurgy in the new Metals Processing Laboratory is described (page 97) by PROFESSOR HOWARD F. TAYLOR, 2-46, of the Department of Metallurgy. Professor Taylor received the B.S. and M.S. degrees in 1936 and 1938, respectively, from Michigan State College,

*(Concluded on page 76)*

**ARTISAN  
METAL PRODUCTS INC  
EQUIPMENT FABRICATORS  
WALTHAM  
MASS U S A**

THE HALLMARK  
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SUPERIOR  
EQUIPMENT

Artisan engineers and workmen are skilled in the techniques of metal working. Their combined knowledge and experience in engineering and building special equipment and machinery have been of value to many leading mechanical and process industries.

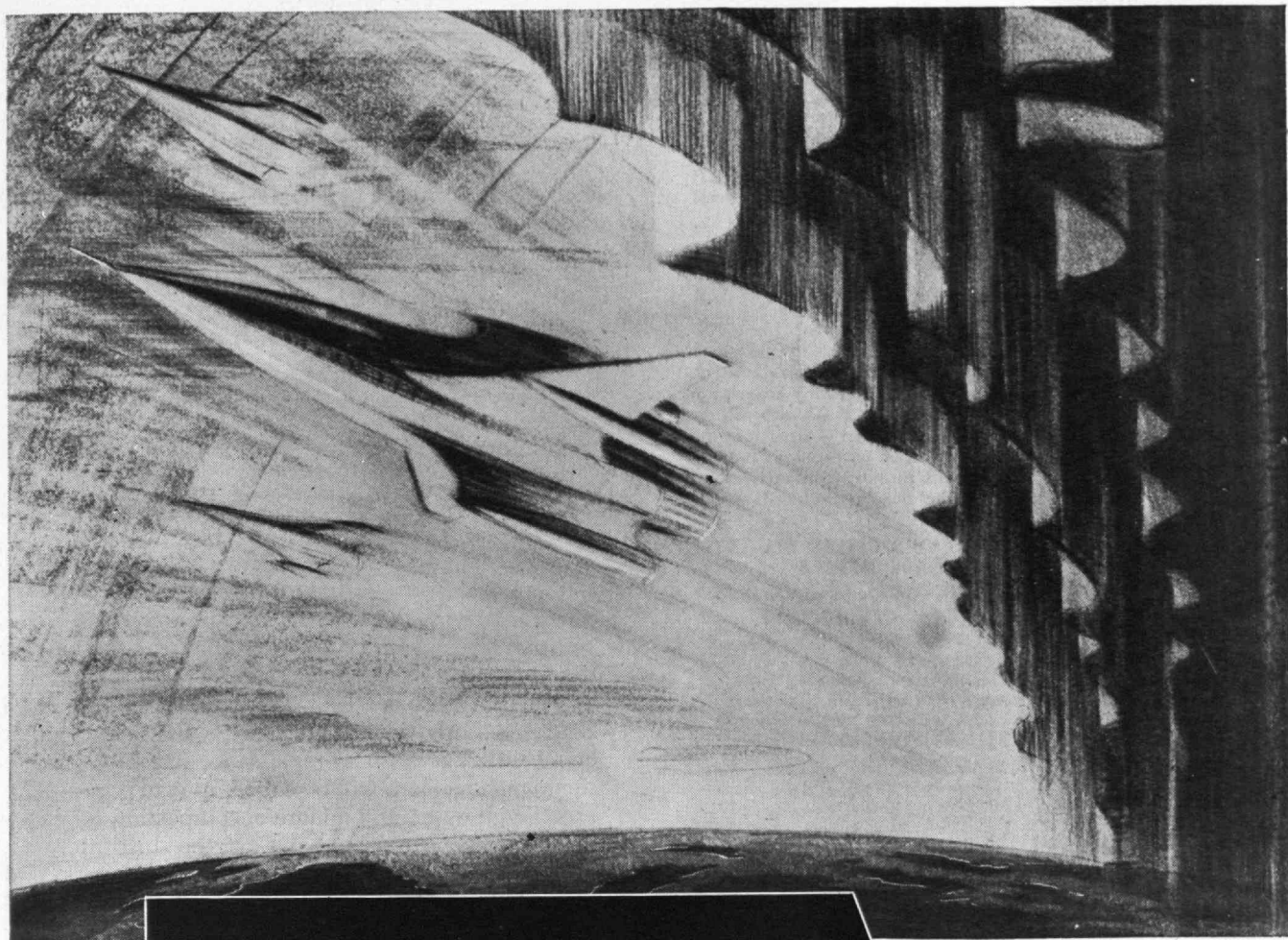
Write for a copy of "Process Equipment". For a qualified engineer to call to discuss your equipment requirements, telephone Waltham 5-6800 or write to: — James Donovan, '28, General Manager.

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HEAT EXCHANGERS  
DISTILLATION  
EQUIPMENT  
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## BEYOND THE HORIZON....

Progress in reaction-motor propulsion becomes possible only as the metallurgist supplies new alloys to withstand the stresses, temperatures, and corrosive attack developed by new rocket fuels.

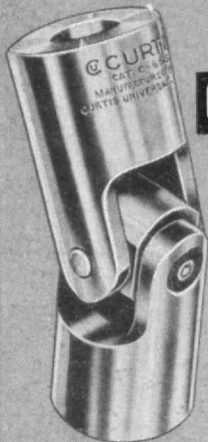
Molybdenum additions to many alloys are known to improve strength at high temperatures. For this reason Molybdenum will be used more and more in the reaction motors of the future.

Climax furnishes authoritative engineering data on Molybdenum applications.

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Specialists in Universal Joints for over 30 years, Curtis offers more than just time saving availability. Made of the finest alloy steels, accurately machined — with either solid or bored hubs — they may be easily applied to most universal joint needs, ranging from instrument controls to heavy steel mill applications.

#### ONLY CURTIS OFFERS ALL THESE ADVANTAGES

**Availability** — 14 sizes always in stock.

**Simplicity** — fewer parts, simpler construction.

**Government Tests** — complete equipment for government tests in our plant.

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**CURTIS UNIVERSAL JOINT CO., INC.**

8 Birnie Ave., Springfield, Mass.  
As near to you as your telephone

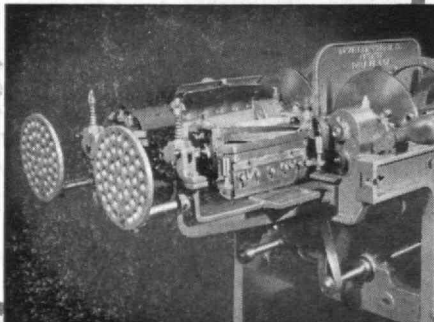


A MANUFACTURER OF UNIVERSAL JOINTS SINCE 1919



## + PRACTICAL Arithmetic proves the efficiency of H-D Equipment

Comparisons of production costs proves the savings made by new, improved H-D Equipment. Write TODAY for new bulletins that show economies and profits, lower unit costs, and increased production.



Shear (Clippers) on Formers



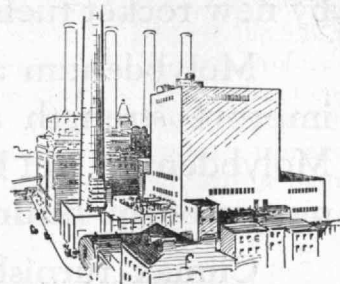
**HASKELL-DAWES MACHINE CO., INC.**  
2231 E. ONTARIO ST., PHILADELPHIA 34, PA.

## THE TABULAR VIEW

(Concluded from page 74)

and spent a year at that institution in a teaching capacity. From 1937 to 1945 he was engaged in welding and steel-casting research at the Naval Research Laboratory in Washington, D.C. Upon the conclusion of World War II, he came to the Institute as associate professor of mechanical metallurgy, and was promoted to a full professorship in 1952. Professor Taylor is the author of numerous articles in his professional field, and in this issue of The Review takes opportunity to outline the educational philosophy underlying undergraduate and graduate teaching in mechanical metallurgy at M.I.T. In 1945 Professor Taylor won the Simpson Medal, American Foundrymen's Society.

**Management.**—In the political campaign just ended as these words are written, both sides made a strong plea for new leadership, for high moral courage, for spiritual strength to play the leading role. A plea of the same type is made by EDWARD MCSWEENEY, '23, in his article (page 101) entitled "The Managerial Evolution." Mr. McSweeney holds that the stage is being set for a business renaissance in which professional management will be called upon to play a more exacting, a wiser, and a more encompassing role than ever before. After studying at the Institute, Mr. McSweeney was engaged in newspaper work and was subsequently affiliated with Conde Nast Publications and Butterick Publications for several years before founding his own company of management consultants, Edward McSweeney Associates, in 1933. At present he is treasurer and director of the Perkins-Goodwin Company, and a director of MacFadden Publications, Inc., Southland Paper Mills, Inc., National Heart Committee, Castleton China, Inc., and the Philadelphia Publications Corporation. He has been lecturer at New York and Northwestern Universities, and is a member of the Advisory Committee of the School of Industrial Management at M.I.T.



After we completed our work on the above building, the

**CONSOLIDATED EDISON COMPANY** awarded us another contract for the construction of their new generating plant in Astoria, L. I., now under construction.

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